



YANKEE ATOMIC ELECTRIC COMPANY

49 Yankee Road, Rowe, Massachusetts 01367

November 9, 2007
BYR 2007-069

Mr. David Howland
Massachusetts Department of Environmental Protection
DEP Western Region
436 Dwight Street
Suite 402
Springfield, MA 01103

Subject: Final Draft of the Method 3 Risk Characterization Report for the Yankee Nuclear Power Station (YNPS)

Dear Mr. Howland:

The Yankee Atomic Electric Company submitted the Draft Method 3 Risk Characterization Report to the Massachusetts Department of Environmental Protection (DEP) on June 26, 2007 with Letter BYR 2007-038, "Cumulative Risk Assessment." The DEP completed a review of the draft document and provided comments to the Yankee Atomic Electric Company (YAEC) on August 24, 2007. YAEC completed the review of those comments and has updated the Method 3 Risk Characterization Report in response to the DEP comments. Attached is the Final Draft of the Method 3 Risk Characterization Report. It is the understanding of YAEC that this Final Draft will be offered for Public Participation and that any additional comments will be provided to the YAEC in January 2008 and allows a final version of the Method 3 Risk Characterization Report of the YNPS to be issued in February 2008.

The result of the Method 3 Risk Characterization continues to show that the cumulative risk meets the DEP levels for an acceptable risk at the YNPS.

Should you require additional information please contact me at 413-424-5261 Extension 303 or Joseph Bourassa at 413-424-5261 Extension 302.

Sincerely,

YANKEE ATOMIC ELECTRIC CO

Robert Mitchell for R.M. Mitchell

Robert Mitchell
ISFSI Manager

cc: L. Hansen, MA DEP (WRO)
Public Repository at Greenfield Community College

Appendix A
Sampling Results – Chemical

List of Tables

Table A.1.1	Summary Statistics of All Soil Sample Results – Background Area
Table A.1.2	Soil Sample Results – Background Area
Table A.1.3	Summary Statistics of All Soil Sample Results – YAEC BUD/TSCA
Table A.1.4	Soil Sample Results – YAEC BUD/TSCA
Table A.1.5	Summary Statistics of All Soil Sample Results – YAEC SCFA/TSCA
Table A.1.6	Soil Sample Results – YAEC SCFA/TSCA
Table A.1.7	Summary Statistics of All Soil Sample Results – YAEC Non-BUD/TSCA
Table A.1.8	Soil Sample Results – YAEC Non-BUD/TSCA
Table A.1.9	Summary Statistics of All Soil Sample Results – TransCanada Property Study Area
Table A.1.10	Soil Sample Results – TransCanada Property Study Area
Table A.1.11	Summary Statistics of All Soil Sample Results – TransCanada Inside BUD Area
Table A.1.12	Soil Sample Results – TransCanada Inside BUD Area
Table A.1.13	Summary Statistics of Soil Sample Results – TransCanada Shoreline Study Area
Table A.1.14	Soil Sample Results – TransCanada Shoreline Study Area
Table A.2.1	Summary Statistics of All Sediment Sample Results – Background Area
Table A.2.2	Sediment Sample Results – Background Area
Table A.2.3	Summary Statistics of All Sediment Sample Results – Deerfield River Adjacent to Site
Table A.2.4	Sediment Sample Results – Deerfield River Adjacent to Site
Table A.2.5	Summary Statistics of All Sediment Sample Results – Deerfield River Downstream from Site
Table A.2.6	Sediment Sample Results – Deerfield River Downstream from Site
Table A.2.7	Summary Statistics of All Sediment Sample Results – Sherman Reservoir Study Area
Table A.2.8	Sediment Sample Results – Sherman Reservoir Study Area
Table A.2.9	Summary Statistics of All Sediment Sample Results – TransCanada WSD Area
Table A.2.10	Sediment Sample Results – TransCanada WSD Study Area
Table A.2.11	Summary Statistics of All Sediment Sample Results – Wheeler Brook Study Area
Table A.2.12	Sediment Sample Results – Wheeler Brook Study Area
Table A.3.1	Summary Statistics of All Surface Water Sample Results – Background Area
Table A.3.2	Surface Water Sample Results – Background Area
Table A.3.3	Summary Statistics of All Surface Water Sample Results – Deerfield River Adjacent to Site Study Area
Table A.3.4	Surface Water Sample Results – Deerfield River Adjacent to Site
Table A.3.5	Summary Statistics of All Surface Water Sample Results – Deerfield River Downstream from Site Area
Table A.3.6	Surface Water Sample Results – Deerfield River Downstream from Site
Table A.3.7	Summary Statistics of All Surface Water Sample Results – Sherman Reservoir Study Area
Table A.3.8	Surface Water Sample Results – Sherman Reservoir Study Area
Table A.3.9	Summary Statistics of All Surface Water Sample Results – TransCanada WSD Area
Table A.3.10	Surface Water Sample Results – TransCanada WSD Study Area
Table A.3.11	Summary Statistics of All Surface Water Sample Results – Wheeler Brook Study Area
Table A.3.12	Surface Water Sample Results – Wheeler Brook Study Area
Table A.4.1	Summary Statistics of All Groundwater Sample Results – YAEC BUD/TSCA
Table A.4.2	Groundwater Sample Results – YAEC BUD/TSCA
Table A.4.3	Summary Statistics of All Groundwater Sample Results – YAEC Non-BUD/TSCA
Table A.4.4	Groundwater Sample Results – YAEC Non-BUD/TSCA

Table A.4.5	Summary Statistics of All Groundwater Sample Results – TransCanada Inside BUD Study Area
Table A.4.6	Groundwater Sample Results – TransCanada Inside BUD Area
Table A.4.7	Summary Statistics of All Groundwater Sample Results – TransCanada Property Study Area
Table A.4.8	Groundwater Sample Results – TransCanada Property Study Area
Table A.4.9	Summary Statistics of All Groundwater Sample Results – Wheeler Brook Study Area
Table A.4.10	Groundwater Sample Results – Wheeler Brook Study Area

Appendix Table A.1.1
 Summary Statistics of All Soil Sample Results --
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	Summary Statistics of All Soil Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Dioxin / Furan (pg/g)</i>						
1,2,3,4,6,7,8-HpCDD	1	2	50%	3.80	2.38	3.80
1,2,3,4,6,7,8-HpCDF	1	2	50%	1.10	0.63	1.10
1,2,3,4,7,8,9-HpCDF	0	2	0%		0.073	
1,2,3,4,7,8-HxCDD	0	2	0%		0.10	
1,2,3,6,7,8-HxCDD	1	2	50%	0.30	0.20	0.30
1,2,3,7,8,9-HxCDD	1	2	50%	0.35	0.22	0.35
1,2,3,4,7,8-HxCDF	1	2	50%	0.57	0.36	0.57
1,2,3,6,7,8-HxCDF	1	2	50%	0.21	0.12	0.21
1,2,3,7,8,9-HxCDF	0	2	0%		0.05	
2,3,4,6,7,8-HxCDF	1	2	50%	0.28	0.16	0.28
1,2,3,4,5,6,7,8-OCDD	1	2	50%	21.00	11.68	21.00
1,2,3,4,5,6,7,8-OCDF	1	2	50%	1.70	0.93	1.70
1,2,3,7,8-PeCDD	0	2	0%		0.08	
1,2,3,7,8-PeCDF	0	2	0%		0.09	
2,3,4,7,8-PeCDF	1	2	50%	0.38	0.23	0.38
2,3,7,8-TCDD	0	2	0%		0.16	
2,3,7,8-TCDF	0	2	0%		0.13	
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	7	0%		0.13	
Acenaphthylene	1	7	14%	0.14	0.13	0.14
Unadjusted C19-C36 Aliphatics	0	7	0%		26.37	
Unadjusted C9-C18 Aliphatics	0	7	0%		26.37	
Anthracene	0	7	0%		0.13	
Adjusted C11-C22 Aromatics	0	7	0%		26.37	
Unadjusted C11-C22 Aromatics	0	8	0%		32.76	
Benzo(a)anthracene	0	7	0%		0.13	
Benzo(a)pyrene	0	7	0%		0.13	
Benzo(b)fluoranthene	2	7	29%	0.030	0.10	0.034
Benzo(g,h,i)perylene	0	7	0%		0.13	
Benzo(k)fluoranthene	0	7	0%		0.13	
Chrysene	3	7	43%	0.026	0.083	0.046
Dibenzo(a,h)anthracene	0	7	0%		0.13	
Fluoranthene	6	7	86%	0.030	0.055	0.082
Fluorene	0	7	0%		0.13	
Indeno(1,2,3-cd)pyrene	0	7	0%		0.13	
2-Methylnaphthalene	0	7	0%		0.13	
Naphthalene	0	7	0%		0.13	
Phenanthrene	0	7	0%		0.13	
Pyrene	0	7	0%		0.13	
Adjusted TPH	0	7	0%		26.37	
Unadjusted TPH	0	7	0%		26.37	
<i>Herbicide (µg/Kg)</i>						
2,4-D	0	4	0%		3.35	
Dalapon	0	4	0%		3.35	
2,4-DB	0	5	0%		17.68	
Dicamba	0	5	0%		17.68	
Dichloroprop	0	5	0%		17.68	
Dinoseb	0	5	0%		17.68	
MCPA	0	4	0%		335.00	
MCPB	0	4	0%		335.00	
MCPP	0	4	0%		335.00	
2,4,5-T	0	5	0%		17.68	
2,4,5-TP (Silvex)	0	5	0%		17.68	
<i>Inorganics (mg/Kg)</i>						
Antimony	1	7	14%	4.75	1.73	4.75
Arsenic	27	28	96%	0.70	2.39	5.61
Beryllium	4	28	14%	0.19	0.47	0.48
Boron	2	2	100%	18.00	18.50	19.00
Cadmium	5	27	19%	0.25	0.50	0.79
Chromium	28	28	100%	1.94	14.90	34.00
Copper	22	28	79%	2.30	6.76	18.70
Lead	27	27	100%	0.97	17.76	101.00
Lithium	2	2	100%	23.00	24.50	26.00
Mercury	8	28	29%	0.06	0.34	0.32
Nickel	28	28	100%	3.80	10.42	29.00
Selenium	4	28	14%	1.41	1.62	2.45
Silver	4	26	15%	1.36	0.52	3.22
Thallium	3	27	11%	0.41	0.60	0.73
Zinc	28	28	100%	30.80	52.85	75.80

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.1
Summary Statistics of All Soil Sample Results --
Background Area
YNPS Rowe, MA

Oil or Hazardous Material	Summary Statistics of All Soil Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	0	13	0%		183.54	
Acenaphthylene	1	13	8%	96.50	182.85	96.50
Aniline	0	13	0%		183.54	
Anthracene	1	13	8%	48.00	179.12	48.00
Atrazine	0	4	0%		174.00	
Azobenzene	0	13	0%		183.54	
Benzidine	0	3	0%		2266.67	
Benzo(a)anthracene	1	13	8%	232.00	193.27	232.00
Benzo(a)pyrene	2	13	15%	132.00	185.92	219.00
Benzo(b)fluoranthene	2	13	15%	384.00	229.46	533.00
Benzo(g,h,i)perylene	2	13	15%	71.80	172.52	105.00
Benzo(k)fluoranthene	2	13	15%	133.00	185.85	217.00
Benzoic acid	2	13	15%	2290.00	941.19	3500.00
Benzyl alcohol	0	13	0%		297.00	
Bis(2-chloroethoxy)methane	0	13	0%		183.54	
Bis(2-chloroethyl)ether	0	13	0%		183.54	
Bis(2-ethylhexyl)phthalate	0	13	0%		183.54	
4-Bromophenyl phenyl ether	0	13	0%		183.54	
Butyl benzyl phthalate	0	13	0%		183.54	
Carbazole	0	13	0%		183.54	
4-Chloro-3-methylphenol	0	13	0%		297.00	
4-Chloroaniline	0	13	0%		297.00	
Bis(2-chloroisopropyl) ether	0	13	0%		297.00	
2-Chloronaphthalene	0	13	0%		183.54	
2-Chlorophenol	0	13	0%		183.54	
4-Chlorophenyl phenyl ether	0	13	0%		183.54	
Chrysene	3	13	23%	76.90	190.30	337.00
3+4-Methylphenol	0	13	0%		183.54	
Dibenzo(a,h)anthracene	0	13	0%		183.54	
Dibenzofuran	0	13	0%		183.54	
1,2-Dichlorobenzene	0	13	0%		183.54	
1,3-Dichlorobenzene	0	13	0%		183.54	
1,4-Dichlorobenzene	0	13	0%		183.54	
3,3'-Dichlorobenzidine	0	12	0%		271.75	
2,4-Dichlorophenol	0	13	0%		183.54	
Diethyl phthalate	0	13	0%		183.54	
Dimethyl phthalate	0	13	0%		183.54	
2,4-Dimethylphenol	0	13	0%		183.54	
Di-n-butyl phthalate	0	13	0%		183.54	
2,4-Dinitrophenol	0	13	0%		613.92	
2,4-Dinitrotoluene	0	13	0%		183.54	
2,6-Dinitrotoluene	0	13	0%		183.54	
Di-n-octyl phthalate	0	13	0%		183.54	
Fluoranthene	6	13	46%	47.80	216.37	552.00
Fluorene	0	13	0%		183.54	
Hexachlorobenzene	0	13	0%		183.54	
Hexachlorobutadiene	0	13	0%		183.54	
Hexachlorocyclopentadiene	0	9	0%		156.78	
Hexachloroethane	0	13	0%		183.54	
Indeno(1,2,3-cd)pyrene	1	13	8%	119.00	184.58	119.00
Isophorone	0	13	0%		183.54	
4,6-Dinitro-2-methylphenol	0	10	0%		428.10	
1-Methylnaphthalene	0	7	0%		132.79	
2-Methylnaphthalene	0	13	0%		183.54	
2-Methylphenol	0	13	0%		183.54	
Naphthalene	0	13	0%		183.54	
2-Nitroaniline	0	13	0%		613.92	
3-Nitroaniline	0	13	0%		613.92	
4-Nitroaniline	0	13	0%		613.92	
Nitrobenzene	0	13	0%		183.54	
2-Nitrophenol	0	13	0%		183.54	
4-Nitrophenol	0	13	0%		613.92	
N-Nitroso-di-n-propylamine	0	13	0%		183.54	
N-Nitrosodiphenylamine	0	13	0%		183.54	
N-Nitrosodimethylamine	0	13	0%		297.00	
Pentachlorophenol	0	13	0%		613.92	
Phenanthrene	4	13	31%	74.20	210.41	357.00
Phenol	0	13	0%		183.54	
Pyrene	4	13	31%	64.80	251.66	773.00
Pyridine	0	7	0%		133.00	
1,2,4-Trichlorobenzene	0	13	0%		183.54	
2,4,5-Trichlorophenol	0	13	0%		183.54	
2,4,6-Trichlorophenol	0	13	0%		183.54	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.1
 Summary Statistics of All Soil Sample Results --
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	Summary Statistics of All Soil Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	1	8	13%	4.95	2.10	4.95
Adjusted C9-C12 Aliphatics	8	8	100%	0.36	7.77	35.30
Unadjusted C5-C8 Aliphatics	8	8	100%	1.81	2.89	4.95
Unadjusted C9-C12 Aliphatics	8	8	100%	1.02	24.17	124.00
Adjusted C9-C10 Aromatics	7	8	88%	1.00	16.43	89.00
Benzene	0	7	0%		0.12	
Ethylbenzene	0	7	0%		0.12	
Methyl-t-butyl ether	0	7	0%		0.12	
Naphthalene	0	7	0%		0.12	
Toluene	1	7	14%	0.84	0.22	0.84
o-Xylene	0	7	0%		0.12	
m+p-Xylenes	0	7	0%		0.23	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.2
 Soil Sample Results - Dioxin-Furan
 Background Area
 YNPS Rowe, MA

Sample ID	SB160006I	SB1600203F
Upper Depth (in.)	0	24
Lower Depth (in.)	6	36
Date Sampled	10/21/2003	10/21/2003
Dioxin/Furan (pg/g)		
1,2,3,4,6,7,8-HpCDD	3.8 J	1.9 U
1,2,3,4,6,7,8-HpCDF	1.1 J	0.3 UJQ
1,2,3,6,7,8-HxCDD	0.18 U	0.3 J
1,2,3,7,8,9-HxCDD	0.17 U	0.35 J
1,2,3,4,7,8-HxCDF	0.57 J	0.29 UJQ
1,2,3,6,7,8-HxCDF	0.21 J	0.075 U
2,3,4,6,7,8-HxCDF	0.28 J	0.089 U
1,2,3,4,5,6,7,8-OCDD	21 J	4.7 U
1,2,3,4,5,6,7,8-OCDF	1.7 J	0.3 UQ
2,3,4,7,8-PeCDF	0.38 J	0.14 UJQ

Appendix Table A.1.2
 Soil Sample Results - EPH
 Background Area
 YNPS Rowe, MA

Sample ID	SB170-006I	SB171-006I	SB172-006I	SB173-006I	SB174-006I	SB175-006I	SB176-006I	SB177-006I
Upper Depth (in.)	0	0	0	0	0	0	0	0
Lower Depth (in.)	6	6	6	6	6	6	6	6
Date Sampled	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/5/2006	7/5/2006	7/5/2006	7/5/2006
EPH (mg/Kg)								
Acenaphthylene	0.169 U	0.282 U	0.136 J	0.328 U	0.251 UJ	R	0.267 UJ	0.273 UJ
Benzo(b)fluoranthene	0.169 U	0.0339 J	0.0298 J	0.328 U	0.251 UJ	R	0.267 UJ	0.273 UJ
Chrysene	0.169 U	0.0255 J	0.0298 J	0.0461 J	0.251 UJ	R	0.267 UJ	0.273 UJ
Fluoranthene	0.169 U	0.0537 J	0.0461 J	0.0823 J	0.0302 J	R	0.0348 J	0.0519 J

Appendix Table A.1.2
 Soil Sample Results - Inorganics
 Background Area
 YNPS Rowe, MA

Sample ID		SB1600006I	SB1600203F	SB1610006I	SB1610203F	FD204-102103	SB1620006I	SB1620102F	SB1630006I	SB1630102F	FD2010006I	SB1640006I
Upper Depth (in.)		0	24	0	24	0	0	12	0	12	0	0
Lower Depth (in.)		6	36	6	36	6	6	24	6	24	6	6
Date Sampled	MCP S-1	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003
Inorganics (mg/Kg)												
Antimony	20	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	1.8	1.8	2.9	1.5	1.7	1.5	1.6	1.6	0.7	2.2	2.5
Beryllium	0.7	1.1 U	1.1 U	1.1 U	0.87 U	1.6 U	1.2 U	1 U	1.9 U	0.96 U	0.81 U	1.3 U
Boron		18	19									
Cadmium	2	1 U	1 U	1.1 U	0.83 U	1.5 U	1.1 U	0.99 U	1.8 U	0.91 U	0.77 U	1.2 U
Chromium	30	11	14	13	14	21	14	17	6.3 J	15 J	10 J	20 J
Copper		1.7 U	1.6 U	1.7 U	6.4	2.4 U	1.8 U	2.6	5.9 J	3.6 J	19 J	8.5 J
Lead	300	1.9 J	2.4 J	0.97 J	1.3 J	3.8 J	1.2 J	1.4 J	3.4 J	2 J	2.6 J	R
Lithium		23	26									
Mercury	20	0.8 U	0.79 U	0.69 U	0.51 U	1.2 U	0.87 U	0.69 U	1.4 U	0.76 U	0.56 U	0.96 U
Nickel	20	5.5	7.1	3.8	11	11	8.1	9.3	9.3	17	16	12
Selenium	400	3.2 U	3.2 U	3.3 U	2.6 U	4.8 U	3.6 U	3.1 U	5.7 U	2.8 U	2.4 U	3.8 U
Silver	100	0.33 U	0.32 U	0.34 U	0.26 U	0.48 U	0.36 U	0.31 U	0.58 U	0.29 U	0.24 U	0.38 U
Thallium	8	0.76 U	0.75 U	0.78 U	0.61 U	1.1 U	0.84 U	0.73 U	1.3 U	0.67 U	0.57 U	0.89 U
Zinc	2500	66	69	39	51	77	62	62	54	60	53	49

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blanks indicate not analyzed

Appendix Table A.1.2
 Soil Sample Results - Inorganics
 Background Area
 YNPS Rowe, MA

Sample ID		SB1640203F	SB16500061	SB1650102F	SB1660006I	SB1660102F	FD2000006I	SB1670006I	SB1670203F	SB1680006I	SB1680203F	SB1690006I
Upper Depth (in.)		24	0	12	0	12	0	0	24	0	24	0
Lower Depth (in.)		36	72	24	6	24	6	6	36	6	36	6
Date Sampled	MCP S-1	10/16/2003	10/14/2003	10/14/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/16/2003	10/16/2003	10/16/2003
Inorganics (mg/Kg)												
Antimony	20	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	1.2	2.1	1.6	1.9	1.6	2	2.1	1.2	3.2	1.3	2
Beryllium	0.7	0.95 U	1.4 U	1.1 U	1.4 U	1.1 U	1 U	0.97 U	1.1 U	1 U	0.89 U	1.2 U
Boron												
Cadmium	2	0.9 U	1.3 U	1 U	1.4 U	1.1 U	0.95 U	0.93 U	1 U	0.98 U	0.84 U	1.2 U
Chromium	30	29 J	7.9	17	11	16	15	15	15	15 J	23 J	15 J
Copper		10 J	2.1 U	2.4	4.5 J	1.7 U	3.4 J	3.8 J	2.3 J	9.3 J	11 J	7.4 J
Lead	300	2.6 J	55	31	57 J	3.8 J	4.1 J	4.3 J	1.9 J	6.7 J	2.4 J	1.9 J
Lithium												
Mercury	20	0.73 U	1.1 U	0.83 U	1.1 U	0.88 U	0.71 U	0.71 U	0.81 U	0.73 U	0.61 U	0.96 U
Nickel	20	20	6.5	7.5	10 J	8.4 J	9.6 J	9.3 J	8.9 J	11	28	10
Selenium	400	2.8 U	4.1 U	3.1 U	4.2 U	3.4 U	3 U	2.9 U	3.1 U	3.1 U	2.6 U	3.6 U
Silver	100	0.29 U	0.42 U	0.32 U	0.43 U	0.34 U	0.3 U	0.29 U	0.31 U	0.31 U	0.27 U	0.37 U
Thallium	8	0.66 U	0.97 U	1.5 U	1 U	0.79 U	0.7 U	0.68 U	0.73 U	0.72 U	0.62 U	0.86 U
Zinc	2500	71	36	45	45 J	57 J	58 J	59 J	54 J	50	67	58

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blanks indicate not analyzed

Appendix Table A.1.2
 Soil Sample Results - Inorganics
 Background Area
 YNPS Rowe, MA

Sample ID		SB1690203F	SB170-006I	SB171-006I	SB172-006I	SB173-006I	SB174-006I	SB175-006I	SB176-006I	SB177-006I
Upper Depth (in.)		24	0	0	0	0	0	0	0	0
Lower Depth (in.)		36	6	6	6	6	6	6	6	6
Date Sampled	MCP S-1	10/16/2003	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/5/2006	7/5/2006	7/5/2006	7/5/2006
Inorganics (mg/Kg)										
Antimony	20	R	2.31 UJ	4.75 J	2.83 UJ	2.88 UJ	2.39 U	R	1.62 U	2.63 U
Arsenic	20	1.1	3.85	4.38	2.83 U	4.78	5.61	3.35 J	4.03	4.39
Beryllium	0.7	0.87 U	0.194 U	0.413 U	0.377 U	0.434 U	0.332 J	0.482 J	0.194 J	0.249 J
Boron										
Cadmium	2	0.83 U	0.293	0.421	0.245 J	0.79	0.692	R	0.317 U	0.383 U
Chromium	30	34 J	12.5	15.9	1.94	18.6	13.4	5.58 J	14.3	12.8
Copper		10 J	10.7	8.55	5.09	15.6	12.6	18.7 J	11.6	13.3
Lead	300	2.9 J	17	19.3	31.2	24.4	25.4	101 J	27.2	49.9
Lithium										
Mercury	20	0.65 U	0.0581 J	0.0719 J	0.157	0.106 J	0.155	0.318 J	0.144	0.107
Nickel	20	29	8.4	7.11	4.93	10.6	6.67	7.29 J	6.51	8.56
Selenium	400	2.6 U	1.66 U	2.53 U	2.83 U	3.34 U	1.57 J	2.45 J	1.42 J	1.41 J
Silver	100	0.26 U	1.64 J	3.22 J	R	2 J	1.36 J	R	1.76 UJ	1.91 UJ
Thallium	8	0.73 J	1.66 U	2.53 U	0.49 J	3.34 U	0.411 J	R	2.64 U	2.87 U
Zinc	2500	64	41	53.8	30.8	75.8	33.8	34.3 J	44	48.3

> MCP S-1

Appendix Table A.1.2
 Soil Sample Results - SVOC
 Background Area
 YNPS Rowe, MA

Sample ID		SB1610006I	SB1610203F	SB1640006I	SB1640203F	FD2000006I	SB1670006I	SB1670203F	SB170-006I	SB171-006I	SB172-006I	SB173-006I
Upper Depth (in.)		0	24	0	24	0	0	24	0	0	0	0
Lower Depth (in.)		6	36	6	36	6	6	36	6	6	6	6
Date Sampled	MCP S-1	10/21/2003	10/21/2003	10/16/2003	10/16/2003	10/15/2003	10/15/2003	10/15/2003	7/6/2006	7/6/2006	7/6/2006	7/6/2006
SVOC (µg/Kg)												
Acenaphthylene	100000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	96.5 J	429 U	342 U	410 U
Anthracene	1000000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	48 J	429 U	342 U	410 U
Benzo(a)anthracene	7000	530 U	400 U	590 U	430 U	460 UJ	460 UJ	500 UJ	232	429 U	342 U	410 U
Benzo(a)pyrene	2000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	219	132 J	342 U	410 U
Benzo(b)fluoranthene	7000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	384	533	342 U	410 U
Benzo(g,h,i)perylene	1000000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	105 J	71.8 J	342 U	410 U
Benzo(k)fluoranthene	70000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	217	133 J	342 U	410 U
Benzoic acid		2600 U	1900 U	3500 J	2100 UJ	2200 UJ	2200 UJ	2400 UJ	211 U	429 U	342 U	410 U
Chrysene	7000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	337	199 J	342 U	76.9 J
Fluoranthene	1000000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	552	330 J	342 U	118 J
Indeno(1,2,3-cd)pyrene	7000	530 U	400 U	590 U	430 U	460 U	460 U	500 U	119 J	429 U	342 U	410 U
Phenanthrene	1000000	530 U	400 U	590 UJ	430 UJ	460 UJ	460 U	500 UJ	357	290 J	342 U	410 U
Pyrene	1000000	530 U	400 U	590 UJ	430 UJ	460 UJ	460 U	500 UJ	773	418 J	342 U	410 U

Appendix Table A.1.2
 Soil Sample Results - SVOC
 Background Area
 YNPS Rowe, MA

Sample ID		SB174-006I	SB175-006I	SB176-006I	SB177-006I
Upper Depth (in.)		0	0	0	0
Lower Depth (in.)		6	6	6	6
Date Sampled	MCP S-1	7/5/2006	7/5/2006	7/5/2006	7/5/2006
SVOC (µg/Kg)					
Acenaphthylene	100000	171 U	R	199 U	100 U
Anthracene	1000000	171 U	R	199 U	100 U
Benzo(a)anthracene	7000	171 U	R	199 U	100 U
Benzo(a)pyrene	2000	171 U	R	199 U	100 UJ
Benzo(b)fluoranthene	7000	171 U	R	199 U	100 UJ
Benzo(g,h,i)perylene	1000000	171 U	R	199 U	100 UJ
Benzo(k)fluoranthene	70000	171 U	R	199 U	100 UJ
Benzoic acid		2290	R	199 U	100 U
Chrysene	7000	171 U	R	199 U	100 U
Fluoranthene	1000000	59.7 J	R	47.8 J	79.3 J
Indeno(1,2,3-cd)pyrene	7000	171 U	R	199 U	100 UJ
Phenanthrene	1000000	83.6 J	R	199 U	74.2 J
Pyrene	1000000	64.8 J	R	199 U	85.3 J

Appendix Table A.1.2
 Soil Sample Results - VPH
 Background Area
 YNPS Rowe, MA

Sample ID		SB170-006I	SB171-006I	SB172-006I	SB173-006I	SB174-006I	SB175-006I	SB176-006I	SB177-006I
Upper Depth (in.)		0	0	0	0	0	0	0	0
Lower Depth (in.)		6	6	6	6	6	6	6	6
Date Sampled	MCP S-1	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/5/2006	7/5/2006	7/5/2006	7/5/2006
VPH (mg/Kg)									
Adjusted C5-C8 Aliphatics		2.35 U	4.07 U	5.06 U	3.25 U	2.57 U	4.95 J	3.35 U	2.98 U
Adjusted C9-C12 Aliphatics		2.6	2.49	35.3	0.364 J	6.18	10.4 J	3.38	1.45
Unadjusted C5-C8 Aliphatics	100	1.81 J	2.84 J	2.32 J	3.13 J	2.57 J	4.95 J	3.01 J	2.51 J
Unadjusted C9-C12 Aliphatics	1000	5.72	6.39	124	1.02 J	17.9	27	8.9	2.45
Adjusted C9-C10 Aromatics	100	3.12	3.89	89	1.08 U	11.8	16.6 J	5.52	0.996
Toluene		0.157 U	0.271 U	0.337 U	0.839	0.228 U	R	0.223 U	0.199 U

Appendix Table A.1.3
 Summary Statistics of All Soil Sample Results --
 Plant RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Dioxin / Furan (pg/g)</i>						
1,2,3,4,6,7,8-HpCDD	15	27	56%	2.70	6.93	43.00
Total HpCDDs	5	5	100%	9.90	16.98	25.00
1,2,3,4,6,7,8-HpCDF	15	27	56%	1.40	3.87	18.00
1,2,3,4,7,8,9-HpCDF	7	27	26%	0.16	0.84	5.20
Total HpCDFs	5	5	100%	6.40	17.02	28.00
1,2,3,4,7,8-HxCDD	1	27	4%	0.24	0.25	0.24
1,2,3,6,7,8-HxCDD	1	27	4%	0.21	0.33	0.21
1,2,3,7,8,9-HxCDD	0	27	0%		0.33	
Total HxCDDs	0	5	0%		0.88	
1,2,3,4,7,8-HxCDF	9	27	33%	0.20	1.29	8.50
1,2,3,6,7,8-HxCDF	3	27	11%	0.17	0.38	1.70
1,2,3,7,8,9-HxCDF	0	27	0%		0.21	
2,3,4,6,7,8-HxCDF	2	27	7%	0.60	0.34	1.50
Total HxCDFs	4	5	80%	2.60	6.03	10.00
1,2,3,4,5,6,7,8-OCDD	16	27	59%	16.00	53.21	320.00
1,2,3,4,5,6,7,8-OCDF	9	27	33%	2.60	9.91	71.00
1,2,3,7,8-PeCDD	0	27	0%		0.24	
Total PeCDDs	0	5	0%		0.88	
1,2,3,7,8-PeCDF	2	27	7%	0.55	0.32	1.20
2,3,4,7,8-PeCDF	1	27	4%	1.50	0.35	1.50
Total PeCDFs	4	5	80%	1.70	3.39	6.10
2,3,7,8-TCDD	2	27	7%	1.00	0.55	4.20
Total TCDDs	0	5	0%		0.18	
2,3,7,8-TCDF	6	27	22%	0.45	0.44	3.10
Total TCDFs	4	5	80%	4.40	5.48	8.70
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	11	57	19%	0.025	0.11	0.56
Acenaphthylene	1	57	2%	0.06	0.08	0.06
Unadjusted C19-C36 Aliphatics	56	190	29%	7.84	33.52	1010.00
Unadjusted C9-C18 Aliphatics	22	190	12%	9.38	27.30	628.00
Anthracene	18	57	32%	0.022	0.12	0.92
Adjusted C11-C22 Aromatics	6	28	21%	31.00	36.21	389.00
Unadjusted C11-C22 Aromatics	58	190	31%	7.17	37.94	788.00
Benzo(a)anthracene	11	57	19%	0.045	0.18	3.21
Benzo(a)pyrene	15	57	26%	0.026	0.15	2.04
Benzo(b)fluoranthene	19	57	33%	0.015	0.12	1.69
Benzo(g,h,i)perylene	11	57	19%	0.023	0.11	0.75
Benzo(k)fluoranthene	16	57	28%	0.033	0.15	2.23
Chrysene	20	57	35%	0.016	0.18	3.18
Dibenzo(a,h)anthracene	3	57	5%	0.031	0.085	0.29
Fluoranthene	29	57	51%	0.019	0.30	5.31
Fluorene	11	57	19%	0.021	0.12	0.77
Indeno(1,2,3-cd)pyrene	7	57	12%	0.067	0.11	0.82
2-Methylnaphthalene	6	57	11%	0.020	0.081	0.15
Naphthalene	2	57	4%	0.095	0.082	0.11
Phenanthrene	20	57	35%	0.039	0.28	2.41
Pyrene	26	57	46%	0.056	0.27	4.34
Adjusted TPH	23	57	40%	28.80	120.52	1210.00
Unadjusted TPH	24	57	42%	28.80	121.87	1220.00
<i>Hydrazine (µg/Kg)</i>						
Hydrazine	0	3	0%		130.00	
UDMH	0	3	0%		263.33	
MMH	0	3	0%		130.00	
<i>Inorganics (mg/Kg)</i>						
Antimony	0	31	0%		2.66	
Arsenic	98	112	88%	0.66	2.96	27.00
Beryllium	3	130	2%	0.34	0.29	0.61
Boron	0	3	0%		5.00	
Cadmium	2	130	2%	2.50	1.08	2.50
Chromium	116	121	96%	5.00	13.03	49.00
Copper	98	130	75%	2.10	13.87	94.00
Lead	131	137	96%	0.46	9.24	83.20
Lithium	3	3	100%	13.00	16.00	18.00
Mercury	13	130	10%	0.01	0.23	0.50
Nickel	81	121	67%	4.90	12.44	110.00
Selenium	10	130	8%	5.30	4.65	13.00
Silver	0	130	0%		0.44	
Thallium	0	107	0%		1.90	
Zinc	37	113	33%	26.00	86.73	750.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.3
 Summary Statistics of All Soil Sample Results --
 Plant RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Inorganics by Toxicity Characteristic Leaching Procedure (mg/L)</i>						
Antimony	1	4	25%	0.0022	0.0024	0.0022
Arsenic	0	4	0%		0.0038	
Barium	4	4	100%	0.27	0.37	0.50
Beryllium	1	4	25%	0.00050	0.00031	0.00050
Cadmium	1	4	25%	0.0013	0.00068	0.0013
Chromium	2	4	50%	0.0012	0.0012	0.0016
Copper	1	4	25%	0.0090	0.0044	0.0090
Lead	2	4	50%	0.0014	0.0040	0.0036
Mercury	0	4	0%		0.00020	
Nickel	2	4	50%	0.0046	0.0058	0.0076
Selenium	1	4	25%	0.0054	0.0037	0.0054
Silver	0	4	0%		0.0025	
Thallium	0	4	0%		0.0025	
Zinc	4	4	100%	0.042	0.73	2.35
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	554	0%		7.53	
Aroclor-1268	0	554	0%		7.53	
Aroclor-1016	0	705	0%		11.67	
Aroclor-1221	0	705	0%		11.67	
Aroclor-1232	0	705	0%		11.67	
Aroclor-1242	0	705	0%		11.67	
Aroclor-1248	0	705	0%		11.67	
Aroclor-1254	517	705	73%	10.10	353.48	3100.00
Aroclor-1260	410	705	58%	3.50	119.13	1970.00
<i>Pesticides (µg/Kg)</i>						
Aldrin	0	1	0%		9.30	
alpha-BHC	0	1	0%		9.30	
beta-BHC	0	1	0%		9.30	
delta-BHC	0	1	0%		9.30	
gamma-BHC (Lindane)	0	1	0%		9.30	
Chlordane	0	1	0%		46.40	
alpha Chlordane	0	1	0%		9.30	
gamma Chlordane	0	1	0%		9.30	
4,4'-DDD	0	1	0%		9.30	
4,4'-DDE	0	1	0%		9.30	
4,4'-DDT	0	1	0%		9.30	
Dieldrin	0	1	0%		9.30	
Endosulfan I	0	1	0%		9.30	
Endosulfan II	0	1	0%		9.30	
Endosulfan sulfate	0	1	0%		9.30	
Endrin	0	1	0%		9.30	
Endrin aldehyde	0	1	0%		9.30	
Endrin ketone	0	1	0%		9.30	
Heptachlor	0	1	0%		9.30	
Heptachlor epoxide	0	1	0%		9.30	
Methoxychlor	0	1	0%		9.30	
Toxaphene	0	1	0%		46.40	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.3
 Summary Statistics of All Soil Sample Results --
 Plant RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	8	73	11%	80.00	194.12	530.00
Acenaphthylene	10	73	14%	1.14	215.89	822.00
Aniline	0	66	0%		189.62	
Anthracene	17	73	23%	23.80	237.70	1500.00
Atrazine	0	11	0%		111.82	
Azobenzene	0	73	0%		189.59	
Benzidine	2	44	5%	214.00	1516.16	234.00
Benzo(a)anthracene	26	73	36%	21.50	354.11	2210.00
Benzo(a)pyrene	24	73	33%	36.90	327.82	2830.00
Benzo(b)fluoranthene	22	73	30%	81.00	359.69	3210.00
Benzo(g,h,i)perylene	17	73	23%	78.00	234.97	837.00
Benzo(k)fluoranthene	22	73	30%	76.00	343.01	2850.00
Benzoic acid	0	63	0%		818.41	
Benzyl alcohol	0	73	0%		359.52	
Bis(2-chloroethoxy)methane	0	73	0%		189.59	
Bis(2-chloroethyl)ether	0	73	0%		189.59	
Bis(2-ethylhexyl)phthalate	1	73	1%	448.00	198.88	448.00
4-Bromophenyl phenyl ether	0	73	0%		189.59	
Butyl benzyl phthalate	0	73	0%		189.59	
Carbazole	6	73	8%	89.00	196.88	810.00
4-Chloro-3-methylphenol	0	72	0%		358.89	
4-Chloroaniline	0	73	0%		359.52	
Bis(2-chloroisopropyl) ether	0	73	0%		359.52	
2-Chloronaphthalene	0	73	0%		189.59	
2-Chlorophenol	0	72	0%		189.44	
4-Chlorophenyl phenyl ether	0	73	0%		189.59	
Chrysene	25	73	34%	40.30	395.33	2840.00
Dibenzo(a,h)anthracene	7	73	10%	92.00	186.32	210.00
Dibenzofuran	3	73	4%	110.00	196.77	450.00
1,2-Dichlorobenzene	0	25	0%		203.46	
1,3-Dichlorobenzene	0	25	0%		203.46	
1,4-Dichlorobenzene	0	25	0%		203.46	
3,3'-Dichlorobenzidine	0	72	0%		356.39	
2,4-Dichlorophenol	0	72	0%		189.44	
Diethyl phthalate	0	73	0%		189.59	
Dimethyl phthalate	0	73	0%		189.59	
2,4-Dimethylphenol	0	72	0%		189.44	
Di-n-butyl phthalate	0	73	0%		189.59	
2,4-Dinitrophenol	0	72	0%		844.10	
2,4-Dinitrotoluene	0	73	0%		189.59	
2,6-Dinitrotoluene	0	73	0%		189.59	
Di-n-octyl phthalate	0	73	0%		189.59	
Fluoranthene	33	73	45%	31.30	601.37	4090.00
Fluorene	5	73	7%	100.00	199.12	750.00
Hexachlorobenzene	0	73	0%		189.59	
Hexachlorobutadiene	0	73	0%		189.59	
Hexachlorocyclopentadiene	0	60	0%		188.58	
Hexachloroethane	0	73	0%		189.59	
Indeno(1,2,3-cd)pyrene	15	73	21%	95.00	234.03	892.00
Isophorone	1	73	1%	135.00	189.59	135.00
4,6-Dinitro-2-methylphenol	0	68	0%		838.60	
1-Methylnaphthalene	1	12	8%	185.00	117.88	185.00
2-Methylnaphthalene	2	73	3%	100.00	191.97	348.00
3+4-Methylphenol	0	72	0%		189.44	
2-Methylphenol	0	72	0%		189.44	
Naphthalene	4	73	5%	75.00	191.94	420.00
2-Nitroaniline	0	73	0%		846.23	
3-Nitroaniline	0	73	0%		846.23	
4-Nitroaniline	0	73	0%		846.23	
Nitrobenzene	0	73	0%		189.59	
2-Nitrophenol	0	73	0%		189.59	
4-Nitrophenol	0	72	0%		844.10	
N-Nitroso-di-n-propylamine	0	73	0%		189.59	
N-Nitrosodiphenylamine	0	73	0%		189.59	
N-Nitrosodimethylamine	0	73	0%		359.52	
Pentachlorophenol	0	72	0%		844.10	
Phenanthrene	19	72	26%	54.60	353.50	4000.00
Phenol	0	72	0%		186.88	
Pyrene	31	73	42%	26.90	547.13	4990.00
Pyridine	0	12	0%		110.42	
1,2,4-Trichlorobenzene	0	25	0%		203.46	
2,4,5-Trichlorophenol	0	72	0%		189.44	
2,4,6-Trichlorophenol	0	72	0%		189.44	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	25	35	71%	2.50	13.05	60.00
TPH-GRO	1	12	8%	150.00	13.67	150.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.3
 Summary Statistics of All Soil Sample Results --
 Plant RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (μg/Kg)</i>						
Acetone	14	57	25%	3.70	75.23	200.00
Acrylonitrile	0	58	0%		15.14	
Allyl Chloride	0	44	0%		2.66	
t-Amyl methyl ether	0	45	0%		16.22	
Benzene	0	58	0%		13.19	
Bromobenzene	0	58	0%		13.19	
Bromochloromethane	0	58	0%		13.19	
Bromodichloromethane	0	58	0%		13.19	
Bromoform	0	58	0%		13.19	
Bromomethane	0	58	0%		28.27	
2-Butanone	15	56	27%	1.60	118.87	12.00
tert-Butyl Alcohol	0	4	0%		1561.75	
n-Butylbenzene	1	58	2%	35.00	13.75	35.00
sec-Butylbenzene	1	58	2%	3.20	13.20	3.20
tert-Butylbenzene	0	58	0%		13.19	
Carbon Disulfide	5	58	9%	0.50	57.65	13.50
Carbon Tetrachloride	0	58	0%		15.21	
Chlorobenzene	0	58	0%		13.19	
1-Chlorobutane	0	44	0%		2.66	
Chloroethane	0	58	0%		28.27	
2-Chloroethylvinyl Ether	0	36	0%		7.86	
Chloroform	0	58	0%		17.12	
Chloromethane	0	58	0%		24.32	
2-Chlorotoluene	0	58	0%		13.19	
4-Chlorotoluene	0	58	0%		13.19	
1,2-Dibromo-3-Chloropropane	0	50	0%		27.80	
Dibromochloromethane	0	58	0%		13.19	
1,2-Dibromoethane	0	58	0%		13.19	
Dibromomethane	0	58	0%		13.19	
1,2-Dichlorobenzene	0	58	0%		13.19	
1,3-Dichlorobenzene	0	58	0%		13.19	
1,4-Dichlorobenzene	0	58	0%		13.19	
Dichlorodifluoromethane	2	58	3%	1.50	24.38	6.70
1,1-Dichloroethane	0	58	0%		13.19	
1,2-Dichloroethane	1	58	2%	9.30	13.31	9.30
cis-1,2-Dichloroethene	0	57	0%		13.38	
trans-1,2-Dichloroethene	0	58	0%		13.19	
1,1-Dichloroethene	0	58	0%		13.19	
1,3-Dichloropropane	0	58	0%		13.19	
2,2-Dichloropropane	0	58	0%		13.19	
1,2-Dichloropropane	0	58	0%		13.19	
1,1-Dichloropropene	0	58	0%		13.19	
cis-1,3-Dichloropropene	0	58	0%		13.19	
trans-1,3-Dichloropropene	0	58	0%		13.19	
Diethyl Ether	0	58	0%		16.10	
Diisopropyl ether	0	45	0%		16.22	
1,4-Dioxane	0	5	0%		624.33	
Ethyl Methacrylate	0	44	0%		2.66	
Ethylbenzene	0	58	0%		13.19	
Ethyl-t-butyl ether	0	45	0%		16.22	
Hexachlorobutadiene	0	26	0%		26.16	
Hexachloroethane	0	13	0%		2.69	
2-Hexanone	1	58	2%	1.00	113.26	1.00
Iodomethane	0	44	0%		2.66	
Isopropylbenzene	1	58	2%	1.00	13.14	1.00
4-Isopropyltoluene	1	58	2%	5.80	13.25	5.80
Methacrylonitrile	0	44	0%		2.66	
Methyl Methacrylate	0	44	0%		2.66	
4-Methyl-2-Pentanone	3	58	5%	3.90	113.85	9.00
Methylene Chloride	0	58	0%		119.50	
Methyl-t-butyl ether	0	58	0%		17.22	
Naphthalene	0	26	0%		26.25	
Nitrobenzene	0	8	0%		13.75	
2-Nitropropane	0	33	0%		5.24	
Pentachloroethane	0	44	0%		2.66	
Propionitrile	0	17	0%		23.74	
n-Propylbenzene	1	58	2%	1.40	13.17	1.40
Styrene	0	58	0%		13.19	
1,1,1,2-Tetrachloroethane	0	58	0%		13.19	
1,1,2,2-Tetrachloroethane	0	58	0%		13.19	
Tetrachloroethene	2	58	3%	0.50	13.13	0.80
Tetrahydrofuran	0	49	0%		36.64	
Toluene	18	58	31%	1.10	119.27	5740.00
trans-1,4-Dichloro-2-Butene	0	44	0%		2.66	
1,2,3-Trichlorobenzene	0	58	0%		13.19	
1,2,4-Trichlorobenzene	0	58	0%		13.19	
1,1,1-Trichloroethane	0	58	0%		15.21	
1,1,2-Trichloroethane	0	58	0%		13.19	
Trichloroethene	0	58	0%		13.19	
Trichlorofluoromethane	7	58	12%	0.80	13.21	5.60
1,2,3-Trichloropropane	0	58	0%		13.19	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.3
 Summary Statistics of All Soil Sample Results --
 Plant RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons cont. (µg/Kg)</i>						
1,1,2-Trichlorotrifluoroethane	0	9	0%		2.27	
1,2,4-Trimethylbenzene	1	58	2%	5.10	13.23	5.10
1,3,5-Trimethylbenzene	1	58	2%	4.50	13.22	4.50
Vinyl Acetate	0	43	0%		7.87	
Vinyl Chloride	0	58	0%		13.18	
o-Xylene	1	58	2%	1.80	13.18	1.80
m+p-Xylenes	1	58	2%	1.80	24.32	1.80
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	13	0%		0.37	
Adjusted C9-C12 Aliphatics	6	13	46%	0.037	0.96	10.30
Unadjusted C5-C8 Aliphatics	17	67	25%	0.24	2.82	19.30
Unadjusted C9-C12 Aliphatics	21	67	31%	0.12	7.36	143.00
Adjusted C9-C10 Aromatics	10	29	34%	0.38	5.83	69.40
Unadjusted C9-C10 Aromatics	0	38	0%		3.73	
Benzene	0	29	0%		1.08	
Ethylbenzene	0	29	0%		1.08	
Methyl-t-butyl ether	0	29	0%		1.08	
Naphthalene	3	29	10%	0.020	1.14	0.99
Toluene	5	29	17%	0.020	1.25	4.84
o-Xylene	1	29	3%	0.046	1.08	0.046
m+p-Xylenes	2	29	7%	0.037	2.15	0.08

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.4
 Soil Sample Results - Dioxin/Furan
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	EX-3-021	EX-3-022	EX-3-023	EX-3-024	EX-3-025	FD205-102203	SB0200006I	SB0200203F	SB020-A0006I	SB020-B0006I
Upper Depth (in.)	0	0	0	0	0	24	0	24	0	0
Lower Depth (in.)	3	3	3	3	3	36	6	36	6	6
Date Sampled	9/20/2005	9/14/2005	9/14/2005	9/20/2005	9/20/2005	10/22/2003	10/22/2003	10/22/2003	7/8/2004	7/8/2004
Dioxin/Furan (pg/g)										
1,2,3,4,6,7,8-HpCDD	4.8 J	7.8	13	9	7.3	0.24 UQ	8.3	0.7 U	9.5	3.3 UJ
Total HpCDDs	9.9	16	25	18	16					
1,2,3,4,6,7,8-HpCDF	8.1	6.4	6.1	8.6	8.3	0.09 UJQ	5.2 J	0.38 UJQ	6.4	1.6 UJ
1,2,3,4,7,8,9-HpCDF	1.6 J	4.9 U	1.6 J	3.4 J	4.3 J	0.095 U	0.49 UJQ	0.28 J	1.2 UJ	0.29 UJQ
Total HpCDFs	17	6.4	7.7	28	26					
1,2,3,4,7,8-HxCDD	0.99 U	4.9 U	0.98 U	0.98 U	0.99 U	0.095 U	0.24 J	0.12 U	0.25 UJ	0.13 U
1,2,3,6,7,8-HxCDD	0.99 U	4.9 U	0.98 U	0.98 U	0.99 U	0.11 U	0.71 UJQ	0.13 U	0.43 UJ	0.14 U
1,2,3,4,7,8-HxCDF	2.2 J	4.9 U	2.7 J	3.8 J	5.4	0.049 U	1.5 J	0.2 J	1.8 UJQ	0.42 UJ
1,2,3,6,7,8-HxCDF	0.99 U	4.9 U	0.98 U	0.98 U	0.99 U	0.048 U	0.79 J	0.17 J	0.28 UJQ	0.24 UJ
2,3,4,6,7,8-HxCDF	0.99 U	4.9 U	0.98 U	0.98 U	0.99 U	0.057 U	0.6 J	0.087 U	0.39 UJ	0.16 UJQ
Total HxCDFs	6.5	4.9 U	2.6 J	8.6	10					
1,2,3,4,5,6,7,8-OCDD	39	100	140	88	62	0.84 U	35	3 U	60	22 U
1,2,3,4,5,6,7,8-OCDF	21	11	21	40	45	0.22 U	4.4 J	0.79 UQ	19 UJ	3.8 UJ
1,2,3,7,8-PeCDF	0.99 U	4.9 U	0.98 U	0.98 U	0.99 U	0.086 U	0.55 J	0.095 U	0.31 UJ	0.1 U
2,3,4,7,8-PeCDF	0.99 U	4.9 U	0.98 U	0.98 U	1.5 J	0.071 U	0.57 UJQ	0.073 U	0.4 UJ	0.2 UJQ
Total PeCDFs	1.7 J	4.9 U	2.2 J	4.5 J	6.1					
2,3,7,8-TCDD	0.47 UJQ	0.99 U	0.2 U	0.2 U	12 UJQ	0.22 U	4.2	0.23 U	0.25 U	0.29 U
2,3,7,8-TCDF	0.45 J	0.99 U	0.66 J	0.87 J	0.91 J	0.17 U	1.1 J	0.17 U	0.34 UJQ	0.22 U
Total TCDFs	4.4	0.99 U	6.3	7.5	8.7					

Appendix Table A.1.4
 Soil Sample Results - Dioxin/Furan
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	SB020-C0006I	SB020-D0006I	SB020-E0006I	SB020-F0006I	SB020-G0006I	SB020-H0006I	SB020-H0102F	SB020-I0006I	FD003-0006I-070804	SB020-R0006I
Upper Depth (in.)	0	0	0	0	0	0	12	0	0	0
Lower Depth (in.)	6	6	6	6	6	6	24	6	6	6
Date Sampled	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004	7/8/2004
Dioxin/Furan (pg/g)										
1,2,3,4,6,7,8-HpCDD	2.2 UJ	2 UJ	12	27	17	6.5 J	1.3 UJQ	7.6	1.6 UJ	1.8 UJQ
Total HpCDDs										
1,2,3,4,6,7,8-HpCDF	1.1 UJ	0.93 UJQ	7.3	6.6	10	4.3 UJ	0.79 UJ	4.8 UJ	0.84 UJ	0.95 UJ
1,2,3,4,7,8,9-HpCDF	0.21 UJQ	0.12 U	0.75 UJ	0.66 UJ	1.3 UJ	0.55 UJQ	0.16 UJ	0.31 UJ	0.2 UJ	0.23 U
Total HpCDFs										
1,2,3,4,7,8-HxCDD	0.15 U	0.13 U	0.29 UJ	0.47 UJ	0.56 UJQ	0.21 UJQ	0.12 U	0.27 UJ	0.1 U	0.2 U
1,2,3,6,7,8-HxCDD	0.32 UJQ	0.13 U	0.44 UJ	1.3 UJQ	1.1 UJ	0.33 UJQ	0.12 U	0.35 UJ	0.11 U	0.22 U
1,2,3,4,7,8-HxCDF	0.22 UJQ	0.17 UJQ	0.75 UJ	1.8 UJ	3.5 J	1.4 UJ	0.3 UJ	0.47 UJQ	0.25 UJ	0.07 UJQ
1,2,3,6,7,8-HxCDF	0.068 U	0.18 UJQ	0.69 UJ	1.4 UJQ	1.7 UJQ	0.59 UJQ	0.16 UJ	0.51 UJQ	0.19 UJQ	0.13 UJQ
2,3,4,6,7,8-HxCDF	0.14 UJQ	0.079 U	0.48 UJ	0.62 UJ	1.6 UJ	0.56 UJ	0.12 UJ	0.22 UJ	0.15 UJ	0.091 U
Total HxCDFs										
1,2,3,4,5,6,7,8-OCDD	14 U	14 U	82	240	92	35 U	9.8 UJ	46	9.9 UJ	13 U
1,2,3,4,5,6,7,8-OCDF	1.7 UJ	2.3 UJ	14 U	20 U	12 UJ	4.8 UJ	0.99 UJ	10 UJ	1.8 UJ	1.9 UJQ
1,2,3,7,8-PeCDF	0.1 U	0.12 U	0.2 UJQ	0.49 UJ	1.6 UJ	0.52 UJ	0.095 U	0.27 UJQ	0.084 U	0.14 U
2,3,4,7,8-PeCDF	0.18 UJQ	0.087 U	0.27 UJ	0.69 UJ	1.6 UJQ	0.61 UJQ	0.12 UJQ	0.31 UJQ	0.16 UJ	0.1 U
Total PeCDFs										
2,3,7,8-TCDD	0.57 UJQ	0.28 U	0.26 U	0.29 U	1 J	0.32 UJQ	0.2 U	0.38 U	0.26 U	0.28 U
2,3,7,8-TCDF	0.27 UJQ	0.22 U	0.55 UJQ	0.94 UJQ	3.1	1.1 UJQ	0.18 U	0.7 UJQ	0.19 U	0.24 U
Total TCDFs										

Appendix Table A.1.4
 Soil Sample Results - Dioxin/Furan
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	SB-023 0006I	SB-023 0203F	FD004-090804	SB-074 0203F	SB-074 1213F	SB075A-0006I	SB075A-0203F	SB075A-1415F	SB075B-0006I	SB075B-0203F
Upper Depth (in.)	0	24	144	24	144	0	24	168	0	24
Lower Depth (in.)	6	36	156	36	156	6	36	180	6	36
Date Sampled	9/8/2004	9/8/2004	9/8/2004	9/8/2004	9/8/2004	12/1/2004	12/1/2004	12/1/2004	12/2/2004	12/2/2004
Dioxin/Furan (pg/g)										
1,2,3,4,6,7,8-HpCDD	43	0.55 UJQ	0.22 U	0.21 U	0.2 U	2.7 J	2.6 UJQ	0.12 U	3 J	2.1 UJQ
Total HpCDDs										
1,2,3,4,6,7,8-HpCDF	18	0.27 UJQ	0.12 U	0.15 UJQ	0.11 U	1.5 J	1.5 J	0.054 U	1.5 J	1.4 J
1,2,3,4,7,8,9-HpCDF	5.2 J	0.17 U	0.15 U	0.16 U	0.15 U	0.18 UJQ	0.11 U	0.09 U	0.16 J	0.11 U
Total HpCDFs										
1,2,3,4,7,8-HxCDD	0.55 UJQ	0.12 U	0.15 U	0.14 U	0.12 U	0.13 UJQ	0.081 U	0.11 U	0.094 U	0.095 U
1,2,3,6,7,8-HxCDD	2.2 UJQ	0.13 U	0.17 U	0.16 U	0.13 U	0.21 J	0.081 U	0.11 U	0.097 U	0.065 UJQ
1,2,3,4,7,8-HxCDF	8.5	0.078 U	0.086 U	0.094 UJQ	0.064 U	0.39 UJQ	0.42 UJQ	0.056 U	0.31 J	0.21 UJQ
1,2,3,6,7,8-HxCDF	1.7 J	0.086 U	0.092 U	0.072 U	0.068 U	0.19 UJ	0.062 U	0.054 U	0.051 U	0.045 U
2,3,4,6,7,8-HxCDF	1.5 J	0.089 U	0.093 U	0.072 U	0.071 U	0.23 UJQ	0.096 UJQ	0.061 U	0.06 U	0.048 U
Total HxCDFs										
1,2,3,4,5,6,7,8-OCDD	320	1.7 UJ	0.62 UJQ	0.86 UJQ	0.9 UJQ	16	24	1.2 UJ	18	17
1,2,3,4,5,6,7,8-OCDF	71	0.71 UJQ	0.25 U	0.71 UJQ	0.29 U	2.6 J	2.4 UJ	0.19 U	2.7 J	2.1 UJ
1,2,3,7,8-PeCDF	1.2 J	0.099 U	0.12 U	0.085 U	0.093 U	0.12 UJQ	0.084 U	0.085 U	0.15 UJQ	0.092 U
2,3,4,7,8-PeCDF	2.1 UJQ	0.08 U	0.1 U	0.072 U	0.071 U	0.068 U	0.22 UJQ	0.062 U	0.079 U	0.11 UJQ
Total PeCDFs										
2,3,7,8-TCDD	0.56 UJQ	0.28 U	0.39 U	0.24 U	0.25 U	0.16 U	0.16 U	0.2 U	0.14 U	0.18 U
2,3,7,8-TCDF	2.2 UJQ	0.2 U	0.28 U	0.18 U	0.2 U	0.18 U	0.2 U	0.18 U	0.26 U	0.22 UJQ
Total TCDFs										

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		CAT-B6-SPILL	Drywell-EW-01	Drywell-FI-01	Drywell-NW-01	Drywell-SW-01	Drywell-WW-01	EX002-0002F	EX003-0002F	EX-201-0020F
Upper Depth (in.)								0	0	0
Lower Depth (in.)								24	24	240
Date Sampled	MCP S-1	6/27/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	5/6/2005	5/6/2005	8/5/2005
EPH (mg/Kg)										
Acenaphthene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.114 J			0.143 U
Acenaphthylene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.152 U			0.143 U
Unadjusted C19-C36 Aliphatics	3000	145	30.2 U	30 U	30 U	33.4 U	30.5 U	7.66 U	7.41 U	77.5
Unadjusted C9-C18 Aliphatics	1000	28 U	30.2 U	30 U	30 U	33.4 U	30.5 U	7.66 U	7.41 U	299
Anthracene		0.139 UJ	0.151 UJ	0.149 UJ	0.149 UJ	0.166 UJ	0.155 J			0.0443 J
Adjusted C11-C22 Aromatics		28 UJ	30.2 U	30 U	30 U	33.4 U	30.5 U			
Unadjusted C11-C22 Aromatics	800	28 U	30.2 U	30 U	30 U	33.4 U	30.5 U	7.66 U	7.41 U	150
Benzo(a)anthracene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.364			0.143 U
Benzo(a)pyrene		0.139 UJ	0.151 U	0.149 U	0.0389 J	0.166 U	0.334			0.143 U
Benzo(b)fluoranthene		0.139 UJ	0.151 U	0.015 J	0.03 J	0.166 U	0.222			0.143 U
Benzo(g,h,i)perylene		0.139 UJ	0.151 U	0.149 U	0.0315 J	0.166 U	0.219			0.143 U
Benzo(k)fluoranthene		0.139 UJ	0.151 U	0.149 U	0.0344 J	0.166 U	0.404			0.143 U
Chrysene		0.139 UJ	0.151 U	0.0344 J	0.0659 J	0.166 U	0.468			0.143 U
Dibenzo(a,h)anthracene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.152 U			0.143 U
Fluoranthene		0.139 UJ	0.151 UJ	0.0569 J	0.121 J	0.166 UJ	1 J			0.143 U
Fluorene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.0686 J			0.143 U
Indeno(1,2,3-cd)pyrene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.184			0.143 U
2-Methylnaphthalene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.0198 J			0.143 U
Naphthalene		0.139 UJ	0.151 U	0.149 U	0.149 U	0.166 U	0.0945 J			0.143 UJ
Phenanthrene		0.139 UJ	0.151 UJ	0.149 UJ	0.0389 J	0.166 UJ	0.559 J			0.0458 J
Pyrene		0.139 UJ	0.151 UJ	0.149 UJ	0.102 J	0.166 UJ	0.802 J			0.0772 J
Adjusted TPH		145	30.2 U	30 U	30 U	33.4 U	36.9			526
Unadjusted TPH		145	30.2 U	30 U	30 U	33.4 U	41.6			526

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-202-0020F	EX-203-0020F	EX-204-0020F	EX-205-0020F	FD001-080505	EX-206-0003F	EX-207-0003F	EX-208-0004F	EX-209-0004F	EX-BARK-14
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	
Lower Depth (in.)		240	240	240	240	240	36	36	48	48	
Date Sampled	MCP S-1	8/5/2005	8/5/2005	8/5/2005	8/5/2005	8/5/2005	8/11/2005	10/6/2005	10/11/2005	10/11/2005	9/7/2006
EPH (mg/Kg)											
Acenaphthene		0.559	0.296	0.167	0.0281 J	0.0414 J	0.145 U	0.14 U	0.147 U	0.143 U	0.15 U
Acenaphthylene		0.142 U	0.145 U	0.145 U	0.147 U	0.159 U	0.145 U	0.14 U	0.147 U	0.143 U	0.15 U
Unadjusted C19-C36 Aliphatics	3000	91.8	151	47.8	29.6 U	31.9 U	32.7	28.2 U	29.5 U	28.8 U	30.2 UJ
Unadjusted C9-C18 Aliphatics	1000	409	628	220	45.4	54.4	29.2 U	28.2 U	29.5 U	28.8 U	30.2 UJ
Anthracene		0.343	0.354	0.395	0.037 J	0.0287 J	0.145 U	0.14 U	0.147 U	0.143 U	0.15 U
Adjusted C11-C22 Aromatics											30.2 U
Unadjusted C11-C22 Aromatics	800	497	436	97.4	26.6 J	36.6	29.2 U	28.2 U	29.5 U	34.5	30.2 U
Benzo(a)anthracene		0.142 U	0.145 U	0.6	0.147 U	0.159 U	0.145 U	0.0478 J	0.147 UJ	0.143 UJ	0.15 U
Benzo(a)pyrene		0.142 U	0.145 UJ	0.381 J	0.147 UJ	0.159 UJ	0.145 U	0.0521 J	0.147 UJ	0.143 UJ	0.15 U
Benzo(b)fluoranthene		0.142 U	0.145 UJ	0.381 J	0.0251 J	0.159 UJ	0.145 U	0.0394 J	0.028 J	0.143 UJ	0.15 U
Benzo(g,h,i)perylene		0.142 U	0.145 UJ	0.148 J	0.147 UJ	0.159 UJ	0.145 U	0.0281 J	0.147 UJ	0.143 UJ	0.15 U
Benzo(k)fluoranthene		0.142 U	0.145 U	0.275	0.147 U	0.159 U	0.145 U	0.0577 J	0.147 U	0.143 U	0.15 U
Chrysene		0.142 U	0.0304 J	0.546	0.0296 J	0.159 U	0.145 U	0.0605 J	0.147 U	0.143 U	0.15 U
Dibenzo(a,h)anthracene		0.142 U	0.145 UJ	0.145 UJ	0.147 UJ	0.159 UJ	0.145 U	0.14 U	0.147 UJ	0.143 UJ	0.15 U
Fluoranthene		0.0912 J	0.0507 J	1.14	0.037 J	0.159 U	0.145 U	0.125 J	0.0722 J	0.0633 J	0.133 J
Fluorene		0.772	0.635	0.251	0.0458 J	0.0637 J	0.145 U	0.14 U	0.147 U	0.143 U	0.15 U
Indeno(1,2,3-cd)pyrene		0.142 U	0.145 UJ	0.138 J	0.147 UJ	0.159 UJ	0.145 U	0.14 U	0.147 UJ	0.143 UJ	0.15 U
2-Methylnaphthalene		0.0926 J	0.145 U	0.15	0.147 U	0.159 U	0.145 U	0.0267 J	0.147 U	0.143 U	0.15 U
Naphthalene		0.114 J	0.145 U	0.145 U	0.147 U	0.159 U	0.145 U	0.14 U	0.147 U	0.143 U	0.15 UJ
Phenanthrene		2.41	1.84	1.3	0.114 J	0.14 J	0.145 U	0.0422 J	0.147 UJ	0.143 UJ	0.15 U
Pyrene		0.15	0.135 J	1.01	0.147 U	0.159 U	0.145 U	0.11 J	0.0604 J	0.0589 J	0.142 J
Adjusted TPH		994	1210	358	85	107	35.4	28.2 U	29.5 U	51.6	30.2 U
Unadjusted TPH		998	1220	365	85	107	35.4	28.2 U	29.5 U	51.6	30.2 U

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-BARK-16	EX-BARK-18	EX-BARK-20	EX-BARK-22	EX-BARK-24	PCA1-TUB-01	SB-010 0006I	SB-010 0203F	SB-017 0006I	SB-017 0203F	SB-021 0006I
Upper Depth (in.)								0	24	0	24	0
Lower Depth (in.)								6	36	6	36	6
Date Sampled	MCP S-1	9/7/2006	9/7/2006	9/7/2006	9/7/2006	9/7/2006	10/28/2005	9/7/2004	9/7/2004	9/9/2004	9/9/2004	9/9/2004
EPH (mg/Kg)												
Acenaphthene		0.144 U	0.155 U	0.208	0.147 U	0.152 U	0.176 U					
Acenaphthylene		0.144 U	0.155 U	0.15 U	0.147 U	0.152 U	0.176 U					
Unadjusted C19-C36 Aliphatics	3000	28.9 UJ	31.1 UJ	38.9 J	32.2 J	30.5 UJ	35.4 U	11.3	7.41 U	22.6	7.75 U	84.1
Unadjusted C9-C18 Aliphatics	1000	28.9 UJ	33.5 J	55.2 J	59.6 J	37.9 J	35.4 U	7.02 U	7.41 U	7.75 U	7.75 U	38.3 U
Anthracene		0.0389 J	0.155 U	0.924	0.0221 J	0.0259 J	0.176 U					
Adjusted C11-C22 Aromatics		28.9 U	31 J	86.3	46.6	33.1						
Unadjusted C11-C22 Aromatics	800	28.9	31 J	113	47.1	33.5	35.4 U	17.9	7.41 U	7.75 U	7.75 U	121
Benzo(a)anthracene		0.213	0.155 U	3.21	0.147 U	0.101 J	0.176 UJ					
Benzo(a)pyrene		0.199	0.155 U	2.04	0.147 U	0.0884 J	0.176 UJ					
Benzo(b)fluoranthene		0.149	0.155 U	1.69	0.147 U	0.0701 J	0.176 UJ					
Benzo(g,h,i)perylene		0.088 J	0.155 U	0.753	0.147 U	0.152 U	0.176 UJ					
Benzo(k)fluoranthene		0.159	0.155 U	2.23	0.147 U	0.0655 J	0.176 U					
Chrysene		0.273	0.155 U	3.18	0.147 U	0.128 J	0.176 U					
Dibenzo(a,h)anthracene		0.144 U	0.155 U	0.139 J	0.147 U	0.152 U	0.176 UJ					
Fluoranthene		0.516	0.152 J	5.31	0.256	0.232	0.0265 J					
Fluorene		0.144 U	0.155 U	0.145 J	0.147 U	0.152 U	0.176 U					
Indeno(1,2,3-cd)pyrene		0.0837 J	0.155 U	0.821	0.147 U	0.152 U	0.176 UJ					
2-Methylnaphthalene		0.144 U	0.155 U	0.15 U	0.147 U	0.152 U	0.176 U					
Naphthalene		0.144 UJ	0.155 UJ	0.15 UJ	0.147 UJ	0.152 UJ	0.176 U					
Phenanthrene		0.183	0.155 U	2.03	0.0794 J	0.0472 J	0.176 UJ					
Pyrene		0.381	0.135 J	4.34	0.215	0.193	0.176 U					
Adjusted TPH		43.9	85.5	180	138	90.8	35.4 U					
Unadjusted TPH		46	85.5	207	139	91.3	35.4 U					

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-021 0203F	SB-023 0006I	SB-023 0203F	SB024-0006I	SB024-0203F	SB028-0006I	SB029-0203F	SB-036 0006I	SB-036 0203F	SB037-0006I	SB037-0203F
Upper Depth (in.)		24	0	24	0	24	0	24	0	24	0	24
Lower Depth (in.)		36	6	36	6	36	6	36	6	36	6	36
Date Sampled	MCP S-1	9/9/2004	9/8/2004	9/8/2004	10/7/2004	10/7/2004	12/2/2004	10/19/2004	9/8/2004	9/8/2004	10/7/2004	10/7/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	8.03 U	43.5	7.75 U	7.66 U	7.49 U	9.66	7.66 U	8.1 J	7.09 U	6.94 U	7.17 U
Unadjusted C9-C18 Aliphatics	1000	8.03 U	23.8 U	7.75 U	7.66 U	7.49 U	7.25 U	7.66 U	7.58 UJ	7.09 U	6.94 U	7.17 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	8.03 U	63.5	9.17	7.66 U	7.49 U	7.25 U	13.8	7.58 U	7.09 U	6.94 U	7.17 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB037-0910F	SB038-0006I	SB038-0203F	SB038-0506F	SB039-0006I	SB039-0203F	SB039-1415F	SB040-0006I	SB040-01415F	SB040-0203F	FD-007-100704
Upper Depth (in.)		108	0	24	60	0	24	168	0	168	24	24
Lower Depth (in.)		120	6	36	72	6	36	180	6	180	36	36
Date Sampled	MCP S-1	10/7/2004	12/2/2004	12/2/2004	12/2/2004	10/24/2004	10/24/2004	10/24/2004	12/1/2004	12/1/2004	12/1/2004	10/7/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	7.41 U	10.5	7.02 U	7.25 U	7.09 U	7.09 U	7.25 U	20.8	7.49 U	7.17 U	7.33 U
Unadjusted C9-C18 Aliphatics	1000	7.41 U	7.25 U	7.02 U	7.25 U	7.09 U	7.09 U	7.25 U	7.25 U	7.49 U	7.17 U	7.33 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	7.41 U	7.25 U	7.02 U	7.25 U	7.09 U	7.09 U	7.25 U	12.8	7.49 U	7.17 U	7.33 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB041-0203F	SB041-1415F	SB042-0510F	SB-044 0203F	SB045-0607F	SB046 0006I	SB046 0506F	SB-047-0006I	SB-047-0203F	SB-047-0607F	SB050-0006I
Upper Depth (in.)		24	168	60	24	72	0	60	0	24	72	0
Lower Depth (in.)		36	180	120	36	84	6	72	6	36	84	6
Date Sampled	MCP S-1	10/7/2004	10/7/2004	10/24/2004	9/8/2004	12/2/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	10/24/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	7.25 U	7.25 U	36.6	14.1	16.4	10.3	6.94 U	7.33 U	132	7.17 U	210
Unadjusted C9-C18 Aliphatics	1000	7.25 U	7.25 U	7.75 U	6.94 U	7.58 U	6.87 U	6.94 U	7.33 U	7.66 U	7.17 U	7.49 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	9.1	7.25 U	13.3	14.4	16.1	6.87 U	6.94 U	7.33 U	65.6	7.17 U	109
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB050-0203F	SB051-0006I	SB051-0203F	SB052-0006I	SB-053 0006I	SB-053 0203F	SB-056 0006I	SB-056 0203F	SB-056 1415F	SB-063 0006I	SB-063 0203F
Upper Depth (in.)		24	0	24	0	0	24	0	24	168	0	24
Lower Depth (in.)		36	6	36	6	6	36	6	36	180	6	36
Date Sampled	MCP S-1	10/24/2004	10/16/2004	10/16/2004	12/2/2004	9/8/2004	9/8/2004	9/7/2004	9/7/2004	9/7/2004	9/30/2004	9/30/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	183	7.25 U	24	18.6	70.8	92.6	7.25 U	7.33 U	7.09 U	1010	6.94 U
Unadjusted C9-C18 Aliphatics	1000	8.03 U	7.25 U	7.41 U	7.02 U	9.38	6.8 U	7.25 U	7.33 U	7.09 U	30.5	6.94 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	33	7.25 U	7.41 U	7.02 U	45.6	57.8	7.25 U	7.33 U	7.09 U	788	6.94 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-063 1415F	SB064-0006I	SB064-0203F	SB064-1415F	SB065 0203F	SB065 1415F	SB065-0006I	SB066-0006I	SB066-0203F	SB067-0006I	SB067-0203F	SB067-1415F
Upper Depth (in.)		168	0	24	168	24	168	0	0	24	0	24	168
Lower Depth (in.)		180	6	36	180	36	180	6	6	36	6	36	180
Date Sampled	MCP S-1	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	11/30/2004	11/30/2004	10/7/2004	10/7/2004	10/7/2004
EPH (mg/Kg)													
Acenaphthene													
Acenaphthylene													
Unadjusted C19-C36 Aliphatics	3000	21.4	116	7.33 U	7.41 U	7.25 U	89.4	7.58 U	6.94 U	6.94 U	6.94 U	7.66 U	7.49 U
Unadjusted C9-C18 Aliphatics	1000	7.09 U	7.25 U	7.33 U	7.41 U	7.25 U	7.09 U	7.58 U	6.94 U	6.94 U	6.94 U	7.66 U	7.49 U
Anthracene													
Adjusted C11-C22 Aromatics													
Unadjusted C11-C22 Aromatics	800	12.8	37.5	7.33 U	7.41 U	7.25 U	51.2	7.58 U	6.94 U	6.94 U	6.94 U	7.66 U	7.49 U
Benzo(a)anthracene													
Benzo(a)pyrene													
Benzo(b)fluoranthene													
Benzo(g,h,i)perylene													
Benzo(k)fluoranthene													
Chrysene													
Dibenzo(a,h)anthracene													
Fluoranthene													
Fluorene													
Indeno(1,2,3-cd)pyrene													
2-Methylnaphthalene													
Naphthalene													
Phenanthrene													
Pyrene													
Adjusted TPH													
Unadjusted TPH													

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB070-0006I	SB070-0203F	SB070-0809F	SB071-0006I	SB071-0203F	SB072-0006I	SB072-0203F	SB073-0203F	SB-074 0203F	SB-074 1213F	SB075A-0006I
Upper Depth (in.)		0	24	96	0	24	0	24	24	24	144	0
Lower Depth (in.)		6	36	108	6	36	6	36	36	36	156	6
Date Sampled	MCP S-1	12/14/2004	12/14/2004	12/14/2004	10/19/2004	10/19/2004	10/19/2004	10/19/2004	11/16/2004	9/8/2004	9/8/2004	12/1/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	37	149	7.17 U	7.75 U	7.41 U	7.94 U	7.66 U	7.66 U	9.89	7.25 U	20
Unadjusted C9-C18 Aliphatics	1000	34.7	486	35.2	7.75 U	7.41 U	7.94 U	7.66 U	7.66 U	7.09 U	7.25 U	7.09 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	8.39	99.5	26.6	7.75 U	7.41 U	7.94 U	24.5	7.66 U	17.1	7.25 U	17.9
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB075A-0203F	SB075A-1415F	SB075B-0006I	SB075B-0203F	SB076-0203F	SB076-0809F	SB077 0006I	SB077 0203F	SB077 1415F	SB0780006I	SB0780102F
Upper Depth (in.)		24	168	0	24	24	96	0	24	168	0	12
Lower Depth (in.)		36	180	6	36	36	108	6	36	180	6	24
Date Sampled	MCP S-1	12/1/2004	12/1/2004	12/2/2004	12/2/2004	12/2/2004	12/2/2004	1/25/2005	1/25/2005	1/25/2005	9/27/2004	9/27/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	7.33 U	8.23 U	7.02 U	10.1	7.02 U	7.33 U	34.2	14.8 U	7.94 U	7.58 U	7.94 U
Unadjusted C9-C18 Aliphatics	1000	7.33 U	8.23 U	7.02 U	7.02 U	7.02 U	7.33 U	6.94 U	14.8 U	7.94 U	7.58 U	7.94 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	7.33 U	8.23 U	7.02 U	8.84	7.02 U	7.33 U	13	339	7.94 U	7.58 U	7.94 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB079-0006I	SB079-0203F	SB079-1415F	SB080-0006I	SB080-0203F	SB080-1415F	SB081-0006I	SB081-0203F	SB082-0006I	SB082-0203F	SB082-0708F
Upper Depth (in.)		0	24	168	0	24	168	0	24	0	24	84
Lower Depth (in.)		6	36	180	6	36	180	6	36	6	36	96
Date Sampled	MCP S-1	10/24/2004	10/24/2004	10/24/2004	11/30/2004	11/30/2004	11/30/2004	12/2/2004	12/2/2004	12/2/2004	12/2/2004	12/2/2004
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	24.6	7.09 U	7.17 U	7.75 U	7.84	7.02 U	9.22	7.09 U	17.3	9.73	6.94 U
Unadjusted C9-C18 Aliphatics	1000	7.09 U	7.09 U	7.17 U	7.75 U	25.2	7.02 U	7.25 U	7.09 U	6.94 U	6.8 U	6.94 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	7.09 U	7.09 U	7.17 U	7.75 U	10.5	19.7	44.5	7.09 U	11.9	7.17	6.94 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB083-0006I-121404	SB083-0203F-121404	SB084-0006I	SB084-0203F	SB084-1415F	SB085-0203F	SB086-0203F	SB091-0006I
Upper Depth (in.)		0	24	0	24	168	24	24	0
Lower Depth (in.)		6	36	6	36	180	36	36	6
Date Sampled	MCP S-1	12/14/2004	12/14/2004	10/16/2004	10/16/2004	10/16/2004	10/19/2004	10/17/2004	10/24/2004
EPH (mg/Kg)									
Acenaphthene									
Acenaphthylene									
Unadjusted C19-C36 Aliphatics	3000	384	680	14	7.49 U	8.23 U	7.41 U	7.02 U	11.7
Unadjusted C9-C18 Aliphatics	1000	183 U	192 U	7.94 U	7.49 U	8.23 U	7.41 U	7.02 U	7.02 U
Anthracene									
Adjusted C11-C22 Aromatics									
Unadjusted C11-C22 Aromatics	800	438	702	7.94 U	7.49 U	8.23 U	7.41 U	7.02 U	7.02 U
Benzo(a)anthracene									
Benzo(a)pyrene									
Benzo(b)fluoranthene									
Benzo(g,h,i)perylene									
Benzo(k)fluoranthene									
Chrysene									
Dibenzo(a,h)anthracene									
Fluoranthene									
Fluorene									
Indeno(1,2,3-cd)pyrene									
2-Methylnaphthalene									
Naphthalene									
Phenanthrene									
Pyrene									
Adjusted TPH									
Unadjusted TPH									

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB092-0006I	SB092-0203F	SB092-1415F	FD-008-101704	SB093-0006I	SB093-0203F	SB093-1415F	SB094-0006I	SB094-0203F
Upper Depth (in.)		0	24	168	0	0	24	168	0	24
Lower Depth (in.)		6	36	180	6	6	36	180	6	36
Date Sampled	MCP S-1	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/20/2004	10/20/2004
EPH (mg/Kg)										
Acenaphthene										
Acenaphthylene										
Unadjusted C19-C36 Aliphatics	3000	116	38.5	7.17 U	8.13 U	8.66 U	7.09 U	7.41 U	7.49 U	7.09 U
Unadjusted C9-C18 Aliphatics	1000	202	22.7	7.17 U	8.13 U	8.66 U	7.09 U	7.41 U	7.49 U	7.09 U
Anthracene										
Adjusted C11-C22 Aromatics										
Unadjusted C11-C22 Aromatics	800	84	12	7.17 U	8.13 U	8.66 U	7.09 U	7.41 U	7.49 U	7.09 U
Benzo(a)anthracene										
Benzo(a)pyrene										
Benzo(b)fluoranthene										
Benzo(g,h,i)perylene										
Benzo(k)fluoranthene										
Chrysene										
Dibenzo(a,h)anthracene										
Fluoranthene										
Fluorene										
Indeno(1,2,3-cd)pyrene										
2-Methylnaphthalene										
Naphthalene										
Phenanthrene										
Pyrene										
Adjusted TPH										
Unadjusted TPH										

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD009-102404	SB095-0006I	SB095-0203F	SB095-1213F	FD006-090904	SB-096 0006I	SB-096 0203F	SB097-0006I	SB097-0203F	SB-549-0305F	SB-549-0507F
Upper Depth (in.)		0	0	24	144	24	0	24	0	24	36	60
Lower Depth (in.)		6	6	36	156	36	6	36	6	36	60	84
Date Sampled	MCP S-1	10/24/2004	10/24/2004	10/24/2004	10/24/2004	9/9/2004	9/9/2004	9/9/2004	11/30/2004	11/30/2004	1/8/2005	1/8/2005
EPH (mg/Kg)												
Acenaphthene												
Acenaphthylene												
Unadjusted C19-C36 Aliphatics	3000	7.17 UJ	22 J	6.8 U	6.94 U	7.84 U	7.17 U	7.66 UJ	259	7.09 U	7.58 U	7.41 U
Unadjusted C9-C18 Aliphatics	1000	7.17 U	7.25 U	6.8 U	6.94 U	7.84 U	7.17 U	7.66 UJ	35.5 U	7.09 U	7.58 U	7.41 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	7.17 U	7.25 U	6.8 U	6.94 U	7.84 U	7.17 U	7.66 U	227	7.09 U	7.58 U	7.41 U
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Dibenzo(a,h)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Naphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-549-0709F	SB-550-0305F	SB-550-0507F	SB-550-1214F	FD 001-010805	SB-551-0305F	SB-551-0507F	SB-551-1012F	SB-552-0305F	SB-553-0608F	SB-553-A
Upper Depth (in.)		84	36	60	144	120	36	60	120	36	72	
Lower Depth (in.)		108	60	84	168	144	60	84	144	60	96	
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/27/2005	12/1/2005
EPH (mg/Kg)												
Acenaphthene												0.165 U
Acenaphthylene												0.165 U
Unadjusted C19-C36 Aliphatics	3000	7.58 U	7.49 U	7.17 U	7.41 U	7.25 U	7.09 U	7.33 U	7.33 U	7.66 U	293	70.8
Unadjusted C9-C18 Aliphatics	1000	7.58 U	7.49 U	7.17 U	7.41 U	7.25 U	7.09 U	7.33 U	7.33 U	7.66 U	195	352
Anthracene												0.195
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	7.58 U	7.49 U	7.17 U	27.8	7.25 U	7.09 U	7.33 U	7.33 U	7.66 U	181	270
Benzo(a)anthracene												0.165 UJ
Benzo(a)pyrene												0.165 UJ
Benzo(b)fluoranthene												0.165 UJ
Benzo(g,h,i)perylene												0.165 UJ
Benzo(k)fluoranthene												0.165 U
Chrysene												0.165 U
Dibenzo(a,h)anthracene												0.165 UJ
Fluoranthene												0.106 J
Fluorene												0.165 U
Indeno(1,2,3-cd)pyrene												0.165 UJ
2-Methylnaphthalene												0.165 U
Naphthalene												0.165 U
Phenanthrene												0.318 J
Pyrene												0.115 J
Adjusted TPH												692
Unadjusted TPH												693

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-554-0002F	SB-554-0204F	SB-554-0406F	SB-554-0608F	SB612-0103F	FD001-042805	SB613-0103F	SB614-0103F	SB7250608F	DUP 01-041206	SB7260810F
Upper Depth (in.)		0	24	48	72	12	12	12	12	72	96	96
Lower Depth (in.)		24	48	72	96	36	36	36	36	96	120	120
Date Sampled	MCP S-1	1/27/2005	1/27/2005	1/27/2005	1/27/2005	4/28/2005	4/28/2005	4/28/2005	4/28/2005	4/12/2006	4/12/2006	4/12/2006
EPH (mg/Kg)												
Acenaphthene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Acenaphthylene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Unadjusted C19-C36 Aliphatics	3000	7.58 U	34.7 U	7.66 U	7.17 U	31.1 U	31 U	30.6 U	30 U	27.3 U	29.3 U	27.4 U
Unadjusted C9-C18 Aliphatics	1000	7.58 U	34.7 U	7.66 U	7.17 U	31.1 U	31 U	30.6 U	30 U	27.3 U	29.3 U	27.4 U
Anthracene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Adjusted C11-C22 Aromatics										27.3 UJ	29.3 U	27.4 U
Unadjusted C11-C22 Aromatics	800	7.58 U	34.7 U	7.66 U	7.17 U	31.1 U	31 U	30.6 U	30 U	27.3 U	29.3 U	27.4 U
Benzo(a)anthracene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.0451 J
Benzo(a)pyrene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.0382 J
Benzo(b)fluoranthene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.0146 J	0.0273 J
Benzo(g,h,i)perylene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Benzo(k)fluoranthene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.0546 J
Chrysene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.0219 J	0.0533 J
Dibenzo(a,h)anthracene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Fluoranthene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.0409 J	0.113 J
Fluorene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Indeno(1,2,3-cd)pyrene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
2-Methylnaphthalene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Naphthalene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Phenanthrene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.136 U
Pyrene						0.385 U	0.383 U	0.378 U	0.371 U	0.136 UJ	0.146 U	0.111 J
Adjusted TPH						31.1 U	31 U	30.6 U	30 U	27.3 U	29.3 U	27.4 U
Unadjusted TPH						31.1 U	31 U	30.6 U	30 U	27.3 U	29.3 U	27.4 U

Sample ID		ST-102-Decon-01	ST-102-Decon-02	SY-EX017	SY-EX018	SY-EX019	SY-EX023	SY-EX024	SY-EX026	SY-EX028	SY-EX-035	SY-EX-036	SY-EX-040
Upper Depth (in.)											0	0	0
Lower Depth (in.)											12	12	3
Date Sampled	MCP S-1	4/25/2006	4/25/2006	7/12/2006	7/12/2006	7/12/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/19/2006	7/19/2006	7/19/2006
EPH (mg/Kg)													
Acenaphthene		0.152 U	0.158 U	0.143 U	0.242 J	0.52	0.157 U	0.162 U	0.0626 J	0.159 UJ	0.0247 J	0.145 U	0.142 UJ
Acenaphthylene		0.152 U	0.158 U	0.143 U	0.153 UJ	0.0613 J	0.157 U	0.162 U	0.145 UJ	0.159 UJ	0.137 U	0.145 U	0.142 UJ
Unadjusted C19-C36 Aliphatics	3000	30.2 J	31.8 U	28.7 U	30.7 U	128	73.6	32.5 U	29.2 U	31.9 U	27.5 UJ	29 U	28.5 U
Unadjusted C9-C18 Aliphatics	1000	30.5 U	31.8 U	28.7 U	30.7 U	562	31.6 U	32.5 U	26.4 J	31.9 U	27.5 UJ	29 U	28.5 U
Anthracene		0.152 UJ	0.158 UJ	0.143 U	0.754 J	0.242	0.157 U	0.162 U	0.13 J	0.159 UJ	0.0495 J	0.145 U	0.0427 J
Adjusted C11-C22 Aromatics		30.5 U	31.8 U	28.7 U	30.7 UJ	389	101	32.5 U	29.2 UJ	31.9 UJ	27.5 U	29 U	28.5 UJ
Unadjusted C11-C22 Aromatics	800	30.5 U	31.8 U	28.7 U	32.2	392	101	32.5 U	29.2 U	31.9 U	27.5 U	29 U	28.5 U
Benzo(a)anthracene		0.152 U	0.158 U	0.143 U	1.73 J	0.0613 J	0.157 U	0.162 U	0.172 J	0.159 UJ	0.088 J	0.145 U	0.142 UJ
Benzo(a)pyrene		0.0259 J	0.158 U	0.143 U	1.52 J	0.142 U	0.0725 J	0.162 U	0.189 J	0.159 UJ	0.117 J	0.0363 J	0.0299 J
Benzo(b)fluoranthene		0.0305 J	0.158 U	0.143 UJ	0.783 J	0.0242 J	0.0442 J	0.162 UJ	0.0845 J	0.159 UJ	0.0564 J	0.0203 J	0.0214 J
Benzo(g,h,i)perylene		0.0702 J	0.158 U	0.143 U	0.735 J	0.142 U	0.0442 J	0.162 U	0.128 J	0.159 UJ	0.137 U	0.0232 J	0.142 UJ
Benzo(k)fluoranthene		0.0412 J	0.158 U	0.143 U	1.43 J	0.0328 J	0.0347 J	0.162 U	0.178 J	0.159 UJ	0.129 J	0.0421 J	0.0484 J
Chrysene		0.0229 J	0.0159 J	0.143 U	1.75 J	0.0271 J	0.0647 J	0.162 U	0.326 J	0.159 UJ	0.151	0.0479 J	0.0456 J
Dibenzo(a,h)anthracene		0.0305 J	0.158 U	0.143 U	0.292 J	0.142 U	0.157 U	0.162 U	0.145 UJ	0.159 UJ	0.137 U	0.145 U	0.142 UJ
Fluoranthene		0.029 J	0.019 J	0.143 U	4 J	0.201	0.0473 J	0.162 U	0.471 J	0.0573 J	0.245	0.0798 J	0.0669 J
Fluorene		0.152 U	0.158 U	0.143 U	0.284 J	0.539	0.157 U	0.162 U	0.0495 J	0.159 UJ	0.0206 J	0.145 U	0.142 UJ
Indeno(1,2,3-cd)pyrene		0.0671 J	0.158 U	0.143 U	0.599 J	0.142 U	0.157 U	0.162 U	0.0801 J	0.159 UJ	0.137 U	0.145 U	0.142 UJ
2-Methylnaphthalene		0.152 U	0.158 U	0.143 U	0.153 UJ	0.13 J	0.157 U	0.162 U	0.145 UJ	0.159 UJ	0.137 U	0.145 U	0.142 UJ
Naphthalene		0.152 U	0.158 U	0.143 U	0.153 UJ	0.142 U	0.157 U	0.162 U	0.145 UJ	0.159 UJ	0.137 U	0.145 U	0.142 UJ
Phenanthrene		0.152 UJ	0.158 UJ	0.143 U	2.39 J	1.01	0.157 U	0.162 U	0.262 J	0.159 UJ	0.128 J	0.0537 J	0.0498 J
Pyrene		0.152 UJ	0.158 UJ	0.143 U	3.21 J	0.362	0.0915 J	0.162 U	0.382 J	0.0557 J	0.206	0.0682 J	0.0569 J
Adjusted TPH		30.2 J	31.8 U	28.7 U	30.7 U	1080	175	32.5 U	44.8	31.9 U	27.5 U	29 U	28.5 U
Unadjusted TPH		30.2 J	31.8 U	28.7 U	32.2	1080	175	32.5 U	46.8	31.9 U	27.5 U	29 U	28.5 U

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD009-071906	SY-EX-041	SY-EX-042	TBO-EX-001	TBO-EX-002	TBO-EX-003	TBO-EX-004	TBO-EX-005	TBO-EX-006	TBO-EX-007	TBO-EX-008	TBO-EX-009
Upper Depth (in.)			0	0									
Lower Depth (in.)			3	3									
Date Sampled	MCP S-1	7/19/2006	7/19/2006	7/19/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006	8/9/2006
EPH (mg/Kg)													
Acenaphthene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Acenaphthylene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Unadjusted C19-C36 Aliphatics	3000	29.1 U	29.5 U	28.2 U	28.4 U	29.2 U	27.6 U	28.6 U	28.3 U	28.2 U	28.4 U	29.1 U	29.3 U
Unadjusted C9-C18 Aliphatics	1000	29.1 U	29.5 U	28.2 U	28.4 U	29.2 U	27.6 U	28.6 U	28.3 U	28.2 U	28.4 U	29.1 U	29.3 U
Anthracene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Adjusted C11-C22 Aromatics		29.1 UJ	29.5 UJ	28.2 UJ									
Unadjusted C11-C22 Aromatics	800	29.1 U	29.5 U	28.2 U	28.4 U	29.2 U	27.6 U	28.6 U	28.3 U	28.2 U	28.4 U	29.1 U	29.3 U
Benzo(a)anthracene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Benzo(a)pyrene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Benzo(b)fluoranthene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Benzo(g,h,i)perylene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Benzo(k)fluoranthene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Chrysene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Dibenzo(a,h)anthracene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Fluoranthene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Fluorene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Indeno(1,2,3-cd)pyrene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
2-Methylnaphthalene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Naphthalene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Phenanthrene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Pyrene		0.145 UJ	0.147 UJ	0.14 UJ	0.141 U	0.145 U	0.138 U	0.142 U	0.141 U	0.141 U	0.142 U	0.145 U	0.146 U
Adjusted TPH		29.1 U	29.5 U	28.2 U	28.4 U	29.2 U	27.6 U	28.6 U	28.3 U	28.2 U	28.4 U	29.1 U	29.3 U
Unadjusted TPH		29.1 U	29.5 U	28.2 U	28.4 U	29.2 U	27.6 U	28.6 U	28.3 U	28.2 U	28.4 U	29.1 U	29.3 U

Appendix Table A.1.4
 Soil Sample Results - EPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		TBO-EX-010	TK-55-009	TK-55-010	TK-55-011	TK-55-012	TK-55-013
Upper Depth (in.)							
Lower Depth (in.)							
Date Sampled	MCP S-1	8/9/2006	9/14/2005	9/14/2005	11/8/2005	11/8/2005	11/8/2005
EPH (mg/Kg)							
Acenaphthene		0.188 U	0.163 U	0.0415 J	0.153 U	0.149 U	0.168 U
Acenaphthylene		0.188 U	0.163 U	0.153 U	0.153 U	0.149 U	0.168 U
Unadjusted C19-C36 Aliphatics	3000	37.7 U	32.6 U	30.8 U	30.6 U	29.8 U	37.3
Unadjusted C9-C18 Aliphatics	1000	37.7 U	32.6 U	68.2	30.6 U	29.8 U	33.7 U
Anthracene		0.188 U	0.163 U	0.0338 J	0.0245 J	0.149 U	0.168 U
Adjusted C11-C22 Aromatics							
Unadjusted C11-C22 Aromatics	800	37.7 U	32.6 U	69.1	42.8	29.8 U	55.5
Benzo(a)anthracene		0.188 U	0.163 U	0.153 U	0.153 UJ	0.149 UJ	0.168 UJ
Benzo(a)pyrene		0.188 U	0.163 U	0.153 U	0.153 UJ	0.149 UJ	0.168 UJ
Benzo(b)fluoranthene		0.188 U	0.163 U	0.153 U	0.153 UJ	0.149 UJ	0.168 UJ
Benzo(g,h,i)perylene		0.188 U	0.163 UJ	0.153 UJ	0.153 UJ	0.149 UJ	0.168 UJ
Benzo(k)fluoranthene		0.188 U	0.163 U	0.153 U	0.153 U	0.149 U	0.168 U
Chrysene		0.188 U	0.163 U	0.153 U	0.153 U	0.149 U	0.168 U
Dibenzo(a,h)anthracene		0.188 U	0.163 UJ	0.153 UJ	0.153 UJ	0.149 UJ	0.168 UJ
Fluoranthene		0.188 U	0.163 U	0.153 U	0.153 U	0.149 U	0.168 U
Fluorene		0.188 U	0.163 U	0.0907 J	0.153 U	0.149 U	0.168 U
Indeno(1,2,3-cd)pyrene		0.188 U	0.163 UJ	0.153 UJ	0.153 UJ	0.149 UJ	0.168 UJ
2-Methylnaphthalene		0.188 U	0.163 U	0.153 U	0.0673 J	0.149 U	0.168 U
Naphthalene		0.188 U	0.163 U	0.153 U	0.153 U	0.149 U	0.168 U
Phenanthrene		0.188 U	0.163 U	0.177	0.153 UJ	0.149 UJ	0.168 UJ
Pyrene		0.188 U	0.163 U	0.0722 J	0.153 U	0.149 U	0.168 U
Adjusted TPH		37.7 U	28.8 J	159	68.5	29.8 U	103
Unadjusted TPH		37.7 U	28.8 J	160	68.5	29.8 U	103

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD005-062906	PCA1-TUB-01	SB0090006I	SB0090102F	SB-010 0006I	SB-010 0203F	SB0130006I	SB0130203F	SB-017 0006I	SB-017 0203F
Upper Depth (in.)				0	12	0	24	0	24	0	24
Lower Depth (in.)				6	24	6	36	6	36	6	36
Date Sampled	MCP S-1	6/29/2006	10/28/2005	10/20/2003	10/20/2003	9/7/2004	9/7/2004	10/20/2003	10/20/2003	9/9/2004	9/9/2004
Inorganics (mg/Kg)											
Antimony	20		1.84 UJ	R	R	R	R	R	R	5 UJ	5 UJ
Arsenic	20		1.84 U	1.4 J	1.2 J	7.3 J	3.6 J	2.5 J	1.7 J	3.2 J	5.2 J
Beryllium	0.7		0.343	1.2 U	1 U	0.5 U	0.5 U	1.1 U	0.5 U	0.5 U	0.5 U
Cadmium	2		0.307 U	1.1 U	0.98 U	2.5 U	2.5 U	1 U	0.83 U	2.5 U	5 U
Chromium	30		12.6	12	15	20 J	9 J	12	12	13 J	16 J
Copper			18.9	1.7 U	1.6 U	7 UJ	12 UJ	1.6 U	1.3 U	9.8 U	13 U
Lead	300	48.3 J	33.7	1.4 J	1.8 J	R	R	0.99 J	1.1 J	5.7	6.8
Lithium											
Mercury	20		0.215 U	0.75 U	0.74 U	0.5 U	0.5 U	0.8 U	0.67 U	0.5 U	0.5 U
Nickel	20		13.7	5.6	7.9	18 J	10 U	4.9	6.2	10 U	16 U
Selenium	400		1.84 U	3.4 U	3 U	10 U	10 U	3.1 U	2.6 U	10 U	10 U
Zinc	2500		59.4	58	61	150 U	150 U	44	40	150 U	150 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD205-102203	SB0200006I	SB0200203F	SB-021 0006I	SB-021 0203F	FD202-102003	SB0220006I	SB0220102F	SB-023 0006I	SB-023 0203F	SB024-0006I	SB024-0203F
Upper Depth (in.)		24	0	24	0	24	0	0	12	0	24	0	24
Lower Depth (in.)		36	6	36	6	36	6	6	24	6	36	6	36
Date Sampled	MCP S-1	10/22/2003	10/22/2003	10/22/2003	9/9/2004	9/9/2004	10/20/2003	10/20/2003	10/20/2003	9/8/2004	9/8/2004	10/7/2004	10/7/2004
Inorganics (mg/Kg)													
Antimony	20	0.76 J	R	R	5 UJ	5 UJ	R	R	R	5 UJ	5 UJ	5 UJ	5 UJ
Arsenic	20	0.19 U	1.3	1.8	3.5 J	4.1 J	0.22 UJ	2 J	3.9 J	3.3 J	4 J	1.3 J	1 UJ
Beryllium	0.7	0.85 U	0.86 U	0.83 U	0.5 U	0.5 U	0.97 U	1 U	0.86 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
Cadmium	2	0.81 U	0.81 U	0.79 U	2.5 U	2.5 U	0.92 U	0.95 U	0.81 U	2.5 U	2.5 U	2.5 UJ	2.5 UJ
Chromium	30	12	9.3	13	12 J	19 J	9.8	10	7.9	16 J	17 J	R	R
Copper		3.5	6	2.9	11 U	14 U	3	3.7	15	12 U	15 U	6.7 J	14 J
Lead	300	1.2	27 J	2.4 J	7.3	5.5	R	R	1 J	13	13	5.2	3.7
Lithium													
Mercury	20	0.68 U	0.63 U	0.59 U	0.5 U	0.5 U	0.68 U	0.76 U	0.67 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20	8.5	9.7	8	10 U	15 U	7.3	7.6	5.8	12	25	R	R
Selenium	400	2.5 U	2.5 U	2.5 U	10 U	10 U	2.9 U	3 U	2.5 U	10 U	10 U	10 UJ	10 UJ
Zinc	2500	68	62	62	150 U	150 J	43	46	88	150 U	150 U	R	R

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0270102F	SB028-0006I	SB029-0203F	SB0320006I	SB0320102F	SB0330006I	SB0330102F	SB0350006I	SB0350102F	SB-036 0006I	SB-036 0203F	SB037-0006I
Upper Depth (in.)		12	0	24	0	12	0	12	0	12	0	24	0
Lower Depth (in.)		24	6	36	6	24	6	24	6	24	6	36	6
Date Sampled	MCP S-1	10/22/2003	12/2/2004	10/19/2004	10/20/2003	10/20/2003	10/22/2003	10/22/2003	10/20/2003	10/20/2003	9/8/2004	9/8/2004	10/7/2004
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	R	R	0.52 U	0.52 U	R	R	5 UJ
Arsenic	20	0.66	8.4	R	0.22 UJ	0.24 UJ	0.98	0.93	1.6	0.94	3.4 J	3.2 J	1.1 J
Beryllium	0.7	0.88 U	0.5 U	0.5 U	0.99 U	1.1 U	0.84 U	0.82 U	0.75 U	0.75 U	0.5 U	0.5 U	0.5 UJ
Cadmium	2	0.83 U	2.5 U	2.5 U	2.5	1 U	0.8 U	0.78 U	0.71 U	0.71 U	2.5 U	2.5 U	2.5 UJ
Chromium	30	8.5	6 J	10 J	20	26	16	15	9.1	8.4	12 J	49 J	R
Copper		8.5	21 J	9.3	24	7.6	49	16	31	13	16 UJ	20 UJ	14 J
Lead	300	2.7 J	5.1 J	R	R	R	3.1 J	3 J	1.8 J	0.46 J	8.2 J	8.5 J	3.7
Lithium													
Mercury	20	0.54 U	0.5 U	0.5 U	0.67 U	0.4 U	0.52 U	0.4 U	0.64 U	0.54 U	0.5 U	0.5 U	0.5 U
Nickel	20	8.1	10 U	10 J	8.9	14	15	15	11	9.2	11 J	15 J	R
Selenium	400	2.6 U	10 U	10 UJ	2.9 U	3.2 U	2.5 U	2.4 U	2.2 U	2.2 U	10 U	10 U	10 UJ
Zinc	2500	46	150 U	150 UJ	750	330	67	63	84	35	150 U	150 U	R

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB037-0203F	SB037-0910F	SB038-0006I	SB038-0203F	SB038-0506F	SB039-0006I	SB039-0203F	SB039-1415F	SB040-0006I	SB040-0203F	SB040-1415F	FD-007-100704
Upper Depth (in.)		24	108	0	24	60	0	24	168	0	24	168	24
Lower Depth (in.)		36	120	6	36	72	6	36	180	6	36	180	36
Date Sampled	MCP S-1	10/7/2004	10/7/2004	12/2/2004	12/2/2004	12/2/2004	10/24/2004	10/24/2004	10/24/2004	12/1/2004	12/1/2004	12/1/2004	10/7/2004
Inorganics (mg/Kg)													
Antimony	20	5 UJ	5 UJ	R	R	R	R	R	R	R	R	R	5 UJ
Arsenic	20	1.2 J	1 UJ	3.8	1 U	3.5	R	R	R	2.4	3.5	2	1.2 J
Beryllium	0.7	0.5 UJ	0.5 J	0.5 U	0.5 UJ								
Cadmium	2	2.5 UJ	2.5 UJ	2.5 U	2.5 UJ								
Chromium	30	R	R	5 U	6.5 J	9.2 J	8.2	7.4	19	7 J	12 J	19 J	R
Copper		27 J	10 J	5 U	5.8 J	12 J	7.3	11	10	5 U	20 J	28 J	16 J
Lead	300	7.8	3.4	7 J	2.3 J	4.6 J	R	R	R	6.1 J	7.3 J	3.4 J	5.3
Lithium													
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20	R	R	10 U	10 U	10 U	10 U	10 U	14	10 U	13 J	13 J	R
Selenium	400	10 UJ	10 UJ	10 U	10 UJ								
Zinc	2500	R	R	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	R

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		MS007-SB041	SB041-0203F	SB041-1415F	SB042-0510F	SB-044 0203F	SB045-0607F	SB046 0006I	SB046 0506F	SB-047-0006I	SB-047-0203F	SB-047-0607F	SB0480006I
Upper Depth (in.)			24	168	60	24	72	0	60	0	24	72	0
Lower Depth (in.)			36	180	120	36	84	6	72	6	36	84	6
Date Sampled	MCP S-1	10/7/2004	10/7/2004	10/7/2004	10/24/2004	9/8/2004	12/2/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	10/30/2003
Inorganics (mg/Kg)													
Antimony	20	5 UJ	5 UJ	5 UJ	R	R	R	R	R	R	R	R	R
Arsenic	20	1.4 J	1.7 J	1.4 J	R	2.3 J	2.5	4.6 J	3.1 J	8.7 J	7.8 J	1.1 J	4 J
Beryllium	0.7	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.74 U
Cadmium	2	2.5 UJ	2.5 UJ	2.5 UJ	2.5 U	2.5 U	2.5 U	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	0.71 U
Chromium	30	R	R	R	11	16 J	16 J	20 J	11 J	26 J	21 J	23 J	10
Copper		9.6 J	19 J	20 J	12	6 UJ	12 J	16 J	14 J	21 J	15 J	13 J	15
Lead	300	21	4.1	6.3	R	3.5 J	5.8 J	5.9 J	6.1 J	4.5 J	9.3 J	3.3 J	0.48 J
Lithium													
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.011 J				
Nickel	20	R	R	R	10	110 J	15 J	19 J	12 J	28 J	19 J	14 J	16
Selenium	400	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	5.3
Zinc	2500	R	R	R	150 U	150 U	150 U	R	R	R	R	R	49

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0480203F	SB050-0006I	SB050-0203F	SB051-0006I	SB051-0203F	SB052-0006I	SB-053 0006I	SB-053 0203F	SB-056 0006I	SB-056 0203F	SB-056 1415F	FD-208-103003
Upper Depth (in.)		24	0	24	0	24	0	0	24	0	24	168	168
Lower Depth (in.)		36	6	36	6	36	6	6	36	6	36	180	180
Date Sampled	MCP S-1	10/30/2003	10/24/2004	10/24/2004	10/16/2004	10/16/2004	12/2/2004	9/8/2004	9/8/2004	9/7/2004	9/7/2004	9/7/2004	10/30/2003
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	1.2 J	R	R	3.1	2.7	2.3	3.5 J	1.8 J	3.5 J	3 J	4.3 J	2.6
Beryllium	0.7	0.82 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.75 U
Cadmium	2	0.78 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.71 U
Chromium	30	16	17	44	8.7	15	10 J	13 J	12 J	18 J	11 J	16 J	18
Copper		19	15	94	9.3 J	16 J	11 J	21 UJ	19 UJ	21 UJ	20 UJ	16 UJ	25
Lead	300	1.1 J	R	R	4.7	10	8.8 J	9.9 J	3.2 J	8.5 J	5.8 J	4.8 J	0.75 J
Lithium													
Mercury	20	0.014 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.006
Nickel	20	17	12	100	10 U	11	10 J	13 J	16 J	10 U	12 J	15 J	16
Selenium	400	9.2	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	8.2
Zinc	2500	70	150 U	220	150	150 U	150 U	150 U	150 U	150 U	150 U	150 U	61

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0570006I	SB0570203F	SB0571415F	SB0580006I	SB0580203F	SB0580506F	SB0611415F	SB-063 1415F	SB064-1415F	SB065 1415F	SB067-1415F	SB0691415F
Upper Depth (in.)		0	24	168	0	24	60	168	168	168	168	168	168
Lower Depth (in.)		6	36	180	6	36	72	180	180	180	180	180	180
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	9/30/2004	9/30/2004	9/30/2004	10/7/2004	10/30/2003
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	R	R	R	R	R	5 UJ	R
Arsenic	20	1.6	1.7	1.8	27	1.6	2.4	0.93 J	2.4 J	1.8 J	2.1 J	1 UJ	1.4
Beryllium	0.7	0.98 U	0.81 U	0.77 U	0.78 U	0.8 U	0.79 U	0.78 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.8 U
Cadmium	2	0.93 U	1 U	0.73 U	0.74 U	0.76 U	0.75 U	0.74 U	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ	0.76 U
Chromium	30	13	11	19	20	17	14	8.2	18 J	6.6 J	10 J	R	16
Copper		19	16	16	36	17	22	20	16 J	11 J	21 J	7.8 J	16
Lead	300	R	0.52 J	R	0.57 J	1 J	0.88 J	R	7.2 J	3.7 J	5.1 J	4.3	0.48 J
Lithium													
Mercury	20	0.019	0.016	0.008	0.015	0.019	0.015	0.007 J	0.5 U	0.5 U	0.5 U	0.5 U	0.009
Nickel	20	14	13	13	16	15	19	13	14 J	10 UJ	17 J	R	17
Selenium	400	2.9 U	7.4	8.7	2.3 U	8.2	6.3	11	10 UJ	10 UJ	10 UJ	10 UJ	13
Zinc	2500	44	50	51	57	61	59	81	R	R	R	R	78

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB070-0006I	SB-074 0203F	SB-074 1213F	SB075A-0006I	SB075A-0203F	SB075A-1415F	SB075B-0006I	SB075B-0203F	SB076-0203F	SB076-0809F	SB077 0006I
Upper Depth (in.)		0	24	144	0	24	168	0	24	24	96	0
Lower Depth (in.)		6	36	156	6	36	180	6	36	36	108	6
Date Sampled	MCP S-1	12/14/2004	9/8/2004	9/8/2004	12/1/2004	12/1/2004	12/1/2004	12/2/2004	12/2/2004	12/2/2004	12/2/2004	1/25/2005
Inorganics (mg/Kg)												
Antimony	20	5 U	5 UJ	5 UJ	R	R	R	R	R	R	R	R
Arsenic	20	1 U	3.3 J	3.3 J	2.9	2.2	1 U	3.1	7.7	1.5	1.5	R
Beryllium	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chromium	30	7.3	17 J	8.7 J	5 U	12 J	9.2 J	8.6 J	14 J	9.7 J	8.2 J	5 U
Copper		11	12 U	15 U	5 U	16 J	12 U	15	12	14	24	14
Lead	300	2.2 J	5.7	2.9	5.8 J	4.2 J	2.7 J	7 J	4.8 J	2.4 J	3.9 J	R
Lithium												
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20	16	12 U	13 U	10 U	10 J	10 U	10 U	11	11	16	10 U
Selenium	400	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U
Zinc	2500	150	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB077 0203F	SB077 1415F	SB0780006I	SB0780102F	SB079-0006I	SB079-0203F	SB079-1415F	SB080-0006I	SB080-0203F	SB080-1415F	SB081-0006I	SB081-0203F
Upper Depth (in.)		24	168	0	12	0	24	168	0	24	168	0	24
Lower Depth (in.)		36	180	6	24	6	36	180	6	36	180	6	36
Date Sampled	MCP S-1	1/25/2005	1/25/2005	9/27/2004	9/27/2004	10/24/2004	10/24/2004	10/24/2004	11/30/2004	11/30/2004	11/30/2004	12/2/2004	12/2/2004
Inorganics (mg/Kg)													
Antimony	20	R	R	5 UJ	5 UJ	R	R	R	R	R	R	R	R
Arsenic	20	R	R	2.1	1.6	R	R	R	3.9	2.5	1.8	4.5	1.3
Beryllium	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 UJ
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chromium	30	11	17	10	9	13	13	14	5 J	5 U	15 J	16 J	6.5 J
Copper		10	5.2	22	12	14	6.5	7	7.2 J	5 U	23 J	15	5 U
Lead	300	R	R	4.9 J	3.9 J	R	R	R	5 UJ	5.2 UJ	2.7 UJ	6 J	2.8 J
Lithium													
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20	10 U	15	13	12	10 U	11	10 U	10 U	10 U	12 J	11	10 U
Selenium	400	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 J	10 UJ	10 UJ
Zinc	2500	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB082-0006I	SB082-0203F	SB082-0708F	SB083-0006I	SB083-0006I-121404	SB083-0203F	SB083-0203F-121404	SB084-0006I	SB084-0203F	SB084-1415F	SB085-0203F
Upper Depth (in.)		0	24	84	0	0	24	24	0	24	168	24
Lower Depth (in.)		6	36	96	6	6	36	36	6	36	180	36
Date Sampled	MCP S-1	12/2/2004	12/2/2004	12/2/2004	10/30/2003	12/14/2004	10/30/2003	12/14/2004	10/16/2004	10/16/2004	10/16/2004	10/19/2004
Inorganics (mg/Kg)												
Antimony	20	R	R	R	R	5 U	R	5 U	R	R	R	R
Arsenic	20	2.2	3.9	2.4	4.1 J	1 U	1.8 J	1 U	2.6	3.3	2.8	R
Beryllium	0.7	0.5 UJ	0.5 UJ	0.5 UJ	0.72 U	0.5 U	0.83 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cadmium	2	2.5 U	2.5 U	2.5 U	0.69 U	2.5 U	0.79 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chromium	30	11 J	11 J	5 UJ	12	12	6.4	11	20	7.6	34	6.7 J
Copper		16	14	54	2.1	21	8	14	6.6 J	5 UJ	6.8 J	5 U
Lead	300	5.5 J	4.9 J	2 U	0.85 J	13 J	0.58 J	2.8 J	2.7	3	3	R
Lithium												
Mercury	20	0.5 U	0.5 U	0.5 U	0.007 J	0.5 U	0.011 J	0.5	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20	10 U	11	10 U	23	16	8.1	19	15	10 U	28	10 UJ
Selenium	400	10 UJ	10 UJ	10 UJ	2.1 U	10 U	2.5 U	10 U	10 U	10 U	10 U	10 UJ
Zinc	2500	150 U	150 U	150 U	26	150 U	42	150 U	150 U	150 U	150 U	150 UJ

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB086-0203F	SB091-0006I	SB092-0006I	SB092-0203F	SB092-1415F	FD-008-101704	SB093-0006I	SB093-0203F	SB093-1415F	SB094-0006I	SB094-0203F
Upper Depth (in.)		24	0	0	24	168	0	0	24	168	0	24
Lower Depth (in.)		36	6	6	36	180	6	6	36	180	6	36
Date Sampled	MCP S-1	10/17/2004	10/24/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/20/2004	10/20/2004
Inorganics (mg/Kg)												
Antimony	20	R	R	R	R	R	R	R	R	R	5 UJ	5 UJ
Arsenic	20	4.5	R	9.8	7.4	4.5	5.1	4.6	2.7	2.9	4.7	2.7
Beryllium	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chromium	30	8.2	10	32	15	15	9.9	8.1	5.8	9.7	10 J	13 J
Copper		11 J	14	93 J	7.3 J	15 J	5 UJ	9.4 J	12 J	11 J	5 U	8.7
Lead	300	5.7	R	4.6	42	12	10	9.4	8.9	3.8	7.4	6.4
Lithium												
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U					
Nickel	20	10 U	12	26	10 U	14	10 U	10 U	10 U	12	10 UJ	16 J
Selenium	400	10 U	10 U	10 U	10 U	10 UJ	10 UJ					
Zinc	2500	150	150 U	150	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD009-102404	SB095-0006I	SB095-0203F	SB095-1213F	FD006-090904	SB-096 0006I	SB097-0006I	SB097-0203F	SB612-0103F
Upper Depth (in.)		0	0	24	144	24	0	0	24	12
Lower Depth (in.)		6	6	36	156	36	6	6	36	36
Date Sampled	MCP S-1	10/24/2004	10/24/2004	10/24/2004	10/24/2004	9/9/2004	9/9/2004	11/30/2004	11/30/2004	4/28/2005
Inorganics (mg/Kg)										
Antimony	20	R	R	R	R	5 UJ	5 UJ	R	R	13.5 U
Arsenic	20	R	R	R	R	3.9 J	7.3 J	3.5	3.1	3.11 U
Beryllium	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.415 U
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5	2.5 U	2.5 U	0.519 U
Chromium	30	14	7.3	11	10	11 J	12 J	6 J	11 J	15.1
Copper		9.8	13	13	17	14 U	13 U	40 J	7.5 J	20.7
Lead	300	R	R	R	R	5.2	9.6	3.4 UJ	3.9 UJ	2.22
Lithium		14	13	18	17					
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.188 U
Nickel	20	10 U	10 U	10 U	13	12 U	17 U	17 J	10 U	15.9
Selenium	400	10 U	10 U	10 U	10 U	10 U	10 U	10 J	10 U	3.11 U
Zinc	2500	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	270

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD001-042805	SB613-0103F	SB614-0103F	FD901-001-110704	SY-EX001	SY-EX007	SY-EX008	SY-EX012	SY-EX017	SY-EX018	SY-EX020
Upper Depth (in.)		12	12	12		0	0	0				
Lower Depth (in.)		36	36	36		12	3	3				
Date Sampled	MCP S-1	4/28/2005	4/28/2005	4/28/2005	11/7/2004	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/13/2006
Inorganics (mg/Kg)												
Antimony	20	7.76 U	14.2 U	9.63 U	5 U							
Arsenic	20	3.32 U	3.05 U	3.21 U	2.4							
Beryllium	0.7	0.443 U	0.609	0.428 U	0.5 U							
Cadmium	2	0.554 U	0.508 U	0.535 U	2.5 U							
Chromium	30	8.08	13.2	14	20							
Copper		13.5	19.4	15.2	20							
Lead	300	1.66 U	1.65	35.2	2 U	79.2 J	9.33 J	3.55 J	2.51 J	3.96 J	2.3 J	3.56 J
Lithium												
Mercury	20	0.193 U	0.202 U	0.19 U	0.5 U							
Nickel	20	9.05	13.7	14.9	27							
Selenium	400	3.32 U	3.05 U	3.21 U	10 U							
Zinc	2500	216	169	128	150 U							

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SY-EX021	SY-EX022	SY-EX023	SY-EX024	SY-EX025	SY-EX026	FD008-071306	SY-EX027	SY-EX028	SY-EX-029	SY-EX-030	SY-EX-031	SY-EX-032	SY-EX-033	SY-EX-034
Upper Depth (in.)													0	0	0	0
Lower Depth (in.)													8	10	3	3
Date Sampled	MCP S-1	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/13/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006
Inorganics (mg/Kg)																
Antimony	20															
Arsenic	20															
Beryllium	0.7															
Cadmium	2															
Chromium	30															
Copper																
Lead	300	6.75 J	14.6 J	10.7 J	4.61 J	21.6 J	54.8 J	10.5 J	10.1 J	12.9 J	40.8 J	64.8 J	35.5 J	3.4 J	4.03 J	7.83
Lithium																
Mercury	20															
Nickel	20															
Selenium	400															
Zinc	2500															

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SY-EX-035
Upper Depth (in.)		0
Lower Depth (in.)		12
Date Sampled	MCP S-1	7/19/2006
Inorganics (mg/Kg)		
Antimony	20	
Arsenic	20	
Beryllium	0.7	
Cadmium	2	
Chromium	30	
Copper		
Lead	300 J	83.2 J
Lithium		
Mercury	20	
Nickel	20	
Selenium	400	
Zinc	2500	

 > MCP S-1

Appendix Table A.1.4
 Soil Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SY-EX-036	SY-EX-037	SY-EX-038	SY-EX-039	SY-EX-040	FD009-071906	SY-EX-041	SY-EX-042	YRDTS-003	YRDTS-007	YRDTS-017	YRDTS-018
Upper Depth (in.)		0	0	0	0	0		0	0	0	0	0	0
Lower Depth (in.)		12	12	12	3	3		3	3	2	2	2	2
Date Sampled	MCP S-1	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	7/19/2006	10/18/2000	10/24/2000	11/15/2000	11/15/2000
Inorganics (mg/Kg)													
Antimony	20												
Arsenic	20												
Beryllium	0.7												
Cadmium	2												
Chromium	30												
Copper													
Lead	300	22.1 J	53 J	2.65 J	3.32 J	9.31 J	2.26 J	2.36 J	6.79 J	11	15	25	21
Lithium													
Mercury	20												
Nickel	20												
Selenium	400												
Zinc	2500												

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX0007-008F	FD001-060305-1	EX004-0002F	EX005-0002F	EX006-0002F	EX-1-001	EX-1-002R2	EX-1-003	EX-1-004	EX-1-007
Upper Depth (in.)		0		0	0	0	0	0	0	0	0
Lower Depth (in.)		96		24	24	24	3	3	3	3	3
Date Sampled	MCP S-1	6/3/2005	6/3/2005	5/6/2005	5/6/2005	5/6/2005	6/29/2005	9/26/2005	8/30/2005	8/31/2005	8/22/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	153	174	1400	1200	370	95.1	463	673	11.5	57.8
Aroclor-1260	2000	25.8	33	33 U	34 U	33 U	65.8	659	133	3.5 J	13.4

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		TFD005-082205	EX-1-007R	EX-1-008	EX-1-008R	EX-1-011R	EX-1-014	EX-1-015	EX-1-016	EX-1-017	EX-1-018R	EX-1-019R	EX-1-020R2	EX-1-021
Upper Depth (in.)			0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)			3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	8/22/2005	8/30/2005	8/22/2005	8/30/2005	8/30/2005	8/11/2005	8/11/2005	8/22/2005	8/6/2005	8/10/2005	10/6/2005	8/12/2005	8/22/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	49.6	673	469	1080	612	797	240	39.5	429	1740	136	96.8	153
Aroclor-1260	2000	22	153	133	619	601	195	65	9.01 J	81.1	263	188	9.94 U	44

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-022	EX-1-023R2	EX-1-025R	EX-1-026	EX-1-027	EX-1-028R2	TFD003-081005	EX-1-030	EX-1-031R	EX-1-032	EX-1-038	EX-1-039	EX-1-041
Upper Depth (in.)		0	0	0	0	0	0		0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3		3	3	3	3	3	3
Date Sampled	MCP S-1	8/6/2005	8/10/2005	8/8/2005	8/22/2005	8/6/2005	8/10/2005	8/10/2005	8/8/2005	8/30/2005	8/6/2005	9/19/2005	9/19/2005	9/19/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	551	383	2080	282	398	1020 J	2000 J	607	1150	1030	129	88.3	744
Aroclor-1260	2000	105	97.1	361	102	84.7	172	283	105	388	279	19	12.3	127

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-043	EX-1-044	EX-1-045	TFD011-091905	EX-1-046R	EX-1-047R	EX-1-048	EX-1-050	EX-1-051	EX-1-053	EX-1-054	EX-1-055	EX-1-056	EX-1-058
Upper Depth (in.)		0	0	0		0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3		3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/19/2005	9/19/2005	9/19/2005	9/19/2005	10/3/2005	10/3/2005	9/13/2005	8/1/2005	11/8/2005	8/1/2005	9/12/2005	11/8/2005	8/1/2005	9/12/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	438	680	496	422	968	371	682	146	116	281	269	213	434	370
Aroclor-1260	2000	65.2	158	88.8	73.3	170	81.7	166	27.9	23	82.2	43.3	66.9	83.8	65.3

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-060	EX-1-079R	EX-1-080R	EX-1-087	EX-1-089-R3	EX-1-090-R3	EX-1-091-R3	EX-1-092	TFD004-081805	EX-1-093	EX-1-094	EX-1-097	EX-1-100
Upper Depth (in.)		0	0	0	0	0	0	0	0		0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3		3	3	3	3
Date Sampled	MCP S-1	8/1/2005	10/3/2005	10/3/2005	8/9/2005	8/18/2005	8/18/2005	8/18/2005	8/18/2005	8/18/2005	8/18/2005	8/18/2005	8/6/2005	9/19/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	144	1260	1100	245	160	454	16.9	90.3	112	18	159	515	1130
Aroclor-1260	2000	40.1	220	183	38.7	35	89.2	91.4	67.7	53.3	10 U	179	104	177

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-101	EX-1-102	EX-1-103	EX-1-104	EX-1-107	EX-1-108R	EX-1-109	EX-1-113	EX-1-114	EX-1-115	EX-1-119	EX-1-120	EX-1-121	EX-1-122
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/19/2005	9/19/2005	9/19/2005	8/31/2005	8/30/2005	9/14/2005	9/2/2005	8/6/2005	8/6/2005	8/6/2005	7/21/2005	7/21/2005	7/21/2005	7/21/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	296	678	1350	29.7	1760	2560	952	363	206	1260	300	496	264	1060
Aroclor-1260	2000	39.4	138	235	5.45 J	402	572	254	121	50.9	240	65.7	125	66.8	162

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-124	EX-1-125	EX-1-126	EX-1-127	EX-1-128	EX-1-132	EX-1-201	EX-1-202	EX-1-203	EX-1-204	EX-1-205	EX-1-206	EX-1-207	EX-1-208
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	8/29/2005	8/29/2005	9/15/2005	9/15/2005	9/2/2005	6/29/2005	9/27/2005	9/27/2005	9/27/2005	9/27/2005	9/27/2005	9/27/2005	9/27/2005	9/27/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	268	378	128	424	703	414	9.67 U	9.84 U	184	106	9.76 U	9.78 U	9.77 U	9.66 U
Aroclor-1260	2000	39.8	63.6	64.3	73.6	149	118	1480 J	1680	163	160	1890	1970 J	1200	938

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-1-209	TFD015-092705	EX-1-210	EX-2-001	EX-2-002	EX-2-003	EX-2-004	TFD023-111705	EX-2-005	EX-2-006	EX-2-007	EX-2-008	EX-2-009
Upper Depth (in.)		0		0	0	0	0	0		0	0	0	0	0
Lower Depth (in.)		3		3	3	3	3	3		3	3	3	3	3
Date Sampled	MCP S-1	9/27/2005	9/27/2005	9/27/2005	11/17/2005	11/17/2005	11/17/2005	11/17/2005	11/17/2005	11/17/2005	11/17/2005	12/1/2005	12/2/2005	12/2/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	9.77 U	9.79 U	9.86 U	278	168	126	2190	1440	2290	634	2210	2780	2050
Aroclor-1260	2000	1060	1200	609	152	48.4	69.4	410	333	446	195	614	882	403

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-201-0020F	EX-2-010	EX-2-011	EX-202-0020F	EX-203-0020F	EX-204-0020F	EX-205-0020F	FD001-080505	EX-206-0003F	EX-207-0003F	EX-3-001	EX-3-002
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		240	3	3	240	240	240	240	240	36	36	3	3
Date Sampled	MCP S-1	8/5/2005	12/2/2005	4/17/2006	8/5/2005	8/5/2005	8/5/2005	8/5/2005	8/5/2005	8/11/2005	10/6/2005	9/19/2005	9/20/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	19.8 U	1760	1070	19.8 U	9.8 U	9.98 U	9.91 U	9.85 U	112	165	1090	562
Aroclor-1260	2000	19.8 U	365	221	19.8 U	9.8 U	9.98 U	9.91 U	9.85 U	19.8	33.8	193	272

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-003	TFD012-092005	EX-3-004	TFD009-091405	EX-3-005	EX-3-007	EX-3-008	EX-3-009R	EX-3-010	EX-3-011R	EX-3-012
Upper Depth (in.)		0		0		0	0	0	0	0	0	0
Lower Depth (in.)		3		3		3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/20/2005	9/20/2005	9/14/2005	9/14/2005	9/19/2005	9/14/2005	9/19/2005	10/5/2005	9/13/2005	10/6/2005	9/13/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	259	346	1940	1410	468	1790	199	306	386	93	504
Aroclor-1260	2000	928	1200	299	239	145	302	317	1180	83.4	169	1000

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-013	EX-3-014	EX-3-015	EX-3-016	EX-3-017R	EX-3-018	EX-3-019	EX-3-020R	EX-3-026	EX-3-027
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/13/2005	9/13/2005	9/13/2005	9/14/2005	10/7/2005	9/20/2005	9/19/2005	10/5/2005	7/28/2005	9/27/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	431	512	328	797	192	1850	516	2120	783	55
Aroclor-1260	2000	201	956	277	1010	481	1100	216	371 J	155	27.5

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-028	EX-3-029	EX-3-030	EX-3-031	EX-3-031-SW	EX-3-032	EX-3-033	EX-3-034	EX-3-034-SW	EX-3-035	EX-3-036	TFD025-120605
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	
Date Sampled	MCP S-1	9/27/2005	7/28/2005	8/9/2005	8/1/2005	8/1/2005	12/6/2005	12/6/2005	8/1/2005	8/1/2005	12/6/2005	12/6/2005	12/6/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	365	918	282	108	116	146	615	94.8	103	138	83.3	113
Aroclor-1260	2000	63	218	45.9	25.5	24.6	40.9	128	22.7	26.2	41.9	23.9	23.9

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-037	EX-3-038	EX-3-040	EX-3-041-080105	EX-3-041-080905	EX-3-042	EX-3-043	EX-3-044	EX-3-046	EX-3-047	EX-3-048	EX-3-049	EX-3-050
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	12/6/2005	7/28/2005	8/1/2005	8/1/2005	8/9/2005	8/9/2005	7/28/2005	12/6/2005	12/6/2005	12/6/2005	9/30/2005	9/30/2005	9/30/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	506	260	46.9	271	265	237	321	10.1	93.9	296	184	190	80.6
Aroclor-1260	2000	130	54.3	15.5	9.86 U	55.5	48.9	80.4	10.1 U	14.1	68.8	40.3	33	15.9

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-051	EX-3-052	EX-3-053	EX-3-054	EX-3-055R	EX-3-056	EX-3-057R	EX-3-058	EX-3-059	EX-3-060	EX-3-061	EX-3-062	EX-3-063	EX-3-064
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/30/2005	9/28/2005	9/28/2005	9/28/2005	10/6/2005	9/13/2005	10/6/2005	7/15/2005	7/15/2005	7/20/2005	7/20/2005	7/20/2005	9/27/2005	9/27/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	398	510	891	1070	195	383	1150 J	378	663	453	872	1380	355	145
Aroclor-1260	2000	61.4	73	136	181	61	54.3	183	133	115	110	183	255	65	26.7

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-065	EX-3-066	EX-3-067	EX-3-068	TFD001-072605	EX-3-069	EX-3-070	EX-3-080	EX-3-081	EX-3-084	EX-3-085	TFD007-090905	EX-3-086
Upper Depth (in.)		0	0	0	0		0	0	0	0	0	0		0
Lower Depth (in.)		3	3	3	3		3	3	3	3	3	3		3
Date Sampled	MCP S-1	9/27/2005	9/27/2005	9/27/2005	7/26/2005	7/26/2005	7/26/2005	7/26/2005	9/9/2005	9/9/2005	9/9/2005	9/9/2005	9/9/2005	9/9/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	490	354	101	260	317	272	650	1220	1670	822	824	806	1890
Aroclor-1260	2000	78.4	67	19.4	108	139	101	676	230	274	145	157	153	441

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-090	EX-3-091	EX-3-092	EX-3-093	EX-3-094	EX-3-095	TFD022-111105	EX-3-096	EX-3-097	EX-3-098	EX-3-099	EX-3-100	EX-3-101
Upper Depth (in.)		0	0	0	0	0	0		0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3		3	3	3	3	3	3
Date Sampled	MCP S-1	10/31/2005	10/31/2005	10/31/2005	10/31/2005	10/31/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	12/6/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	160	111	255	95.8	334	114	150	190	156	115	98	117	143
Aroclor-1260	2000	57.9	18.3	80.6	30.8	88.2	25.1	26.1	64	37.5	39.6	24.7	28	50.8

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-102	EX-3-103	EX-3-104	EX-4-001R	EX-4-002	EX-4-003	EX-4-004	EX-4-005	EX-4-006	EX-4-007	EX-4-008	EX-4-009	EX-4-010	EX-4-011
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	12/8/2005	12/8/2005	12/8/2005	7/28/2005	6/16/2005	6/16/2005	6/16/2005	6/17/2005	6/17/2005	6/17/2005	6/17/2005	6/17/2005	6/20/2005	6/20/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	52.2	25.2	75.8	10 U	219	96.2	129	81.5	46.8	91.9	185	215	60.3	2910
Aroclor-1260	2000	21	5.82 J	26.3	10 U	57.6	78.4	321 J	22.4	18.6	21	43.4	141	22.9	552

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-4-012	EX-4-013	EX-4-014	EX-4-015	EX-4-016	EX-4-017	EX-4-018	EX-4-019	EX-4-020	EX-4-021	EX-4-022	TFD001-062305	EX-4-023	EX-4-024R
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0		0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3		3	3
Date Sampled	MCP S-1	6/20/2005	6/21/2005	6/21/2005	6/21/2005	6/21/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/23/2005	6/23/2005	6/23/2005	9/30/2005
PCBs (µg/Kg)															
Aroclor-1254	2000	61	102	321	188	57	233	190	202	109	106	29.2 J	113 J	245	1960
Aroclor-1260	2000	10.9	21.3	71.9	45.1	24.6	44.9	40.2	39.4	30.5	24.4	22.6 J	61.1 J	216	307

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		TFD016-093005	EX-4-025R	EX-4-026	EX-4-027	EX-4-028	EX-4-029	EX-4-030	EX-4-031	EX-4-032R	EX-4-034R	EX-4-035R	EX-4-036	EX-4-037
Upper Depth (in.)			0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)			3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	9/30/2005	9/30/2005	9/22/2005	9/22/2005	9/22/2005	9/23/2005	9/23/2005	9/23/2005	10/3/2005	10/3/2005	10/3/2005	9/23/2005	9/23/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	1190	563	1790	1210	21.4	264	281	243	1410	1240	895	280	82.4 J
Aroclor-1260	2000	222	87.3	354	293	9.76 U	62.6	60.1	93.6	414	528	895	185	46 J

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		TFD013-092305	EX-4-038R	EX-4-039	EX-4-040	EX-4-041	EX-4-042	EX-4-045	EX-4-047	EX-4-048	EX-4-050	TFD017-100505
Upper Depth (in.)			0	0	0	0	0	0	0	0	0	
Lower Depth (in.)			3	3	3	3	3	3	3	3	3	
Date Sampled	MCP S-1	9/23/2005	10/3/2005	9/23/2005	9/23/2005	9/23/2005	9/23/2005	9/23/2005	9/30/2005	9/30/2005	10/5/2005	10/5/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	1060 J	1340	1100	556	680	3000	106	702	66.8	814	1110 J
Aroclor-1260	2000	259 J	441	416	135	143	533	36.4	185	99.9	129	161

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-4-051	EX-4-052	EX-4-055	EX-4-056	EX-4-060	TFD019-110305	EX-4-061	EX-4-062	TFD021-110905	EX-4-063
Upper Depth (in.)		0	0	0	0	0		0	0		0
Lower Depth (in.)		3	3	3	3	3		3	3		3
Date Sampled	MCP S-1	10/5/2005	10/5/2005	7/25/2005	7/25/2005	11/3/2005	11/3/2005	11/3/2005	11/9/2005	11/9/2005	11/18/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	1570	881	120	273	119 J	228 J	917	75.9	71.6	437
Aroclor-1260	2000	300	167	84.1	186	38.3	60	230	15.7	18.2	98.8

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-4-064	EX-FPH-001	EX-FPH-002	EX-FPH-003	EX-FPH-004	EX-FPH-005	NW-Lagoon-01	NW-Lagoon-02	NW-Lagoon-03	NW-Lagoon-04	PAB-001-0006I
Upper Depth (in.)		0	0	0	0	0	0					0
Lower Depth (in.)		3	3	3	3	3	3					6
Date Sampled	MCP S-1	11/18/2005	8/12/2005	8/12/2005	8/12/2005	8/12/2005	8/12/2005	5/22/2006	5/22/2006	5/22/2006	5/22/2006	10/16/2004
PCBs (µg/Kg)												
Aroclor-1254	2000	107	587	156	261	689	217	12.3 U	10.4 U	10.3 U	10.6 U	290
Aroclor-1260	2000	39.5	139	18.4	32	148	36.9	1550	308	829	242	39 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		PAB-003-0006I	PCA1-TUB-01	SB0090006I	SB-010 0006I	SB0130006I	SB-017 0006I	SB-017 0203F	SB0200006I	SB-021 0006I	SB-021 0203F	FD202-102003	SB0220006I
Upper Depth (in.)		0		0	0	0	0	24	0	0	24	0	0
Lower Depth (in.)		6		6	6	6	6	36	6	6	36	6	6
Date Sampled	MCP S-1	10/16/2004	10/28/2005	10/20/2003	9/7/2004	10/20/2003	9/9/2004	9/9/2004	10/22/2003	9/9/2004	9/9/2004	10/20/2003	10/20/2003
PCBs (µg/Kg)													
Aroclor-1254	2000	470	99.3	53	34 U	140	1100	37 UJ	400	170 J	40 U	1100	680
Aroclor-1260	2000	36 U	39.3	53 U	34 U	50 U	38 U	37 UJ	180	37 UJ	40 U	43 U	46 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0220102F	SB-023 0006I	SB-023 0203F	SB024-0006I	SB024-0203F	SB0270102F	SB028-0006I	SB029-0203F	SB0320006I	SB0330006I	SB0330102F	SB0350006I	SB0350102F
Upper Depth (in.)		12	0	24	0	24	12	0	24	0	0	12	0	12
Lower Depth (in.)		24	6	36	6	36	24	6	36	6	6	24	6	24
Date Sampled	MCP S-1	10/20/2003	9/8/2004	9/8/2004	10/7/2004	10/7/2004	10/22/2003	12/2/2004	10/19/2004	10/20/2003	10/22/2003	10/22/2003	10/20/2003	10/20/2003
PCBs (µg/Kg)														
Aroclor-1254	2000	40 U	37 U	35 U	41 U	38 U	120	33 U	280	2500	570	150	530	33 U
Aroclor-1260	2000	40 U	820	35 U	41 U	38 U	67	33 U	33 U	230 U	250	36 U	350	33 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-036 0006I	SB-036 0203F	SB037-0006I	SB037-0203F	SB037-0910F	SB038-0006I	SB038-0203F	SB038-0506F	SB039-0006I	SB039-0203F	SB040-0006I	SB040-0203F
Upper Depth (in.)		0	24	0	24	108	0	24	60	0	24	0	24
Lower Depth (in.)		6	36	6	36	120	6	36	72	6	36	6	36
Date Sampled	MCP S-1	9/8/2004	9/8/2004	10/7/2004	10/7/2004	10/7/2004	12/2/2004	12/2/2004	12/2/2004	10/24/2004	10/24/2004	12/1/2004	12/1/2004
PCBs (µg/Kg)													
Aroclor-1254	2000	630	36 U	97	36 U	38 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	670 J	36 U	34 U	36 U	38 U	33 U	33 U	33 U	33 U	33 U	91	33 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD-007-100704	MS007-SB041	SB041-0203F	SB041-1415F	SB042-0510F	SB-044 0203F	SB046 0006I	SB046 0506F	SB-047-0006I	SB-047-0203F	SB0480006I	SB0480203F
Upper Depth (in.)		24		24	168	60	24	0	60	0	24	0	24
Lower Depth (in.)		36		36	180	120	36	6	72	6	36	6	36
Date Sampled	MCP S-1	10/7/2004	10/7/2004	10/7/2004	10/7/2004	10/24/2004	9/8/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	10/30/2003	10/30/2003
PCBs (µg/Kg)													
Aroclor-1254	2000	360	150	540	36 U	62	34 U	1400 J	920	82	400 J	120	210
Aroclor-1260	2000	37 U	37 U	35 U	36 U	33 U	34 U	35 U	34 U	36 U	38 U	70	110

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB050-0006I	SB050-0203F	SB051-0006I	SB052-0006I	SB-053 0006I	SB-053 0203F	SB-056 0006I	SB-056 0203F	SB-056 1415F	SB0570006I	SB0580006I	SB0580203F
Upper Depth (in.)		0	24	0	0	0	24	0	24	168	0	0	24
Lower Depth (in.)		6	36	6	6	6	36	6	36	180	6	6	36
Date Sampled	MCP S-1	10/24/2004	10/24/2004	10/16/2004	12/2/2004	9/8/2004	9/8/2004	9/7/2004	9/7/2004	9/7/2004	10/30/2003	10/30/2003	10/30/2003
PCBs (µg/Kg)													
Aroclor-1254	2000	82	47 J	37 U	33 U	320 J	34 U	57	36 U	35 U	36 J	350	36 U
Aroclor-1260	2000	58	33 U	37 U	33 U	36 U	34 U	36 U	36 U	35 U	43 U	190	36 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0580506F	SB-063 1415F	SB064-1415F	SB065 1415F	SB-074 0203F	SB075A-0006I	SB075A-0203F	SB075B-0006I	SB075B-0203F	SB077 0006I	SB0780006I	SB0780006I A
Upper Depth (in.)		60	168	168	168	24	0	24	0	24	0	0	0
Lower Depth (in.)		72	180	180	180	36	6	36	6	36	6	6	6
Date Sampled	MCP S-1	10/30/2003	9/30/2004	9/30/2004	9/30/2004	9/8/2004	12/1/2004	12/1/2004	12/2/2004	12/2/2004	1/25/2005	9/27/2004	10/6/2004
PCBs (µg/Kg)													
Aroclor-1254	2000	49	35 U	36 U	36 U	35 U	33 U	120	96	84 J	33 U	520 J	2100
Aroclor-1260	2000	36 U	35 U	36 U	36 U	35 U	33 U	33 U	33 U	33 U	33 U	37 U	75 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0780006I B	SB0780006I C	SB0780616I A	SB0780616I C	SB0780618I B	SB079-0006I	SB080-0006I	SB081-0006I	SB082-0006I	SB084-0006I	SB0870006I	SB0870102F
Upper Depth (in.)		0	0	6	6	6	0	0	0	0	0	0	12
Lower Depth (in.)		6	6	16	16	18	6	6	6	6	6	6	24
Date Sampled	MCP S-1	10/6/2004	10/6/2004	10/6/2004	10/6/2004	10/6/2004	10/24/2004	11/30/2004	12/2/2004	12/2/2004	10/16/2004	10/20/2003	10/20/2003
PCBs (µg/Kg)													
Aroclor-1254	2000	240	1100	89	200	63 J	33 U	35 J	42	45 J	64 J	110	51
Aroclor-1260	2000	37 U	39 U	38 U	38 U	39 U	33 U	33 U	33 U	33 U	36 U	74	36 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0890006I	SB0890102F	SB0900006I	SB0900102F	SB091-0006I	SB092-0006I	SB092-0203F	SB092-1415F	FD-008-101704	SB093-0006I	SB093-0203F	SB093-1415F
Upper Depth (in.)		0	12	0	12	0	0	24	168	0	0	24	168
Lower Depth (in.)		6	24	6	24	6	6	36	180	6	6	36	180
Date Sampled	MCP S-1	10/20/2003	10/20/2003	10/20/2003	10/20/2003	10/24/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004	10/17/2004
PCBs (µg/Kg)													
Aroclor-1254	2000	300	33 U	510	120	33 U	34 U	3100	37 U	40 U	R	35 U	37 U
Aroclor-1260	2000	400	33 U	33 U	36 U	33 U	34 U	71 U	37 U	40 U	R	35 U	37 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB094-0006I	SB094-0203F	FD009-102404	SB095-0006I	SB095-0203F	SB095-1213F	SB-096 0006I	SB-096 0203F	SB097-0006I
Upper Depth (in.)		0	24	0	0	24	144	0	24	0
Lower Depth (in.)		6	36	6	6	36	156	6	36	6
Date Sampled	MCP S-1	10/20/2004	10/20/2004	10/24/2004	10/24/2004	10/24/2004	10/24/2004	9/9/2004	9/9/2004	11/30/2004
PCBs (µg/Kg)										
Aroclor-1254	2000	46 J	33 U	33 U	67 J	33 U	33 U	35 U	38 UJ	260
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	35 U	38 U	33 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1001 0003I	SB1001 0102F	SB1001 0203F	SB1001 0304F	SB1002 0003I	SB1002 0102F	SB1002 0203F	SB1002 0304F	SB1003 0003I	SB1003 0102F
Upper Depth (in.)		0	12	24	36	0	12	24	36	0	12
Lower Depth (in.)		3	24	36	48	3	24	36	48	3	24
Date Sampled	MCP S-1	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/21/2005	2/21/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	20.2 U	279	20.2 U	20.1 U	97.9	19 U	20.3 U	18.7 U	307	61.3
Aroclor-1260	2000	20.2 U	130	20.2 U	20.1 U	59.7	19 U	20.3 U	18.7 U	228	19.8 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1003 0203F	SB1003 0304F	SB-1004 0003I	SB-1004 0102F	SB-1004 0203F	SB-1004 0304F	SB-1006 0003I	SB-1006 0102F	SB-1006 0203F	SB-1006 0304F	FD-003-022205
Upper Depth (in.)		24	36	0	12	24	36	0	12	24	36	12
Lower Depth (in.)		36	48	3	24	36	48	3	24	36	48	24
Date Sampled	MCP S-1	2/21/2005	2/21/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/22/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	217	20.1 U	20.6 U	20.5 U	21.4 U	20.5 U	21.1	42.9	102	80.7	413
Aroclor-1260	2000	61.3	20.1 U	20.6 U	20.5 U	21.4 U	20.5 U	20.1 U	100	75.3	81.8	1160

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1008 0003I	SB1008 0102F	SB1008 0203F	SB1008 0304F	SB1009 0203F	SB1009 0304F	SB-1012 0608F	SB1022 0608F	SB1022-0304F	SB1022-0406F	SB1026-0203F
Upper Depth (in.)		0	12	24	36	24	36	72	72	36	48	24
Lower Depth (in.)		3	24	36	48	36	48	96	96	48	72	36
Date Sampled	MCP S-1	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/22/2005	2/24/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	416	753	20.1 U	20.1 U	19.1 U	19.6 U	79.2	20.2 U	139	160	468
Aroclor-1260	2000	624	1140	20.1 U	20.1 U	19.1 U	19.6 U	158	20.2 U	51.7	51.4	93.4

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1026-0304F	SB1027-0304F	SB-1028-0203F	SB-1028-0304F	SB1029-0203F	SB1029-0304F	SB1030-0203F	SB1030-0304F	SB1031-0003I	SB1031-0102F	SB1031-0203F
Upper Depth (in.)		36	36	24	36	24	36	24	36	0	12	24
Lower Depth (in.)		48	48	36	48	36	48	36	48	3	24	36
Date Sampled	MCP S-1	2/28/2005	2/28/2005	2/28/2005	2/28/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	2/28/2005	2/28/2005	2/28/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	463	136	252	61.4	159	58.9	1600	311	466	215	298
Aroclor-1260	2000	111	32.5	95.5	21.1	63.3	40	301	57.6	119	41.1	59

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1031-0304F	FD 008-022805	SB1032-0003I	SB1032-0102F	SB1032-0203F	SB1032-0304F	FD 009-022805	SB-1033-0003I	SB-1033-0203F	SB-1033-0304F	SB 1034 0203F
Upper Depth (in.)		36	12	0	12	24	36	24	0	24	36	24
Lower Depth (in.)		48	24	3	24	36	48	36	3	36	48	36
Date Sampled	MCP S-1	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	3/4/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	20.6 U	19.9 U	20.5 U	20.6 U	498	116	197 J	20.3 U	1420 J	27.3	85.5
Aroclor-1260	2000	20.6 U	19.9 U	20.5 U	20.6 U	136	28.5	59.5 J	20.3 U	304 J	20.2 U	50

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1034 0304F	SB1035-0003I	SB1035-0102F	SB1035-0203F	SB1035-0304F	FD 010-022805	SB-1036-0003I	SB-1036-0102F	SB-1036-0203F	SB-1036-0304F	SB1037-0203F
Upper Depth (in.)		36	0	12	24	36	24	0	12	24	36	24
Lower Depth (in.)		48	3	24	36	48	36	3	24	36	48	36
Date Sampled	MCP S-1	3/4/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	3/4/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	58.6	19.8 U	20 U	20.8 U	20.1 U	101 J	20.8 U	20.9 U	376 J	823	20.7 U
Aroclor-1260	2000	81.6	19.8 U	20 U	20.8 U	20.1 U	34.8 J	20.8 U	20.9 U	119 J	164	20.7 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1037-0304F	SB 1038 0203F	SB 1038 0304F	SB1039-0003I	SB1040-0003I	SB1041-0003I	SB1042-0003I	FD016-030305	SB 1043 0003I	SB 1044 0003I	SB 1044 0102F
Upper Depth (in.)		36	24	36	0	0	0	0	0	0	0	12
Lower Depth (in.)		48	36	48	3	3	3	3	3	3	3	24
Date Sampled	MCP S-1	3/4/2005	3/7/2005	3/7/2005	3/3/2005	2/23/2005	2/23/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	20 U	29.7 U	20 U	241	486	729	303	82.7	44.1	20.9 U	21.7 U
Aroclor-1260	2000	20 U	29.7 U	20 U	42.9	68	190	70.8	11.1 J	10.5 J	20.9 U	21.7 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1045 0003I	SB 1046 0003I	SB 1047 0003I	SB 1048 0003I	SB1049-0003I	SB 1050 0003I	SB1051NR	SB1051SR	SB 1052 0003I	SB 1052 0102F	SB 1053 0003I	SB1054-0003I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	12	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	24	3	3
Date Sampled	MCP S-1	3/3/2005	3/3/2005	3/3/2005	3/3/2005	2/23/2005	3/3/2005	10/21/2005	10/21/2005	3/3/2005	3/3/2005	3/3/2005	2/23/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	21.2 U	325	821	465	2110	1080	269	309	77	16.9 J	505	484
Aroclor-1260	2000	21.2 U	130	157	72.6	415	210	11.9 U	78.8	17.9 J	9.5 J	1330	78.2

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1056-0003I	SB1057-0003I	SB1058R	SB1059R	TFD018-102105	SB-1060-0003I	SB-1060-0102F	SB-1061-0003I	SB-1061-0102F	SB-1062-0102F	FD011-022505
Upper Depth (in.)		0	0	0	0		0	12	0	12	12	12
Lower Depth (in.)		3	3	3	3		3	24	3	24	24	24
Date Sampled	MCP S-1	2/23/2005	2/23/2005	10/21/2005	10/21/2005	10/21/2005	2/25/2005	2/25/2005	2/25/2005	2/25/2005	2/25/2005	2/25/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	507	925	488	50.3 J	112 J	442	81.3	107	121	40.2	21.1 U
Aroclor-1260	2000	98.1	151	112	11.2 U	11.2 U	112	21.9	19.7 U	21.2 U	21.2 U	21.1 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-1063-0102F	SB1064 0003I	SB-1064-0102F	SB1065 0003I	SB1066R	SB1067 0003I	SB1068 0003I	SB 1069 0003I	SB 1069 0102F	SB 1069 0203F	SB 1069 0304F
Upper Depth (in.)		12	0	12	0	0	0	0	0	12	24	36
Lower Depth (in.)		24	3	24	3	3	3	3	3	24	36	48
Date Sampled	MCP S-1	2/25/2005	2/22/2005	2/25/2005	2/22/2005	10/21/2005	2/22/2005	2/22/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	20.6 U	908	59	1190	1580	52.2	19.9 U	20.3 U	20.4 U	20 U	20.8 U
Aroclor-1260	2000	20.6 U	175	21.1 U	220	312	20.1 U	19.9 U	20.3 U	20.4 U	20 U	20.8 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1070 0003I	SB 1070 0102F	SB 1070 0203F	SB 1070 0304F	FD 019-030705	SB 1071 0003I	SB 1071 0102F	SB 1071 0203F	SB 1071 0304F	SB 1072 0003I	SB 1072 0102F
Upper Depth (in.)		0	12	24	36	24	0	12	24	36	0	12
Lower Depth (in.)		3	24	36	48	36	3	24	36	48	3	24
Date Sampled	MCP S-1	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005	3/7/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	20.4 U	20.5 U	19.4 U	20.9 U	33.8 J	20.4 U	20.2 U	20.3 UJ	65.1	21.2 U	20 U
Aroclor-1260	2000	20.4 U	20.5 U	19.4 U	20.9 U	52.8 J	20.4 U	20.2 U	20.3 UJ	115	21.2 U	20 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1072 0203F	SB 1072 0304F	SB-1073 0003I	SB-1073 0102F	SB-1073 0203F	SB-1073 0304F
Upper Depth (in.)		24	36	0	12	24	36
Lower Depth (in.)		36	48	3	24	36	48
Date Sampled	MCP S-1	3/7/2005	3/7/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005
PCBs (µg/Kg)							
Aroclor-1254	2000	15.7 J	34	20.5 U	456	229	948
Aroclor-1260	2000	15.7 J	25.8	20.5 U	228	98.5	276

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1074-0003I	SB1074-0102F	SB1074-0203F	SB1074-0304F	SB1075-0003I	SB1075-0102F	SB1075-0203F	SB1075-0304F	FD 007-022405	SB-1076 0003I
Upper Depth (in.)		0	12	24	36	0	12	24	36	24	0
Lower Depth (in.)		3	24	36	48	3	24	36	48	36	3
Date Sampled	MCP S-1	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/28/2005	2/24/2005	2/24/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	160	184	592	21.2 U	47.2	221	220	366	79	20 U
Aroclor-1260	2000	543	675	259	21.2 U	179	551	594	776	215	20 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-1076 0102F	SB-1076 0203F	SB-1076 0304F	SB-1078 0003I	SB-1078 0102F	SB-1078 0203F	SB-1078 0304F	SB-1079 0203F	SB-1079 0304F	SB-1080 0203F	SB-1080 0304F
Upper Depth (in.)		12	24	36	0	12	24	36	24	36	24	36
Lower Depth (in.)		24	36	48	3	24	36	48	36	48	36	48
Date Sampled	MCP S-1	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	322	76	26.3	21	220	103	75.2	21.1 U	21.1 U	389	56.6
Aroclor-1260	2000	168	264	17.2 J	16.8 J	48.9	42.4	15 J	21.1 U	21.1 U	55	19.2 J

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-1082 0102F	SB-1082 0203F	SB-1082 0304F	FD 006-022405	SB-1084 0003I	SB-1084 0203F	SB-1084 0304F	FD-001-022105	SB1086 0003I	SB1086 0102F	SB1086 0203F
Upper Depth (in.)		12	24	36	0	0	24	36	36	0	12	24
Lower Depth (in.)		24	36	48	3	3	36	48	48	3	24	36
Date Sampled	MCP S-1	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/24/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	70.8	20.5 U	20.2 U	46.3 J	207 J	179	41.1	19.6 U	24.9	18.5 U	22 U
Aroclor-1260	2000	32.9	20.5 U	20.2 U	20.1 UJ	44.2 J	61	15.4 J	19.6 U	21.6 U	18.5 U	22 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1086 0304F	SB1087 0203F	SB1087 0304F	SB1088 0003I	SB1088 0102F	SB1088 0203F	SB1088 0304F	FD 002-022105	SB1089 0003I	SB1089 0102F	SB1089 0203F	SB1089 0304F
Upper Depth (in.)		36	24	36	0	12	24	36	0	0	12	24	36
Lower Depth (in.)		48	36	48	3	24	36	48	3	3	24	36	48
Date Sampled	MCP S-1	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	20.3 U	19.9 U	19.6 U	44.8	20 U	1970	20.5 U	20.1 U	20.5 U	20.4 U	206	20.1 U
Aroclor-1260	2000	20.3 U	19.9 U	19.6 U	33.6	20 U	356	20.5 U	20.1 U	20.5 U	20.4 U	42.9	20.1 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1090 0003I	SB1090 0102F	SB1090 0304F	SB1091 0003I	SB1091 0102F	SB1091 0203F	SB1091 0304F	SB1092 0003I	SB1092 0102F	SB1092 0203F	SB1092 0304F	SB 1095 0003I
Upper Depth (in.)		0	12	36	0	12	24	36	0	12	24	36	0
Lower Depth (in.)		3	24	48	3	24	36	48	3	24	36	48	3
Date Sampled	MCP S-1	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	3/2/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	20.1 U	19.6 U	20.1 U	2650	402 U	112	19.9 U	57.2	48.1	86.3	20.2 U	40.3
Aroclor-1260	2000	20.1 U	19.6 U	20.1 U	594	402 U	36.3	19.9 U	25.1	21	48.3	20.2 U	18.3 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1095 0102F	SB 1095 0203F	SB 1095 0304F	FD014-030205	SB 1096 0003I	SB 1096 0102F	SB 1096 0203F	SB 1096 0304F	SB 1097 0003I	SB 1097 0102F	SB 1097 0203F
Upper Depth (in.)		12	24	36	0	0	12	24	36	0	12	24
Lower Depth (in.)		24	36	48	3	3	24	36	48	3	24	36
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	51.6	127	19.9 U	34.4 J	155 J	19 U	19.4 U	18.6 U	114	58.7	19.7 U
Aroclor-1260	2000	20.6 U	21	19.9 U	21.6 J	68 J	19 U	19.4 U	18.6 U	23.9	34.4	19.7 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1097 0304F	SB 1098 0003I	SB 1098 0102F	SB 1098 0203F	SB 1098 0304F	SB 1099 0003I	SB 1099 0102F	SB 1099 0203F	SB 1099 0304F	FD013-030205	SB 1100 0003I
Upper Depth (in.)		36	0	12	24	36	0	12	24	36	12	0
Lower Depth (in.)		48	3	24	36	48	3	24	36	48	24	3
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	19.6 U	159	143	272	26	67.1	51.2	82.5	19.3 U	19.3 U	151
Aroclor-1260	2000	19.6 U	80.5	48.9	74.1	20 U	74	19.3 U	41.2	19.3 U	19.3 U	34.7

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1100 0102F	SB 1100 0203F	SB 1100 0304F	SB 1101 0003I	SB 1101 0102F	SB 1101 0203F	SB 1101 0304F	FD012-030205	SB 1102 0003I	SB 1102 0102F	SB 1102 0203F
Upper Depth (in.)		12	24	36	0	12	24	36	24	0	12	24
Lower Depth (in.)		24	36	48	3	24	36	48	36	3	24	36
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	19.7 U	25.5	19.9 U	43.3	45.2	68.3	20.3 U	19.3 U	21 U	139	21.2 U
Aroclor-1260	2000	19.7 U	19.6 U	19.9 U	19.3 U	20.1 U	24.1	20.3 U	19.3 U	21 U	30	21.2 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1102 0304F	SB 1103 0003I	SB 1103 0102F	SB 1103 0203F	SB 1103 0304F	SB 1105 0003I	SB 1105 0102F	SB 1105 0203F	SB 1105 0304F	SB 1106 0003I	SB 1106 0102F
Upper Depth (in.)		36	0	12	24	36	0	12	24	36	0	12
Lower Depth (in.)		48	3	24	36	48	3	24	36	48	3	24
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005	3/2/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	35.9	28.9	27.5	57.4	47.9	18.5 U	20.2 U	19.2 U	20.4 U	31.9	19.3 U
Aroclor-1260	2000	20.5 U	19.3 U	19 U	18.8 U	20 U	18.5 U	20.2 U	19.2 U	20.4 U	18.8 U	19.3 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1106 0203F	SB 1106 0304F	FD015-030305	SB 1107 0003I	SB 1107 0102F	SB 1109 0003I	SB 1109 0102F	SB 1109 0203F	SB 1109 0304F	SB 1110 0003I	SB 1110 0102F
Upper Depth (in.)		24	36	12	0	12	0	12	24	36	0	12
Lower Depth (in.)		36	48	24	3	24	3	24	36	48	3	24
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005
PCBs (µg/Kg)												
Aroclor-1254	2000	60.8	90.1	47.1 J	20.8 U	21.3 UJ	20.1 J	43.1	21.3 U	20.6 U	20.3 U	27.9
Aroclor-1260	2000	20.3 U	20.6	14.4 J	20.8 U	21.3 U	21.2 U	18.9 J	21.3 U	20.6 U	20.3 U	21.5 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB 1110 0203F	SB 1110 0304F	FD001-041105	SB1130-0003i	SB1130-0612i	SB1130-1218i	SB1131-0003i	SB1131-0612i	SB1131-1218i	SB1132-0003i	SB1132-0612i	SB1132-1218i
Upper Depth (in.)		24	36	0	0	6	12	0	6	12	0	6	12
Lower Depth (in.)		36	48	3	3	12	18	3	12	18	3	12	18
Date Sampled	MCP S-1	3/3/2005	3/3/2005	4/11/2005	4/11/2005	4/11/2005	4/11/2005	4/11/2005	4/11/2005	4/11/2005	4/12/2005	4/12/2005	4/12/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	23.4	20.9 U	1020 J	169 J	10.1 U	34	2090	12.3	10.4 U	2540	176	10.1 U
Aroclor-1260	2000	21.3 U	20.9 U	180 J	36.7 J	10.1 U	10.1 U	344	10.3 U	10.4 U	425	23.6	10.1 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1133-0003i	SB1133-0612i	SB1133-1218i	SB1134-0612i
Upper Depth (in.)		0	6	12	6
Lower Depth (in.)		3	12	18	12
Date Sampled	MCP S-1	4/11/2005	4/11/2005	4/11/2005	4/12/2005
PCBs (µg/Kg)					
Aroclor-1254	2000	201	11.9 U	10.1 U	158
Aroclor-1260	2000	39.2	11.9 U	10.1 U	30.1

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1134-1218i	SB1134R	FD 002-041205	SB1135 0003i	SB1135 0612i	SB1135 1218i	SB1136R	SB1137-0003I	SB1137-0612I	SB1138-0003I
Upper Depth (in.)		12	0	0	0	6	12	0	0	6	0
Lower Depth (in.)		18	3	3	3	12	18	3	3	12	3
Date Sampled	MCP S-1	4/12/2005	10/21/2005	4/12/2005	4/12/2005	4/12/2005	4/12/2005	10/21/2005	4/8/2005	4/8/2005	4/8/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	10.8 U	171	2090 J	832 J	285	10.1 U	651	1440	10.5 U	239
Aroclor-1260	2000	10.8 U	12.5 U	394 J	176 J	43	10.1 U	153	233	10.5 U	42.2

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1139-0003I	SB1139-0612I	SB1140-0003I	SB1140-0612I	SB1141-0003I	SB1141-0612I	SB1142-0003I	SB1143-0003I	FD001-050605	SB1144-0003I	SB1145-0003I	SB1146-0003I
Upper Depth (in.)		0	6	0	6	0	6	0	0	0	0	0	0
Lower Depth (in.)		3	12	3	12	3	12	3	3	3	3	3	3
Date Sampled	MCP S-1	4/8/2005	4/8/2005	4/8/2005	4/8/2005	4/8/2005	4/8/2005	4/8/2005	4/8/2005	5/6/2005	5/6/2005	5/6/2005	5/6/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	2180	10.2 U	1700	10.2 U	774	10.1 U	87.8	257	42.3 J	92.1 J	994	350
Aroclor-1260	2000	337	10.2 U	277	10.2 U	133	10.1 U	20.4 U	41	13.4	18.4	150	63.6

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1147-0003I	SB1150-0003I	SB1151R	SB1152-0003I	FD001-062105	SB1156-0003I	SB1160-0003I	SB1160-0612I	SB1161-0003I	SB1161-0612I	SB1182-0003I	SB1183-0003I
Upper Depth (in.)		0	0	0	0	0	0	0	6	0	6	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	12	3	12	3	3
Date Sampled	MCP S-1	5/6/2005	5/6/2005	10/21/2005	5/6/2005	6/21/2005	6/21/2005	5/9/2005	5/9/2005	5/9/2005	5/9/2005	6/20/2005	6/20/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	596	10.2 U	985	1180	417	325	1430	11.1 U	942	38.4	14	712
Aroclor-1260	2000	123	10.2 U	219	199	76.6	52.6	243	11.1 U	251	10.1 U	10 U	110

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB612-0103F	FD001-042805	SB613-0103F	SB614-0103F	SB667-0003I	SB904-0001F	SB904-0102F	SB908-0001F	SB908-0102F	SB908-0203F	FD901-001-110704	SB915-0001F
Upper Depth (in.)		12	12	12	12	0	0	12	0	12	24		0
Lower Depth (in.)		36	36	36	36	3	12	24	12	24	36		12
Date Sampled	MCP S-1	4/28/2005	4/28/2005	4/28/2005	4/28/2005	5/19/2005	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004
PCBs (µg/Kg)													
Aroclor-1254	2000	9.84 U	369	10 U	85.3	10.3 U	100	48	460	33 U	130	1400	45
Aroclor-1260	2000	9.84 U	65.1	10 U	45.8	10.3 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB915-0102F	SB915-0203F	SB916-0001F	SB916-0102F	SB916-0203F	SB917-0001F	SB917-0102F	SB917-0203F	SCFA-TOP-016	SCFA-TOP-017	ST-10-001	ST-102-Decon-01
Upper Depth (in.)		12	24	0	12	24	0	12	24				
Lower Depth (in.)		24	36	12	24	36	12	24	36				
Date Sampled	MCP S-1	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	11/7/2004	5/11/2006	5/11/2006	3/29/2006	4/25/2006
PCBs (µg/Kg)													
Aroclor-1254	2000	33 U	33 U	140	150	84	33 U	33 U	33 U	21.6	24.9	1400	83.3
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	11.1	10.4	250	25.6

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-102-Decon-02	ST-11558-001	ST-126 128 144-001	ST-140-001	ST-145-001	ST-148-001	ST-148-002	ST-148-003R	ST-148-004	ST-148-005	ST-148-006R	ST-148-007
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	4/25/2006	3/30/2006	3/29/2006	10/24/2005	3/29/2006	4/25/2006	4/25/2006	5/4/2006	4/25/2006	4/25/2006	5/4/2006	4/25/2006
PCBs (µg/Kg)													
Aroclor-1254	2000	46.6	250	83.3 J	27.6	55.8	146	507	95	182 J	517	1330	338
Aroclor-1260	2000	31.1	43.1	229	9.86 U	18.7	172	267	31.3 J	78.6 J	199	389	131

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-159-002	ST-159-003	ST-159-004	ST-25/75-001	ST-26-001	ST-26-002	ST-26-003	ST-26-004	ST-26-005	ST-26-006	TK-55-006	TS-169-01	YRDTS-003
Upper Depth (in.)														0
Lower Depth (in.)														2
Date Sampled	MCP S-1	4/26/2006	4/26/2006	4/26/2006	6/6/2006	6/22/2006	7/14/2006	7/14/2006	7/14/2006	7/14/2006	7/14/2006	9/14/2005	4/19/2006	10/18/2000
PCBs (µg/Kg)														
Aroclor-1254	2000	153	292	235	520	140	105	411 J	168	132	58.1	9.97 U	66	200 U
Aroclor-1260	2000	154	146	119	122	31.6 J	19.2 J	61 J	26.8 J	31.8	16	9.97 U	18.3 J	200 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-006D 12-18 in	YRDTS-006R	YRDTS-007	YRDTS-016D 12-18 in	YRDTS-016R	YRDTS-017	YRDTS-017-4-6	YRDTS-018	YRDTS-018A 0-2 in	YRDTS-018B 2-4 in
Upper Depth (in.)		12	0	0	12	0	0	4	0	0	2
Lower Depth (in.)		18	2	2	18	2	2	6	2	2	4
Date Sampled	MCP S-1	11/11/2002	4/17/2006	10/24/2000	11/11/2002	4/13/2006	11/15/2000	11/20/2000	11/15/2000	11/11/2002	11/11/2002
PCBs (µg/Kg)											
Aroclor-1254	2000	40 U	1440	1100	71	331	2800	850	2500	1800	600
Aroclor-1260	2000	40 U	325	200 U	40 U	108	200 U	200 U	200 U	180 U	36 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-023C 6-12 in	YRDTS-023D 12-18 in	YRDTS-032A 0-2 in	YRDTS-032B 2-4 in	YRDTS-033A 0-2 in	YRDTS-033B 2-4 in	YRDTS-034A 0-2 in	YRDTS-034B 2-4 in
Upper Depth (in.)		6	12	0	2	0	2	0	2
Lower Depth (in.)		12	18	2	4	2	4	2	4
Date Sampled	MCP S-1	11/11/2002	11/11/2002	11/11/2002	11/11/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002
PCBs (µg/Kg)									
Aroclor-1254	2000	95	130	170	910	360 U	400 U	160	81
Aroclor-1260	2000	36 U	36 U	40 U	360 U	360 U	400 U	40 U	40 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-035A 0-2 in	YRDTS-035B 2-4 in	YRDTS-036A 0-2 in	YRDTS-036B 2-4 in	YRDTS-037A 0-2 in	YRDTS-037B 2-4 in	YRDTS-038A 0-2 in	YRDTS-038B 2-4 in	YRDTS-039A 0-2 in
Upper Depth (in.)		0	2	0	2	0	2	0	2	0
Lower Depth (in.)		2	4	2	4	2	4	2	4	2
Date Sampled	MCP S-1	11/5/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002	11/4/2002	11/4/2002	11/4/2002
PCBs (µg/Kg)										
Aroclor-1254	2000	2200	1100	340	160	460	140	40 U	40 U	51
Aroclor-1260	2000	200 U	40 U	43 U	43 U	43 U	43 U	40 U	40 U	40 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-039B 2-4 in	YRDTS-041A 0-2 in	YRDTS-041B 2-4 in	YRDTS-042A 0-2 in	YRDTS-042B 2-4 in	YRDTS-043A 0-2 in	YRDTS-043B 2-4 in
Upper Depth (in.)		2	0	2	0	2	0	2
Lower Depth (in.)		4	2	4	2	4	2	4
Date Sampled	MCP S-1	11/4/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002
PCBs (µg/Kg)								
Aroclor-1254	2000	36 U	2100	930	720	510	1600	640
Aroclor-1260	2000	36 U	270 U	40 U	43 U	43 U	43 U	49 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-3-045	EX-RR-0003	FD001-091305	EX-RR-0004	EX-RR-0005	EX-RR-0006	EX-RR-0007	EX-RR001	EX-RR002	PCA1-TUB-01
Upper Depth (in.)		0									
Lower Depth (in.)		3									
Date Sampled	MCP S-1	9/27/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	9/13/2005	6/30/2005	7/8/2005	10/28/2005
SVOC (µg/Kg)											
Acenaphthene	1000000	2.81 U	270 U	270 U	254 U	124 J	117 J	263 U	190 U	482	147 U
Acenaphthylene	100000	1.14 J	540	693	557	309	318	255 J	158 J	822	147 U
Anthracene	1000000	23.8	372	377	745	482	503	208 J	128 J	962	147 U
Benzidine		227 UJ	270 U	234 J	254 U	276 U	214 J	234 J	190 U	189 U	147 UJ
Benzo(a)anthracene	7000	30.1	1940	2000	2210	1120	891	971	329	1110	21.5 J
Benzo(a)pyrene	2000	36.9	1870	2580	2830	1150	1050	1150	258	745	147 U
Benzo(b)fluoranthene	7000	227 U	2390	2940	3210	1460	1490	1550	234	703	147 U
Benzo(g,h,i)perylene	1000000	227 U	837	730	811	251 J	417	503	190	689	147 U
Benzo(k)fluoranthene	70000	227 U	2160	2480	2850	1230	1200	1300	230	686	147 U
bis(2-Ethylhexyl)phthalate	200000	227 U	448	453	254 U	276 U	261 U	263 U	190 U	189 U	147 U
Carbazole		227 U	113 J	270 U	254 U	276 U	261 U	263 U	190 U	230	147 U
Chrysene	7000	40.3	2460	2490	2840	1730	1320	1330	308	1150	147 U
Dibenzo(a,h)anthracene	700	2.81 U	151 J	261 J	254 U	276 U	261 U	263 U	190 U	210	147 U
Dibenzofuran		227 U	270 U	270 U	254 U	276 U	261 U	263 U	190 U	419	147 U
Fluoranthene	1000000	95.4	3730	3810	4090	3110	1760	1640	535	2620	31.3 J
Fluorene	1000000	2.81 U	270 U	270 U	254 U	276 U	261 U	263 U	190 U	537	147 U
Indeno(1,2,3-cd)pyrene	7000	227 U	839	819	892	284	451	487	183 J	790	147 U
Isophorone		227 U	135 J	270 U	254 U	276 U	261 U	263 U	190 U	189 U	147 U
1-Methylnaphthalene		227 U	270 U	269 U	254 U	275 U	260 U	263 U	190 U	185 J	147 U
2-Methylnaphthalene	500000	227 U	270 U	270 U	254 U	276 U	261 U	263 U	190 U	348	147 U
Naphthalene	500000	227 U	270 U	270 U	254 U	276 U	261 U	263 U	190 U	420	147 U
Phenanthrene	1000000	227 U	310	337	727	430	492	253 J	54.6 J	2000	147 U
Pyrene	1000000	86.9 J	3460	4000	4990	3170	1970	1750	527	1930	26.9 J

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-021 0006I	SB-021 0203F	FD202-102003	SB0220006I	SB0220102F	SB-023 0006I	SB-023 0203F	SB029-0203F	SB0350006I	SB0350102F	SB038-0006I
Upper Depth (in.)		0	24	0	0	12	0	24	24	0	12	0
Lower Depth (in.)		6	36	6	6	24	6	36	36	6	24	6
Date Sampled	MCP S-1	9/9/2004	9/9/2004	10/20/2003	10/20/2003	10/20/2003	9/8/2004	9/8/2004	10/19/2004	10/20/2003	10/20/2003	12/2/2004
SVOC (µg/Kg)												
Acenaphthene	1000000	170 J	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Acenaphthylene	100000	370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Anthracene	1000000	260 J	400 U	430 U	460 U	400 U	370 U	350 U	200 J	350 U	340 U	360 U
Benzidine		R	R	4300 U	4600 U	4000 U	R	R	R	3500 U	3400 U	3600 UJ
Benzo(a)anthracene	7000	640	400 U	430 U	460 U	400 U	120 J	350 U	730	350 U	340 U	110 J
Benzo(a)pyrene	2000	570	400 U	430 U	460 U	400 U	160 J	350 U	480	350 U	340 U	92 J
Benzo(b)fluoranthene	7000	540	400 U	430 U	460 U	400 U	160 J	350 U	440	350 U	340 U	82 J
Benzo(g,h,i)perylene	1000000	330 J	400 U	430 U	460 U	400 U	110 J	350 U	230 J	350 U	340 U	360 UJ
Benzo(k)fluoranthene	70000	440	400 U	430 U	460 U	400 U	120 J	350 U	560	350 U	340 U	76 J
bis(2-Ethylhexyl)phthalate	200000	370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Carbazole		110 J	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Chrysene	7000	670	400 U	430 U	460 U	400 U	150 J	350 U	830	350 U	340 U	110 J
Dibenzo(a,h)anthracene	700	100 J	400 U	430 U	460 U	400 U	370 U	350 U	110 J	350 U	340 U	360 UJ
Dibenzofuran		370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Fluoranthene	1000000	1300	400 U	430 U	460 U	400 U	170 J	84 J	2000	350 U	340 U	160 J
Fluorene	1000000	110 J	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Indeno(1,2,3-cd)pyrene	7000	290 J	400 U	430 U	460 U	400 U	100 J	350 U	240 J	350 U	340 U	360 U
Isophorone		370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
1-Methylnaphthalene												
2-Methylnaphthalene	500000	370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Naphthalene	500000	370 U	400 U	430 U	460 U	400 U	370 U	350 U	380 U	350 U	340 U	360 U
Phenanthrene	1000000	780	400 U	430 U	460 U	400 U	370 U	350 U	430	350 U	340 U	360 U
Pyrene	1000000	1100 J	400 U	430 U	460 U	400 U	170 J	75 J	1500	350 U	340 U	130 J

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB038-0203F	SB038-0506F	FD-007-100704	MS007-SB041	SB041-0203F	SB041-1415F	SB042-0510F	FD003-090804	SB-044 0203F	SB046 0006I	SB046 0506F
Upper Depth (in.)		24	60	24		24	168	60	24	24	0	60
Lower Depth (in.)		36	72	36		36	180	120	36	36	6	72
Date Sampled	MCP S-1	12/2/2004	12/2/2004	10/7/2004	10/7/2004	10/7/2004	10/7/2004	10/24/2004	9/8/2004	9/8/2004	9/30/2004	9/30/2004
SVOC (µg/Kg)												
Acenaphthene	1000000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Acenaphthylene	100000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Anthracene	1000000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Benzidine		3400 UJ	3600 UJ	R	R	R	R	4100 UJ	3400 UJ	R	R	R
Benzo(a)anthracene	7000	340 U	360 U	370 U	370 U	89 J	360 U	410 U	340 U	340 U	340 U	340 U
Benzo(a)pyrene	2000	340 U	360 U	370 U	370 U	74 J	360 U	410 U	340 U	340 U	340 U	340 U
Benzo(b)fluoranthene	7000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 UJ	340 U	340 U	340 U
Benzo(g,h,i)perylene	1000000	340 UJ	360 UJ	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Benzo(k)fluoranthene	70000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
bis(2-Ethylhexyl)phthalate	200000	340 U	360 U	380 U	420 U	350 U	520 U	410 U	340 U	340 U	340 U	340 U
Carbazole		340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Chrysene	7000	340 U	360 U	370 U	370 U	89 J	360 U	410 U	340 U	340 U	340 U	340 U
Dibenzo(a,h)anthracene	700	340 UJ	360 UJ	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Dibenzofuran		340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Fluoranthene	1000000	340 U	360 U	110 J	80 J	180 J	360 U	410 U	340 U	340 U	340 U	340 U
Fluorene	1000000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Indeno(1,2,3-cd)pyrene	7000	340 U	360 U	370 U	370 U	350 U	360 U	410 UJ	340 U	340 U	340 U	340 U
Isophorone		340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
1-Methylnaphthalene												
2-Methylnaphthalene	500000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Naphthalene	500000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Phenanthrene	1000000	340 U	360 U	370 U	370 U	350 U	360 U	410 U	340 U	340 U	340 U	340 U
Pyrene	1000000	340 U	360 U	86 J	370 U	130 J	360 U	410 U	340 U	340 U	340 U	340 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0480006I	SB0480203F	SB050-0006I	SB050-0203F	SB052-0006I	SB-056 0006I	SB-056 0203F	SB-056 1415F	SB0580006I	SB0580203F	SB0580506F
Upper Depth (in.)		0	24	0	24	0	0	24	168	0	24	60
Lower Depth (in.)		6	36	6	36	6	6	36	180	6	36	72
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/24/2004	10/24/2004	12/2/2004	9/7/2004	9/7/2004	9/7/2004	10/30/2003	10/30/2003	10/30/2003
SVOC (µg/Kg)												
Acenaphthene	1000000	1400 U	380 U	410 U	390 U	360 U	530	360 U	350 U	140 J	360 U	370 U
Acenaphthylene	100000	1400 U	380 U	410 U	390 U	360 U	360 U	360 U	350 U	360 U	360 U	370 U
Anthracene	1000000	1400 U	380 U	410 U	390 U	360 U	1500	360 U	350 U	130 J	360 U	370 U
Benzidine		14000 UJ	3800 UJ	4100 UJ	3900 UJ	3600 UJ	3600 UJ	3600 UJ	3500 UJ	3600 U	3600 U	3700 U
Benzo(a)anthracene	7000	1400 U	380 U	410 U	390 U	360 U	1600	360 U	350 U	380	130 J	370 U
Benzo(a)pyrene	2000	1400 U	380 U	410 U	390 U	360 U	1400	360 U	350 U	310 J	92 J	370 U
Benzo(b)fluoranthene	7000	1400 U	380 U	410 U	390 U	360 U	1300	360 U	350 U	320 J	86 J	370 U
Benzo(g,h,i)perylene	1000000	1400 U	380 U	410 U	390 U	360 UJ	660	360 U	350 U	180 J	360 U	370 U
Benzo(k)fluoranthene	70000	1400 U	380 U	410 U	390 U	360 U	1300	360 U	350 U	280 J	92 J	370 U
bis(2-Ethylhexyl)phthalate	200000	1400 U	380 U	410 U	390 U	360 U	360 U	360 U	350 U	360 U	360 U	370 U
Carbazole		1400 U	380 U	410 U	390 U	360 U	810	360 U	350 U	150 J	360 U	370 U
Chrysene	7000	1400 U	380 U	410 U	390 U	360 U	1600	360 U	350 U	410	110 J	370 U
Dibenzo(a,h)anthracene	700	1400 U	380 U	410 U	390 U	360 UJ	190 J	360 U	350 U	360 U	360 U	370 U
Dibenzofuran		1400 U	380 U	410 U	390 U	360 U	450	360 U	350 U	110 J	360 U	370 U
Fluoranthene	1000000	1400 U	380 U	410 U	83 J	360 U	4000	360 U	350 U	940	260 J	370 U
Fluorene	1000000	1400 U	380 U	410 U	390 U	360 U	750	360 U	350 U	140 J	360 U	370 U
Indeno(1,2,3-cd)pyrene	7000	1400 U	380 U	410 U	390 U	360 U	360 U	360 U	350 U	230 J	360 U	370 U
Isophorone		1400 U	380 U	410 U	390 U	360 U	360 U	360 U	350 U	360 U	360 U	370 U
1-Methylnaphthalene												
2-Methylnaphthalene	500000	1400 U	380 U	410 U	390 U	360 U	100 J	360 U	350 U	360 U	360 U	370 U
Naphthalene	500000	1400 U	380 U	410 U	390 U	360 U	220 J	360 U	350 U	360 U	360 U	370 U
Phenanthrene	1000000	1400 U	380 U	410 U	390 U	360 U	4000	360 U	350 U	830	200 J	370 U
Pyrene	1000000	1400 U	380 U	410 U	390 U	360 U	2400	360 U	350 U	690	200 J	370 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-063 1415F	SB064-1415F	SB065 1415F	SB067-1415F	SB0691415F	SB070-0006I	SB070-0203F	SB070-0809F	SB071-0006I	SB072-0006I	SB-074 0203F
Upper Depth (in.)		168	168	168	168	168	0	24	96	0	0	24
Lower Depth (in.)		180	180	180	180	180	6	36	108	6	6	36
Date Sampled	MCP S-1	9/30/2004	9/30/2004	9/30/2004	10/7/2004	10/30/2003	12/14/2004	12/14/2004	12/14/2004	10/19/2004	10/19/2004	9/8/2004
SVOC (µg/Kg)												
Acenaphthene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	80 J	93 J	350 U
Acenaphthylene	100000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	380 U	390 U	350 U
Anthracene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	580	120 J	350 U
Benzidine		R	R	R	R	3700 U	R	R	R	R	R	R
Benzo(a)anthracene	7000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	1800	420	350 U
Benzo(a)pyrene	2000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	1000	380 J	350 U
Benzo(b)fluoranthene	7000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	970	340 J	350 U
Benzo(g,h,i)perylene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	290 J	200 J	350 U
Benzo(k)fluoranthene	70000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	990	360 J	350 U
bis(2-Ethylhexyl)phthalate	200000	350 U	470 U	350 U	780 U	370 U	360 U	360 U	370 U	380 U	390 U	350 U
Carbazole		350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	380 U	89 J	350 U
Chrysene	7000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	1700	500	350 U
Dibenzo(a,h)anthracene	700	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	190 J	92 J	350 U
Dibenzofuran		350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	380 U	390 U	350 U
Fluoranthene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	2600	1100	350 U
Fluorene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	100 J	390 U	350 U
Indeno(1,2,3-cd)pyrene	7000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	340 J	210 J	350 U
Isophorone		350 U	360 U	350 U	370 U	370 U	360 UJ	360 UJ	370 UJ	380 U	390 U	350 U
1-Methylnaphthalene												
2-Methylnaphthalene	500000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	380 U	390 U	350 U
Naphthalene	500000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	380 U	390 U	350 U
Phenanthrene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	85 J	1300	720	350 U
Pyrene	1000000	350 U	360 U	350 U	370 U	370 U	360 U	360 U	370 U	2200	830	350 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB075A-0006I	SB075A-0203F	SB075B-0006I	SB075B-0203F	SB077 0006I	SB0780006I	SB079-0006I	SB080-0006I	SB081-0006I	SB082-0006I	SB083-0006I
Upper Depth (in.)		0	24	0	24	0	0	0	0	0	0	0
Lower Depth (in.)		6	36	6	36	6	6	6	6	6	6	6
Date Sampled	MCP S-1	12/1/2004	12/1/2004	12/2/2004	12/2/2004	1/25/2005	9/27/2004	10/24/2004	11/30/2004	12/2/2004	12/2/2004	10/30/2003
SVOC (µg/Kg)												
Acenaphthene	1000000	360 UJ	660 U	350 U	350 UJ	350 UJ	370 U	340 UJ	370 U	350 U	350 U	330 U
Acenaphthylene	100000	170 J	660 U	350 U	110 J	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Anthracene	1000000	360 UJ	660 U	110 J	83 J	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Benzidine		R	6600 UJ	3500 UJ	R	3500 UJ	3700 UJ	3400 UJ	3700 UJ	3500 UJ	3500 UJ	3300 UJ
Benzo(a)anthracene	7000	97 J	660 U	320 J	160 J	350 U	370 U	340 UJ	370 U	130 J	130 J	330 U
Benzo(a)pyrene	2000	83 J	660 U	230 J	140 J	350 U	370 U	340 UJ	370 U	350 U	100 J	330 U
Benzo(b)fluoranthene	7000	81 J	660 U	210 J	140 J	350 U	370 U	340 UJ	370 U	95 J	96 J	330 U
Benzo(g,h,i)perylene	1000000	360 UJ	660 U	130 J	88 J	350 U	370 U	340 UJ	370 UJ	350 U	78 J	330 U
Benzo(k)fluoranthene	70000	360 UJ	660 U	220 J	110 J	350 U	370 U	340 UJ	370 U	89 J	93 J	330 U
bis(2-Ethylhexyl)phthalate	200000	360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Carbazole		360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Chrysene	7000	97 J	660 U	340 J	160 J	350 U	370 U	340 UJ	370 U	140 J	150 J	330 U
Dibenzo(a,h)anthracene	700	360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 UJ	350 U	350 U	330 U
Dibenzofuran		360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Fluoranthene	1000000	200 J	230 J	740	360	350 U	370 U	340 UJ	370 U	250 J	220 J	330 U
Fluorene	1000000	360 UJ	660 U	350 U	350 UJ	350 UJ	370 U	340 UJ	370 U	350 U	350 U	330 U
Indeno(1,2,3-cd)pyrene	7000	360 UJ	660 U	140 J	95 J	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Isophorone		360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
1-Methylnaphthalene												
2-Methylnaphthalene	500000	360 UJ	660 U	350 U	350 UJ	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Naphthalene	500000	86 J	660 U	350 U	75 J	350 U	370 U	340 UJ	370 U	350 U	350 U	330 U
Phenanthrene	1000000	140 J	660 U	370	290 J	350 UJ	370 U	340 UJ	370 U	350 U	350 U	330 U
Pyrene	1000000	160 J	150 J	490	270 J	350 U	370 U	340 UJ	370 U	200 J	170 J	330 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB083-0006I-121404	SB083-0203F	SB083-0203F-121404	SB084-0006I	SB091-0006I	SB092-0006I	FD-008-101704	SB093-0006I	SB094-0006I	FD009-102404
Upper Depth (in.)		0	24	24	0	0	0	0	0	0	0
Lower Depth (in.)		6	36	36	6	6	6	6	6	6	6
Date Sampled	MCP S-1	12/14/2004	10/30/2003	12/14/2004	10/16/2004	10/24/2004	10/17/2004	10/17/2004	10/17/2004	10/20/2004	10/24/2004
SVOC (µg/Kg)											
Acenaphthene	1000000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Acenaphthylene	100000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Anthracene	1000000	440 J	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Benzidine		R	3800 UJ	R	R	3600 UJ	R	R	R	R	R
Benzo(a)anthracene	7000	1200 J	380 U	370 U	170 J	360 U	340 U	400 U	400 U	400 U	360 UJ
Benzo(a)pyrene	2000	370 J	380 U	370 U	110 J	360 U	340 U	400 U	400 U	400 U	360 UJ
Benzo(b)fluoranthene	7000	1800 U	380 U	370 U	97 J	360 U	340 U	400 U	400 U	400 U	360 UJ
Benzo(g,h,i)perylene	1000000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Benzo(k)fluoranthene	70000	1000 J	380 U	370 U	110 J	360 U	340 U	400 U	400 U	400 U	360 UJ
bis(2-Ethylhexyl)phthalate	200000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Carbazole		1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Chrysene	7000	1400 J	380 U	370 U	150 J	360 U	340 U	400 U	400 U	400 U	360 UJ
Dibenzo(a,h)anthracene	700	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Dibenzofuran		1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Fluoranthene	1000000	3200	110 J	120 J	230 J	360 U	340 U	400 U	400 U	130 J	360 UJ
Fluorene	1000000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Indeno(1,2,3-cd)pyrene	7000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 UJ	360 UJ
Isophorone		1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
1-Methylnaphthalene											
2-Methylnaphthalene	500000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Naphthalene	500000	1800 U	380 U	370 U	360 UJ	360 U	340 U	400 U	400 U	400 U	360 UJ
Phenanthrene	1000000	2300	380 U	370 U	94 UJ	360 U	340 U	400 U	400 U	R	360 UJ
Pyrene	1000000	2700	96 J	120 J	230 J	360 U	340 U	400 U	400 U	97 J	360 UJ

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB095-0006I	SB612-0103F	FD001-042805	SB613-0103F	SB614-0103F	FD901-001-110704
Upper Depth (in.)		0	12	12	12	12	
Lower Depth (in.)		6	36	36	36	36	
Date Sampled	MCP S-1	10/24/2004	4/28/2005	4/28/2005	4/28/2005	4/28/2005	11/7/2004
SVOC (µg/Kg)							
Acenaphthene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Acenaphthylene	100000	340 U	190 U	192 U	189 U	194 U	360 U
Anthracene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Benzidine		3400 UJ	190 U	192 U	189 U	194 U	3600 U
Benzo(a)anthracene	7000	340 U	190 U	192 U	189 U	194 U	360 U
Benzo(a)pyrene	2000	340 U	190 U	192 U	189 U	194 U	360 U
Benzo(b)fluoranthene	7000	340 U	190 U	192 U	189 U	194 U	360 U
Benzo(g,h,i)perylene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Benzo(k)fluoranthene	70000	340 U	190 U	192 U	189 U	194 U	360 U
bis(2-Ethylhexyl)phthalate	200000	340 U	190 U	192 U	189 U	194 U	360 U
Carbazole		340 U	190 U	192 U	189 U	194 U	360 U
Chrysene	7000	340 U	190 U	192 U	189 U	194 U	360 U
Dibenzo(a,h)anthracene	700	340 U	190 U	192 U	189 U	194 U	360 U
Dibenzofuran		340 U	190 U	192 U	189 U	194 U	360 U
Fluoranthene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Fluorene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Indeno(1,2,3-cd)pyrene	7000	340 U	190 U	192 U	189 U	194 U	360 U
Isophorone		340 U	190 U	192 U	189 U	194 U	360 U
1-Methylnaphthalene			190 U	192 U	189 U	194 U	
2-Methylnaphthalene	500000	340 U	190 U	192 U	189 U	194 U	360 U
Naphthalene	500000	340 U	190 U	192 U	189 U	194 U	360 U
Phenanthrene	1000000	340 U	190 U	192 U	189 U	194 U	360 U
Pyrene	1000000	340 U	190 U	192 U	189 U	194 U	360 U

> MCP S-1

Appendix Table A.1.4
 Soil Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0090006I	SB0090102F	SB0130006I	SB0130203F	FD205-102203	SB0200006I	SB0200203F	FD202-102003	SB0220006I
Upper Depth (in.)		0	12	0	24	24	0	24	0	0
Lower Depth (in.)		6	24	6	36	36	6	36	6	6
Date Sampled	MCP S-1	10/20/2003	10/20/2003	10/20/2003	10/20/2003	10/22/2003	10/22/2003	10/22/2003	10/20/2003	10/20/2003
TPH (mg/Kg)										
TPH-DRO	800	19	4.3	44	8.8	2.4 U	7.4	2.4 U	25 J	28
TPH-GRO	800								3 U	3 U

Appendix Table A.1.4
 Soil Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0220102F	SB0270102F	SB0320006I	SB0320102F	SB0330006I	SB0330102F	SB0350006I	SB0350102F	SB0480006I	SB0480203F	FD-208-103003
Upper Depth (in.)		12	12	0	12	0	12	0	12	0	24	168
Lower Depth (in.)		24	24	6	24	6	24	6	24	6	36	180
Date Sampled	MCP S-1	10/20/2003	10/22/2003	10/20/2003	10/20/2003	10/22/2003	10/22/2003	10/20/2003	10/20/2003	10/30/2003	10/30/2003	10/30/2003
TPH (mg/Kg)												
TPH-DRO	800	14	2.4 U	42	33	2.8	3	31 J	60 J	59 J	4.1	2 U
TPH-GRO	800	2.5 U						2.5 U	2.5 U	2.5 U	150	

Appendix Table A.1.4
 Soil Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0570006I	SB0570203F	SB0571415F	SB0580006I	SB0580203F	SB0580506F	SB0610006I	SB0610203F	SB0611415F	SB0690006I	SB0690203F	SB0691415F	SB083-0006I
Upper Depth (in.)		0	24	168	0	24	60	0	24	168	0	24	168	0
Lower Depth (in.)		6	36	180	6	36	72	6	36	180	6	36	180	6
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003
TPH (mg/Kg)														
TPH-DRO	800	8.2	4.8	2.2 U	20 J	2.5	2.2 U			2.2 U	2.2 U	2.2 U	2.2 U	2 U
TPH-GRO	800				2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U				

Appendix Table A.1.4
 Soil Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB083-0203F	SB0870006I	SB0870102F	SB0890006I	SB0890102F	SB0900006I	SB0900102F
Upper Depth (in.)		24	0	12	0	12	0	12
Lower Depth (in.)		36	6	24	6	24	6	24
Date Sampled	MCP S-1	10/30/2003	10/20/2003	10/20/2003	10/20/2003	10/20/2003	10/20/2003	10/20/2003
TPH (mg/Kg)								
TPH-DRO	800	11	6.5 J	5.4 J	5.6	2 U	15	6.5
TPH-GRO	800							

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		BFT-EX-01	BFT-EX-02	Drywell-EW-01	Drywell-FI-01	Drywell-NW-01	Drywell-SW-01	Drywell-WW-01	PCA1-TUB-02	SB-021 0006I
Upper Depth (in.)										0
Lower Depth (in.)										6
Date Sampled	MCP S-1	7/7/2006	7/7/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	10/28/2005	9/9/2004
VOC (µg/Kg)										
Acetone	500000	44.9 J	34.9 J	90.9 U	89.5 U	44.2 J	146 U	92.3 U	66.2 J	24 UJ
2-Butanone	500000	R	R	45.5 U	44.7 U	3.7 J	72.8 U	46.1 U	52.8 UJ	10 UJ
n-Butylbenzene		3.4 UJ	2.7 UJ	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
sec-Butylbenzene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
Carbon disulfide		16.8 U	13.6 U	0.5 J	22.4 U	22.3 U	36.4 U	23.1 U	26.4 U	5 UJ
Dichlorodifluoromethane		6.7 U	5.4 U	9.1 UJ	8.9 UJ	8.9 UJ	14.6 UJ	9.2 UJ	10.6 UJ	5 UJ
1,2-Dichloroethane	10000	3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 UJ	5 UJ
2-Hexanone		33.6 U	27.1 U	45.5 U	44.7 U	44.7 U	72.8 U	46.1 U	1 J	5 U
Isopropylbenzene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
4-Isopropyltoluene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
4-Methyl-2-pentanone	500000	33.6 U	27.1 U	45.5 U	44.7 U	44.7 U	72.8 U	46.1 U	52.8 UJ	5 U
n-Propylbenzene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
Tetrachloroethene	30000	3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 UJ
Toluene	500000	3.4 U	2.7 U	9.2	2.3 J	2.5 J	5.5 J	1.7 J	4.2 J	5 U
Trichlorofluoromethane		3.4 U	2.7 U	4.5 UJ	4.5 UJ	0.8 J	7.3 UJ	0.8 J	5.3 U	5 UJ
1,2,4-Trimethylbenzene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
1,3,5-Trimethylbenzene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
o-Xylene		3.4 U	2.7 U	4.5 U	4.5 U	4.5 U	7.3 U	4.6 U	5.3 U	5 U
m+p-Xylenes		6.7 U	5.4 U	9.1 U	8.9 U	8.9 U	14.6 U	9.2 U	10.6 U	5 U

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-021 0203F	SB-023 0006I	SB-023 0203F	SB029-0203F	SB038-0006I	SB038-0203F	SB038-0506F	FD-007-100704	MS007-SB041	SB041-0203F	SB041-1415F
Upper Depth (in.)		24	0	24	24	0	24	60	24		24	168
Lower Depth (in.)		36	6	36	36	6	36	72	36		36	180
Date Sampled	MCP S-1	9/9/2004	9/8/2004	9/8/2004	10/19/2004	12/2/2004	12/2/2004	12/2/2004	10/7/2004	10/7/2004	10/7/2004	10/7/2004
VOC (µg/Kg)												
Acetone	500000	45 U	10 U	130 UJ	12 UJ	12 U	10 U	16 U	12 U	10 U	14 U	14 U
2-Butanone	500000	11 U	10 U	33 UJ	12 UJ	12 U	2 J	2 J	12 UJ	10 UJ	14 UJ	10 UJ
n-Butylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
sec-Butylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
Carbon disulfide		5.5 U	5 U	5 UJ	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
Dichlorodifluoromethane		5.5 U	5 U	5 UJ	6 UJ	6 U	1.5 J	5 U	6 U	5 U	7 U	5 U
1,2-Dichloroethane	10000	5.5 U	5 U	5 UJ	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
2-Hexanone		5.5 U	5 U	5 U	6 UJ	6 U	5 U	5 U	6 U	5 U	7 U	5 U
Isopropylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
4-Isopropyltoluene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
4-Methyl-2-pentanone	500000	5.5 U	5 U	5 U	6 UJ	3.9 J	5 U	5 U	6 U	5 U	7 U	5 U
n-Propylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
Tetrachloroethene	30000	5.5 UJ	5 UJ	5 UJ	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
Toluene	500000	5.5 U	5 U	5 UJ	6 U	59	5 U	5 U	10 U	5 U	11	7.2
Trichlorofluoromethane		5.5 U	5 U	5 UJ	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
1,2,4-Trimethylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
1,3,5-Trimethylbenzene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
o-Xylene		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U
m+p-Xylenes		5.5 U	5 U	5 U	6 U	6 U	5 U	5 U	6 U	5 U	7 U	5 U

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB042-0510F	SB-044 0203F	SB046 0006I	SB046 0506F	SB0480203F	SB050-0006I	SB050-0203F	SB052-0006I	FD002-090704	SB-056 0006I	SB-056 0203F
Upper Depth (in.)		60	24	0	60	24	0	24	0	168	0	24
Lower Depth (in.)		120	36	6	72	36	6	36	6	180	6	36
Date Sampled	MCP S-1	10/24/2004	9/8/2004	9/30/2004	9/30/2004	10/30/2003	10/24/2004	10/24/2004	12/2/2004	9/7/2004	9/7/2004	9/7/2004
VOC (µg/Kg)												
Acetone	500000	47 J	10 u	10 U	12 U	86 J	12 UJ	3.7 J	10 U	73 J	12 UJ	11 UJ
2-Butanone	500000	12 J	5 U	10 U	12 U	10 U	3.7 J	6.6 J	2.6 J	11 UJ	12 UJ	11 UJ
n-Butylbenzene		5 UJ	5 U	5 UJ	6 U	35	6 UJ	5 UJ	5 U	5.5 UJ	6 UJ	5.5 UJ
sec-Butylbenzene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
Carbon disulfide		4.1 J	5 U	5 U	9	5 UJ	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
Dichlorodifluoromethane		5 UJ	5 U	5 U	6 U	5 UJ	6 UJ	5 UJ	5 U	5.5 UJ	5 UJ	5.5 UJ
1,2-Dichloroethane	10000	5 U	9.3 J	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
2-Hexanone		5 UJ	5 U	5 U	6 U	5 U	6 UJ	5 UJ	5 U	5.5 UJ	6 UJ	5.5 UJ
Isopropylbenzene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	2.4 UJ
4-Isopropyltoluene		5 U	5 U	5 U	6 U	5 UJ	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
4-Methyl-2-pentanone	500000	5 UJ	5 U	5 U	6 U	5 U	6 UJ	5 UJ	5 U	5.5 UJ	6 UJ	5.5 UJ
n-Propylbenzene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
Tetrachloroethene	30000	5 UJ	5 UJ	5 U	6 U	5 U	6 UJ	5 UJ	5 U	5.5 UJ	6 UJ	5.5 UJ
Toluene	500000	5 U	8 u	27	23	5 U	6 U	5 U	5.2 U	5.5 UJ	9.7 UJ	11 UJ
Trichlorofluoromethane		5 U	5.6 U	2.3 J	5.6 J	5 UJ	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
1,2,4-Trimethylbenzene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
1,3,5-Trimethylbenzene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
o-Xylene		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ
m+p-Xylenes		5 U	5 U	5 U	6 U	5 U	6 U	5 U	5 U	5.5 UJ	6 UJ	5.5 UJ

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-056 1415F	SB-063 1415F	SB064-1415F	SB065 1415F	SB067-1415F	SB070-0006I	SB070-0203F	SB070-0809F	SB071-0006I	SB072-0006I	SB077 0006I	SB0780006I
Upper Depth (in.)		168	168	168	168	168	0	24	96	0	0	0	0
Lower Depth (in.)		180	180	180	180	180	6	36	108	6	6	6	6
Date Sampled	MCP S-1	9/7/2004	9/30/2004	9/30/2004	9/30/2004	10/7/2004	12/14/2004	12/14/2004	12/14/2004	10/19/2004	10/19/2004	1/25/2005	9/27/2004
VOC (µg/Kg)													
Acetone	500000	200 J	10 U	10 U	10 U	12 U	12 U	10 U	11	10 UJ	12 UJ	12 UJ	10 U
2-Butanone	500000	11 UJ	10 U	10 U	10 U	12 UJ	12 U	10 U	10 U	10 UJ	12 UJ	12 UJ	10 U
n-Butylbenzene		5.5 UJ	5 UJ	5 UJ	5 UJ	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
sec-Butylbenzene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	3.2 J	5 U	6 U	6 U	5 U
Carbon disulfide		5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
Dichlorodifluoromethane		5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 UJ	6 UJ	6 U	5 U
1,2-Dichloroethane	10000	5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
2-Hexanone		5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 UJ	6 UJ	6 U	5 U
Isopropylbenzene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	1 J	5 U	6 U	6 U	5 U
4-Isopropyltoluene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	5.8	5 U	6 U	6 U	5 U
4-Methyl-2-pentanone	500000	5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 UJ	6 UJ	6 U	5 U
n-Propylbenzene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	1.4 J	5 U	6 U	6 U	5 U
Tetrachloroethene	30000	5.5 UJ	5 U	5 U	5 U	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
Toluene	500000	5.5 UJ	6.1 U	8.2 U	5 U	22	6 U	5 U	5 U	5 U	6 U	98	5 U
Trichlorofluoromethane		5.5 UJ	5 U	2 J	2 J	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
1,2,4-Trimethylbenzene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	5.1	5 U	6 U	6 U	5 U
1,3,5-Trimethylbenzene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	4.5 J	5 U	6 U	6 U	5 U
o-Xylene		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U
m+p-Xylenes		5.5 UJ	5 U	5 UJ	5 U	6 U	6 U	5 U	5 U	5 U	6 U	6 U	5 U

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0780102F	SB079-0006I	SB080-0006I	SB081-0006I	SB082-0006I	SB084-0006I	SB091-0006I	SB092-0006I	FD-008-101704	SB093-0006I	SB094-0006I
Upper Depth (in.)		12	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		24	6	6	6	6	6	6	6	6	6	6
Date Sampled	MCP S-1	9/27/2004	10/24/2004	11/30/2004	12/2/2004	12/2/2004	10/16/2004	10/24/2004	10/17/2004	10/17/2004	10/17/2004	10/20/2004
VOC (µg/Kg)												
Acetone	500000	10 U	10 UJ	10 UJ	10 U	14 U	11 J	6.9 J	24 J	10 UJ	12 UJ	77 J
2-Butanone	500000	10 U	3.8 J	1.8 J	1.6 J	2.3 J	5.3 J	6 J	3.5 J	10 UJ	12 UJ	10 UJ
n-Butylbenzene		5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 U	6 UJ	5 U	5 U	6 U	5 UJ
sec-Butylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 UJ
Carbon disulfide		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U
Dichlorodifluoromethane		5 U	5 UJ	5 UJ	5 U	6.7	5 U	6 UJ	5 U	5 U	6 U	5 U
1,2-Dichloroethane	10000	5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U
2-Hexanone		5 U	5 UJ	5 UJ	5 U	5 U	5 U	6 UJ	5 U	5 U	6 UJ	5 U
Isopropylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U
4-Isopropyltoluene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 UJ
4-Methyl-2-pentanone	500000	5 U	5 UJ	5 UJ	5 U	5 U	5 U	6 UJ	4.1 J	5 U	6 U	9 J
n-Propylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 UJ
Tetrachloroethene	30000	5 U	5 UJ	5 UJ	5 U	5 U	5 U	6 UJ	5 U	5 U	6 U	5 U
Toluene	500000	5 U	5 U	1.1 J	5 U	5 U	5 U	6 U	5 U	5 U	6 U	12
Trichlorofluoromethane		5 U	5 U	5 UJ	5 U	5 U	5 UJ	6 U	5 UJ	5 UJ	6 UJ	5.2 J
1,2,4-Trimethylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 UJ
1,3,5-Trimethylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	5 U	5 U	6 U	5 UJ
o-Xylene		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	1.8 J	5 U	6 U	5 U
m+p-Xylenes		5 U	5 U	5 UJ	5 U	5 U	5 U	6 U	1.8 J	5 U	6 U	5 U

Appendix Table A.1.4
 Soil Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD009-102404	SB095-0006I	SB-553-A	SB612-0103F	FD001-042805	SB613-0103F	SB614-0103F	SB7250608F	DUP 01-041206	SB7260810F	FD901-001-110704
Upper Depth (in.)		0	0		12	12	12	12	72	96	96	
Lower Depth (in.)		6	6		36	36	36	36	96	120	120	
Date Sampled	MCP S-1	10/24/2004	10/24/2004	12/1/2005	4/28/2005	4/28/2005	4/28/2005	4/28/2005	4/12/2006	4/12/2006	4/12/2006	11/7/2004
VOC (µg/Kg)												
Acetone	500000	14 UJ	10 UJ	R	2810 U	2470 U	2360 U	887 U	93.8 U	98.2 U	67.5 J	10 U
2-Butanone	500000	5.7 J	3.6 J	9460 U	1410 U	1230 U	1180 U	444 U	46.9 UJ	49.1 UJ	46.3 UJ	2.9 J
n-Butylbenzene		7 UJ	5 UJ	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
sec-Butylbenzene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
Carbon disulfide		7 U	5 U	4730 U	703 U	616 U	589 U	222 U	2.2 J	24.6 U	13.5 J	5 U
Dichlorodifluoromethane		7 UJ	5 UJ	1890 U	281 U	247 U	236 U	88.7 U	9.4 U	9.8 U	9.3 U	5 U
1,2-Dichloroethane	10000	7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
2-Hexanone		7 UJ	5 UJ	9460 U	1410 U	1230 U	1180 U	444 U	46.9 U	49.1 U	46.3 U	5 U
Isopropylbenzene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
4-Isopropyltoluene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
4-Methyl-2-pentanone	500000	7 UJ	5 UJ	9460 U	1410 U	1230 U	1180 U	444 U	46.9 U	49.1 U	46.3 U	5 U
n-Propylbenzene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
Tetrachloroethene	30000	7 UJ	5 UJ	946 U	141 U	123 U	118 U	44.4 U	0.8 J	0.9 J	0.5 J	5 U
Toluene	500000	7 U	5 U	946 U	5740	3960	197	114	4.7 U	4.9 U	4.6 U	3.7 J
Trichlorofluoromethane		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
1,2,4-Trimethylbenzene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
1,3,5-Trimethylbenzene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
o-Xylene		7 U	5 U	946 U	141 U	123 U	118 U	44.4 U	4.7 U	4.9 U	4.6 U	5 U
m+p-Xylenes		7 U	5 U	1890 U	281 U	247 U	236 U	88.7 U	9.4 U	9.8 U	9.3 U	5 U

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		Drywell-EW-01	Drywell-FI-01	Drywell-NW-01	Drywell-SW-01	Drywell-WW-01	EX002-0002F	EX003-0002F	EX-201-0020F	EX-202-0020F	EX-203-0020F
Upper Depth (in.)							0	0	0	0	0
Lower Depth (in.)							24	24	240	240	240
Date Sampled	MCP S-1	4/27/2006	4/27/2006	4/27/2006	4/27/2006	4/27/2006	5/6/2005	5/6/2005	8/5/2005	8/5/2005	8/5/2005
VPH (mg/Kg)											
Adjusted C9-C12 Aliphatics		0.0955 J	0.0527 J	0.263 U	0.288 U	0.277 U					
Unadjusted C5-C8 Aliphatics	100	0.728 J	0.655 J	0.786 J	0.684 J	0.351 J	3.44 U	3.07 U	0.3 U	2.45 U	0.434 U
Unadjusted C9-C12 Aliphatics	1000	0.245 J	0.205 J	0.2 J	0.232 J	0.247 J	3.44 U	3.07 U	12	143	24.6
Adjusted C9-C10 Aromatics	100	0.261 U	0.258 UJ	0.263 U	0.288 U	0.277 U			5.57	69.4	11.6
Naphthalene		0.0522 U	0.0515 UJ	0.0526 U	0.0577 U	0.0553 U			0.0293 U	0.117 U	0.029 U
Toluene		0.221	0.0515 UJ	0.0526 U	0.107	0.0553 U			0.0293 U	0.117 U	0.0201 J
o-Xylene		0.0522 U	0.0515 UJ	0.0526 U	0.0577 U	0.0553 U			0.0293 U	0.117 U	0.029 U
m+p-Xylenes		0.104 U	0.0372 J	0.105 U	0.115 U	0.111 U			0.0585 U	0.235 U	0.0579 U

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-204-0020F	EX-205-0020F	FD001-080505	EX-206-0003F	EX-207-0003F	EX-208-0004F	EX-209-0004F	EX-BARK-13	EX-BARK-15	EX-BARK-17	EX-BARK-19
Upper Depth (in.)		0	0	0	0	0	0	0				
Lower Depth (in.)		240	240	240	36	36	48	48				
Date Sampled	MCP S-1	8/5/2005	8/5/2005	8/5/2005	8/11/2005	10/6/2005	10/11/2005	10/11/2005	9/7/2006	9/7/2006	9/7/2006	9/7/2006
VPH (mg/Kg)												
Adjusted C9-C12 Aliphatics									0.162 U	0.199 U	0.21 U	10.3
Unadjusted C5-C8 Aliphatics	100	0.518 U	0.567 U	1.34 U	0.419 U	0.435 U	0.42 U	0.415 U	0.413 J	0.513 J	0.463 J	1.9
Unadjusted C9-C12 Aliphatics	1000	13.5	3.98 J	24 J	0.14 U	0.725 U	0.14 U	0.138 U	0.144 J	0.19 J	0.133 J	25.3
Adjusted C9-C10 Aromatics	100	6.59	1.85 J	11.5 J	0.14 U	0.264 U	0.14 U	0.138 U	0.162 U	0.199 U	0.21 U	15
Naphthalene		0.0346 U	0.0378 U	0.0384 U	0.028 U	0.14 U	0.028 U	0.0276 U	0.0197 J	0.0398 U	0.042 U	0.898
Toluene		0.0346 U	0.0378 U	0.0384 U	0.028 U	0.029 U	0.028 U	0.0276 U	0.0325 U	0.0398 U	0.042 U	0.0712 U
o-Xylene		0.0346 U	0.0378 U	0.0384 U	0.028 U	0.029 U	0.028 U	0.0276 U	0.0325 U	0.0398 U	0.042 U	0.0461 J
m+p-Xylenes		0.0691 U	0.0756 U	0.0768 U	0.0559 U	0.058 U	0.056 U	0.0553 U	0.0649 U	0.0797 U	0.084 U	0.0841 J

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-BARK-21	EX-BARK-23	PCA1-TUB-02	SB-021 0006I	SB-021 0203F	SB-023 0006I	SB-023 0203F	SB029-0203F	SB038-0006I	SB038-0203F	SB038-0506F
Upper Depth (in.)					0	24	0	24	24	0	24	60
Lower Depth (in.)					6	36	6	36	36	6	36	72
Date Sampled	MCP S-1	9/7/2006	9/7/2006	10/28/2005	9/9/2004	9/9/2004	9/8/2004	9/8/2004	10/19/2004	12/2/2004	12/2/2004	12/2/2004
VPH (mg/Kg)												
Adjusted C9-C12 Aliphatics		0.186 U	1.11									
Unadjusted C5-C8 Aliphatics	100	0.482 J	0.63 J	0.731 U	7.91 U	7.4 U	7.8 U	8.43 U	8.44 U	5.46 U	5.67 U	5.72 U
Unadjusted C9-C12 Aliphatics	1000	0.157 J	2.25	0.244 U	7.91 U	7.4 U	7.8 U	8.43 U	8.44 U	5.46 U	5.67 U	5.72 U
Adjusted C9-C10 Aromatics	100	0.186 U	1.14	0.244 U								
Naphthalene		0.0373 U	0.0438 U	0.0487 U								
Toluene		0.0373 U	0.0438 U	0.0487 U								
o-Xylene		0.0373 U	0.0438 U	0.0487 U								
m+p-Xylenes		0.0746 U	0.0876 U	0.0974 U								

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD-007-100704	SB041-0203F	SB041-1415F	SB042-0510F	SB-044 0203F	SB045-0607F	SB046 0006I	SB046 0506F	SB050-0006I	SB050-0203F	SB052-0006I
Upper Depth (in.)		24	24	168	60	24	72	0	60	0	24	0
Lower Depth (in.)		36	36	180	120	36	84	6	72	6	36	6
Date Sampled	MCP S-1	10/7/2004	10/7/2004	10/7/2004	10/24/2004	9/8/2004	12/2/2004	9/30/2004	9/30/2004	10/24/2004	10/24/2004	12/2/2004
VPH (mg/Kg)												
Adjusted C9-C12 Aliphatics												
Unadjusted C5-C8 Aliphatics	100	7.57 U	7.23 U	8.12 U	6.87 U	5.38 U	6.17 U	5.65 U	8.97 U	7.22 U	13.5 U	7.15 U
Unadjusted C9-C12 Aliphatics	1000	7.57 U	7.23 U	8.12 U	6.87 U	5.38 U	6.17 U	5.65 U	8.97 U	7.22 U	13.5 U	7.15 U
Adjusted C9-C10 Aromatics	100											
Naphthalene												
Toluene												
o-Xylene												
m+p-Xylenes												

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		FD002-090704	SB-056 0006I	SB-056 0203F	SB-056 1415F	SB077 0006I	SB0780006I	SB079-0006I	SB080-0006I	SB081-0006I	SB082-0006I	SB084-0006I	SB091-0006I
Upper Depth (in.)		168	0	24	168	0	0	0	0	0	0	0	0
Lower Depth (in.)		180	6	36	180	6	6	6	6	6	6	6	6
Date Sampled	MCP S-1	9/7/2004	9/7/2004	9/7/2004	9/7/2004	1/25/2005	9/27/2004	10/24/2004	11/30/2004	12/2/2004	12/2/2004	10/16/2004	10/24/2004
VPH (mg/Kg)													
Adjusted C9-C12 Aliphatics													
Unadjusted C5-C8 Aliphatics	100	7.25 U	6.91 U	6.35 U	6.07 U	8.78 U	3.45 U	7.62 U	7.45 U	19.3	7.82 U	9.63 U	8.39 U
Unadjusted C9-C12 Aliphatics	1000	7.25 U	6.91 U	6.35 U	6.07 U	8.78 U	3.45 U	7.62 U	7.45 U	6.34 U	7.82 U	9.63 U	8.39 U
Adjusted C9-C10 Aromatics	100												
Naphthalene													
Toluene													
o-Xylene													
m+p-Xylenes													

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB092-0006I	FD-008-101704	SB093-0006I	SB-553-0608F	SB-553-A	SB-554-0002F	SB-554-0204F	SB-554-0406F	SB-554-0608F	SB612-0103F	FD001-042805
Upper Depth (in.)		0	0	0	72		0	24	48	72	12	12
Lower Depth (in.)		6	6	6	96		24	48	72	96	36	36
Date Sampled	MCP S-1	10/17/2004	10/17/2004	10/17/2004	1/27/2005	12/1/2005	1/27/2005	1/27/2005	1/27/2005	1/27/2005	4/28/2005	4/28/2005
VPH (mg/Kg)												
Adjusted C9-C12 Aliphatics												
Unadjusted C5-C8 Aliphatics	100	5.13 U	8.82 U	9.86 U	10 U	6.68 J	12.3 U	11.4 U	8.58 U	7.6 U	10.3	7.26
Unadjusted C9-C12 Aliphatics	1000	5.13 U	8.82 U	9.86 U	10 U	94.9	12.3 U	11.4 U	8.58 U	7.6 U	0.703 U	0.616 U
Adjusted C9-C10 Aromatics	100					42.5					0.703 U	0.616 U
Naphthalene						0.471 U					0.141 U	0.123 U
Toluene						0.471 U					4.84	3.28
o-Xylene						0.471 U					0.141 U	0.123 U
m+p-Xylenes						0.941 U					0.281 U	0.247 U

Appendix Table A.1.4
 Soil Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB613-0103F	SB614-0103F	ST-102-Decon-01	ST-102-Decon-02	TK-55-004	TK-55-005
Upper Depth (in.)		12	12				
Lower Depth (in.)		36	36				
Date Sampled	MCP S-1	4/28/2005	4/28/2005	4/25/2006	4/25/2006	9/14/2005	9/14/2005
VPH (mg/Kg)							
Adjusted C9-C12 Aliphatics				0.0539 J	0.0369 J		
Unadjusted C5-C8 Aliphatics	100	1.77 U	1.79 U	0.244 J	0.409 J	0.728 U	0.752 J
Unadjusted C9-C12 Aliphatics	1000	0.589 U	0.596 U	0.119 J	0.14 J	1.1	27.2
Adjusted C9-C10 Aromatics	100	0.589 U	0.596 U	0.135 U	0.167 U	0.376	12.5
Naphthalene		0.118 U	0.119 U	26.9 U	33.4 U	0.0485 U	0.987
Toluene		0.137	0.119 U	26.9 U	33.4 U	0.0485 U	0.213 U
o-Xylene		0.118 U	0.119 U	26.9 U	33.4 U	0.0485 U	0.213 U
m+p-Xylenes		0.236 U	0.238 U	53.9 U	66.8 U	0.0971 U	0.426 U

Appendix Table A.1.5
 Summary Statistics of All Soil Sample Results --
 SCFA Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from the YAEC SCFA/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Unadjusted C19-C36 Aliphatics	8	28	29%	13.50	30.51	369.00
Unadjusted C9-C18 Aliphatics	2	28	7%	10.60	4.89	21.60
Unadjusted C11-C22 Aromatics	8	28	29%	9.72	23.60	208.00
<i>Inorganics (mg/Kg)</i>						
Arsenic	32	32	100%	1.10	3.51	6.60
Barium	28	28	100%	67.00	85.25	120.00
Beryllium	0	4	0%		0.43	
Cadmium	0	32	0%		1.15	
Chromium	32	32	100%	12.00	15.31	23.00
Copper	4	4	100%	10.00	11.75	13.00
Lead	33	33	100%	3.30	12.68	120.00
Mercury	1	32	3%	0.53	0.27	0.53
Nickel	4	4	100%	9.80	10.20	11.00
Selenium	0	32	0%		4.54	
Silver	0	32	0%		0.45	
Thallium	0	4	0%		0.41	
Zinc	4	4	100%	63.00	71.00	78.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	204	0%		6.54	
Aroclor-1268	0	204	0%		6.54	
Aroclor-1016	0	321	0%		10.25	
Aroclor-1221	0	321	0%		10.25	
Aroclor-1232	0	321	0%		10.25	
Aroclor-1242	0	321	0%		10.25	
Aroclor-1248	6	321	2%	19.00	10.76	71.20
Aroclor-1254	190	321	59%	6.50	276.42	5400.00
Aroclor-1260	172	321	54%	6.68	226.75	3590.00
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	0	14	0%		192.86	
Acenaphthylene	0	14	0%		192.86	
Anthracene	0	14	0%		192.86	
Benzo(a)anthracene	0	14	0%		192.86	
Benzo(a)pyrene	0	14	0%		192.86	
Benzo(b)fluoranthene	0	14	0%		192.86	
Benzo(g,h,i)perylene	0	14	0%		192.86	
Benzo(k)fluoranthene	0	14	0%		192.86	
Carbazole	0	14	0%		192.86	
2-Chloronaphthalene	0	14	0%		192.86	
Chrysene	0	14	0%		192.86	
Dibenzo(a,h)anthracene	0	14	0%		192.86	
Fluoranthene	1	14	7%	90.00	185.71	90.00
Fluorene	0	14	0%		192.86	
Indeno(1,2,3-cd)pyrene	0	14	0%		192.86	
2-Methylnaphthalene	0	14	0%		192.86	
Naphthalene	0	14	0%		192.86	
Phenanthrene	0	14	0%		192.86	
Pyrene	1	14	7%	80.00	185.00	80.00
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	2	2	100%	9.00	12.50	16.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.5
 Summary Statistics of All Soil Sample Results --
 SCFA Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from the YAEC SCFA/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (μg/Kg)</i>						
Acetone	14	26	54%	4.80	29.44	120.00
Acrylonitrile	0	26	0%		7.10	
Allyl Chloride	0	26	0%		3.55	
Benzene	0	26	0%		3.55	
Bromobenzene	0	26	0%		3.55	
Bromochloromethane	0	26	0%		3.55	
Bromodichloromethane	0	26	0%		3.55	
Bromoform	0	26	0%		3.55	
Bromomethane	0	26	0%		10.63	
2-Butanone	11	26	42%	2.10	8.99	17.00
n-Butylbenzene	0	26	0%		3.55	
sec-Butylbenzene	0	26	0%		3.55	
tert-Butylbenzene	0	26	0%		3.55	
Carbon Disulfide	5	26	19%	2.70	3.78	6.40
Carbon Tetrachloride	0	26	0%		7.10	
Chlorobenzene	0	26	0%		3.55	
1-Chlorobutane	0	26	0%		3.55	
Chloroethane	0	26	0%		10.63	
2-Chloroethylvinyl Ether	0	26	0%		10.63	
Chloroform	0	26	0%		10.63	
Chloromethane	0	26	0%		3.55	
2-Chlorotoluene	0	26	0%		3.55	
4-Chlorotoluene	0	26	0%		3.55	
1,2-Dibromo-3-Chloropropane	0	26	0%		3.55	
Dibromochloromethane	0	26	0%		3.55	
1,2-Dibromoethane	0	26	0%		3.55	
Dibromomethane	0	26	0%		3.55	
1,2-Dichlorobenzene	0	26	0%		3.55	
1,3-Dichlorobenzene	0	26	0%		3.55	
1,4-Dichlorobenzene	0	26	0%		3.55	
Dichlorodifluoromethane	0	26	0%		3.55	
1,1-Dichloroethane	0	26	0%		3.55	
1,2-Dichloroethane	0	26	0%		3.55	
cis-1,2-Dichloroethene	0	26	0%		3.55	
trans-1,2-Dichloroethene	0	26	0%		3.55	
1,1-Dichloroethene	0	26	0%		3.55	
1,3-Dichloropropane	0	26	0%		3.55	
2,2-Dichloropropane	0	26	0%		3.55	
1,2-Dichloropropane	0	26	0%		3.55	
1,1-Dichloropropene	0	26	0%		3.55	
cis-1,3-Dichloropropene	0	26	0%		3.55	
trans-1,3-Dichloropropene	0	26	0%		3.55	
Diethyl Ether	7	26	27%	40.00	20.90	79.00
Ethyl Methacrylate	0	26	0%		3.55	
Ethylbenzene	1	26	4%	4.40	3.63	4.40
Ethyl-t-butyl ether	0	26	0%		3.55	
2-Hexanone	0	26	0%		3.55	
Iodomethane	0	26	0%		3.55	
Isopropylbenzene	0	26	0%		3.55	
4-Isopropyltoluene	1	26	4%	3.10	3.58	3.10
Methacrylonitrile	0	26	0%		3.55	
Methyl Methacrylate	0	26	0%		3.55	
4-Methyl-2-Pentanone	0	26	0%		3.55	
Methylene Chloride	7	26	27%	27.00	21.33	97.00
Methyl-t-butyl ether	0	26	0%		10.63	
2-Nitropropane	0	26	0%		7.08	
Pentachloroethane	0	26	0%		3.55	
Propionitrile	0	26	0%		35.71	
n-Propylbenzene	0	26	0%		3.55	
Styrene	0	26	0%		3.55	
1,1,1,2-Tetrachloroethane	0	26	0%		3.55	
1,1,2,2-Tetrachloroethane	0	26	0%		3.55	
Tetrachloroethene	0	26	0%		3.55	
Tetrahydrofuran	0	26	0%		7.10	
Toluene	14	26	54%	2.00	5.41	18.00
trans-1,4-Dichloro-2-Butene	0	26	0%		3.55	
1,2,3-Trichlorobenzene	0	26	0%		3.55	
1,2,4-Trichlorobenzene	0	26	0%		3.55	
1,1,1-Trichloroethane	0	26	0%		7.10	
1,1,2-Trichloroethane	0	26	0%		3.55	
Trichloroethene	0	26	0%		3.55	
Trichlorofluoromethane	0	26	0%		3.55	
1,2,3-Trichloropropane	0	26	0%		3.55	
1,2,4-Trimethylbenzene	0	26	0%		3.55	
1,3,5-Trimethylbenzene	0	26	0%		3.55	
Vinyl Acetate	0	26	0%		10.63	
Vinyl Chloride	0	26	0%		3.55	
o-Xylene	0	26	0%		3.55	
m+p-Xylenes	0	26	0%		3.55	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.6
 Soil Sample Results - EPHs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-10 5-15'	SCFA-11 10-25'	SCFA-12 10-30'	SCFA-13 10-25'	FD011-082004	SCFA-14 10-15'	SCFA-15 10-16.5'	SCFA-16 10-25'	SCFA-17 5-19'
Upper Depth (in.)		60	120	120	120	120	120	120	120	60
Lower Depth (in.)		180	300	360	300	180	180	198	300	228
Date Sampled	MCP S-1	8/19/2004	8/20/2004	8/17/2004	8/20/2004	8/20/2004	8/20/2004	8/20/2004	8/24/2004	8/23/2004
EPH (mg/Kg)										
Unadjusted C19-C36 Aliphatics	3000	7.41 U	8.33 U	8.13 U	8.33 U	22.9	13.5	15.6	7.66 U	7.58 U
Unadjusted C9-C18 Aliphatics	1000	7.41 U	8.33 U	8.13 U	8.33 U	7.25 U	7.49 U	7.49 U	7.66 U	7.58 U
Unadjusted C11-C22 Aromatics	800	7.41 U	8.33 U	8.13 U	8.33 U	31.5	15.2	9.72	7.66 U	7.58 U

Appendix Table A.1.6
 Soil Sample Results - EPHs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-18 10-25'	SCFA-19 10-20'	SCFA-2 20-25'	SCFA-20 10-25'	SCFA-21 10-16.5'	SCFA-22 10-25'	SCFA-23 10-25'	SCFA-24 0-5'	SCFA-25 5-9'
Upper Depth (in.)		120	120	240	120	120	120	120	0	60
Lower Depth (in.)		300	240	300	300	198	300	300	60	108
Date Sampled	MCP S-1	8/23/2004	8/23/2004	8/19/2004	8/17/2004	8/20/2004	8/20/2004	8/20/2004	8/23/2004	8/23/2004
EPH (mg/Kg)										
Unadjusted C19-C36 Aliphatics	3000	31.3	8.03 U	9.39 U	8.03 U	82.3	369	100	8.23 U	7.02 U
Unadjusted C9-C18 Aliphatics	1000	9.52 U	8.03 U	9.39 U	8.03 U	7.94 U	21.6	10.6	8.23 U	7.02 U
Unadjusted C11-C22 Aromatics	800	128	8.03 U	9.39 U	8.03 U	25.9	208	63.7	8.23 U	7.02 U

Appendix Table A.1.6
 Soil Sample Results - EPHs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-26 15-25'	SCFA-27 5-25'	SCFA-28 5-12'	SCFA-29 5-20'	SCFA-3 10-30'	SCFA-30 5-9'	SCFA-5 25-30'	SCFA-6 10-25'	SCFA-7 5-12'	FD012-082404	SCFA-8 10-25'
Upper Depth (in.)		180	60	60	60	120	60	300	120	60	120	120
Lower Depth (in.)		300	300	144	240	360	108	360	300	144	180	300
Date Sampled	MCP S-1	8/23/2004	8/17/2004	8/23/2004	8/23/2004	8/19/2004	8/23/2004	8/19/2004	8/24/2004	8/24/2004	8/24/2004	8/24/2004
EPH (mg/Kg)												
Unadjusted C19-C36 Aliphatics	3000	7.94 U	7.66 U	130	31.8	8.89 U	8.66 U	8.44 U	7.58 U	7.84 U	8.13 U	8.23 U
Unadjusted C9-C18 Aliphatics	1000	7.94 U	7.66 U	7.66 U	7.75 U	8.89 U	8.66 U	8.44 U	7.58 U	7.84 U	8.13 U	8.23 U
Unadjusted C11-C22 Aromatics	800	7.94 U	7.66 U	90.1	39.3	8.89 U	8.66 U	8.44 U	7.58 U	7.84 U	8.13 U	8.23 U

Appendix Table A.1.6
 Soil Sample Results - EPHs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-9 15-25'
Upper Depth (in.)		180
Lower Depth (in.)		300
Date Sampled	MCP S-1	8/19/2004
EPH (mg/Kg)		
Unadjusted C19-C36 Aliphatics	3000	8.44 U
Unadjusted C9-C18 Aliphatics	1000	8.44 U
Unadjusted C11-C22 Aromatics	800	8.44 U

Appendix Table A.1.6
 Soil Sample Results - Inorganics
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		EX-403-0003I	SB0030006I	SB0030203F	SB1340006I	SB1340203F	SCFA-10 5-15'	SCFA-11 10-25'	SCFA-12 10-30'	SCFA-13 10-25'	FD011-082004
Upper Depth (in.)		0	0	24	0	24	60	120	120	120	120
Lower Depth (in.)		3	6	36	6	36	180	300	360	300	180
Date Sampled	MCP S-1	7/8/2005	10/22/2003	10/22/2003	10/22/2003	10/22/2003	8/19/2004	8/20/2004	8/17/2004	8/20/2004	8/20/2004
Inorganics (mg/Kg)											
Arsenic	20		1.1	1.9	1.8	2.9	2.9	4.5	4.2	4.3	3.9
Barium	1000						92	88	86	85	110
Chromium	30		13	12	13	13	16	16	14	14	15
Copper			10	13	12	12					
Lead	300	48	3.3	6.5	120	22	4.6	6.1	5.9	5.1	6.4
Mercury	20		0.66 U	0.55 U	0.67 U	0.64 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20		10	9.8	11	10					
Zinc	2500		63	67	78	76					

Appendix Table A.1.6
 Soil Sample Results - Inorganics
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-14 10-15'	SCFA-15 10-16.5'	SCFA-16 10-25'	SCFA-17 5-19'	SCFA-18 10-25'	SCFA-19 10-20'	SCFA-2 20-25'	SCFA-20 10-25'	SCFA-21 10-16.5'	SCFA-22 10-25'
Upper Depth (in.)		120	120	120	60	120	120	240	120	120	120
Lower Depth (in.)		180	198	300	228	300	240	300	300	198	300
Date Sampled	MCP S-1	8/20/2004	8/20/2004	8/24/2004	8/23/2004	8/23/2004	8/23/2004	8/19/2004	8/17/2004	8/20/2004	8/20/2004
Inorganics (mg/Kg)											
Arsenic	20	5	6.6	2.5	3.3	3.3	4.5	2.1	4.2	4	5.2
Barium	1000	88	74	91	79	76	120	110	67	73	78
Chromium	30	15	15	18	14	14	15	12	16	23	16
Copper											
Lead	300	6.4	6.2	5.1	5.2	7.2	8.8	4.6	5.2	5.4	5.7
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20										
Zinc	2500										

Appendix Table A.1.6
 Soil Sample Results - Inorganics
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-23 10-25'	SCFA-24 0-5'	SCFA-25 5-9'	SCFA-26 15-25'	SCFA-27 5-25'	SCFA-28 5-12'	SCFA-29 5-20'	SCFA-3 10-30'	SCFA-30 5-9'	SCFA-5 25-30'
Upper Depth (in.)		120	0	60	180	60	60	60	120	60	300
Lower Depth (in.)		300	60	108	300	300	144	240	360	108	360
Date Sampled	MCP S-1	8/20/2004	8/23/2004	8/23/2004	8/23/2004	8/17/2004	8/23/2004	8/23/2004	8/19/2004	8/23/2004	8/19/2004
Inorganics (mg/Kg)											
Arsenic	20	4	3.2	2.3	3.5	4.1	3	3.3	4.6	4.2	4.3
Barium	1000	90	73	84	94	79	77	72	83	90	76
Chromium	30	19	14	12	15	14	17	16	19	18	13
Copper											
Lead	300	5.4	4.8	6.9	5.9	7.1	5.7	6.5	47	11	5.1
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.53	0.5 U
Nickel	20										
Zinc	2500										

Appendix Table A.1.6
 Soil Sample Results - Inorganics
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-6 10-25'	SCFA-7 5-12'	FD012-082404	SCFA-8 10-25'	SCFA-9 15-25'
Upper Depth (in.)		120	60	120	120	180
Lower Depth (in.)		300	144	180	300	300
Date Sampled	MCP S-1	8/24/2004	8/24/2004	8/24/2004	8/24/2004	8/19/2004
Inorganics (mg/Kg)						
Arsenic	20	2.8	2.6	4	2.6	3.4
Barium	1000	92	110	92	82	78
Chromium	30	14	18	16	16	16
Copper						
Lead	300	6.1	15	5.1	6.2	4.4
Mercury	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Nickel	20					
Zinc	2500					

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		EX-403-0003I	SB0030006I	SB1117-0003I	SB-SCFA-28A1-1214F	SB-SCFA-28A2-1214F	SB-SCFA-28A3-1214F	SB-SCFA-28A4-1214F	SB-SCFA-28A5-1214F
Upper Depth (in.)		0	0	0	144	144	144	144	144
Lower Depth (in.)		3	6	3	168	168	168	168	168
Date Sampled	MCP S-1	7/8/2005	10/22/2003	3/4/2005	1/25/2005	1/25/2005	1/25/2005	1/25/2005	1/25/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	10 U	40 U	20.8 U	33 U	33 U	33 U	33 U	29 U
Aroclor-1254	2000	211	40 U	40.6	33 U	33 U	33 U	33 U	29 U
Aroclor-1260	2000	439	310	20.8 U	33 U	33 U	33 U	33 U	29 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-28A6-1214F	SB-SCFA-31-1618F	FD001-121304	SB-SCFA-32-0406F	SB-SCFA-32-0608F	SB-SCFA-32-1618F	SB-SCFA-32-2628F	SB-SCFA-33R-0204
Upper Depth (in.)		144	192	312	48	72	192	312	24
Lower Depth (in.)		168	216	336	72	96	216	336	48
Date Sampled	MCP S-1	1/25/2005	12/13/2004	12/13/2004	12/13/2004	12/13/2004	12/13/2004	12/13/2004	1/25/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	28.9 U	33 U	33 U	33 U	33 U	33 U	33 U	28.9 U
Aroclor-1254	2000	28.9 U	33 U	33 U	33 U	33 U	33 U	33 U	31.2
Aroclor-1260	2000	28.9 U	33 U	33 U	33 U	33 U	33 U	33 U	28.9 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-33R-0608	SB-SCFA-33R-1214	SB-SCFA-33R-2224	SB-SCFA-33R-3032	SB-SCFA-33R-3234	SB-SCFA-34-0810F	SB-SCFA-34-1012F	SB-SCFA-34-3032F	SB-SCFA-34-3234F
Upper Depth (in.)		72	144	264	360	384	96	120	360	384
Lower Depth (in.)		96	168	288	384	408	120	144	384	408
Date Sampled	MCP S-1	1/25/2005	1/25/2005	1/25/2005	1/25/2005	1/25/2005	12/15/2004	12/15/2004	12/15/2004	12/15/2004
PCBs (µg/Kg)										
Aroclor-1248	2000	29 U	28.9 U	29 U	28.9 U	28.7 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	29 U	28.9 U	29 U	28.9 U	28.7 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	29 U	28.9 U	29 U	28.9 U	28.7 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		FD006-012605	SB-SCFA-35R-0204F	SB-SCFA-35R-0608F	SB-SCFA-35R-1214F	SB-SCFA-35R-2224F	SB-SCFA-35R-3032F	SB-SCFA-35R-3234F
Upper Depth (in.)		312	24	72	144	264	360	384
Lower Depth (in.)		336	48	96	168	288	384	408
Date Sampled	MCP S-1	1/26/2005	1/26/2005	1/26/2005	1/26/2005	1/26/2005	1/26/2005	1/26/2005
PCBs (µg/Kg)								
Aroclor-1248	2000	35 U	29.2 U	29 U	28.8 U	33 U	33 U	33 U
Aroclor-1254	2000	35 U	29.2 U	42.6	28.8 U	33 U	33 U	33 U
Aroclor-1260	2000	35 U	29.2 U	29 U	38	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		FD014-122004	SB-SCFA-37-1214	SB-SCFA-37-2224	SB-SCFA-37-3032	SB-SCFA-37-3234	FD015-122004	SB-SCFA-38-1214F	SB-SCFA-38-2224F	SB-SCFA-38-3032F
Upper Depth (in.)		144	144	264	360	384	384	144	264	360
Lower Depth (in.)		168	168	288	384	408	408	168	288	384
Date Sampled	MCP S-1	12/20/2004	12/20/2004	12/20/2004	12/20/2004	12/20/2004	12/20/2004	12/20/2004	12/20/2004	12/20/2004
PCBs (µg/Kg)										
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	46	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-38-3234F	SB-SCFA-39-2224F	SB-SCFA-39-3032F	SB-SCFA-39-3234F	SB-SCFA-40-0608F	SB-SCFA-40-1214F	SB-SCFA-40-2022F	SB-SCFA-40-2224F
Upper Depth (in.)		384	264	360	384	72	144	240	264
Lower Depth (in.)		408	288	384	408	96	168	264	288
Date Sampled	MCP S-1	12/20/2004	12/21/2004	12/21/2004	12/21/2004	12/21/2004	12/21/2004	12/21/2004	12/21/2004
PCBs (µg/Kg)									
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	33 U	870	33 U	33 U	33 U	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-40-3032F	SB-SCFA-40-3234F	SB-SCFA-41-2224F	SB-SCFA-42-3032F	SB-SCFA-42-3234F	FD008-121704	SB-SCFA-49-0002F	SB-SCFA-49R-0204F
Upper Depth (in.)		360	384	264	360	384	0	0	24
Lower Depth (in.)		384	408	288	384	408	24	24	48
Date Sampled	MCP S-1	12/21/2004	12/21/2004	12/21/2004	12/21/2004	12/21/2004	12/17/2004	12/17/2004	1/26/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	33 U	33 U	33 U	66 U	33 U	33 U	33 U	29 U
Aroclor-1254	2000	33 U	33 U	33 U	2600	33 U	59	420	144
Aroclor-1260	2000	33 U	33 U	33 U	66 U	33 U	33 U	33 U	74.2

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-49R-0608F	SB-SCFA-49R-1214F	SB-SCFA-50R-0204	SB-SCFA-50R-0608	SB-SCFA-50R-1214	SB-SCFA-50R-2224	MS/MSD005-SB-SCFA-61-2022F	FD010-012605
Upper Depth (in.)		72	144	24	72	144	264	240	144
Lower Depth (in.)		96	168	48	96	168	288	264	168
Date Sampled	MCP S-1	1/26/2005	1/26/2005	1/25/2005	1/25/2005	1/25/2005	1/25/2005	12/22/2004	1/26/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	28.9 U	29 U	33 U	33 U	33 U	28.5 U	33 U	33 U
Aroclor-1254	2000	28.9 U	29 U	55	140	63	51.2	33 U	50
Aroclor-1260	2000	28.9 U	29 U	33 U	33 U	33 U	28.5 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB-SCFA-63R-0608F	SB-SCFA-63R-1214F	SCFA-10 5-15'	SCFA-11 10-25'	SCFA-12 10-30'	SCFA-13 10-25'	FD011-082004	SCFA-14 10-15'	SCFA-15 10-16.5'	SCFA-16 10-25'
Upper Depth (in.)		72	144	60	120	120	120	120	120	120	120
Lower Depth (in.)		96	168	180	300	360	300	180	180	198	300
Date Sampled	MCP S-1	1/26/2005	1/26/2005	8/19/2004	8/20/2004	8/17/2004	8/20/2004	8/20/2004	8/20/2004	8/20/2004	8/24/2004
PCBs (µg/Kg)											
Aroclor-1248	2000	33 U	33 U	37 U	40 U	39 U	43 U	36 U	36 U	39 U	38 U
Aroclor-1254	2000	33 U	65	37 U	40 U	39 U	43 U	5.7 J	6.5 J	14 J	38 U
Aroclor-1260	2000	33 U	33 U	37 U	40 U	39 U	43 U	36 U	36 U	15 J	38 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-17 5-19'	SCFA-18 10-25'	SCFA-19 10-20'	SCFA-2 20-25'	SCFA-20 10-25'	SCFA-21 10-16.5'	SCFA-22 10-25'	SCFA-22R0204F	SCFA-22R0406F	SCFA-23 10-25'
Upper Depth (in.)		60	120	120	240	120	120	120	24	48	120
Lower Depth (in.)		228	300	240	300	300	198	300	48	72	300
Date Sampled	MCP S-1	8/23/2004	8/23/2004	8/23/2004	8/19/2004	8/17/2004	8/20/2004	8/20/2004	11/10/2004	11/10/2004	8/20/2004
PCBs (µg/Kg)											
Aroclor-1248	2000	37 U	46 U	51 U	45 U	37 U	40 U	39 U	33 U	33 U	38 U
Aroclor-1254	2000	37 U	46 U	51 U	45 U	37 U	26 J	120	26 J	350	140
Aroclor-1260	2000	37 U	46 U	51 U	45 U	37 U	40 U	57	33 U	300	86

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-24 0-5'	SCFA-25 5-9'	SCFA-26 15-25'	FD002-111004	SCFA-27 5-25'	SCFA-27R0608F	SCFA-27R0810F	SCFA-27R1012F	SCFA-27R1214F
Upper Depth (in.)		0	60	180	72	60	72	96	120	144
Lower Depth (in.)		60	108	300	96	300	96	120	144	168
Date Sampled	MCP S-1	8/23/2004	8/23/2004	8/23/2004	11/10/2004	8/17/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004
PCBs (µg/Kg)										
Aroclor-1248	2000	40 U	35 U	39 U	33 U	38 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	40 U	35 U	39 U	33 U	190	33 U	33 U	33 U	33 U
Aroclor-1260	2000	40 U	35 U	39 U	33 U	38 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-27R1416F	SCFA-27R1618F	SCFA-27R1820F	SCFA-27R2022F	SCFA-27R2224F	SCFA-27R2426F	SCFA-27R2628F	SCFA-27R2830F	SCFA-28 5-12'	SCFA-28R1012F
Upper Depth (in.)		168	192	216	240	264	288	312	336	60	120
Lower Depth (in.)		192	216	240	264	288	312	336	360	144	144
Date Sampled	MCP S-1	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	8/23/2004	11/9/2004
PCBs (µg/Kg)											
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	39 U	33 U
Aroclor-1254	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	140	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	39 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-29 5-20'	SCFA-3 10-30'	SCFA-3R2022F	SCFA-3R2224F	SCFA-3R2426F	SCFA-3R2628F	SCFA-3R2830F	SCFA-3R3032F	SCFA-3R3234F	SCFA-3R3436F
Upper Depth (in.)		60	120	240	264	288	312	336	360	384	408
Lower Depth (in.)		240	360	264	288	312	336	360	384	408	432
Date Sampled	MCP S-1	8/23/2004	8/19/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004
PCBs (µg/Kg)											
Aroclor-1248	2000	40 U	42 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	40 U	250	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	40 U	42 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-30 5-9'	SCFA-5 25-30'	FD003-111004	SCFA-6 10-25'	SCFA-6R0608F	FD001-110904	SCFA-7 5-12'	SCFA-7R01012F	SCFA-7R0204F	SCFA-7R0406F	SCFA-7R0608F
Upper Depth (in.)		60	300	72	120	72	24	60	120	24	48	72
Lower Depth (in.)		108	360	96	300	96	48	144	144	48	72	96
Date Sampled	MCP S-1	8/23/2004	8/19/2004	11/10/2004	8/24/2004	11/10/2004	11/9/2004	8/24/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004
PCBs (µg/Kg)												
Aroclor-1248	2000	45 U	41 U	33 U	38 U	33 U	33 U	74 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	45 U	41 U	33 U	38 U	33 U	33 U	2000	39	33 U	33 U	33 U
Aroclor-1260	2000	45 U	41 U	33 U	380	33 U	33 U	74 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-7R0810F	SCFA-7A0204F
Upper Depth (in.)		96	24
Lower Depth (in.)		120	48
Date Sampled	MCP S-1	11/9/2004	11/9/2004
PCBs (µg/Kg)			
Aroclor-1248	2000	33 U	33 U
Aroclor-1254	2000	55	86
Aroclor-1260	2000	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-7A0406F	SCFA-7A0608F	SCFA-7A0810F	SCFA-7A1012F	SCFA-7B0204F	SCFA-7B0406F	SCFA-7B0608F	SCFA-7B0810F	SCFA-7B1012F	SCFA-7C0204F
Upper Depth (in.)		48	72	96	120	24	48	72	96	120	24
Lower Depth (in.)		72	96	120	144	48	72	96	120	144	48
Date Sampled	MCP S-1	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004	11/9/2004
PCBs (µg/Kg)											
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	360	33 U	33 U	33 U	33 U	420	140	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-7C0406F	SCFA-7C0608F	SCFA-7C0810F	SCFA-7C1012F	FD012-082404	SCFA-8 10-25'	SCFA-9 15-25'	SCFA-A-EW-01R	SCFA-A-EW-02R	SCFA-A-FL-01R
Upper Depth (in.)		48	72	96	120	120	120	180			
Lower Depth (in.)		72	96	120	144	180	300	300			
Date Sampled	MCP S-1	11/9/2004	11/9/2004	11/9/2004	11/9/2004	8/24/2004	8/24/2004	8/19/2004	8/4/2005	8/4/2005	8/4/2005
PCBs (µg/Kg)											
Aroclor-1248	2000	33 U	33 U	33 U	33 U	38 U	41 U	40 U	20.3 U	20 U	20.4 U
Aroclor-1254	2000	33 U	33 U	33 U	72	38 U	41 U	40 U	374	267	20.4 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	38 U	41 U	40 U	63.7	213	20.4 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		FD001-072605	SCFA-A-FL-02	SCFA-A-FL-03	SCFA-A-FL-04	SCFA-A-FL-05	SCFA-A-FL-06	SCFA-A-FL-07	SCFA-A-NW-01	SCFA-A-NW-02	SCFA-A-NW-03	SCFA-A-SW-01	SCFA-A-SW-02
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	7/26/2005	7/26/2005	7/26/2005	7/26/2005	8/4/2005	8/4/2005	8/4/2005	7/26/2005	7/26/2005	8/4/2005	7/26/2005	7/26/2005
PCBs (µg/Kg)													
Aroclor-1248	2000	9.93 U	9.81 U	9.94 U	9.84 U	20.1 U	20.5 U	20.5 U	10.1 U	10.2 U	20.2 U	10.1 U	9.73 U
Aroclor-1254	2000	9.93 UJ	124 J	100	46.2	20.1 U	184	172	184	49.8	20.2 U	99.1	606
Aroclor-1260	2000	9.93 UJ	27.9 J	99.8	9.84 U	31.1	85.8	39.9	37.7	10.2 U	20.2 U	244	204

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-A-SW-03	SCFA-A-WW-02	SCFA-A-WW-02R	SCFA-B-EW-2	SCFA-B-FL-1	SCFA-FD002-081505	SCFA-B-FL-10	SCFA-B-FL-2	SCFA-B-FL-3	SCFA-B-FL-4
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	8/4/2005	7/26/2005	8/4/2005	8/15/2005	8/15/2005	8/15/2005	10/3/2005	8/15/2005	8/15/2005	8/15/2005
PCBs (µg/Kg)											
Aroclor-1248	2000	20.1 U	9.77 U	20.2 U	10.1 U	10 U	10 U	9.83 U	9.85 U	9.92 U	9.99 U
Aroclor-1254	2000	92.6	77.6	121	603	106	145	170	102	110	189
Aroclor-1260	2000	21.1	9.77 U	23.2	207	82.1	64.9	86.4	106	96.1	275

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-B-FL-5	SCFA-B-FL-6	SCFA-B-FL-7	SCFA-B-FL-8	SCFA-B-FL-9	SCFA-B-NW-1	SCFA-B-NW-2	SCFA-B-WW-1	SCFA-C-FL-03	SCFA-C-FL-04-102405	SCFA-C-FL-05
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	8/15/2005	8/15/2005	10/1/2005	10/1/2005	10/1/2005	8/15/2005	8/15/2005	8/15/2005	10/11/2005	10/24/2005	10/24/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	9.93 U	9.83 U	10 U	9.85 U	10 U	10 U	10.1 U	9.99 U	9.96 U	9.87 U	10.3 U
Aroclor-1254	2000	145	107	141	84.6	78.3	114	21.1	191	73.6	170	456
Aroclor-1260	2000	123	145	41.6	45.7	33.6	33.6	16.1	143	10.4	66.6	179

> MCP S-1

Sample ID		SCFA-C-FL-06	SCFA-C-FL-07	SCFA-C-FL-08	SCFA-C-FL-09	SCFA-C-FL-10	SCFA-C-FL-11	SCFA-FD006-102405	SCFA-C-FL-12	SCFA-C-FL-13R	SCFA-C-FL-15	SCFA-C-FL-16
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	10/24/2005	10/24/2005	10/24/2005	10/24/2005	10/24/2005	10/24/2005	10/24/2005	10/28/2005	11/11/2005	10/28/2005	10/28/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	10.6 U	10 U	10.4 U	10.2 U	10 U	10.2 U	9.96 U	9.95 U	10.7 U	10 U	10 U
Aroclor-1254	2000	630	10 U	146	276	603	210 J	421 J	72.1	692	614	114
Aroclor-1260	2000	298	10 U	44.2	59.1	165	64.6 J	132 J	28.8	436	310	110

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-FL-17R	SCFA-C-FL-18	SCFA-C-FL-19	SCFA-C-FL-20R	SCFA-C-FL-21R	SCFA-C-FL-22R	SCFA-C-FL-28	SCFA-C-FL-29	SCFA-C-L1-EW-1	SCFA-C-L1-EW-2R
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	11/11/2005	10/28/2005	10/28/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	8/9/2005	9/30/2005
PCBs (µg/Kg)											
Aroclor-1248	2000	10.4 U	9.97 U	9.99 U	10.4 U	10.3 U	10.9 U	11 U	10 U	9.8 U	9.99 U
Aroclor-1254	2000	256	219	227	701	1340	2030	487	646	231	51.4
Aroclor-1260	2000	10.4 U	232	245	415	845	682	145	610	165	16.5

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L1-EW-3	SCFA-C-L1-FL-01	SCFA-C-L1-NW-2	SCFA-C-L1-NW-3	SCFA-C-L1-NW-4	SCFA-C-L1-SW-01	SCFA-C-L1-SW-02	SCFA-C-L1-SW-05	SCFA-C-L1-SW-06
Upper Depth (in.)										
Lower Depth (in.)										
Date Sampled	MCP S-1	8/9/2005	9/30/2005	8/10/2005	8/10/2005	8/10/2005	10/11/2005	10/11/2005	10/28/2005	10/28/2005
PCBs (µg/Kg)										
Aroclor-1248	2000	9.8 U	10 U	10 U	9.99 U	10.1 U	10.5 U	10.3 U	10.9 U	10.7 U
Aroclor-1254	2000	419	295	172	125	41.6	60	10.3 U	171	183
Aroclor-1260	2000	67.1	52.1	52	29.9	13.7	368	122	121	176

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L1-SW-08	SCFA-C-L1-SW-09	SCFA-C-L1-SW-10	SCFA-C-L1-SW-11	SCFA-C-L1-SW-12	SCFA-C-L1-SW-13
Upper Depth (in.)							
Lower Depth (in.)							
Date Sampled	MCP S-1	11/5/2005	11/5/2005	11/5/2005	11/5/2005	11/5/2005	11/5/2005
PCBs (µg/Kg)							
Aroclor-1248	2000	10.1 U	10.5 U	10.5 U	10.1 U	10.6 U	10.3 U
Aroclor-1254	2000	2190	1790	358	510	490	366
Aroclor-1260	2000	1010	948	218	174	354	1290

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L1-WW-01R	SCFA-C-L1-WW-02R	SCFA-C-L1-WW-03	SCFA-FD007-102805	SCFA-C-L1-WW-04	SCFA-C-L1-WW-1	SCFA-C-L1-WW-2
Upper Depth (in.)								
Lower Depth (in.)								
Date Sampled	MCP S-1	10/28/2005	10/28/2005	10/28/2005	10/28/2005	10/28/2005	8/10/2005	8/10/2005
PCBs (µg/Kg)								
Aroclor-1248	2000	9.97 U	9.92 U	9.97 U	9.97 U	9.97 U	10 U	9.86 U
Aroclor-1254	2000	739	70.4	53.8	81.1	155	122	82.2
Aroclor-1260	2000	242	180	57.2	56.8	91.1	23.5	19.2

> MCP S-1

Sample ID		SCFA-C-L2-NW-01	SCFA-FD004-101105	SCFA-C-L2-NW-02	SCFA-C-L2-NW-03	SCFA-C-L2-NW-04	SCFA-C-L2-NW-05	SCFA-C-L2-SW-01	SCFA-C-L2-SW-02	SCFA-C-L2-SW-03-2R
Upper Depth (in.)										
Lower Depth (in.)										
Date Sampled	MCP S-1	10/11/2005	10/11/2005	10/11/2005	10/11/2005	10/11/2005	10/11/2005	10/11/2005	10/11/2005	11/11/2005
PCBs (µg/Kg)										
Aroclor-1248	2000	9.8 U	9.6 U	9.87 U	9.8 U	9.64 U	9.74 U	10.6 U	9.68 U	10.4 U
Aroclor-1254	2000	9.8 U	9.6 U	9.87 U	9.8 U	9.64 U	9.74 U	181	102	787
Aroclor-1260	2000	9.8 U	9.6 U	9.87 U	9.8 U	9.64 U	9.74 U	201	261	546

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L2-SW-04R	SCFA-C-L2-WW-01R-111105	SCFA-C-L2-WW-02R-111105	SCFA-C-L2-WW-03	SCFA-C-L2-WW-04	SCFA-C-L2-WW-05R
Upper Depth (in.)							
Lower Depth (in.)							
Date Sampled	MCP S-1	11/11/2005	11/11/2005	11/11/2005	10/28/2005	10/28/2005	11/11/2005
PCBs (µg/Kg)							
Aroclor-1248	2000	10.7 U	10.1 U	10.2 U	9.92 U	9.98 U	9.99 U
Aroclor-1254	2000	2470	1130	255	159	206	2720
Aroclor-1260	2000	1040	3590	70.1	332	103	867

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L2-WWW-01	SCFA-C-L3-EW-01	SCFA-C-L3-EW-02R	SCFA-C-L3-EW-03	SCFA-C-L3-NW-01	SCFA-C-L3-NW-02	SCFA-C-L3-NW-03	SCFA-FD005-101905
Upper Depth (in.)									
Lower Depth (in.)									
Date Sampled	MCP S-1	10/28/2005	10/11/2005	10/19/2005	10/11/2005	10/19/2005	10/19/2005	10/19/2005	10/19/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	9.91 U	10 U	11.1 U	10 U	10.2 U	10.7 U	10.1 U	10.1 U
Aroclor-1254	2000	530	36.1	11.1 U	10 U	41.3	10.7 U	10.1 U	10.1 U
Aroclor-1260	2000	249	18.5	11.1 U	26	10.2 U	10.7 U	10.1 U	10.1 U

> MCP S-1

Sample ID		SCFA-C-L3-NW-04	SCFA-FD008-102805	SCFA-C-L3-NW-05	SCFA-C-L3-WW-01R-111105	SCFA-C-L3-WW-02R-111105	SCFA-C-L3-WW-03	SCFA-C-L3-WW-04	SCFA-C-L3-WW-05R
Upper Depth (in.)									
Lower Depth (in.)									
Date Sampled	MCP S-1	10/28/2005	10/28/2005	10/28/2005	11/11/2005	11/11/2005	10/28/2005	10/28/2005	11/11/2005
PCBs (µg/Kg)									
Aroclor-1248	2000	10 U	10 U	9.99 U	10.1 U	10.1 U	9.96 U	9.97 U	9.85 U
Aroclor-1254	2000	10 U	10 U	9.99 U	2220	834	59.7	33.4	3680
Aroclor-1260	2000	10 U	10 U	9.99 U	994	367	356	20.4	1510

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-L3-WW-06R	SCFA-C-L3-WW-07R	SCFA-C-L3-WW-08R	SCFA-FD012-111105	SCFA-C-L3-WW-09R	SCFA-C-L3-WWW-01	SCFA-C-L4-NW-01	SCFA-C-L4-NW-02	SCFA-C-NW/FL17R
Upper Depth (in.)										
Lower Depth (in.)										
Date Sampled	MCP S-1	11/11/2005	11/11/2005	11/11/2005	11/11/2005	11/11/2005	10/28/2005	10/28/2005	10/28/2005	11/11/2005
PCBs (µg/Kg)										
Aroclor-1248	2000	10.1 U	10.1 U	10.2 U	10.2 U	10.2 U	9.95 U	9.97 U	9.99 U	10 U
Aroclor-1254	2000	1200	5400	1060	450	221	140	264	9.99 U	39.5
Aroclor-1260	2000	391	1050	759	3730	805	147	58.8	9.99 U	10 U

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-SF-EW-01	SCFA-C-SF-EW-02	SCFA-C-SF-FL-01	SCFA-C-SF-FL-02	SCFA-C-SF-FL-03	SCFA-C-SF-FL-04	SCFA-C-SP-01	SCFA-C-SPFL-01	SCFA-C-SPFL-02	SCFA-C-SW/FL17R
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	11/11/2005	11/16/2005	11/16/2005	11/11/2005
PCBs (µg/Kg)											
Aroclor-1248	2000	9.75 U	9.93 U	9.99 U	9.87 U	9.89 U	9.94 U	10.1 U	10.2 U	10 U	10 U
Aroclor-1254	2000	492	455	189	468	5330	1790	682	187	224	7.49 J
Aroclor-1260	2000	226	102	274	271	1040	424	179	110	37	10 U

> MCP S-1

Sample ID		SCFA-C-V-SF-01	SCFA-C-V-SF-02	SCFA-C-V-SF-03	SCFA-C-V-SF-04	SCFA-C-V-SF-05	SCFA-C-V-SF-06	SCFA-C-V-SF-07	SCFA FD015-041906	SCFA-C-V-SF-08	SCFA-C-V-SF-09	SCFA-C-V-SF-10
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006	4/19/2006
PCBs (µg/Kg)												
Aroclor-1248	2000	9.95 U	9.77 U	9.95 U	10 U	9.88 U	10 U	9.93 U	9.76 U	9.88 U	9.96 U	9.83 U
Aroclor-1254	2000	345 J	464	492	1120	906	1010	2210	996	868	1490	831
Aroclor-1260	2000	308	947	577	459	368	396	546	284	239	492	224

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-C-WW/FL17R	SCFA-C-WW-V1	SCFA-C-WW-V2	SCFA-C-WW-V3	SCFA-D-FL-01	SCFA-FD014-111505	SCFA-D-FL-02	SCFA-D-FL-03	SCFA-D-FL-04	SCFA-D-FL-05	SCFA-D-FL-06
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	11/11/2005	11/16/2005	11/16/2005	11/16/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	10.2 U	10.3 U	9.87 U	9.99 U	9.94 U	10.7 U	10.7 U	10.5 U	10.2 U	9.8 U	10.3 U
Aroclor-1254	2000	39.2	43.1	89.2	215	9.94 U	443	10.7 U	2070	10.2 U	9.8 U	10.3 U
Aroclor-1260	2000	10.2 U	6.68 J	21.7	100	2100	2130	2550	1950	2270	2150	972

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-D-FL-07	SCFA-D-FL-08	FD 003-041306	SCFA-D-FL-09	SCFA-D-FL-10R	SCFA-D-FL-11	SCFA-D-FL-12	SCFA-D-FL-13	SCFA-D-L1-EW-01	SCFA-FD013-111505	SCFA-D-L1-EW-02
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	11/15/2005	4/13/2006	4/13/2006	4/13/2006	5/3/2006	4/26/2006	5/3/2006	5/3/2006	11/15/2005	11/15/2005	11/15/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	10.8 U	10.7 UJ	10.9 UJ	10.9 UJ	10.3 U	10.3 U	10.3 U	10.4 U	10.2 U	10.3 U	10 U
Aroclor-1254	2000	10.8 U	10.7 UJ	10.9 UJ	10.9 UJ	49.8	191	56.6	108	402	436	220
Aroclor-1260	2000	702	541 J	1120 J	1830 J	154	505	270 J	146	673	550	650

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-D-L1-EW-03	SCFA-D-L1-EW-04	SCFA-D-L1-WW-01	SCFA-D-L1-WW-02	SCFA-D-L2-EW-01	SCFA-D-L2-EW-02	SCFA-D-L2-EW-03	SCFA-D-L2-EW-04	SCFA-D-L2-SW-01R
Upper Depth (in.)										
Lower Depth (in.)										
Date Sampled	MCP S-1	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	11/15/2005	4/13/2006
PCBs (µg/Kg)										
Aroclor-1248	2000	9.59 U	9.19 U	10.3 U	10.1 U	10.1 U	10.5 U	10.3 U	10.5 U	10.6 UJ
Aroclor-1254	2000	134	76.7	639	729	228	240	125	80.9	106 UJ
Aroclor-1260	2000	64.2	85	549	1300	554	290	306	150	3480 J

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-D-L2-SW-02R	SCFA-D-L2-WW-01	SCFA-D-L2-WW-02	SCFA-D-L2-WW-04	SCFA-D-L2-WW-05	SCFA-D-SW-03	SCFA-D-SW-04	SCFA-FG-0002	SCFA-FG-0002R	SCFA-FD016-081406
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	4/13/2006	11/15/2005	11/15/2005	5/3/2006	5/3/2006	5/3/2006	5/3/2006	8/14/2006	8/18/2006	8/14/2006
PCBs (µg/Kg)											
Aroclor-1248	2000	10.7 UJ	9.76 U	10 U	10.5 UJ	10.3 U	9.83 U	10.6 UJ	19	21.6	14.6
Aroclor-1254	2000	10.7 UJ	9.76 U	644	67.2 J	629	595 J	70.7 J	63.3	242	96.4 J
Aroclor-1260	2000	288 J	2120	1340	133 J	403	3320	182 J	40	352	38.5

> MCP S-1

Sample ID		SCFA-FG-0004	SCFA-FG-0005	SCFA-FG-0006	SCFA-FG-0009	SCFA-R-FL-03	SCFA-R-FL-04	SCFA-R-SW-01	SCFA-R-SW-02R	SCFA-R-SW-03	SCFA-R-SW-04R	SCFA-TOP-001	SCFA-TOP-003
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	8/14/2006	8/14/2006	8/14/2006	8/14/2006	9/29/2005	10/19/2005	7/25/2005	9/29/2005	10/6/2005	10/19/2005	4/19/2006	4/24/2006
PCBs (µg/Kg)													
Aroclor-1248	2000	25	33.9	71.2	21	9.98 U	10.2 U	10 U	9.92 U	9.63 U	10.3 U	10.6 UJ	9.95 U
Aroclor-1254	2000	188 J	140	84.1	227 J	9.98 U	272	21.5	56.5	76	151	660 J	41.5
Aroclor-1260	2000	49.1	79.2	27.4	115	9.98 U	297	10 U	127	102	191	313 J	23.3

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - PCBs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-TOP-004	SCFA-TOP-005	SCFA-TOP-006	SCFA-TOP-010	SCFA-TOP-011	SCFA-TOP-012	ST-151152-007
Upper Depth (in.)								
Lower Depth (in.)								
Date Sampled	MCP S-1	4/24/2006	4/24/2006	4/24/2006	4/24/2006	4/24/2006	4/24/2006	4/5/2006
PCBs (µg/Kg)								
Aroclor-1248	2000	10.1 U	10.2 U	10.1 U	10.1 U	10.1 U	10.2 U	10.7 UJ
Aroclor-1254	2000	47.3	185	135	145	134	183	147 J
Aroclor-1260	2000	25.8	68.5	83.3	55.1	113	285	59.8 J

> MCP S-1

Appendix Table A.1.6
 Soil Sample Results - SVOCs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-22R0204F	SCFA-27R0204F	SCFA-27R0608F	SCFA-27R1012F	SCFA-27R1416F	SCFA-27R1820F	SCFA-27R2224F	SCFA-27R2830F	SCFA-3R2022F	SCFA-3R2426F
Upper Depth (in.)		24	24	72	120	168	216	264	336	240	288
Lower Depth (in.)		48	48	96	144	192	240	288	360	264	312
Date Sampled	MCP S-1	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/10/2004	11/11/2004	11/11/2004
SVOC (µg/Kg)											
Fluoranthene	1000000	90 J	400 U	360 U	370 U	380 U	390 U	360 U	380 U	410 U	450 U
Pyrene	1000000	80 J	400 U	360 U	370 U	380 U	390 U	360 U	380 U	410 U	450 U

Appendix Table A.1.6
 Soil Sample Results - SVOCs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-3R2830F	SCFA-3R3234F	FD003-111004	SCFA-6R0204F	SCFA-6R0608F
Upper Depth (in.)		336	384	72	24	72
Lower Depth (in.)		360	408	96	48	96
Date Sampled	MCP S-1	11/11/2004	11/11/2004	11/10/2004	11/10/2004	11/10/2004
SVOC (µg/Kg)						
Fluoranthene	1000000	390 U	360 U	390 U	360 U	410 U
Pyrene	1000000	390 U	360 U	390 U	360 U	410 U

Appendix Table A.1.6
 Soil Sample Results - TPHs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SB0030006I	SB0030203F
Upper Depth (in.)		0	24
Lower Depth (in.)		6	36
Date Sampled	MCP S-1	10/22/2003	10/22/2003
TPH (mg/Kg)			
TPH-DRO	800	9	16

Appendix Table A.1.6
 Soil Sample Results - VOCs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-10 10-15'	SCFA-11 15-20'	SCFA-12 15-20'	SCFA-13 15-20'	FD011-082004	SCFA-14 10-15'	SCFA-15 10-15'	SCFA-16 20-25'	SCFA-17 15-20'	SCFA-18 5-10'
Upper Depth (in.)		120	180	180	180	120	120	120	240	180	60
Lower Depth (in.)		180	240	240	240	180	180	180	300	240	120
Date Sampled	MCP S-1	8/19/2004	8/20/2004	8/17/2004	8/20/2004	8/20/2004	8/20/2004	8/20/2004	8/24/2004	8/23/2004	8/23/2004
VOC (µg/Kg)											
Acetone	500000	10 U	5.5 J	10 U	11 U	90	5.4 J	10 U	66 B	120 B	35 B
2-Butanone	500000	10 U	12 U	2.1 J	11 U	11 U	10 U	10 U	11 J	17	8 J
Carbon disulfide		6.4	6 U	2.8 J	5.5 U	5.5 U	5 U	5 U	6 U	5 U	5 U
Diethyl Ether		10 U	56	10 U	52	11 U	40	43	12 U	10 U	10 U
Ethylbenzene	500000	5 U	6 U	5 U	5.5 U	5.5 U	5 U	5 U	6 U	5 U	5 U
4-Isopropyltoluene		5 U	6 U	5 U	5.5 U	5.5 U	5 U	5 U	6 U	5 U	5 U
Methylene chloride	200000	15 U	28 B	15 U	34 B	16 U	27 B	38 B	18 U	15 U	15 U
Toluene	500000	2 J	6 U	3.5 J	5.5 U	2.6 J	5 U	5 U	3.3 J	5.8	4.5 J

Appendix Table A.1.6
 Soil Sample Results - VOCs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-19 15-20'	SCFA-2 20-25'	SCFA-20 10-15'	SCFA-21 5-10'	SCFA-22 5-10'	SCFA-23 10-15'	SCFA-24 0-5'	SCFA-25 5-9'	SCFA-26 10-15'	SCFA-27 25-30'	SCFA-28 10-12'
Upper Depth (in.)		180	240	120	60	60	120	0	60	120	300	120
Lower Depth (in.)		240	300	180	120	120	180	60	108	180	360	144
Date Sampled	MCP S-1	8/23/2004	8/19/2004	8/17/2004	8/20/2004	8/20/2004	8/20/2004	8/23/2004	8/23/2004	8/23/2004	8/17/2004	8/23/2004
VOC (µg/Kg)												
Acetone	500000	48 B	10 U	120 B	6.3 J	14 U	10 U	71 B	4.8 JB	54	24 B	81 B
2-Butanone	500000	7.1 J	10 U	14	11 U	14 U	10 U	12	10 U	11 U	5.6 J	15
Carbon disulfide		5 U	5 U	2.9 J	5.5 U	7 U	5 U	2.7 J	5 U	5.5 U	3.6 J	6.5 U
Diethyl Ether		10 U	10 U	10 U	61	79	67	10 U	10 U	11 U	10 U	13 U
Ethylbenzene	500000	5 U	5 U	5.1 U	5.5 U	7 U	5 U	4.4 J	5 U	5.5 U	5.2 U	6.5 U
4-Isopropyltoluene		5 U	5 U	5.1 U	5.5 U	7 U	5 U	3.1 J	5 U	5.5 U	5.2 U	6.5 U
Methylene chloride	200000	15 U	15 U	15 U	47 B	65 B	97 B	15 U	15 U	16 U	16 U	20 U
Toluene	500000	4.1 J	5 U	2 J	5.5 U	7 U	5 U	6.2	8	5.5 U	6.8	7.7

Appendix Table A.1.6
 Soil Sample Results - VOCs
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-30 5-9'	SCFA-5 5-10'	SCFA-6 15-20'	SCFA-7 10-12'	SCFA-8 10-15'	SCFA-9 25-30'
Upper Depth (in.)		60	60	180	120	120	300
Lower Depth (in.)		108	120	240	144	180	360
Date Sampled	MCP S-1	8/23/2004	8/19/2004	8/24/2004	8/24/2004	8/24/2004	8/19/2004
VOC (µg/Kg)							
Acetone	500000	15 B	10 U	10 U	10 U	100 U	14 U
2-Butanone	500000	11 U	10 U	8.6 J	6.4 J	100 U	14 U
Carbon disulfide		5.5 U	5 U	5 U	5 U	50 U	7 U
Diethyl Ether		11 U	10 U	10 U	10 U	100 U	14 U
Ethylbenzene	500000	5.5 U	5 U	5 U	5 U	50 U	7 U
4-Isopropyltoluene		5.5 U	5 U	5 U	5 U	50 U	7 U
Methylene chloride	200000	16 U	15 U	15 U	15 U	150 U	21 U
Toluene	500000	4.2 J	5 U	18	8.7	50 U	7 U

Appendix Table A.1.7
 Summary Statistics of All Soil Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Dioxin / Furan (pg/g)</i>						
1,2,3,4,6,7,8-HpCDD	1	2	50%	5.80	2.96	5.80
1,2,3,4,6,7,8-HpCDF	1	2	50%	6.40	3.24	6.40
1,2,3,4,7,8,9-HpCDF	1	2	50%	1.30	0.69	1.30
1,2,3,4,7,8-HxCDD	0	2	0%		0.14	
1,2,3,6,7,8-HxCDD	0	2	0%		0.16	
1,2,3,7,8,9-HxCDD	0	2	0%		0.14	
1,2,3,4,7,8-HxCDF	0	2	0%		0.48	
1,2,3,6,7,8-HxCDF	0	2	0%		0.16	
1,2,3,7,8,9-HxCDF	0	2	0%		0.11	
2,3,4,6,7,8-HxCDF	0	2	0%		0.22	
1,2,3,4,5,6,7,8-OCDD	1	2	50%	31.00	15.73	31.00
1,2,3,4,5,6,7,8-OCDF	0	2	0%		1.99	
1,2,3,7,8-PeCDD	0	2	0%		0.14	
1,2,3,7,8-PeCDF	0	2	0%		0.17	
2,3,4,7,8-PeCDF	0	2	0%		0.20	
2,3,7,8-TCDD	0	2	0%		0.25	
2,3,7,8-TCDF	0	2	0%		0.22	
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	30	0%		0.14	
Acenaphthylene	0	30	0%		0.14	
Unadjusted C19-C36 Aliphatics	6	44	14%	25.50	20.84	163.00
Unadjusted C9-C18 Aliphatics	3	44	7%	9.98	12.14	37.40
Anthracene	2	30	7%	0.03	0.14	0.06
Adjusted C11-C22 Aromatics	1	21	5%	29.90	17.23	29.90
Unadjusted C11-C22 Aromatics	8	44	18%	22.30	22.00	226.00
Benzo(a)anthracene	2	30	7%	0.06	0.14	0.14
Benzo(a)pyrene	2	30	7%	0.07	0.14	0.17
Benzo(b)fluoranthene	3	30	10%	0.03	0.14	0.18
Benzo(g,h,i)perylene	1	30	3%	0.10	0.14	0.10
Benzo(k)fluoranthene	3	30	10%	0.04	0.14	0.13
Chrysene	5	30	17%	0.05	0.15	0.67
Dibenzo(a,h)anthracene	0	30	0%		0.14	
Fluoranthene	7	30	23%	0.02	0.17	1.10
Fluorene	1	30	3%	0.02	0.14	0.02
Indeno(1,2,3-cd)pyrene	1	30	3%	0.10	0.14	0.10
2-Methylnaphthalene	2	30	7%	0.02	0.14	0.09
Naphthalene	0	30	0%		0.14	
Phenanthrene	7	30	23%	0.04	0.16	0.62
Pyrene	4	30	13%	0.07	0.17	0.97
Adjusted TPH	3	21	14%	34.70	22.34	90.40
Unadjusted TPH	3	21	14%	34.70	22.34	90.40
<i>Herbicide (µg/Kg)</i>						
2,4-DB	0	8	0%		76.88	
Dicamba	0	8	0%		76.88	
Dichloroprop	0	8	0%		76.88	
Dinoseb	0	8	0%		76.88	
2,4,5-T	0	8	0%		76.88	
2,4,5-TP (Silvex)	0	8	0%		76.88	
<i>Inorganics (mg/Kg)</i>						
Antimony	2	8	25%	0.77	1.52	0.83
Arsenic	91	96	95%	0.71	2.67	18.90
Barium	3	3	100%	29.30	44.30	67.70
Beryllium	1	105	1%	1.00	0.40	1.00
Cadmium	3	98	3%	0.94	0.94	1.39
Chromium	98	98	100%	3.20	13.98	43.90
Copper	74	95	78%	1.80	13.69	330.00
Lead	117	117	100%	0.43	25.16	360.00
Mercury	5	98	5%	0.01	0.29	0.14
Nickel	85	95	89%	3.50	11.93	78.00
Selenium	21	98	21%	5.90	3.34	12.00
Silver	0	98	0%		0.20	
Thallium	0	89	0%		0.51	
Zinc	78	95	82%	22.00	62.09	520.00
<i>Inorganics by Toxicity Characteristic Leaching Procedure (mg/L)</i>						
Arsenic	0	1	0%		0.0075	
Barium	1	1	100%	0.16	0.16	0.16
Cadmium	0	1	0%		0.0013	
Chromium	0	1	0%		0.0025	
Lead	1	1	100%	0.014	0.014	0.014
Mercury	0	1	0%		0.00020	
Selenium	0	1	0%		0.0075	
Silver	0	1	0%		0.0050	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.7
 Summary Statistics of All Soil Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	226	0%		5.76	
Aroclor-1268	0	226	0%		5.76	
Aroclor-1016	14	295	5%	12.70	13.33	83.80
Aroclor-1221	0	295	0%		11.80	
Aroclor-1232	0	295	0%		11.80	
Aroclor-1242	0	295	0%		11.80	
Aroclor-1248	15	295	5%	12.40	17.24	440.00
Aroclor-1254	228	295	77%	5.50	119.18	826.00
Aroclor-1260	200	295	68%	2.99	47.38	617.00
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	0	31	0%		269.68	
Acenaphthylene	3	31	10%	120.00	263.55	190.00
Aniline	0	29	0%		274.66	
Anthracene	3	31	10%	79.00	260.61	130.00
Azobenzene	0	31	0%		269.68	
Benzidine	0	2	0%		2075.00	
Benzo(a)anthracene	7	31	23%	88.00	264.74	420.00
Benzo(a)pyrene	7	31	23%	96.00	269.39	490.00
Benzo(b)fluoranthene	5	31	16%	210.00	265.97	370.00
Benzo(g,h,i)perylene	5	31	16%	94.00	270.94	340.00
Benzo(k)fluoranthene	4	31	13%	170.00	275.65	340.00
Benzoic acid	0	31	0%		1306.45	
Benzyl alcohol	0	31	0%		540.97	
Bis(2-chloroethoxy)methane	0	31	0%		269.68	
Bis(2-chloroethyl)ether	0	31	0%		269.68	
Bis(2-ethylhexyl)phthalate	0	31	0%		269.68	
4-Bromophenyl phenyl ether	0	31	0%		269.68	
Butyl benzyl phthalate	0	31	0%		269.68	
Carbazole	0	31	0%		269.68	
4-Chloro-3-methylphenol	0	31	0%		540.97	
4-Chloroaniline	0	31	0%		540.97	
Bis(2-chloroisopropyl) ether	0	31	0%		540.97	
2-Chloronaphthalene	0	31	0%		269.68	
2-Chlorophenol	0	31	0%		269.68	
4-Chlorophenyl phenyl ether	0	31	0%		269.68	
Chrysene	7	31	23%	100.00	272.10	550.00
Dibenzo(a,h)anthracene	0	31	0%		269.68	
Dibenzofuran	0	31	0%		269.68	
1,2-Dichlorobenzene	0	27	0%		252.78	
1,3-Dichlorobenzene	0	27	0%		252.78	
1,4-Dichlorobenzene	0	27	0%		252.78	
3,3'-Dichlorobenzidine	0	31	0%		540.97	
2,4-Dichlorophenol	0	31	0%		269.68	
Diethyl phthalate	0	31	0%		269.68	
Dimethyl phthalate	0	31	0%		269.68	
2,4-Dimethylphenol	0	31	0%		269.68	
Di-n-butyl phthalate	3	31	10%	74.00	260.06	84.00
2,4-Dinitrophenol	0	31	0%		1306.45	
2,4-Dinitrotoluene	0	31	0%		269.68	
2,6-Dinitrotoluene	0	31	0%		269.68	
Di-n-octyl phthalate	0	31	0%		269.68	
Fluoranthene	9	31	29%	74.00	302.19	770.00
Fluorene	0	31	0%		269.68	
Hexachlorobenzene	0	31	0%		269.68	
Hexachlorobutadiene	0	31	0%		269.68	
Hexachlorocyclopentadiene	0	29	0%		273.97	
Hexachloroethane	0	31	0%		269.68	
Indeno(1,2,3-cd)pyrene	2	31	6%	170.00	269.19	260.00
Isophorone	0	31	0%		269.68	
4,6-Dinitro-2-methylphenol	0	29	0%		1327.59	
2-Methylnaphthalene	0	31	0%		269.68	
3+4-Methylphenol	0	31	0%		269.68	
2-Methylphenol	0	31	0%		269.68	
Naphthalene	0	31	0%		269.68	
2-Nitroaniline	0	31	0%		1306.45	
3-Nitroaniline	0	31	0%		1306.45	
4-Nitroaniline	0	31	0%		1306.45	
Nitrobenzene	0	31	0%		269.68	
2-Nitrophenol	0	31	0%		269.68	
4-Nitrophenol	0	31	0%		1306.45	
N-Nitroso-di-n-propylamine	0	31	0%		269.68	
N-Nitrosodiphenylamine	0	31	0%		269.68	
N-Nitrosodimethylamine	0	31	0%		540.97	
Pentachlorophenol	0	31	0%		1306.45	
Phenanthrene	4	31	13%	230.00	294.35	600.00
Phenol	0	31	0%		269.68	
Pyrene	8	31	26%	140.00	310.48	930.00
1,2,4-Trichlorobenzene	0	27	0%		252.78	
2,4,5-Trichlorophenol	0	31	0%		269.68	
2,4,6-Trichlorophenol	0	31	0%		269.68	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.7
Summary Statistics of All Soil Sample Results --
Outside RUA
YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	67	77	87%	2.20	32.56	320.00
TPH-GRO	1	23	4%	4.60	1.54	4.60
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	3	9	33%	390.00	590.72	869.00
Acrylonitrile	0	9	0%		22.12	
Allyl Chloride	0	6	0%		2.75	
t-Amyl methyl ether	0	7	0%		25.16	
Benzene	1	9	11%	6.30	20.41	6.30
Bromobenzene	0	9	0%		20.29	
Bromochloromethane	0	9	0%		20.29	
Bromodichloromethane	0	9	0%		20.29	
Bromoform	0	9	0%		20.29	
Bromomethane	1	9	11%	5.00	41.71	5.00
2-Butanone	3	9	33%	38.40	204.32	130.00
tert-Butyl Alcohol	0	2	0%		55.50	
n-Butylbenzene	0	9	0%		20.29	
sec-Butylbenzene	0	9	0%		20.29	
tert-Butylbenzene	0	9	0%		20.29	
Carbon Disulfide	0	9	0%		94.11	
Carbon Tetrachloride	0	9	0%		22.12	
Chlorobenzene	0	9	0%		20.29	
1-Chlorobutane	0	6	0%		2.75	
Chloroethane	0	9	0%		42.47	
2-Chloroethylvinyl Ether	0	2	0%		7.50	
Chloroform	0	9	0%		23.96	
Chloromethane	0	9	0%		38.80	
2-Chlorotoluene	0	9	0%		20.29	
4-Chlorotoluene	0	9	0%		20.29	
1,2-Dibromo-3-Chloropropane	0	9	0%		38.80	
Dibromochloromethane	0	9	0%		20.29	
1,2-Dibromoethane	0	9	0%		20.29	
Dibromomethane	0	9	0%		20.29	
1,2-Dichlorobenzene	0	9	0%		20.29	
1,3-Dichlorobenzene	0	9	0%		20.29	
1,4-Dichlorobenzene	0	9	0%		20.29	
Dichlorodifluoromethane	0	9	0%		38.80	
1,1-Dichloroethane	0	9	0%		20.29	
1,2-Dichloroethane	0	9	0%		20.29	
cis-1,2-Dichloroethene	0	9	0%		20.29	
trans-1,2-Dichloroethene	0	9	0%		20.29	
1,1-Dichloroethene	0	9	0%		20.29	
1,3-Dichloropropane	0	9	0%		20.29	
2,2-Dichloropropane	0	9	0%		20.29	
1,2-Dichloropropane	0	9	0%		20.29	
1,1-Dichloropropene	0	9	0%		20.29	
cis-1,3-Dichloropropene	0	9	0%		20.29	
trans-1,3-Dichloropropene	0	9	0%		20.29	
Diethyl Ether	0	9	0%		23.07	
Diisopropyl ether	0	7	0%		25.16	
1,4-Dioxane	0	1	0%		3105.00	
Ethyl Methacrylate	0	6	0%		2.75	
Ethylbenzene	0	9	0%		20.29	
Ethyl-t-butyl ether	0	7	0%		25.16	
Hexachlorobutadiene	0	5	0%		34.52	
Hexachloroethane	0	2	0%		3.25	
2-Hexanone	0	9	0%		186.39	
Iodomethane	0	6	0%		2.75	
Isopropylbenzene	0	9	0%		20.29	
4-Isopropyltoluene	0	9	0%		20.29	
Methacrylonitrile	0	6	0%		2.75	
Methyl Methacrylate	0	6	0%		2.75	
4-Methyl-2-Pentanone	0	9	0%		186.39	
Methylene Chloride	0	9	0%		190.06	
Methyl-t-butyl ether	0	9	0%		23.96	
Naphthalene	1	5	20%	3.80	34.24	3.80
Nitrobenzene	0	2	0%		16.25	
2-Nitropropane	0	6	0%		5.50	
Pentachloroethane	0	6	0%		2.75	
Propionitrile	0	5	0%		28.00	
n-Propylbenzene	0	9	0%		20.29	
Styrene	0	9	0%		20.29	
1,1,1,2-Tetrachloroethane	0	9	0%		20.29	
1,1,2,2-Tetrachloroethane	0	9	0%		20.29	
Tetrachloroethene	0	9	0%		20.29	
Tetrahydrofuran	0	7	0%		226.14	
Toluene	3	9	33%	2.10	21.04	14.00
trans-1,4-Dichloro-2-Butene	0	6	0%		2.75	
1,2,3-Trichlorobenzene	0	9	0%		20.29	
1,2,4-Trichlorobenzene	0	9	0%		20.29	
1,1,1-Trichloroethane	0	9	0%		22.12	
1,1,2-Trichloroethane	0	9	0%		20.29	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.7
 Summary Statistics of All Soil Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatiles Organic Carbons cont. (µg/Kg)</i>						
Trichloroethene	0	9	0%		20.29	
Trichlorofluoromethane	0	9	0%		20.29	
1,2,3-Trichloropropane	0	9	0%		20.29	
1,1,2-Trichlorotrifluoroethane	0	3	0%		55.37	
1,2,4-Trimethylbenzene	0	9	0%		20.29	
1,3,5-Trimethylbenzene	0	9	0%		20.29	
Vinyl Acetate	0	4	0%		7.50	
Vinyl Chloride	0	9	0%		20.29	
o-Xylene	0	9	0%		20.29	
m+p-Xylenes	0	9	0%		38.80	
<i>Volatiles Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	19	0%		0.51	
Adjusted C9-C12 Aliphatics	15	19	79%	0.05	0.74	7.36
Unadjusted C5-C8 Aliphatics	19	32	59%	0.17	2.48	2.17
Unadjusted C9-C12 Aliphatics	19	32	59%	0.13	2.90	16.00
Adjusted C9-C10 Aromatics	3	19	16%	2.05	0.82	8.60
Unadjusted C9-C10 Aromatics	0	13	0%		4.86	
Benzene	0	28	0%		0.08	
Ethylbenzene	0	28	0%		0.08	
Methyl-t-butyl ether	0	28	0%		0.11	
Naphthalene	4	28	14%	0.08	0.33	0.55
Toluene	7	28	25%	0.02	0.10	0.29
o-Xylene	3	28	11%	0.03	0.08	0.39
m+p-Xylenes	3	28	11%	0.03	0.10	0.06

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Table A.1.8
Soil Sample Results - Dioxins - Furans
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID	SB-014 0006I	SB-014 0203F
Upper Depth (in.)	0	24
Lower Depth (in.)	6	36
Date Sampled	9/8/2004	9/8/2004
Dioxin/Furan (pg/g)		
1,2,3,4,6,7,8-HpCDD	5.8 J	0.22 U
1,2,3,4,6,7,8-HpCDF	6.4 J	0.14 U
1,2,3,4,7,8,9-HpCDF	1.3 J	0.16 U
1,2,3,4,5,6,7,8-OCDD	31 J	0.93 UJ

Table A.1.8
Soil Sample Results - EPHs
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID		FLH-01-003I	FLH-01-01-02F	FLH-02-003I	FLH-02-01-02F	FLH-03-003I	FLH-03-01-02F	FLH-04-003I	FLH-04-01-02F	FLH-05-003I	FLH-05-01-02F
Upper Depth (in.)		0	12	0	12	0	12	0	12	0	12
Lower Depth (in.)		3	24	3	24	3	24	3	24	3	24
Date Sampled	MCP S-1	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/7/2006	7/7/2006
EPH (mg/Kg)											
Unadjusted C19-C36 Aliphatics	3000	30 U	30.5 U	30.4 U	33.2 U	30.3 U	29.4 U	29.8 U	31.1 U	31.4 U	30.8 U
Unadjusted C9-C18 Aliphatics	1000	37.4	28 J	30.4 U	33.2 U	30.3 U	29.4 U	29.8 U	31.1 U	31.4 U	30.8 U
Anthracene		0.0344 J	0.152 U	0.152 U	0.166 UJ	0.151 U	0.146 U	0.148 U	0.155 U	0.156 UJ	0.153 UJ
Adjusted C11-C22 Aromatics		29.9 J	30.5 U	30.4 U	33.2 UJ	30.3 U	29.4 U	29.8 U	31.1 U	31.4 UJ	30.8 UJ
Unadjusted C11-C22 Aromatics	800	29.9 J	30.5 U	30.4 U	33.2 U	30.3 U	29.4 U	29.8 U	31.1 U	31.4 U	30.8 U
Benzo(a)anthracene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Benzo(a)pyrene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Benzo(b)fluoranthene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Benzo(g,h,i)perylene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Benzo(k)fluoranthene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Chrysene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Fluoranthene		0.021 J	0.152 U	0.152 U	0.166 UJ	0.151 U	0.146 U	0.148 U	0.155 U	0.156 UJ	0.153 UJ
Fluorene		0.149 U	0.152 U	0.152 U	0.166 UJ	0.151 U	0.146 U	0.148 U	0.155 U	0.156 UJ	0.153 UJ
Indeno(1,2,3-cd)pyrene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
2-Methylnaphthalene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Phenanthrene		0.115 J	0.152 U	0.152 U	0.166 UJ	0.151 U	0.146 U	0.148 U	0.155 U	0.156 UJ	0.153 UJ
Pyrene		0.149 UJ	0.152 UJ	0.152 UJ	0.166 UJ	0.151 UJ	0.146 UJ	0.148 UJ	0.155 UJ	0.156 UJ	0.153 UJ
Adjusted TPH		90.4	34.7	30.4 U	33.2 U	30.3 U	29.4 U	29.8 U	31.1 U	31.4 U	30.8 U
Unadjusted TPH		90.4	34.7	30.4 U	33.2 U	30.3 U	29.4 U	29.8 U	31.1 U	31.4 U	30.8 U

Table A.1.8
Soil Sample Results - EPHs
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID		FLH-06-003I	FLH-06-01-02F	FLH-07-003I	FLH-07-01-02F	Potable Water Tank 0-6	Potable Water Tank 12-18	Potable Water Tank 6-12	SB-005 0006I	SB-005 0203F
Upper Depth (in.)		0	12	0	12	0	12	6	0	24
Lower Depth (in.)		3	24	3	24	6	18	12	6	36
Date Sampled	MCP S-1	7/7/2006	7/7/2006	7/7/2006	7/7/2006	5/17/2006	5/17/2006	5/17/2006	9/7/2004	9/7/2004
EPH (mg/Kg)										
Unadjusted C19-C36 Aliphatics	3000	32.1 U	29.3 U	30.4 U	30.6 U	26.8 U	28.5 U	26.3 U	163	7.25 U
Unadjusted C9-C18 Aliphatics	1000	32.1 U	29.3 U	30.4 U	30.6 U	26.8 U	28.5 U	26.3 U	34.7 U	7.25 U
Anthracene		0.16 UJ	0.146 UJ	0.151 U	0.152 U	0.133 U	0.142 U	0.131 U		
Adjusted C11-C22 Aromatics		32.1 UJ	29.3 UJ	30.4 U	30.6 U	26.8 U	28.5 U	26.3 U		
Unadjusted C11-C22 Aromatics	800	32.1 U	29.3 U	30.4 U	30.6 U	26.8 U	28.5 U	26.3 U	226	7.25 U
Benzo(a)anthracene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Benzo(a)pyrene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Benzo(b)fluoranthene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Benzo(g,h,i)perylene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Benzo(k)fluoranthene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Chrysene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Fluoranthene		0.16 UJ	0.146 UJ	0.0273 J	0.152 U	0.133 U	0.142 U	0.131 U		
Fluorene		0.16 UJ	0.146 UJ	0.151 U	0.152 U	0.133 U	0.142 U	0.131 U		
Indeno(1,2,3-cd)pyrene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
2-Methylnaphthalene		0.16 UJ	0.146 UJ	0.088 J	0.0214 J	0.133 U	0.142 U	0.131 U		
Phenanthrene		0.16 UJ	0.146 UJ	0.0925 J	0.0443 J	0.133 U	0.142 U	0.131 U		
Pyrene		0.16 UJ	0.146 UJ	0.151 UJ	0.152 U	0.133 U	0.142 U	0.131 U		
Adjusted TPH		32.1 U	29.3 U	42.5	30.6 U	26.8 U	28.5 U	26.3 U		
Unadjusted TPH		32.1 U	29.3 U	42.5	30.6 U	26.8 U	28.5 U	26.3 U		

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Table A.1.8
Soil Sample Results - EPHs
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID		SB-006 0006I	SB-006 0203F	SB-007 0006I	SB-007 0203F	FD001-090704	SB-011 0006I	SB-011 0203F	SB-014 0006I	SB-014 0203F	FD005-090904	SB-015 0006I
Upper Depth (in.)		0	24	0	24	24	0	24	0	24	24	0
Lower Depth (in.)		6	36	6	36	36	6	36	6	36	36	6
Date Sampled	MCP S-1	9/7/2004	9/7/2004	9/7/2004	9/7/2004	9/7/2004	9/7/2004	9/7/2004	9/8/2004	9/8/2004	9/9/2004	9/9/2004
EPH (mg/Kg)												
Unadjusted C19-C36 Aliphatics	3000	71.1	7.75 U	7.17 U	8.55 UJ	7.41 U	7.75 U	7.33 U	8.13 U	7.75 U	7.58 U	59.4
Unadjusted C9-C18 Aliphatics	1000	34.7 U	7.75 U	7.17 U	8.55 UJ	7.41 U	7.75 U	7.33 U	8.13 U	7.75 U	7.58 U	36.2 U
Anthracene												
Adjusted C11-C22 Aromatics												
Unadjusted C11-C22 Aromatics	800	117	7.75 U	7.17 U	8.55 U	7.41 U	7.75 U	7.33 U	8.13 U	7.75 U	7.58 U	47.8
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene												
Benzo(k)fluoranthene												
Chrysene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
2-Methylnaphthalene												
Phenanthrene												
Pyrene												
Adjusted TPH												
Unadjusted TPH												

Table A.1.8
Soil Sample Results - EPHs
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID		SB-015 0203F	SB016-0006I	SB016-0203F	SB-156R-0203F	SB-156R-0506F	SB-156R-1011F	FD001-011405	SB-157R-0203F	SB-157R-0708F	SB-158R-0203F
Upper Depth (in.)		24	0	24	24	60	120	24	24	84	24
Lower Depth (in.)		36	6	36	36	72	132	36	36	96	36
Date Sampled	MCP S-1	9/9/2004	10/19/2004	10/19/2004	1/14/2005	1/14/2005	1/14/2005	1/14/2005	1/14/2005	1/14/2005	1/14/2005
EPH (mg/Kg)											
Unadjusted C19-C36 Aliphatics	3000	7.66 U	79.8	89.4	7.17 U	36.2 U	11.7 U	7.17 U	7.41 U	7.94 U	7.58 U
Unadjusted C9-C18 Aliphatics	1000	7.66 U	7.75 U	7.66 U	7.17 U	36.2 U	11.7 U	7.17 U	7.41 U	7.94 U	7.58 U
Anthracene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Adjusted C11-C22 Aromatics											
Unadjusted C11-C22 Aromatics	800	7.66 U	45	49.5	7.17 U	36.2 U	22.3	7.17 U	7.41 U	7.94 U	7.58 U
Benzo(a)anthracene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Benzo(a)pyrene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Benzo(b)fluoranthene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Benzo(g,h,i)perylene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Benzo(k)fluoranthene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Chrysene					0.358 U	1.81 U	0.668	0.358 U	0.37 U	0.397 U	0.379 U
Fluoranthene					0.358 U	1.81 U	1.1	0.358 U	0.37 U	0.397 U	0.379 U
Fluorene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Indeno(1,2,3-cd)pyrene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
2-Methylnaphthalene					0.358 U	1.81 U	0.585 U	0.358 U	0.37 U	0.397 U	0.379 U
Phenanthrene					0.358 U	1.81 U	0.617	0.358 U	0.37 U	0.397 U	0.379 U
Pyrene					0.358 U	1.81 U	0.973	0.358 U	0.37 U	0.397 U	0.379 U
Adjusted TPH											
Unadjusted TPH											

Table A.1.8
Soil Sample Results - EPHs
YAEC Non-BUD/TSCA
YNPS Rowe, MA

Sample ID		SB-158R-0506F	SB-517-0506F	SB-517-0607F	Dup 1-060506	TP4 0002F
Upper Depth (in.)		60	60	72		0
Lower Depth (in.)		72	72	84		24
Date Sampled	MCP S-1	1/14/2005	1/14/2005	1/14/2005	6/5/2006	6/5/2006
EPH (mg/Kg)						
Unadjusted C19-C36 Aliphatics	3000	25.5	8.03 U	7.84 U	31.5 U	32.1 U
Unadjusted C9-C18 Aliphatics	1000	9.98	8.03 U	7.84 U	31.5 U	32.1 U
Anthracene		0.366 U	0.402 U	0.392 U	0.0598 J	0.0594 J
Adjusted C11-C22 Aromatics					31.5 U	32.1 U
Unadjusted C11-C22 Aromatics	800	22.7	8.03 U	7.84 U	31.5 U	32.1 U
Benzo(a)anthracene		0.366 U	0.402 U	0.392 U	0.181	0.136 J
Benzo(a)pyrene		0.366 U	0.402 U	0.392 U	0.192	0.17
Benzo(b)fluoranthene		0.366 U	0.402 U	0.392 U	0.145 J	0.178
Benzo(g,h,i)perylene		0.366 U	0.402 U	0.392 U	0.112 J	0.104 J
Benzo(k)fluoranthene		0.366 U	0.402 U	0.392 U	0.22	0.125 J
Chrysene		0.366 U	0.402 U	0.392 U	0.249	0.186
Fluoranthene		0.366 U	0.402 U	0.392 U	0.395	0.318
Fluorene		0.366 U	0.402 U	0.392 U	0.022 J	0.0225 J
Indeno(1,2,3-cd)pyrene		0.366 U	0.402 U	0.392 U	0.0976 J	0.104 J
2-Methylnaphthalene		0.366 U	0.402 U	0.392 U	0.157 U	0.16 U
Phenanthrene		0.366 U	0.402 U	0.392 U	0.19	0.154 J
Pyrene		0.366 U	0.402 U	0.392 U	0.359	0.284
Adjusted TPH					31.5 U	32.1 U
Unadjusted TPH					31.5 U	32.1 U

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-409-0003I	EX-410-0003I	EX-411-0003I	SB0010006I	SB0010203F	SB001-A0006I	SB001-A0203F	SB001-B0006I	SB001-B0203F	SB001-C0006I
Upper Depth (in.)		0	0	0	0	24	0	24	0	24	0
Lower Depth (in.)		3	3	3	6	36	6	36	6	36	6
Date Sampled	MCP S-1	7/14/2005	7/14/2005	7/14/2005	10/23/2003	10/22/2003	7/13/2004	7/13/2004	7/13/2004	7/13/2004	7/9/2004
Inorganics (mg/Kg)											
Antimony	20				R	R					
Arsenic	20				1.7	1.5					
Beryllium	0.7				0.9 U	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cadmium	2				0.86 U	0.79 U					
Chromium	30				13	20					
Copper					5.5	15					
Lead	300	67.7	122	141	3.3	4.7					
Mercury	20				0.65 U	0.62 U					
Nickel	20				11	14					
Selenium	400				2.7 U	2.5 U					
Zinc	2500				55	84					

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB001-C0203F	SB001-D0006I	SB001-D0203F	FD001-0006I-070904	SB001-R0006I	SB001-R0203F	SB0020006I	SB0020203F	SB0040006I	SB0040102F	SB-005 0006I
Upper Depth (in.)		24	0	24	0	0	24	0	24	0	12	0
Lower Depth (in.)		36	6	36	6	6	36	6	36	6	24	6
Date Sampled	MCP S-1	7/9/2004	7/9/2004	7/9/2004	7/9/2004	7/9/2004	7/9/2004	10/22/2003	10/22/2003	10/22/2003	10/23/2003	9/7/2004
Inorganics (mg/Kg)												
Antimony	20							R	R	R	R	R
Arsenic	20							2.6	1.7	1.2	0.46 U	5.3 J
Beryllium	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.86 U	0.8 U	0.95 U	0.83 U	0.5 U
Cadmium	2							0.82 U	0.76 U	0.9 U	0.79 U	2.5 U
Chromium	30							13	13	9.9	8.9	16 J
Copper								11	8.5	1.8	1.3 U	23 UJ
Lead	300							2.9	1.3	1.8	2	R
Mercury	20							0.68 U	0.6 U	0.63 U	0.62 U	0.5 U
Nickel	20							12	10	7	9.6	19 J
Selenium	400							2.6 U	2.4 U	2.8 U	2.5 U	10 U
Zinc	2500							61	55	54	51	150 U

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-005 0203F	SB-006 0006I	SB-006 0203F	SB-007 0006I	SB-007 0203F	SB0080006I	SB0080102F	FD001-090704	SB-011 0006I	SB-011 0203F	SB0120006I	SB0120203F
Upper Depth (in.)		24	0	24	0	24	0	12	24	0	24	0	24
Lower Depth (in.)		36	6	36	6	36	6	24	36	6	36	6	36
Date Sampled	MCP S-1	9/7/2004	9/7/2004	9/7/2004	9/7/2004	9/7/2004	10/22/2003	10/22/2003	9/7/2004	9/7/2004	9/7/2004	10/22/2003	10/22/2003
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	0.83 J	R	R	R	R	R	R
Arsenic	20	12 J	5.9 J	3.2 J	4.3 J	7.7 J	1.4	1.2	4.4 J	4.3 J	3.9 J	1.6	0.89
Beryllium	0.7	0.5 U	0.89 U	0.89 U	0.5 U	0.5 U	0.5 U	1 U	0.97 U				
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	0.84 U	0.85 U	7.2 J	2.5 U	2.5 U	0.96 U	0.93 U
Chromium	30	10 J	24 J	16 J	11 J	9.3 J	11	12	14 J	17 J	15 J	9.8	20
Copper		8.8 UJ	13 UJ	19 UJ	14 UJ	5 U	12	14	13 UJ	18 UJ	21 UJ	1.5 U	2
Lead	300	R	5.6 J	8.6 J	R	15 J	10	3.9	R	4.8	5.6 J	R	0.86 J
Mercury	20	0.5 U	0.65 U	0.61 U	0.5 U	0.5 U	0.5 U	0.68 U	0.68 U				
Nickel	20	10 U	22 J	14 J	10 U	10 U	10	14	12 J	17 J	15 J	4.5	7.7
Selenium	400	10 U	10 U	10 U	10 U	10 U	2.6 U	2.6 U	10 U	10 U	10 U	3 U	2.9 U
Zinc	2500	150 U	150 U	150 U	150 U	150 U	58	66	150 U	150 U	150 U	25 U	53

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-014 0006I	SB-014 0203F	FD005-090904	SB-015 0006I	SB-015 0203F	SB016-0006I	SB016-0203F	SB0180006I	SB0180203F	SB0190006I	SB0190102F	SB0250006I
Upper Depth (in.)		0	24	24	0	24	0	24	0	24	0	12	0
Lower Depth (in.)		6	36	36	6	36	6	36	6	36	6	24	6
Date Sampled	MCP S-1	9/8/2004	9/8/2004	9/9/2004	9/9/2004	9/9/2004	10/19/2004	10/19/2004	10/22/2003	10/22/2003	10/20/2003	10/20/2003	10/22/2003
Inorganics (mg/Kg)													
Antimony	20	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	R	R	R	R	R	R	R
Arsenic	20	3.6 J	4.4 J	4.8 J	4.2 J	1 U	R	R	5	2.4	1.3 J	7.9 J	1.3
Beryllium	0.7	0.5 U	0.5 U	0.5 U	2 U	0.97 U	1.2 U	1.1 U	0.93 U				
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	1.9 U	0.92 U	1.2 U	1.1 U	0.88 U
Chromium	30	10 J	9.3 J	11 J	11 J	5.6 J	5.3 J	10 J	3.6	12	3.2	17	15
Copper		13 U	6.8 U	14 U	12 U	8.4 U	5.8	7.4	3 U	1.5 U	2.5	1.7 U	1.4 U
Lead	300	8	4.5	5.5	4.5	3.4	R	R	150 J	0.72 J	R	R	0.69 J
Mercury	20	0.5 U	0.5 U	0.5 U	0.4 U	0.74 U	0.95 U	0.79 U	0.69 U				
Nickel	20	10 U	10 U	11 UJ	12 U	78 J	10 UJ	10 UJ	6.5	4.9	3.1 U	6.8	3.5
Selenium	400	10 U	10 U	10 U	10 U	10 U	10 UJ	10 UJ	5.9 U	2.9 U	3.6 U	3.3 U	2.7 U
Zinc	2500	150 U	150 U	150 U	150 U	150 U	150 UJ	150 UJ	50 U	35	34	86	32

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0250203F	SB0260203F	SB0300102F	SB0490006I	SB0490203F	SB1000006I	SB1000102F	SB1010006I	SB1010102F	SB1020006I	SB1020102F	SB1030006I	SB1030102F
Upper Depth (in.)		24	24	12	0	24	0	12	0	12	0	12	0	12
Lower Depth (in.)		36	36	24	6	36	6	24	6	24	6	24	6	24
Date Sampled	MCP S-1	10/22/2003	10/22/2003	10/22/2003	10/30/2003	10/30/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003
Inorganics (mg/Kg)														
Antimony	20	R	R	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	1.4	2.1	1.6	3 J	0.18 U	1.3	1.8	1.2 J	0.88 J	0.98 J	1.6 J	1.4 J	1.7 J
Beryllium	0.7	0.97 U	1.3 U	0.9 U	0.83 U	0.82 U	0.91 U	0.89 U	0.89 U	0.91 U	0.88 U	0.81 U	1.2 U	1.2 U
Cadmium	2	0.92 U	1.2 U	0.86 U	0.79 U	0.78 U	0.86 U	0.85 U	0.85 U	0.86 U	0.84 U	0.77 U	1.2 U	1.2 U
Chromium	30	15	8.7	19	8.6	21	18	16	12	13	12	18	24	18
Copper		1.5 U	1.9 U	1.4 U	12	25	16	15	6.6	6.8	11	18	6.6	5
Lead	300	0.99 J	R	0.68 J	0.63 J	1.5 J	63 J	62 J	1.7 J	0.98 J	1.9 J	3.2 J	2.1 J	1.2 J
Mercury	20	0.69 U	0.91 U	0.7 U	0.008 J	0.007 J	0.66 U	0.63 U	0.61 U	0.56 U	0.6 U	0.57 U	0.83 U	0.93 U
Nickel	20	5.7	3.3 U	9.5	11	23	15	14	9.7	10	11	15	15	12
Selenium	400	2.9 U	3.8 U	2.7 U	9.2	11	2.7 U	2.6 U	2.6 U	2.7 U	2.6 U	2.4 U	3.7 U	3.7 U
Zinc	2500	34	32 U	51	520	82	68	71	49	56	58	63	100	75

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1040006I	SB1040102F	SB1160006I	SB1160203F	SB116C-0203F	SB116CD-0203F	SB116E-0203F	SB116N-0203F	SB116S-0203F	SB116W-0203F	SB1170006I	SB1170102F
Upper Depth (in.)		0	12	0	24	24	24	24	24	24	24	0	12
Lower Depth (in.)		6	24	6	36	36	36	36	36	36	36	6	24
Date Sampled	MCP S-1	10/21/2003	10/21/2003	10/15/2003	10/15/2003	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	6/5/2006	10/15/2003	10/15/2003
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R							R	R
Arsenic	20	1.6 J	1.5 J	3.7	2.5							2.8	3.1
Beryllium	0.7	0.84 U	0.84 U	0.81 U	0.88 U							0.92 U	0.97 U
Cadmium	2	0.8 U	0.8 U	0.77 U	0.84 U							0.87 U	0.92 U
Chromium	30	12	12	12	17							16	15
Copper		16	14	11 J	330 J							14 J	13 J
Lead	300	3.1 J	2.8 J	57 J	360 J	162	171	110	120	98.5	110	8.9 J	4.2 J
Mercury	20	0.58 U	0.6 U	0.61 U	0.68 U							0.65 U	0.72 U
Nickel	20	12	11	11 J	13 J							14 J	11 J
Selenium	400	2.5 U	2.5 U	2.4 U	2.6 U							2.7 U	2.9 U
Zinc	2500	64	56	58 J	460 J							55 J	41 J

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1180006I	SB1180102F	SB1230006I	SB1230203F	SB1230304F	SB1260006I	SB1260203F	SB1270006I	SB1270102F	SB1280006I	SB1280203F	SB1290006I
Upper Depth (in.)		0	12	0	24	36	0	24	0	12	0	24	0
Lower Depth (in.)		6	24	6	36	48	6	36	6	24	72	36	72
Date Sampled	MCP S-1	10/15/2003	10/15/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/14/2003	10/14/2003	10/14/2003
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	4.9	2.3	1.8 J	1.7 J	1.4 J	2.3 J	1.6 J	3 J	1.7 J	3.8	1.6	0.98
Beryllium	0.7	0.81 U	0.93 U	0.79 UJ	0.8 UJ	0.82 UJ	0.82 UJ	0.88 UJ	0.96 UJ	0.8 UJ	0.77 U	0.76 U	0.76 U
Cadmium	2	0.77 U	0.88 U	0.75 UJ	0.76 UJ	0.78 UJ	0.78 UJ	0.84 UJ	0.91 UJ	0.76 UJ	0.73 U	0.73 U	0.72 U
Chromium	30	17	11	14 J	14 J	14 J	12 J	15 J	15 J	20 J	18	28	11
Copper		9.3 J	9.8 J	12 J	14 J	13 J	12 J	9.7 J	17 J	17 J	19	15	10
Lead	300	17 J	81 J	0.84 J	1.5 J	1.5 J	2.2 J	1.1 J	2 J	1.3 J	10	7.9	6
Mercury	20	0.6 U	0.62 U	0.55 UJ	0.57 UJ	0.63 UJ	0.59 UJ	0.68 UJ	0.7 UJ	0.5 UJ	0.62 U	0.58 U	0.54 U
Nickel	20	14 J	10 J	12 J	12 J	13 J	11 J	11 J	14 J	18 J	16	20	8
Selenium	400	2.4 U	2.7 U	7.7 J	8.5 J	9 J	7.1 J	8.4 J	8.9 J	8.6 J	2.3 U	2.3 U	2.3 U
Zinc	2500	40 J	40 J	51 J	55 J	56 J	54 J	41 J	69 J	65 J	45	51	50

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1290102F	SB13000061	SB1300203F	SB13100061	SB1310203F	SB1320006I	SB1320203F	SB1330006I	SB1330102F	SB1350203F	SB1410006I	SB1410203F	SB1440006I
Upper Depth (in.)		12	0	24	0	24	0	24	0	12	24	0	24	0
Lower Depth (in.)		24	72	36	72	36	6	36	6	24	36	6	36	6
Date Sampled	MCP S-1	10/14/2003	10/14/2003	10/14/2003	10/14/2003	10/14/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/22/2003	10/16/2003	10/16/2003	10/23/2003
Inorganics (mg/Kg)														
Antimony	20	R	R	R	R	R	R	R	R	R	R	0.53 UJ	0.57 UJ	R
Arsenic	20	0.97	0.87	1.1	0.71	0.76	1.6 J	1.3 J	2.1 J	1 J	1.8	4.1	3.2	5.2
Beryllium	0.7	0.8 U	0.82 U	0.84 U	0.75 U	0.74 U	0.76 U	0.74 U	0.87 U	0.79 U	0.85 U	0.76 U	0.81 U	0.5 U
Cadmium	2	76 U	0.78 U	0.8 U	0.71 U	0.7 U	0.73 U	0.7 U	0.83 U	0.75 U	0.81 U	0.73 U	0.77 U	0.7 U
Chromium	30	8.9	13	17	18	12	7.4	10	12	14	13	7.3	19	12
Copper		6.9	9.6	9.9	15	15	11	14	13	17	13	8.3	14	15
Lead	300	5	8.3	8.8	5	4.9	0.79 J	1.1 J	1.7 J	0.97 J	160	2.4 J	8 J	1.5
Mercury	20	0.67 U	0.69 U	0.73 U	0.54 U	0.53 U	0.51 U	0.4 U	0.56 U	0.53 U	0.4 U	0.6 U	0.57 U	0.61 U
Nickel	20	10	8.9	12	13	10	8.8	9.8	15	16	10	6.1	18	13
Selenium	400	2.4 U	2.4 U	2.5 U	2.2 U	2.2 U	2.3 U	2.2 U	2.6 U	2.3 U	2.5 U	2.3 U	2.4 U	2.2 U
Zinc	2500	44	53	54	38	34	29	40	58	49	86	22	45	39

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1440102F	FD206-102303	SB1450006I	SB1450102F	SB1460006I	SB1460102F	SB1530006I	SB1530203F	SB1540006I	SB1540102F	SB1550006I	SB1550203F	SB1560006I
Upper Depth (in.)		12	12	0	12	0	12	0	24	0	12	0	24	0
Lower Depth (in.)		24	24	6	24	6	24	6	36	6	24	6	36	6
Date Sampled	MCP S-1	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/28/2003
Inorganics (mg/Kg)														
Antimony	20	0.77 J	0.56 J	R	R	R	R	R	R	R	R	R	R	R
Arsenic	20	2	1.4	2.5	1.2	4	2.5	2.5	0.88	2.1	1.7	3	2.3	1.3 J
Beryllium	0.7	0.76 U	0.76 U	0.78 U	0.76 U	0.76 U	0.79 U	0.83 U	0.74 U	0.83 U	0.81 U	0.79 U	0.81 U	0.79 UJ
Cadmium	2	0.72 U	0.72 U	0.74 U	0.72 U	0.72 U	0.75 U	0.79 U	0.7 U	0.79 U	0.77 U	0.75 U	0.77 U	0.75 UJ
Chromium	30	11	6.3	14	9.1	17	15	13	9.8	14	11	12	11	15 J
Copper	12	9.5	19	11	22	22	10 J	18 J	12 J	11 J	9.5 J	10 J	18 J	
Lead	300	1.8	0.83	0.98	0.96	0.43	1.3	4.2 J	0.51 J	46 J	40 J	26 J	17 J	1.8 J
Mercury	20	0.53 U	0.51 U	0.52 U	0.49 U	0.52 U	0.62 U	0.58 U	0.43 U	0.62 U	0.65 U	0.67 U	0.64 U	0.4 UJ
Nickel	20	11	8.7	15	11	14	16	13 J	11 J	14 J	11 J	12 J	10 J	15 J
Selenium	400	2.2 U	2.2 U	2.3 U	2.2 U	7.6	12	2.5 U	2.2 U	2.5 U	2.4 U	2.3 U	2.4 U	11 J
Zinc	2500	42	27	38	30	34	54	38 J	37 J	39 J	33 J	34 J	38 J	55 J

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1560607F	SB1570006I	SB1570405F	SB1570506F	FD207-102803	MSSB0506F102803	SB1580006I	SB1580203F	SB1580506F	SB1590006I	SB1590203F	SBG 127R
Upper Depth (in.)		72	0	48	60	24		0	24	60	0	24	
Lower Depth (in.)		84	6	60	72	36		6	36	72	6	36	
Date Sampled	MCP S-1	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	6/27/2006
Inorganics (mg/Kg)													
Antimony	20	R	R	R	R	R	R	R	R	R	R	R	
Arsenic	20	0.16 UJ	2.2 J	1.2 J	0.89 J	1.5 J	1.6 J	0.17 UJ	0.93 J	1.4 J	1.9 J	2 J	
Beryllium	0.7	0.77 UJ	0.78 UJ	0.78 UJ	0.76 UJ	0.81 UJ	0.82 UJ	0.77 UJ	0.83 UJ	0.76 UJ	0.81 UJ	0.86 UJ	
Cadmium	2	0.74 UJ	0.74 UJ	0.74 UJ	0.72 UJ	0.77 UJ	0.78 UJ	0.73 UJ	0.79 UJ	0.73 UJ	0.77 UJ	0.82 UJ	
Chromium	30	17 J	15 J	14 J	17 J	15 J	11 J	10 J	10 J	16 J	11 J	16 J	
Copper		3.8 J	14 J	16 J	13 J	21 J	14 J	14 J	8.3 J	9.6 J	12 J	7.5 J	
Lead	300	R	2.5 J	1.6 J	0.6 J	1.4 J	1.3 J	R	0.5 J	1.4 J	2 J	0.83 J	1.23 J
Mercury	20	0.54 UJ	0.52 UJ	0.53 UJ	0.54 UJ	0.59 UJ	0.64 UJ	0.59 UJ	0.55 UJ	0.6 UJ	0.58 UJ	0.56 UJ	
Nickel	20	9.7 J	16 J	14 J	13 J	13 J	11 J	10 J	8.5 J	14 J	11 J	9.9 J	
Selenium	400	7 J	8.2 J	6.9 J	6.9 J	9.2 J	6.6 J	5.9 J	2.4 UJ	9.2 J	6.3 J	8.3 J	
Zinc	2500	29 J	39 J	41 J	35 J	40 J	40 J	33 J	27 J	44 J	100 J	42 J	

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SY-EX002	SY-EX003	SY-EX004	SY-EX005	SY-EX006	FD007-071206	SY-EX009
Upper Depth (in.)		0	0	0	0	0		0
Lower Depth (in.)		12	12	12	12	12		3
Date Sampled	MCP S-1	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006
Inorganics (mg/Kg)								
Antimony	20							
Arsenic	20							
Beryllium	0.7							
Cadmium	2							
Chromium	30							
Copper								
Lead	300	39.1 J	24 J	17.8 J	18.3 J	41 J	9.91 J	45 J
Mercury	20							
Nickel	20							
Selenium	400							
Zinc	2500							

> MCP S-1

Appendix Table A.1.8
 Soil Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SY-EX010	SY-EX011	SY-EX013	SY-EX014	SY-EX015	SY-EX016	YRDTS-004	YRDTS-008	YRDTS-009	YRDTS-010	YRDTS-011	YRDTS-12	YRDTS-13	YRDTS-15A	YRDTS-15B
Upper Depth (in.)		0	0					0	0	0	0	0	0	0	0	4
Lower Depth (in.)		3	3					2	2	2	2	2	2	2	2	6
Date Sampled	MCP S-1	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	7/12/2006	10/18/2000	10/24/2000	10/24/2000	10/24/2000	10/24/2000	10/24/2000	10/24/2000	10/24/2000	10/24/2000
Inorganics (mg/Kg)																
Antimony	20															
Arsenic	20															
Beryllium	0.7															
Cadmium	2															
Chromium	30															
Copper																
Lead	300	2.08 J	9.04 J	20.6 J	15 J	6.05 J	3.51 J	50	16	16	14	17	14	11	13	9.7
Mercury	20															
Nickel	20															
Selenium	400															
Zinc	2500															

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-409-0003I	EX-410-0003I	EX-411-0003I	EX-413-0003I	EX-5-001	EX-5-002	TFD020-110705	EX-5-003	EX-5-004	EX-ABC-001
Upper Depth (in.)		0	0	0	0	0	0		0	0	
Lower Depth (in.)		3	3	3	3	3	3		3	3	
Date Sampled	MCP S-1	7/14/2005	7/14/2005	7/14/2005	7/21/2005	11/7/2005	11/7/2005	11/7/2005	11/5/2005	11/5/2005	10/28/2005
PCBs (µg/Kg)											
Aroclor-1262	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1268	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1016	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1221	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1232	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1242	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1248	2000	10.3 U	10 U	9.61 U	10 U	10.8 U	14.6 U	14.4 U	14 U	13.7 U	9.96 U
Aroclor-1254	2000	28.7	71.2	18.7	612	73.1	266	236	106	515	172
Aroclor-1260	2000	47.1	92.8	30.7	461	17.2	90.6	74.3 J	20.2	173 J	61.7

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		EX-ABC-002	FD001-102805	EX-ABC-003	EX-ABC-004	EX-ABC-005	EX-ABC-006	EX-Westmidlot-01	EX-Westmidlot-02	EX-Westmidlot-03	EX-Westmidlot-04
Upper Depth (in.)								0	0	0	0
Lower Depth (in.)								3	3	3	3
Date Sampled	MCP S-1	10/28/2005	10/28/2005	10/28/2005	10/28/2005	10/31/2005	10/31/2005	5/24/2006	5/24/2006	5/24/2006	5/24/2006
PCBs (µg/Kg)											
Aroclor-1262	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1268	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1016	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1221	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1232	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1242	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1248	2000	9.56 U	9.98 U	9.85 U	9.68 U	9.99 U	9.86 U	9.89 U	9.91 U	9.94 U	10 U
Aroclor-1254	2000	73.1	54.3	9.85 U	182	76.9	20.2	164	174	118	52.9
Aroclor-1260	2000	30.1	19.9	25.1	58.5	30.4	7.88 J	84.5	46.6	37.5	18.5

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		Potable Water Tank 0-18	SB0010006I	SB0010203F	SB0020006I	SB1116-0003I	SB0040006I	SB-005 0006I	SB-006 0006I	SB-007 0006I	SB0080006I	SB1118-0003I	FD001-090704
Upper Depth (in.)		0	0	24	0	0	0	0	0	0	0	0	24
Lower Depth (in.)		18	6	36	6	3	6	6	6	6	6	3	36
Date Sampled	MCP S-1	5/17/2006	10/23/2003	10/22/2003	10/22/2003	3/4/2005	10/22/2003	9/7/2004	9/7/2004	9/7/2004	10/22/2003	3/4/2005	9/7/2004
PCBs (µg/Kg)													
Aroclor-1262	2000	10 U				20.9 U						20.4 U	
Aroclor-1268	2000	10 U				20.9 U						20.4 U	
Aroclor-1016	2000	10 U	40 U	40 U	40 U	20.9 U	43 U	35 U	35 U	36 U	40 U	20.4 U	37 U
Aroclor-1221	2000	10 U	40 U	40 U	40 U	20.9 U	43 U	35 U	35 U	36 U	40 U	20.4 U	37 U
Aroclor-1232	2000	10 U	40 U	40 U	40 U	20.9 U	43 U	35 U	35 U	36 U	40 U	20.4 U	37 U
Aroclor-1242	2000	10 U	40 U	40 U	40 U	20.9 U	43 U	35 U	35 U	36 U	40 U	20.4 U	37 U
Aroclor-1248	2000	10 U	40 U	40 U	40 U	20.9 U	43 U	35 U	35 U	36 U	40 U	20.4 U	37 U
Aroclor-1254	2000	10 U	40 U	40 U	190	43.8	130	35 U	35 U	36 U	150	34.6	37 U
Aroclor-1260	2000	10 U	45	97	140	32.3	43 U	35 U	35 U	36 U	86	13.2 J	37 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-011 0006I	SB0120006I	SB-014 0006I	SB-014 0203F	SB-015 0006I	SB-015 0203F	SB016-0006I	SB016-0203F	SB0180006I	SB0180203F	SB0190006I	SB0250006I	SB0260203F
Upper Depth (in.)		0	0	0	24	0	24	0	24	0	24	0	0	24
Lower Depth (in.)		6	6	6	36	6	36	6	36	6	36	6	6	36
Date Sampled	MCP S-1	9/7/2004	10/22/2003	9/8/2004	9/8/2004	9/9/2004	9/9/2004	10/19/2004	10/19/2004	10/22/2003	10/22/2003	10/20/2003	10/22/2003	10/22/2003
PCBs (µg/Kg)														
Aroclor-1262	2000													
Aroclor-1268	2000													
Aroclor-1016	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U
Aroclor-1221	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U
Aroclor-1232	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U
Aroclor-1242	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U
Aroclor-1248	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U
Aroclor-1254	2000	38 U	16 J	190 J	R	38 U	38 UJ	180	390	92 U	26 J	520 J	43 U	120
Aroclor-1260	2000	38 U	46 U	38 UJ	R	38 U	38 U	33 U	33 U	92 U	43 U	56 U	43 U	59 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0490006I	SB0490203F	SB0880006I	SB0880102F	SB1000006I	SB1010006I	SB1010102F	SB1020006I	SB1030006I	SB1040006I	SB1077 0003I	SB1077 0102F	SB1077 0203F
Upper Depth (in.)		0	24	0	12	0	0	12	0	0	0	0	12	24
Lower Depth (in.)		6	36	6	24	6	6	24	6	6	6	3	24	36
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/20/2003	10/20/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	2/21/2005	2/21/2005	2/21/2005
PCBs (µg/Kg)														
Aroclor-1262	2000											20.1 U	19.9 U	20.4 U
Aroclor-1268	2000											20.1 U	19.9 U	20.4 U
Aroclor-1016	2000	40 U	36 U	40 U	36 U	43 U	40 U	40 U	40 U	56 U	40 U	20.1 U	19.9 U	20.4 U
Aroclor-1221	2000	40 U	36 U	40 U	36 U	43 U	40 U	40 U	40 U	56 U	40 U	20.1 U	19.9 U	20.4 U
Aroclor-1232	2000	40 U	36 U	40 U	36 U	43 U	40 U	40 U	40 U	56 U	40 U	20.1 U	19.9 U	20.4 U
Aroclor-1242	2000	40 U	36 U	40 U	36 U	43 U	40 U	40 U	40 U	56 U	40 U	20.1 U	19.9 U	20.4 U
Aroclor-1248	2000	40 U	36 U	40 U	36 U	43 U	40 U	40 U	40 U	56 U	40 U	20.1 U	19.9 U	20.4 U
Aroclor-1254	2000	260	36 U	83	36 U	130	36 J	14 J	350	34 J	59	20.1 U	345	20.4 U
Aroclor-1260	2000	110	36 U	40 U	36 U	100	40 U	40 U	270	56 U	40 U	20.1 U	125	20.4 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1077 0304F	SB1083 0003I	SB1083 0102F	SB1083 0203F	SB1083 0304F	SB1111-0003I	SB1111-0102F	FD017-030405	SB1112-0003I	SB1112-0102F	SB1113-0003I	SB1113-0102F
Upper Depth (in.)		36	0	12	24	36	0	12	0	0	12	0	12
Lower Depth (in.)		48	3	24	36	48	3	24	3	3	24	3	24
Date Sampled	MCP S-1	2/21/2005	2/21/2005	2/21/2005	2/21/2005	2/21/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005
PCBs (µg/Kg)													
Aroclor-1262	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1268	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1016	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1221	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1232	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1242	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1248	2000	19 U	18.3 U	19.7 U	20 U	19.5 U	20.5 U	21.3 U	20.1 U	20.7 U	20.7 U	21 U	21.2 U
Aroclor-1254	2000	113	18.3 U	19.7 U	26.9	19.5 U	101	21.3 U	135 J	392 J	250	153	48.8
Aroclor-1260	2000	69.4	18.3 U	19.7 U	20 U	19.5 U	19.5 J	21.3 U	28.1 J	70.5 J	35.1	31.5	13.8 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1114-0003I	SB1114-0102F	SB1115-0003I	SB1115-0102F	SB1119-0003I	SB1122-0003I	SB1148-0003I	SB1153-0003I	SB1154-0003I	SB1155-0003I	SB1157-0003I	SB1160006I
Upper Depth (in.)		0	12	0	12	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	24	3	24	3	3	3	3	3	3	3	6
Date Sampled	MCP S-1	3/4/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	3/4/2005	5/9/2005	5/6/2005	5/6/2005	5/9/2005	6/20/2005	10/15/2003
PCBs (µg/Kg)													
Aroclor-1262	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	
Aroclor-1268	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	
Aroclor-1016	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	36 U
Aroclor-1221	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	36 U
Aroclor-1232	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	36 U
Aroclor-1242	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	36 U
Aroclor-1248	2000	20.1 U	20.5 U	21.3 U	20.8 U	21.2 U	20.5 U	12.3 U	10.3 U	10.3 U	9.94 U	22.8 U	36 U
Aroclor-1254	2000	77.2	26.7	13.8 J	219	816	185	826	10.3 U	144	109	61.4	36 U
Aroclor-1260	2000	16 J	15.4 J	21.3 U	61.4	149	69.6	146	10.3 U	26.8	19.4	11.4 J	36 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1160203F	SB1170006I	SB1170102F	SB1170-0003I	SB1172-0003I	SB1180006I	SB1180102F	SB1180-0003I	SB1181-0003I	SB1230304F	SB1260203F	SB1270102F	SB1280006I
Upper Depth (in.)		24	0	12	0	0	0	12	0	0	36	24	12	0
Lower Depth (in.)		36	6	24	3	3	6	24	3	3	48	36	24	72
Date Sampled	MCP S-1	10/15/2003	10/15/2003	10/15/2003	5/6/2005	5/6/2005	10/15/2003	10/15/2003	6/21/2005	6/21/2005	10/28/2003	10/28/2003	10/28/2003	10/14/2003
PCBs (µg/Kg)														
Aroclor-1262	2000				18.8 U	12.9 U			12.1 U	11.6 U				
Aroclor-1268	2000				18.8 U	12.9 U			12.1 U	11.6 U				
Aroclor-1016	2000	40 U	43 U	43 U	18.8 U	12.9 U	36 U	43 U	12.1 U	11.6 U	36 U	40 U	36 U	36 U
Aroclor-1221	2000	40 U	43 U	43 U	18.8 U	12.9 U	36 U	43 U	12.1 U	11.6 U	36 U	40 U	36 U	36 U
Aroclor-1232	2000	40 U	43 U	43 U	18.8 U	12.9 U	36 U	43 U	12.1 U	11.6 U	36 U	40 U	36 U	36 U
Aroclor-1242	2000	40 U	43 U	43 U	18.8 U	12.9 U	36 U	43 U	12.1 U	11.6 U	36 U	40 U	36 U	36 U
Aroclor-1248	2000	40 U	43 U	43 U	18.8 U	12.9 U	36 U	43 U	12.1 U	11.6 U	36 U	40 U	36 U	36 U
Aroclor-1254	2000	40 U	43 U	43 U	394	576	36 U	43 U	151	140	36 U	29 J	130	36 U
Aroclor-1260	2000	40 U	43 U	43 U	53.4	127	36 U	43 U	30.3	26.8	36 U	40 U	36 U	36 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB12900061	SB13000061	SB13100061	SB1410006I	SB1410203F	FD206-102303	SB1450006I	SB1450102F	SB1530006I	SB1530203F	SB1540006I	SB1540102F	SB1560006I
Upper Depth (in.)		0	0	0	0	24	12	0	12	0	24	0	12	0
Lower Depth (in.)		72	72	72	6	36	24	6	24	6	36	6	24	6
Date Sampled	MCP S-1	10/14/2003	10/14/2003	10/14/2003	10/16/2003	10/16/2003	10/23/2003	10/23/2003	10/23/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/28/2003
PCBs (µg/Kg)														
Aroclor-1262	2000													
Aroclor-1268	2000													
Aroclor-1016	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1221	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1232	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1242	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1248	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1254	2000	33	46	33 U	36 U	28 J	33 U	36 U	33 U	46	33 U	44	36 U	36 U
Aroclor-1260	2000	33 U	36 U	33 U	36 U	36 U	33 U	36 U	33 U	40 U	33 U	36 U	36 U	36 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1570006I	SB1580006I	SB1590006I	SB575-0003I	SB576-0003I	SB577-0003I	SB578-0003I	SB579-0003I	SB580-0003I	SB581-0003I	FD001-060905-1	SB583-0003I	SB584-1720I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	17
Lower Depth (in.)		6	6	6	3	3	3	3	3	3	3	3	3	20
Date Sampled	MCP S-1	10/28/2003	10/28/2003	10/28/2003	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/9/2005	6/15/2005
PCBs (µg/Kg)														
Aroclor-1262	2000				11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1268	2000				11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1016	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1221	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1232	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1242	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1248	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	9.9 U	9.91 U	9.88 U	9.66 U	9.97 U
Aroclor-1254	2000	36 U	36 U	36 U	5.5 J	9.96 U	10.9 U	10.6 U	10 U	67.8	9.91 U	74	64.6	13.9
Aroclor-1260	2000	36 U	36 U	36 U	11 U	9.96 U	10.9 U	10.6 U	10 U	15.3	9.91 U	21.2	21.7	4.48 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB585-1417I	SB586-1215I	SB587-1215I	SB588-2023I	SB589-0912I	SB590-1316I
Upper Depth (in.)		14	12	12	20	9	13
Lower Depth (in.)		17	15	15	23	12	16
Date Sampled	MCP S-1	6/15/2005	6/15/2005	6/15/2005	6/15/2005	6/15/2005	6/15/2005
PCBs (µg/Kg)							
Aroclor-1262	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1268	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1016	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1221	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1232	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1242	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1248	2000	9.87 U	9.97 U	10 U	9.91 U	10.1 U	10.1 U
Aroclor-1254	2000	15.8	239	10 U	166	91.1	19.6
Aroclor-1260	2000	4.93 J	49.8	10 U	28.2	13.1	3.01 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB591-1013I	SB592-1215I	SB593-1518I	SB594-1417I	SB599-0003I	SB600-0003I	SB601-0003I	SB602-0003I	SB603-0003I	SB604-0003I	SB605-0003I
Upper Depth (in.)		10	12	15	14	0	0	0	0	0	0	0
Lower Depth (in.)		13	15	18	17	3	3	3	3	3	3	3
Date Sampled	MCP S-1	6/15/2005	6/15/2005	6/15/2005	6/15/2005	6/8/2005	6/8/2005	6/8/2005	6/8/2005	6/8/2005	6/8/2005	6/8/2005
PCBs (µg/Kg)												
Aroclor-1262	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1268	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1016	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1221	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1232	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1242	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1248	2000	10 U	10.3 U	10.2 U	9.96 U	9.73 U	10.2 U	10 U	10.1 U	9.9 U	11 U	12.5 U
Aroclor-1254	2000	10 U	13.4	8.7 J	9.96 U	16.5	15.2	40	9.07 J	8.9 J	20.3	22.5
Aroclor-1260	2000	10 U	3.61 J	4.09 J	9.96 U	7.29 J	6.6 J	14.5	10.1 U	3.46 J	5.49 J	6.24 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB606-0003I	SCFA-C-L1-SW-07R	SCFA-FG-0001	SCFA-FG-0001R	SCFA-FG-0003	SCFA-FG-0007	SCFA-FG-0008	SCFA-FG-0010	SCFA-R-FL-01	SCFA-R-FL-02
Upper Depth (in.)		0									
Lower Depth (in.)		3									
Date Sampled	MCP S-1	6/8/2005	11/11/2005	8/14/2006	8/18/2006	8/14/2006	8/14/2006	8/14/2006	8/14/2006	7/25/2005	7/25/2005
PCBs (µg/Kg)											
Aroclor-1262	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1268	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1016	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1221	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1232	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1242	2000	9.91 U	11.6 U	9.8 U	9.79 U	9.7 U	9.71 U	9.88 U	11.6 UJ	10 U	10 U
Aroclor-1248	2000	9.91 U	11.6 U	21.8	27.1 J	28.7	71.3	12.4	18.4 J	10 U	10 U
Aroclor-1254	2000	8.91 J	686	328	257	53	134	13.5	166 J	10 U	116
Aroclor-1260	2000	3.96 J	617	336	37.4	19.5	43.9	5.48 J	80.5 J	377	84.3

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SCFA-TOP-002	SCFAFD016-042406	SCFA-TOP-007	SCFA-TOP-008	SCFA-TOP-009	SCFA-TOP-013	SCFA-TOP-014	SCFA-TOP-015	FD001-071305	SD-MPL-001	SD-MPL-002
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	4/24/2006	4/24/2006	4/24/2006	4/24/2006	4/24/2006	5/11/2006	5/11/2006	5/11/2006	7/13/2005	7/13/2005	7/13/2005
PCBs (µg/Kg)												
Aroclor-1262	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1268	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1016	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1221	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1232	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1242	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1248	2000	9.93 U	10.3 U	9.88 U	10 U	10 U	9.9 U	10.1 U	10 U	10.3	9.89 U	9.86 U
Aroclor-1254	2000	72.1	39.6	62.9	123	63.9	36.3	35.8	10 U	43.3	26.2	36.9
Aroclor-1260	2000	37.2 J	20.6	21.4	35.2	29.1	21.7	17.6 J	581	15.5	16.8	3.94 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SD-MPL-003	SD-MPL-004	SD-MPL-005	SD-MPL-009	SD-MPL-010	SD-MPL-011	SD-MPL-012	SD-MPL-013	SD-MPL-014	FD001-040306	SD-MPL-015	SD-MPL-016
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	7/13/2005	7/13/2005	7/13/2005	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006
PCBs (µg/Kg)													
Aroclor-1262	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1268	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1016	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1221	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1232	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1242	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1248	2000	10.3 U	9.88 U	10 U	10 U	10 U	10.1 U	9.88 U	9.97 U	10.1 U	10 U	9.94 U	10 U
Aroclor-1254	2000	529	86.9	580	355	108	140	92.2	39.1	31.1	34	31.4	43.7
Aroclor-1260	2000	70.7	14.3	62.1	76	27.4	35.2	16.3	9.51 J	7.8 J	6.26 J	6.75 J	11.3

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SD-MPL-017	SD-MPL-018	SD-MPL-019	SD-MPL-020	SD-MPL-021	SD-MPL-022	ST Maxy-020-R3	ST Maxy-021-R3	ST-151152-001	ST-151152-002	ST-151152-003
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	4/3/2006	5/1/2006	5/1/2006	4/5/2006	4/5/2006	4/5/2006
PCBs (µg/Kg)												
Aroclor-1262	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1268	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1016	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1221	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1232	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1242	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	9.98 U	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1248	2000	10.1 U	10.3 U	10.2 U	10.2 U	10.1 U	9.94 U	60.8	10 U	10.7 UJ	10.3 U	10.9 UJ
Aroclor-1254	2000	158	13.3	101	27.9	11.3	71.8	82.4 J	10 U	16.3 J	241	19.8 J
Aroclor-1260	2000	27.9	5.43 J	20.7	7.55 J	2.99 J	13	14.9	12.4 J	20.3 J	66	37.4 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-151152-004	ST-151152-005	ST-151152-006	ST-151152-008	ST-151152-009	TFD01-040506	ST-151152-010	ST-151152-011	ST-151152-012	ST-151152-013	ST-151152-014
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	4/5/2006	4/5/2006	4/5/2006	4/5/2006	4/5/2006	4/5/2006	4/5/2006	4/5/2006	4/6/2006	4/6/2006	4/6/2006
PCBs (µg/Kg)												
Aroclor-1262	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1268	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1016	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1221	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1232	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1242	2000	10.6 UJ	10.5 UJ	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1248	2000	10.6 UJ	440 J	10.7 UJ	10.4 U	10.1 U	10.6 UJ	10.6 U	12.2 U	10.3 U	10.7 UJ	10.1 U
Aroclor-1254	2000	76.3 J	132 J	88.2 J	185	87	110 J	164	145	193	327 J	138
Aroclor-1260	2000	50.1 J	36.9 J	34.3 J	59.9	43.1 J	31 J	42.8	100	53.2	58.7 J	33.7

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-151152-015	ST-151152-016	ST-24-001	ST-24-002	ST-24-003	ST-24-004	ST-24-005	ST-24-006	ST-24-007	ST-24-008	ST-24-009	ST-24-010	ST-24-011
Upper Depth (in.)				1	1	1	1	1	1	1	1	1	1	1
Lower Depth (in.)				3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	4/6/2006	4/6/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006
PCBs (µg/Kg)														
Aroclor-1262	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1268	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1016	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1221	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1232	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1242	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1248	2000	10.2 U	10.1 U	10.7 UJ	12.9 UJ	11.8 UJ	12 UJ	11.4 UJ	11.2 UJ	11.5 UJ	11.9 UJ	11 UJ	11.1 UJ	10.9 UJ
Aroclor-1254	2000	109	97.1	58 J	12.9 UJ	10.8 J	82.8 J	39.7 J	11.2 UJ	288 J	381 J	78.9 J	54.5 J	9.02 J
Aroclor-1260	2000	35	32.8	13 J	12.9 UJ	11.8 UJ	10.3 J	9.03 J	11.2 UJ	73.2 J	74.4 J	19.9 J	11.5 J	10.9 UJ

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-24-012	ST-24-013	ST-24-014	ST-24-015	ST-24-016	ST-24-017	TFD006-052206	ST-24-018	ST-24-019	ST-24-020	ST-24-021	ST-24-022	ST-24-023
Upper Depth (in.)		1	1	1	1	1	1	1	1	1	1	1	1	1
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006
PCBs (µg/Kg)														
Aroclor-1262	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1268	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1016	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1221	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1232	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1242	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1248	2000	11.1 UJ	12.2 UJ	12 UJ	10.3 U	11.1 UJ	10.1 U	10.8 UJ	9.99 U	11.9 UJ	11.9 UJ	11.3 UJ	11 UJ	10.6 UJ
Aroclor-1254	2000	11.2 J	187 J	348 J	6.67 J	69.8 J	10.1 U	5.93 J	29	198 J	146 J	136 J	66 J	28.4 J
Aroclor-1260	2000	11.1 UJ	34.1 J	101 J	10.3 U	13.7 J	10.1 U	4.91 J	6.19 J	36.6 J	30.4 J	28.6 J	18.6 J	10.2 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-24-024	ST-24-025	ST-24-027	ST-24-028	ST-24-029	ST-24-030	TFD007-052206	ST-24-031	ST-24-032	ST-24-033	ST-24-034	ST-24-035	ST-24-036
Upper Depth (in.)		1	1	1	1	1	1	1	1	1	1	1	1	1
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006
PCBs (µg/Kg)														
Aroclor-1262	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1268	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1016	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1221	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1232	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1242	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1248	2000	11 UJ	11.3 UJ	11.2 UJ	10.4 U	10 U	9.91 U	10.4 UJ	10.3 U	10.4 UJ	10.5 UJ	10.9 UJ	10.8 UJ	10.5 UJ
Aroclor-1254	2000	508 J	72.6 J	332 J	73.3	10 U	9.91 U	10.4 UJ	10.3 U	152 J	50.8 J	207 J	138 J	20.5 J
Aroclor-1260	2000	140 J	13.6 J	83.5 J	37.1	10 U	9.91 U	10.4 UJ	10.3 U	46 J	19.6 J	39 J	30.8 J	8 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-24-037	ST-24-038	ST-24-039	ST-24-040	ST-24-041	ST-24-042	ST-24-043	ST-24-044	ST-24-045	ST-24-046	ST-24-047	ST-24-048	ST-26-007	ST-51-001
Upper Depth (in.)		1	1	1	1	1	1	1	1	1	1	1	1		
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3		
Date Sampled	MCP S-1	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	5/22/2006	7/14/2006	4/12/2006
PCBs (µg/Kg)															
Aroclor-1262	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1268	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1016	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1221	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1232	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1242	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1248	2000	10.5 UJ	10.8 UJ	10.9 UJ	11 UJ	11.5 UJ	9.92 U	10.5 UJ	10.9 UJ	11.5 UJ	10.6 UJ	10.5 UJ	10.3 UJ	9.78 U	10.1 U
Aroclor-1254	2000	30.6 J	40.5 J	99.1 J	106 J	159 J	92.8	107 J	29.3 J	198 J	78.9 J	52.9 J	75.8 J	58.6	10.1 U
Aroclor-1260	2000	9.31 J	13.3 J	24.8 J	32.3 J	48.7 J	26.8	36 J	8.2 J	36.9 J	33.8 J	20.3 J	18.2 J	17.2	10.1 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-51-002	ST-51-003	ST-51-004	ST-51-005	ST-51-006	ST-51-007	ST-51-008	ST-51-009
Upper Depth (in.)									
Lower Depth (in.)									
Date Sampled	MCP S-1	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006
PCBs (µg/Kg)									
Aroclor-1262	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1268	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1016	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1221	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1232	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1242	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1248	2000	10.3 U	10.7 UJ	10.7 UJ	10 U	10.3 U	10.7 UJ	9.9 U	10.2 U
Aroclor-1254	2000	162	278 J	187 J	28.7 J	148	180 J	27.1	148
Aroclor-1260	2000	61.8 J	101 J	91.4 J	10 U	73.1 J	160 J	13.7 J	72.9 J

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-51-010	ST-51-011	TFD002-041206	ST-51-012	ST-51-013	ST-51-014	ST-51-015	ST-51-016	ST-51-017	ST-51-018
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006	4/12/2006
PCBs (µg/Kg)											
Aroclor-1262	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1268	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1016	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1221	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1232	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1242	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1248	2000	10.5 UJ	10 U	10 U	10.2 U	11 UJ	9.94 U	10.5 UJ	10.5 UJ	10.7 UJ	10.1 U
Aroclor-1254	2000	348 J	178	296	150	303 J	135	275 J	291 J	53.1 J	123
Aroclor-1260	2000	170 J	70.9 J	155 J	145	156 J	107	175 J	189 J	43 J	113

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-51-019	ST-51-020	ST-51-021	ST-MAXY-001	ST-MAXY-002	ST-MAXY-003	ST-MAXY-004	ST-MAXY-005	TFD024-120505	ST-MAXY-006
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	4/12/2006	4/12/2006	4/12/2006	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005
PCBs (µg/Kg)											
Aroclor-1262	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1268	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1016	2000	10.5 UJ	10.3 U	10.4 U	38.6	36.9	45.9	37.3	83.8	91.6	21
Aroclor-1221	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1232	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1242	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1248	2000	10.5 UJ	10.3 U	10.4 U	10.4 U	10.6 U	9.47 U	10.1 U	10.5 U	10.2 U	9.79 U
Aroclor-1254	2000	89.4 J	95.4	563	298	176	231	174	321	292	73.4
Aroclor-1260	2000	62.7 J	99.7	342	134	84.4	196	139	72.7	58.5	21

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		ST-MAXY-007	ST-MAXY-008	ST-MAXY-009	ST-MAXY-010	ST-MAXY-011	ST-MAXY-012	ST-MAXY-013	ST-MAXY-014	ST-MAXY-015	ST-MAXY-016	ST-Maxy-017R
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/5/2005	12/13/2005	12/13/2005	4/10/2006
PCBs (µg/Kg)												
Aroclor-1262	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	10.1 U
Aroclor-1268	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	10.1 U
Aroclor-1016	2000	16.7	68.8	81.4	26.8	16.9	12.7	18.4	16.5	9.66 U	10.1 U	10.1 U
Aroclor-1221	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	10.1 U
Aroclor-1232	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	10.1 U
Aroclor-1242	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	10.1 U
Aroclor-1248	2000	9.85 U	10.7 U	10.4 U	10.5 U	10.2 U	9.41 U	9.69 U	10 U	9.66 U	10.1 U	211
Aroclor-1254	2000	35.9	280	298	91.4	38.3	32.9	52.3	48.6	117	220	224 J
Aroclor-1260	2000	20.7	57	71	21	14.8	11.3	17.9	20.5	32.8	42.4	23.6

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		TFD001-041006	ST-Maxy-022	ST-Maxy-023	ST-Maxy-024	ST-Maxy-025	ST-Maxy-026	ST-Maxy-027	ST-Maxy-028	TS-Maxy-018-R2R	TS-Maxy-019-R3R	YRDTS-004
Upper Depth (in.)												0
Lower Depth (in.)												2
Date Sampled	MCP S-1	4/10/2006	4/10/2006	4/10/2006	4/10/2006	4/10/2006	4/10/2006	4/10/2006	4/10/2006	5/11/2006	5/11/2006	10/18/2000
PCBs (µg/Kg)												
Aroclor-1262	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	
Aroclor-1268	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	
Aroclor-1016	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	200 U
Aroclor-1221	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	200 U
Aroclor-1232	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	200 U
Aroclor-1242	2000	10.2 U	10.1 U	9.98 U	9.9 U	10.1 U	9.96 U	9.98 U	10 U	10 U	10 U	200 U
Aroclor-1248	2000	456	10.1 U	9.98 U	59.3	103	437	93	10 U	46.2	50.1	200 U
Aroclor-1254	2000	471	10.1 U	73.9	89	119	541	133	81.4	59.6	101	200 U
Aroclor-1260	2000	71.6	10.1 U	5.78 J	9.1 J	9.57 J	47.2	24.1	24.7	17.9	28.6	200 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-008	YRDTS-009	YRDTS-010	YRDTS-011	YRDTS-040A 0-2 in	YRDTS-040B 2-4 in	YRDTS-044A 0-2 in	YRDTS-044B 2-4 in	YRDTS-045A 0-2 in	YRDTS-045B 2-4 in
Upper Depth (in.)		0	0	0	0	0	2	0	2	0	2
Lower Depth (in.)		2	2	2	2	2	4	2	4	2	4
Date Sampled	MCP S-1	10/24/2000	10/24/2000	10/24/2000	10/24/2000	11/5/2002	11/5/2002	11/11/2002	11/11/2002	11/11/2002	11/11/2002
PCBs (µg/Kg)											
Aroclor-1262	2000										
Aroclor-1268	2000										
Aroclor-1016	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U
Aroclor-1221	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U
Aroclor-1232	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U
Aroclor-1242	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U
Aroclor-1248	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U
Aroclor-1254	2000	200 U	300	200 U	200 U	43 U	220	750	41	240	150
Aroclor-1260	2000	200 U	200 U	200 U	200 U	43 U	43 U	360 U	36 U	40 U	40 U

Appendix Table A.1.8
 Soil Sample Results - PCBs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		YRDTS-12	YRDTS-13	YRDTS-15A	YRDTS-15B
Upper Depth (in.)		0	0	0	4
Lower Depth (in.)		2	2	2	6
Date Sampled	MCP S-1	10/24/2000	10/24/2000	10/24/2000	10/24/2000
PCBs (µg/Kg)					
Aroclor-1262	2000				
Aroclor-1268	2000				
Aroclor-1016	2000	200 U	200 U	200 U	200 U
Aroclor-1221	2000	200 U	200 U	200 U	200 U
Aroclor-1232	2000	200 U	200 U	200 U	200 U
Aroclor-1242	2000	200 U	200 U	200 U	200 U
Aroclor-1248	2000	200 U	200 U	200 U	200 U
Aroclor-1254	2000	200 U	700	200 U	200 U
Aroclor-1260	2000	200 U	200 U	200 U	200 U

Appendix Table A.1.8
 Soil Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0010006I	SB0010203F	SB-014 0006I	SB-014 0203F	SB016-0006I	SB016-0203F	SB0180006I	SB0180203F	SB0260203F
Upper Depth (in.)		0	24	0	24	0	24	0	24	24
Lower Depth (in.)		6	36	6	36	6	36	6	36	36
Date Sampled	MCP S-1	10/23/2003	10/22/2003	9/8/2004	9/8/2004	10/19/2004	10/19/2004	10/22/2003	10/22/2003	10/22/2003
SVOC (µg/Kg)										
Acenaphthylene	100000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Anthracene	1000000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Benzo(a)anthracene	7000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Benzo(a)pyrene	2000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Benzo(b)fluoranthene	7000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Benzo(g,h,i)perylene	1000000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Benzo(k)fluoranthene	70000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Chrysene	7000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Di-n-butyl phthalate		430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Fluoranthene	1000000	430 U	400 U	400 J	380 U	390 U	400 U	1600 U	430 U	830 U
Indeno(1,2,3-cd)pyrene	7000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Phenanthrene	1000000	430 U	400 U	1900 U	380 U	390 U	400 U	1600 U	430 U	830 U
Pyrene	1000000	430 U	400 U	400 J	380 U	390 U	400 U	1600 U	430 U	830 U

Appendix Table A.1.8
 Soil Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1010006I	SB1010102F	SB1160203F	SB1170102F	SB1180102F	SB1230304F	SB1260203F	SB1270102F	SB13000061	SB13100061	SB1410006I
Upper Depth (in.)		0	12	24	12	12	36	24	12	0	0	0
Lower Depth (in.)		6	24	36	24	24	48	36	24	72	72	6
Date Sampled	MCP S-1	10/21/2003	10/21/2003	10/15/2003	10/15/2003	10/15/2003	10/28/2003	10/28/2003	10/28/2003	10/14/2003	10/14/2003	10/16/2003
SVOC (µg/Kg)												
Acenaphthylene	100000	400 U	430 U	400 U	430 U	190 J	370 U	400 U	400 U	400 U	330 U	690 U
Anthracene	1000000	400 U	430 U	400 U	120 J	130 J	370 U	400 U	400 U	400 U	330 U	690 U
Benzo(a)anthracene	7000	400 U	430 U	88 J	260 J	420 J	370 U	400 U	400 U	400 UJ	330 UJ	690 U
Benzo(a)pyrene	2000	400 U	430 U	96 J	230 J	490	370 U	400 U	400 U	400 U	330 U	690 U
Benzo(b)fluoranthene	7000	400 U	430 U	400 U	210 J	370 J	370 U	400 U	400 U	400 U	330 U	690 U
Benzo(g,h,i)perylene	1000000	400 U	430 U	400 U	140 J	340 J	370 U	400 U	400 U	400 U	330 U	690 U
Benzo(k)fluoranthene	70000	400 U	430 U	400 U	170 J	340 J	370 U	400 U	400 U	400 U	330 U	690 U
Chrysene	7000	400 U	430 U	110 J	250 J	550	370 U	400 U	400 U	400 U	330 U	690 U
Di-n-butyl phthalate		400 U	430 U	400 U	430 U	430 U	370 U	400 U	400 U	400 U	330 U	690 U
Fluoranthene	1000000	400 U	430 U	180 J	590	630	370 U	400 U	400 U	400 U	330 U	690 U
Indeno(1,2,3-cd)pyrene	7000	400 U	430 U	400 U	430 U	430 U	370 U	400 U	400 U	400 U	330 U	690 U
Phenanthrene	1000000	400 U	430 U	400 UJ	530 J	280 J	370 U	400 U	400 U	400 UJ	330 UJ	690 UJ
Pyrene	1000000	400 U	430 U	140 J	500 J	930 J	370 U	400 U	400 U	400 UJ	330 UJ	690 UJ

Appendix Table A.1.8
 Soil Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1410203F	FD206-102303	SB1450006I	SB1450102F	SB1540006I	SB1540102F	SB1560006I	SS1560405F102803	SB1570006I	SS1570203F102803	SB1580006I	SB1590006I
Upper Depth (in.)		24	12	0	12	0	12	0		0		0	0
Lower Depth (in.)		36	24	6	24	6	24	6		6		6	6
Date Sampled	MCP S-1	10/16/2003	10/23/2003	10/23/2003	10/23/2003	10/15/2003	10/15/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003
SVOC (µg/Kg)													
Acenaphthylene	100000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	120 J	160 J	360 U	350 U	1500 U
Anthracene	1000000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	530 U	79 J	360 U	350 U	1500 U
Benzo(a)anthracene	7000	360 U	350 U	360 U	340 U	400 UJ	360 UJ	360 U	310 J	330 J	94 J	350 U	350 J
Benzo(a)pyrene	2000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	300 J	390	150 J	350 U	340 J
Benzo(b)fluoranthene	7000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	250 J	370	360 U	350 U	310 J
Benzo(g,h,i)perylene	1000000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	210 J	310 J	94 J	350 U	1500 U
Benzo(k)fluoranthene	70000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	230 J	320 J	360 U	350 U	1500 U
Chrysene	7000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	360 J	360	100 J	350 U	350 J
Di-n-butyl phthalate		360 U	350 U	360 U	340 U	400 U	360 UJ	79 J	530 U	84 J	360 U	74 J	1500 U
Fluoranthene	1000000	360 U	350 U	360 U	340 U	400 U	79 J	360 U	770	770	74 J	350 U	650 J
Indeno(1,2,3-cd)pyrene	7000	360 U	350 U	360 U	340 U	400 U	360 UJ	360 U	170 J	260 J	360 U	350 U	1500 U
Phenanthrene	1000000	360 UJ	350 U	360 U	340 U	400 UJ	360 UJ	360 U	600	230 J	360 U	350 U	1500 U
Pyrene	1000000	360 UJ	350 U	360 U	340 U	400 UJ	360 UJ	360 U	740	680	200 J	350 U	630 J

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0010006I	SB0010203F	SB0020006I	SB0020203F	SB0040006I	SB0080006I	SB0080102F	SB0120006I	SB0120203F
Upper Depth (in.)		0	24	0	24	0	0	12	0	24
Lower Depth (in.)		6	36	6	36	6	6	24	6	36
Date Sampled	MCP S-1	10/23/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003
TPH (mg/Kg)										
TPH-DRO	800	6.8	7.4	10	3.2	11	7.5	5.1	89	41
TPH-GRO	800	2.5 U	2.5 U							

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0180006I	SB0180203F	SB0190006I	SB0190102F	SB0250006I	SB0250203F	SB0260203F	SB0300102F	SB0490006I	SB0490203F	SB0880006I
Upper Depth (in.)		0	24	0	12	0	24	24	12	0	24	0
Lower Depth (in.)		6	36	6	24	6	36	36	24	6	36	6
Date Sampled	MCP S-1	10/22/2003	10/22/2003	10/20/2003	10/20/2003	10/22/2003	10/22/2003	10/22/2003	10/22/2003	10/30/2003	10/30/2003	10/20/2003
TPH (mg/Kg)												
TPH-DRO	800	190 J	32	140	40	14	8.7	45	18	2.4 U	14	3.4
TPH-GRO	800	4.2 U	4.6					3.5 U				

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB0880102F	SB1000006I	SB1000102F	SB1010006I	SB1010102F	SB1020006I	SB1020102F	SB1030006I	SB1030102F	SB1040006I	SB1040102F	SB1160006I	SB1160203F
Upper Depth (in.)		12	0	12	0	12	0	12	0	12	0	12	0	24
Lower Depth (in.)		24	6	24	6	24	6	24	6	24	6	24	6	36
Date Sampled	MCP S-1	10/20/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/15/2003	10/15/2003
TPH (mg/Kg)														
TPH-DRO	800	2.2 U	5.2	6	5	4.2	7.9	3.8	23	20	11	16	3.7	28 J
TPH-GRO	800				3 U	2.5 U								3 U

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1170006I	SB1170102F	SB1180006I	SB1180102F	SB1230006I	SB1230203F	SB1230304F	SB1260006I	SB1260203F	SB1270006I	SB1270102F	SB1280006I	SB1280203F
Upper Depth (in.)		0	12	0	12	0	24	36	0	24	0	12	0	24
Lower Depth (in.)		6	24	6	24	6	36	48	6	36	6	24	72	36
Date Sampled	MCP S-1	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/14/2003	10/14/2003
TPH (mg/Kg)														
TPH-DRO	800	17 J	20 J	22	46 J	2.7	6.1	5.7	3	2.4 U	2.6 U	22	16 J	20 J
TPH-GRO	800		2.5 U		2.5 U			2.5 U		2.5 U		2.5 U		

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1290006I	SB1290102F	SB1300006I	SB1300203F	SB1310006I	SB1310203F	SB1410006I	SB1410203F	SB1440006I	SB1440102F	FD206-102303	SB1450006I	SB1450102F
Upper Depth (in.)		0	12	0	24	0	24	0	24	0	12	12	0	12
Lower Depth (in.)		72	24	72	36	72	36	6	36	6	24	24	6	24
Date Sampled	MCP S-1	10/14/2003	10/14/2003	10/14/2003	10/14/2003	10/14/2003	10/14/2003	10/16/2003	10/16/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003
TPH (mg/Kg)														
TPH-DRO	800	5.4	2.2 U	5.5	11	2 U	2 U	110	37	320 J	190 J	3.6	2.2	2.2 J
TPH-GRO	800			2.5 U		2.5 U		2.5 U	2.5 U			2.5 U	2.5 U	2.5 U

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1460006I	SB1460102F	SB1530006I	SB1530203F	SB1540006I	SB1540102F	SB1550006I	SB1550203F	SB1560006I	SB1560607F	SS1560405F102803	SB1570006I	SB1570405F
Upper Depth (in.)		0	12	0	24	0	12	0	24	0	72		0	48
Lower Depth (in.)		6	24	6	36	6	24	6	36	6	84		6	60
Date Sampled	MCP S-1	10/23/2003	10/23/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003
TPH (mg/Kg)														
TPH-DRO	800	3.2	2.2 U	20 J	2 U	8.2	15 J	8	7.7 J	3.5	6		13 J	320 J
TPH-GRO	800					2.5 U	2.5 U					4.8 U		

Appendix Table A.1.8
 Soil Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB1570506F	SS1570203F102803	FD207-102803	MSSB0506F102803	SB1580006I	SB1580203F	SB1580506F	SB1590006I	SB1590203F
Upper Depth (in.)		60		24		0	24	60	0	24
Lower Depth (in.)		72		36		6	36	72	6	36
Date Sampled	MCP S-1	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003
TPH (mg/Kg)										
TPH-DRO	800	79 J		280 J	2.6	2.6	180	140	3.6	2.4 U
TPH-GRO	800		3.2 U							

Appendix Table A.1.8
 Soil Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-014 0006I	SB-014 0203F	SB016-0006I	SB016-0203F	SB116C-0203F	SB116CD-0203F	SS1560405F102803	SS1570203F102803
Upper Depth (in.)		0	24	0	24	24	24		
Lower Depth (in.)		6	36	6	36	36	36		
Date Sampled	MCP S-1	9/8/2004	9/8/2004	10/19/2004	10/19/2004	6/5/2006	6/5/2006	10/28/2003	10/28/2003
VOC (µg/Kg)									
Acetone	500000	120 U	69 U	10 UJ	10 UJ	236 UJ	869 J	730 J	390 J
Benzene	30000	5 U	5 U	5 U	5 U	11.8 U	6.3 J	8 UJ	5 UJ
Bromomethane	50000	15 U	15 U	15 U	15 U	5 J	20.8 U	24 UJ	15 UJ
2-Butanone	500000	10 U	11 U	10 UJ	10 UJ	118 UJ	38.4 J	130 J	41 J
Naphthalene	500000					11.8 U	3.8 J	8 UJ	5 UJ
Toluene	500000	5 U	5 U	5 U	5 U	11.8 U	2.1 J	14 J	2.4 J

Appendix Table A.1.8
 Soil Sample Results - VPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		FLH-01-003I	FLH-01-01-02F	FLH-02-003I	FLH-02-01-02F	FLH-03-003I	FLH-03-01-02F	FLH-04-003I	FLH-04-01-02F	FLH-05-003I	FLH-05-01-02F
Upper Depth (in.)		0	12	0	12	0	12	0	12	0	12
Lower Depth (in.)		3	24	3	24	3	24	3	24	3	24
Date Sampled	MCP S-1	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/6/2006	7/7/2006	7/7/2006
VPH (mg/Kg)											
Adjusted C9-C12 Aliphatics		7.36	2.05	0.0684 J	0.0769 J	0.0976 J	0.0544 J	0.0752 J	0.0685 J	0.119 J	0.259 U
Unadjusted C5-C8 Aliphatics	100	1.15	0.772	1.66	0.984	0.417 J	0.891	0.43 J	0.552 J	0.76 J	0.767 J
Unadjusted C9-C12 Aliphatics	1000	16	4.5	0.172 J	0.128 J	0.157 J	0.142 J	0.146 J	0.127 J	0.263 J	0.209 J
Adjusted C9-C10 Aromatics	100	8.6	2.44	0.209 U	0.179 U	0.176 U	0.162 U	0.151 U	0.193 U	0.299 U	0.259 U
Naphthalene		0.55	0.122	0.0417 U	0.0357 U	0.0352 U	0.0324 U	0.0301 U	0.0385 U	0.0598 U	0.0518 U
Toluene		0.0319 U	0.0384 U	0.294	0.158	0.0193 J	0.161	0.0301 U	0.051	0.0598 U	0.0518 U
o-Xylene		0.0264 J	0.0384 U	0.0417 U	0.0357 U	0.0352 U	0.0324 U	0.0301 U	0.0385 U	0.0598 U	0.0518 U
m+p-Xylenes		0.0251 J	0.0767 U	0.0835 U	0.0715 U	0.0704 U	0.0649 U	0.0602 U	0.077 U	0.12 U	0.104 U

Appendix Table A.1.8
 Soil Sample Results - VPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		FLH-06-003I	FLH-06-01-02F	FLH-07-003I	FLH-07-01-02F	Potable Water Tank 0-6	Potable Water Tank 12-18	Potable Water Tank 6-12	SB-014 0006I	SB-014 0203F
Upper Depth (in.)		0	12	0	12	0	12	6	0	24
Lower Depth (in.)		3	24	3	24	6	18	12	6	36
Date Sampled	MCP S-1	7/7/2006	7/7/2006	7/7/2006	7/7/2006	5/17/2006	5/17/2006	5/17/2006	9/8/2004	9/8/2004
VPH (mg/Kg)										
Adjusted C9-C12 Aliphatics		0.101 J	0.151 J	1.97	0.554	0.26 U	0.114 J	0.209 J		
Unadjusted C5-C8 Aliphatics	100	0.985 J	0.757 J	0.914 J	0.766 J	0.34 J	0.167 J	0.252 J	23.8 U	7.15 U
Unadjusted C9-C12 Aliphatics	1000	0.317 J	0.273 J	4.03	0.901	0.24 J	0.311 J	0.246 J	23.8 U	7.15 U
Adjusted C9-C10 Aromatics	100	0.341 U	0.278 U	2.05	0.347 U	0.26 U	0.362 U	0.288 U		
Naphthalene		0.0682 U	0.0555 U	0.151	0.0759	0.052 U	0.0724 U	0.0575 U		
Toluene		0.0682 U	0.0555 U	0.0618 U	0.063 U	0.0871	0.0724 U	0.0575 U		
o-Xylene		0.0682 U	0.0555 U	0.0318 J	0.063 U	0.052 U	0.0724 U	0.0575 U		
m+p-Xylenes		0.136 U	0.111 U	0.059 J	0.126 U	0.0275 J	0.145 U	0.115 U		

Appendix Table A.1.8
 Soil Sample Results - VPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB016-0006I	SB016-0203F	SB116C-0203F	SB116CD-0203F	SB-156R-0203F	SB-156R-0506F	SB-156R-1011F	FD001-011405	SB-157R-0203F	SB-157R-0708F
Upper Depth (in.)		0	24	24	24	24	60	120	24	24	84
Lower Depth (in.)		6	36	36	36	36	72	132	36	36	96
Date Sampled	MCP S-1	10/19/2004	10/19/2004	6/5/2006	6/5/2006	1/14/2005	1/14/2005	1/14/2005	1/14/2005	1/14/2005	1/14/2005
VPH (mg/Kg)											
Adjusted C9-C12 Aliphatics				0.975 U	0.626 U						
Unadjusted C5-C8 Aliphatics	100	8.86 U	7.13 U	2.17 J	1.41 J	8.96 U	7.98 U	14.4 U	7.12 U	9.73 U	9.63 U
Unadjusted C9-C12 Aliphatics	1000	8.86 U	7.13 U	0.95 J	0.479 J	8.96 U	7.98 U	14.4 U	7.12 U	9.73 U	9.63 U
Adjusted C9-C10 Aromatics	100			0.975 U	0.626 U						
Naphthalene				0.195 U	0.125 U	1.79 U	1.6 U	2.88 U	1.42 U	1.95 U	1.93 U
Toluene				0.195 U	0.125 U	0.359 U	0.319 U	0.577 U	0.285 U	0.389 U	0.385 U
o-Xylene				0.195 U	0.125 U	0.359 U	0.319 U	0.577 U	0.285 U	0.389 U	0.385 J
m+p-Xylenes				0.39 U	0.25 U	0.359 U	0.319 U	0.577 U	0.285 U	0.389 U	0.385 U

Appendix Table A.1.8
 Soil Sample Results - VPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID		SB-158R-0203F	SB-158R-0506F	SB-517-0506F	SB-517-0607F
Upper Depth (in.)		24	60	60	72
Lower Depth (in.)		36	72	72	84
Date Sampled	MCP S-1	1/14/2005	1/14/2005	1/14/2005	1/14/2005
VPH (mg/Kg)					
Adjusted C9-C12 Aliphatics					
Unadjusted C5-C8 Aliphatics	100	8.6 U	6.11 U	7.02 U	7.07 U
Unadjusted C9-C12 Aliphatics	1000	8.6 U	6.11 U	7.02 U	7.07 U
Adjusted C9-C10 Aromatics	100				
Naphthalene		1.72 U	1.22 U	1.4 U	1.41 U
Toluene		0.344 U	0.244 J	0.281 U	0.283 U
o-Xylene		0.344 U	0.244 U	0.281 U	0.283 U
m+p-Xylenes		0.344 U	0.244 U	0.281 U	0.283 U

Appendix Table A.1.9
Summary Statistics of All Soil Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from TransCanada Study Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	9	0%		0.14	
Acenaphthylene	0	9	0%		0.14	
Unadjusted C19-C36 Aliphatics	3	13	23%	7.50	18.94	98.80
Unadjusted C9-C18 Aliphatics	2	13	15%	143.00	32.57	221.00
Anthracene	1	9	11%	0.02	0.14	0.02
Adjusted C11-C22 Aromatics	2	3	67%	92.50	74.78	117.00
Unadjusted C11-C22 Aromatics	5	13	38%	5.50	22.84	117.00
Benzo(a)anthracene	0	9	0%		0.14	
Benzo(a)pyrene	0	9	0%		0.14	
Benzo(b)fluoranthene	0	9	0%		0.14	
Benzo(g,h,i)perylene	0	9	0%		0.14	
Benzo(k)fluoranthene	0	9	0%		0.14	
Chrysene	0	9	0%		0.14	
Dibenzo(a,h)anthracene	0	9	0%		0.14	
Fluoranthene	0	9	0%		0.14	
Fluorene	0	9	0%		0.14	
Indeno(1,2,3-cd)pyrene	0	9	0%		0.14	
2-Methylnaphthalene	2	9	22%	0.15	0.19	0.44
Naphthalene	0	9	0%		0.14	
Phenanthrene	2	9	22%	0.08	0.15	0.10
Pyrene	0	9	0%		0.14	
Total EPH	2	6	33%	6.50	4.43	13.00
Adjusted TPH	2	3	67%	318.00	256.62	437.00
Unadjusted TPH	2	3	67%	318.00	256.62	437.00
<i>Inorganics (mg/Kg)</i>						
Antimony	0	18	0%		1.51	
Arsenic	39	42	93%	0.89	2.17	4.60
Beryllium	0	42	0%		0.36	
Cadmium	1	42	2%	6.20	0.71	6.20
Chromium	39	42	93%	5.00	12.56	28.00
Copper	41	42	98%	4.60	16.04	53.00
Lead	72	80	90%	0.52	6.66	230.00
Mercury	3	42	7%	0.72	0.35	2.00
Nickel	36	42	86%	5.70	15.17	98.00
Selenium	11	42	26%	5.50	4.44	16.00
Silver	1	42	2%	0.81	0.23	0.81
Thallium	2	42	5%	0.60	0.83	0.82
Zinc	33	42	79%	20.00	64.81	250.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	48	0%		5.05	
Aroclor-1268	0	48	0%		5.05	
Aroclor-1016	0	114	0%		11.90	
Aroclor-1221	0	114	0%		11.90	
Aroclor-1232	0	114	0%		11.90	
Aroclor-1242	0	114	0%		11.90	
Aroclor-1248	1	114	1%	9.36	11.94	9.36
Aroclor-1254	37	114	32%	4.85	25.10	120.00
Aroclor-1260	19	114	17%	3.05	13.66	30.30

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.9
Summary Statistics of All Soil Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from TransCanada Study Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	2	31	6%	240.00	173.26	359.00
Acenaphthylene	6	31	19%	118.00	187.58	356.00
Aniline	0	24	0%		186.04	
Anthracene	6	31	19%	68.30	199.35	791.00
Azobenzene	0	24	0%		186.04	
Benzidine	0	10	0%		1,935.00	
Benzo(a)anthracene	8	31	26%	76.00	338.26	2,790.00
Benzo(a)pyrene	7	31	23%	85.00	283.13	2,570.00
Benzo(b)fluoranthene	7	31	23%	80.00	309.52	2,370.00
Benzo(g,h,i)perylene	6	31	19%	66.90	230.49	1,230.00
Benzo(k)fluoranthene	7	31	23%	81.00	287.94	2,430.00
Benzoic acid	1	24	4%	150.00	877.08	150.00
Benzyl alcohol	0	24	0%		374.17	
Bis(2-chloroethoxy)methane	0	24	0%		186.04	
Bis(2-chloroethyl)ether	0	24	0%		186.04	
Bis(2-ethylhexyl)phthalate	0	24	0%		186.04	
4-Bromophenyl phenyl ether	0	24	0%		186.04	
Butyl benzyl phthalate	1	24	4%	500.00	199.38	500.00
Carbazole	1	24	4%	350.00	188.54	350.00
4-Chloro-3-methylphenol	0	24	0%		374.17	
4-Chloroaniline	0	24	0%		374.17	
Bis(2-chloroisopropyl) ether	0	24	0%		374.17	
2-Chloronaphthalene	0	24	0%		186.04	
2-Chlorophenol	0	24	0%		186.04	
4-Chlorophenyl phenyl ether	0	24	0%		186.04	
Chrysene	8	31	26%	85.00	341.68	2,850.00
Dibenzo(a,h)anthracene	2	31	6%	66.20	176.81	400.00
Dibenzofuran	0	24	0%		186.04	
1,2-Dichlorobenzene	0	14	0%		180.71	
1,3-Dichlorobenzene	0	14	0%		180.71	
1,4-Dichlorobenzene	0	14	0%		180.71	
3,3'-Dichlorobenzidine	0	24	0%		374.17	
2,4-Dichlorophenol	0	24	0%		186.04	
Diethyl phthalate	0	24	0%		186.04	
Dimethyl phthalate	0	24	0%		186.04	
2,4-Dimethylphenol	0	24	0%		186.04	
Di-n-butyl phthalate	0	24	0%		186.04	
2,4-Dinitrophenol	0	24	0%		910.42	
2,4-Dinitrotoluene	0	24	0%		186.04	
2,6-Dinitrotoluene	0	24	0%		186.04	
Di-n-octyl phthalate	0	24	0%		186.04	
Fluoranthene	9	31	29%	83.00	537.74	5,860.00
Fluorene	1	31	3%	150.00	169.39	150.00
Hexachlorobenzene	0	24	0%		186.04	
Hexachlorobutadiene	0	24	0%		186.04	
Hexachlorocyclopentadiene	0	24	0%		186.04	
Hexachloroethane	0	24	0%		186.04	
Indeno(1,2,3-cd)pyrene	5	31	16%	76.60	233.08	1,440.00
Isophorone	0	24	0%		186.04	
4,6-Dinitro-2-methylphenol	0	24	0%		910.42	
1-Methylnaphthalene	0	7	0%		132.29	
2-Methylnaphthalene	0	31	0%		173.90	
3+4-Methylphenol	0	24	0%		186.04	
2-Methylphenol	0	24	0%		186.04	
Naphthalene	0	31	0%		173.90	
2-Nitroaniline	0	24	0%		910.42	
3-Nitroaniline	0	24	0%		910.42	
4-Nitroaniline	0	24	0%		910.42	
Nitrobenzene	0	24	0%		186.04	
2-Nitrophenol	0	24	0%		186.04	
4-Nitrophenol	0	24	0%		910.42	
N-Nitroso-di-n-propylamine	0	24	0%		186.04	
N-Nitrosodiphenylamine	0	24	0%		186.04	
N-Nitrosodimethylamine	1	24	4%	72.00	361.96	72.00
Pentachlorophenol	0	24	0%		910.42	
Phenanthrene	7	31	23%	33.40	279.93	2,430.00
Phenol	0	24	0%		186.04	
Pyrene	9	31	29%	76.00	484.77	5,200.00
1,2,4-Trichlorobenzene	0	14	0%		180.71	
2,4,5-Trichlorophenol	0	24	0%		186.04	
2,4,6-Trichlorophenol	0	24	0%		186.04	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	26	34	76%	2.20	7.76	35.00
TPH-GRO	0	13	0%		1.25	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.9
Summary Statistics of All Soil Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from TransCanada Study Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	5	10	50%	35.00	31.15	100.00
Acrylonitrile	0	10	0%		6.20	
Allyl Chloride	0	10	0%		3.30	
t-Amyl methyl ether	0	10	0%		3.30	
Benzene	0	10	0%		3.30	
Bromobenzene	0	10	0%		3.30	
Bromochloromethane	0	10	0%		3.30	
Bromodichloromethane	0	10	0%		3.30	
Bromoform	0	10	0%		3.30	
Bromomethane	0	10	0%		9.90	
2-Butanone	4	10	40%	1.80	5.33	3.60
n-Butylbenzene	0	10	0%		3.30	
sec-Butylbenzene	0	10	0%		3.30	
tert-Butylbenzene	0	10	0%		3.30	
Carbon Disulfide	5	10	50%	1.20	4.87	23.00
Carbon Tetrachloride	0	10	0%		6.60	
Chlorobenzene	0	10	0%		3.30	
1-Chlorobutane	0	10	0%		3.30	
Chloroethane	0	10	0%		9.90	
2-Chloroethylvinyl Ether	0	10	0%		9.90	
Chloroform	0	10	0%		9.90	
Chloromethane	0	10	0%		3.30	
2-Chlorotoluene	0	10	0%		3.30	
4-Chlorotoluene	0	10	0%		3.30	
1,2-Dibromo-3-Chloropropane	0	5	0%		3.40	
Dibromochloromethane	0	10	0%		3.30	
1,2-Dibromoethane	0	10	0%		3.30	
Dibromomethane	0	10	0%		3.30	
1,2-Dichlorobenzene	0	10	0%		3.30	
1,3-Dichlorobenzene	0	10	0%		3.30	
1,4-Dichlorobenzene	0	10	0%		3.30	
Dichlorodifluoromethane	0	10	0%		3.30	
1,1-Dichloroethane	0	10	0%		3.30	
1,2-Dichloroethane	0	10	0%		3.30	
cis-1,2-Dichloroethene	0	10	0%		3.30	
trans-1,2-Dichloroethene	0	10	0%		3.30	
1,1-Dichloroethene	0	10	0%		3.30	
1,3-Dichloropropane	0	10	0%		3.30	
2,2-Dichloropropane	0	10	0%		3.30	
1,2-Dichloropropane	0	10	0%		3.30	
1,1-Dichloropropene	0	10	0%		3.30	
cis-1,3-Dichloropropene	0	10	0%		3.30	
trans-1,3-Dichloropropene	0	10	0%		3.30	
Diethyl Ether	1	10	10%	1.30	6.13	1.30
Diisopropyl ether	0	10	0%		3.30	
Ethyl Methacrylate	0	10	0%		3.30	
Ethylbenzene	0	10	0%		3.30	
Ethyl-t-butyl ether	0	10	0%		3.30	
2-Hexanone	0	10	0%		3.30	
Iodomethane	0	10	0%		3.30	
Isopropylbenzene	0	10	0%		3.30	
4-Isopropyltoluene	0	10	0%		3.30	
Methacrylonitrile	0	10	0%		3.30	
Methyl Methacrylate	0	10	0%		3.30	
4-Methyl-2-Pentanone	0	10	0%		3.30	
Methylene Chloride	0	10	0%		9.90	
Methyl-t-butyl ether	0	10	0%		9.90	
2-Nitropropane	0	10	0%		6.60	
Pentachloroethane	0	10	0%		3.30	
Propionitrile	0	10	0%		28.95	
n-Propylbenzene	0	10	0%		3.30	
Styrene	0	10	0%		3.30	
1,1,1,2-Tetrachloroethane	0	10	0%		3.30	
1,1,2,2-Tetrachloroethane	0	10	0%		3.30	
Tetrachloroethene	0	10	0%		3.30	
Tetrahydrofuran	0	10	0%		6.60	
Toluene	9	10	90%	0.49	56.99	230.00
trans-1,4-Dichloro-2-Butene	0	7	0%		3.36	
1,2,3-Trichlorobenzene	0	10	0%		3.30	
1,2,4-Trichlorobenzene	0	10	0%		3.30	
1,1,1-Trichloroethane	0	10	0%		6.60	
1,1,2-Trichloroethane	0	10	0%		3.30	
Trichloroethene	0	10	0%		3.30	
Trichlorofluoromethane	0	10	0%		3.30	
1,2,3-Trichloropropane	0	10	0%		3.30	
1,2,4-Trimethylbenzene	0	10	0%		3.30	
1,3,5-Trimethylbenzene	0	10	0%		3.30	
Vinyl Acetate	0	10	0%		9.90	
Vinyl Chloride	0	10	0%		3.30	
o-Xylene	0	10	0%		3.30	
m+p-Xylenes	0	10	0%		3.30	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.9
Summary Statistics of All Soil Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from TransCanada Study Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	5	0%		0.44	
Adjusted C9-C12 Aliphatics	3	5	60%	0.48	2.32	7.70
Unadjusted C5-C8 Aliphatics	7	15	47%	0.51	6.30	28.00
Unadjusted C9-C12 Aliphatics	6	15	40%	0.18	7.70	43.00
Adjusted C9-C10 Aromatics	3	11	27%	2.98	5.32	23.00
Unadjusted C9-C10 Aromatics	0	4	0%		6.31	
Benzene	0	11	0%		0.30	
Ethylbenzene	2	11	18%	0.02	0.30	0.04
Methyl-t-butyl ether	0	11	0%		0.13	
Naphthalene	2	11	18%	0.14	0.63	0.32
Toluene	4	11	36%	0.04	1.57	12.00
Total VPH	2	6	33%	16.00	13.25	43.00
o-Xylene	2	11	18%	0.03	0.30	0.07
Xylenes (Total)	0	6	0%		0.52	
m+p-Xylenes	2	11	18%	0.04	0.31	0.14

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.1.10
 Soil Sample Results - EPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-01	EX-BARK-02	EX-BARK-03	SB-501-0305F	FD001-011305	SB-502-0507F	SB-503-0507F	SB-504-0507F	SB-505-0810F	SB-505-1012F
Upper Depth (in.)					36	60	60	60	60	96	120
Lower Depth (in.)					60	84	84	84	84	120	132
Date Sampled	MCP S-1	9/7/2006	9/7/2006	9/7/2006	1/20/2005	1/13/2005	1/13/2005	1/13/2005	1/13/2005	1/24/2005	1/24/2005
EPH (mg/Kg)											
Unadjusted C19-C36 Aliphatics	3000	29.7 UJ	82.3 J	98.8 J	3.6 U	3.6 U	3.6 U	7.5	3.7 U	7.58 U	7.33 U
Unadjusted C9-C18 Aliphatics	1000	29.7 UJ	143 J	221 J	3.6 U	3.6 U	3.6 U	3.5 U	3.7 U	7.58 U	7.33 U
Anthracene		0.148 U	0.147 U	0.0218 J	0.36 U	0.36 U	0.36 U	0.35 U	0.37 U		
Adjusted C11-C22 Aromatics		29.7 U	92.5	117							
Unadjusted C11-C22 Aromatics	800	29.7 U	92.6	117	3.6 U	3.6 U	3.6 U	5.5	6.5	7.58 U	7.33 U
2-Methylnaphthalene		0.148 U	0.15	0.441	0.36 U	0.36 U	0.36 U	0.35 U	0.37 U		
Phenanthrene		0.148 U	0.0779 J	0.101 J	0.36 U	0.36 U	0.36 U	0.35 U	0.37 U		
Total EPH					3.6 U	3.6 U	3.6 U	13	6.5		
Adjusted TPH		29.7 U	318	437							
Unadjusted TPH		29.7 U	318	437							

Appendix Table A.1.10
 Soil Sample Results - EPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I
Upper Depth (in.)		120	156	0	0
Lower Depth (in.)		144	180	6	6
Date Sampled	MCP S-1	1/20/2005	1/20/2005	2/2/2005	2/2/2005
EPH (mg/Kg)					
Unadjusted C19-C36 Aliphatics	3000	3.6 U	3.4 U	40.2 U	12.6 U
Unadjusted C9-C18 Aliphatics	1000	3.6 U	3.4 U	40.2 U	12.6 U
Anthracene		0.36 U	0.34 U		
Adjusted C11-C22 Aromatics					
Unadjusted C11-C22 Aromatics	800	3.6 U	3.4 U	40.2 U	25.8
2-Methylnaphthalene		0.36 U	0.34 U		
Phenanthrene		0.36 U	0.34 U		
Total EPH		3.6 U	3.4 U		
Adjusted TPH					
Unadjusted TPH					

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB0680809F	FD-201-102003	SB1130006I	SB1130102F	SB1140006I	SB1140203F	SB1150006I	SB1150102F	SB1220006I
Upper Depth (in.)		96	0	0	12	0	24	0	12	0
Lower Depth (in.)		108	6	6	24	6	36	6	24	6
Date Sampled	MCP S-1	10/29/2003	10/20/2003	10/20/2003	10/20/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/28/2003
Inorganics (mg/Kg)										
Arsenic	20	1.7 J	2.1 J	1.8 J	1.9 J	1.2	1.4	2.4	1	1.6 J
Cadmium	2	0.77 U	0.83 U	0.83 U	0.76 U	0.73 U	0.75 U	0.73 U	0.75 U	0.86 UJ
Chromium	30	18 J	10	12	9.4	12	22	12	16	12 J
Copper		20 J	11	19	16	13	16	20	12	11 J
Lead	300	1.7 J	2.9 J	2.4 J	1.9 J	0.88 J	0.73 J	1.3 J	1.2 J	3.1 J
Mercury	20	0.61 UJ	0.59 U	0.64 U	0.63 U	0.52 U	0.56 U	0.54 U	0.53 U	0.72 UJ
Nickel	20	16 J	11	12	11	11	16	11	13	9.8 J
Selenium	400	8.7 J	2.6 U	2.6 U	2.4 U	2.3 U	2.3 U	2.3 U	2.3 U	2.7 UJ
Silver	100	0.24 UJ	0.26 U	0.26 U	0.24 U	0.23 U	0.24 U	0.23 U	0.24 U	0.27 UJ
Thallium	8	0.57 UJ	0.61 U	0.61 U	0.56 U	0.53 U	0.55 U	0.54 U	0.55 U	0.63 UJ
Zinc	2500	60 J	48	56	45	39	38	36	46	56 J

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1220203F	SB1221415F	SB1240006I	SB1240203F	SB1240910F	SB1250006I	SB1250203F	SB1250910F	SB1360006I	SB1360102F	SB1370006I
Upper Depth (in.)		24	168	0	24	108	0	24	108	0	12	0
Lower Depth (in.)		36	180	6	36	120	6	36	120	6	24	6
Date Sampled	MCP S-1	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/23/2003	10/23/2003	10/16/2003
Inorganics (mg/Kg)												
Arsenic	20	0.89 J	2.2 J	2.7 J	1.1 J	2 J	3.3 J	1.2 J	1.6 J	1.8	1.5	3.1
Cadmium	2	0.76 UJ	0.74 UJ	0.75 UJ	0.77 UJ	0.73 UJ	0.75 UJ	0.77 UJ	0.71 UJ	0.77 U	0.78 U	0.78 U
Chromium	30	22 J	17 J	12 J	18 J	5 J	16 J	22 J	7 J	12	15	12 J
Copper		6.9 J	53 J	14 J	30 J	4.6 J	14 J	23 J	4.8 J	12	14	19 J
Lead	300	1 J	0.62 J	R	0.89 J	0.32 UJ	R	0.72 J	0.52 J	1.5	0.9	2.2 J
Mercury	20	0.4 UJ	0.6 UJ	0.59 UJ	0.73 J	0.58 UJ	0.55 UJ	0.02 UJ	0.53 UJ	0.6 U	0.4 U	0.65 U
Nickel	20	22 J	21 J	12 J	17 J	5.7 J	14 J	18 J	6.8 J	12	14	15
Selenium	400	13 J	9.8 J	2.3 UJ	9 J	16 J	5.5 J	8.9 J	2.2 UJ	8.9	10	2.4 U
Silver	100	0.24 UJ	0.23 UJ	0.24 UJ	0.81 J	0.23 UJ	0.24 UJ	0.24 UJ	0.22 UJ	0.24 U	0.25 U	0.25 U
Thallium	8	0.82 J	0.54 UJ	0.55 UJ	0.57 UJ	0.6 J	0.55 UJ	0.57 UJ	0.52 UJ	0.57 U	0.57 U	0.57 U
Zinc	2500	63 J	74 J	49 J	97 J	92 J	43 J	59 J	20 J	51	52	57

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1370102F	SB1390006I	SB1390203F	SB1400006I	SB1400203F	SB1420006I	SB1420102F	SB1430006I	SB1430102F	SB1510006I	SB1510102F	SB1520006I	SB1520102F
Upper Depth (in.)		12	0	24	0	24	0	12	0	12	0	12	0	12
Lower Depth (in.)		24	6	36	6	36	6	24	6	24	6	24	6	24
Date Sampled	MCP S-1	10/16/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/15/2003	10/15/2003	10/15/2003	10/15/2003
Inorganics (mg/Kg)														
Arsenic	20	1.8	3.5	1.8	4.4	2	3.2	2.2	2.9	2.1	3.9	2.7	3.5	1.5
Cadmium	2	0.78 U	0.82 U	0.75 U	0.76 U	0.8 U	1 U	0.76 U	0.72 U	0.75 U	0.78 U	0.75 U	0.76 U	0.76 U
Chromium	30	14 J	8.3	24	9.7	13	15	28	7.8	18	12	12	11	10
Copper		27 J	15	20	12	15	21	18	8.1	18	22 J	33 J	12 J	10 J
Lead	300	3.1 J	0.81	1.3	0.59	2.5	9.4 J	2 J	7.2 J	4 J	2.6 J	2.1 J	230 J	3.2 J
Mercury	20	0.61 U	1.3 U	0.61 U	0.55 U	1.2 U	0.62 U	0.62 U	0.52 U	0.58 U	0.62 U	0.61 U	0.55 U	0.57 U
Nickel	20	20	9.3	20	9.9	11	13	21	6.7	23	37 J	24 J	12 J	11 J
Selenium	400	2.4 U	2.6 U	13	2.4 U	8.6	2.4 U	2.4 U	2.3 U	2.4 U	2.4 U	2.3 U	2.4 U	2.4 U
Silver	100	0.25 U	0.26 U	0.24 U	0.24 U	0.25 U	0.24 U	0.24 U	0.23 U	0.24 U	0.25 U	0.24 U	0.24 U	0.24 U
Thallium	8	0.57 U	0.6 U	0.55 U	0.56 U	0.59 U	0.56 U	0.56 U	0.53 U	0.55 U	0.57 U	0.55 U	0.56 U	0.56 U
Zinc	2500	68	42	64	30	56	69	71	46	60	60 J	71 J	72 J	55 J

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-501-0305F	FD001-011305	SB-502-0507F	SB-503-0507F	SB-504-0507F	SB-505-0810F	SB-505-1012F	SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I	SB-555-0002
Upper Depth (in.)		36	60	60	60	60	96	120	120	156	0	0	0
Lower Depth (in.)		60	84	84	84	84	120	132	144	180	6	6	24
Date Sampled	MCP S-1	1/20/2005	1/13/2005	1/13/2005	1/13/2005	1/13/2005	1/24/2005	1/24/2005	1/20/2005	1/20/2005	2/2/2005	2/2/2005	1/8/2005
Inorganics (mg/Kg)													
Arsenic	20	1.3	2.7	3.7	2.1	1.7	1 U	2.4	1 U	1 U	4.6	4.1	
Cadmium	2	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	6.2	
Chromium	30	7.3	5	5.8	5.6	5 U	5 U	12	10	14	11	5 U	
Copper		6.4	7.1	6.5	11	13	5 U	14	15	16	8	28	
Lead	300	4.1	3.2	3.6	3.2	3.5	2 U	7.1	2 U	2.1	11	19	6.8
Mercury	20	0.72	0.5 U	0.5 U	0.5 U	2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	
Nickel	20	10 U	10 U	10 U	10 U	10 U	10 U	12	10 U	11	11	98	
Selenium	400	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
Silver	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
Thallium	8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	
Zinc	2500	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	150 U	250	150 U	

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-555-0204	SB-555-0406	SB-555-0608	SB-555-0810	FD-001-010805	SB-556-0002	SB-556-0204	SB-556-0406	SB-556-0608	SB-556-0810	SB-557-0002	SB-557-0204
Upper Depth (in.)		24	48	72	96	48	0	24	48	72	96	0	24
Lower Depth (in.)		48	72	96	120	72	24	48	72	96	120	24	48
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
Inorganics (mg/Kg)													
Arsenic	20												
Cadmium	2												
Chromium	30												
Copper													
Lead	300	3.9	4.4	5.2	3.4	4.2	6.3	7.3	2 U	4.6	2 U	4.8	5.9
Mercury	20												
Nickel	20												
Selenium	400												
Silver	100												
Thallium	8												
Zinc	2500												

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-557-0406	SB-557-0608	SB-557-0810	SB-558-0002	SB-558-0204	SB-558-0406	SB-558-0608	SB-558-0810	SB-559-0002	SB-559-0204	SB-559-0406	SB-559-0608
Upper Depth (in.)		48	72	96	0	24	48	72	96	0	24	48	72
Lower Depth (in.)		72	96	120	24	48	72	96	120	24	48	72	96
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
Inorganics (mg/Kg)													
Arsenic	20												
Cadmium	2												
Chromium	30												
Copper													
Lead	300	2 U	3.8	2.1	2.6	2 U	4.6	5.2	2.4	4	6.4	7.4	5
Mercury	20												
Nickel	20												
Selenium	400												
Silver	100												
Thallium	8												
Zinc	2500												

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-559-0810	SB-560-0002	SB-560-0204	SB-560-0406	SB-560-0608	SB-560-0810	FD002-010805	SB-561-0002	SB-561-0204	SB-561-0406	SB-561-0608	SB-561-0810
Upper Depth (in.)		96	0	24	48	72	96	0	0	24	48	72	96
Lower Depth (in.)		120	24	48	72	96	120	24	24	48	72	96	120
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
Inorganics (mg/Kg)													
Arsenic	20												
Cadmium	2												
Chromium	30												
Copper													
Lead	300	4.2	7.8	2 U	4.3	4.3	4.1	4.1	10	12	3.1	4.5	3.7
Mercury	20												
Nickel	20												
Selenium	400												
Silver	100												
Thallium	8												
Zinc	2500												

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - Inorganics
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-562-0002	SB-562-0204	SB-562-0406	SB-562-0608	SB-562-0810
Upper Depth (in.)		0	24	48	72	96
Lower Depth (in.)		24	48	72	96	120
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
Inorganics (mg/Kg)						
Arsenic	20					
Cadmium	2					
Chromium	30					
Copper						
Lead	300	6.2	5	3	10	3.2
Mercury	20					
Nickel	20					
Selenium	400					
Silver	100					
Thallium	8					
Zinc	2500					

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		BLKPT-106	BLKPT-107	BLKPT-108	BLKPT-109	FD-201-102003	SB1130006I	SB1140006I	SB1140203F	SB1150006I	SB1150102F
Upper Depth (in.)						0	0	0	24	0	12
Lower Depth (in.)						6	6	6	36	6	24
Date Sampled	MCP S-1	8/17/2006	8/17/2006	8/17/2006	8/17/2006	10/20/2003	10/20/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003
PCBs (µg/Kg)											
Aroclor-1248	2000	10.1 U	10.8 UJ	13.7 UJ	9.36 J	40 U	40 U	33 U	36 U	36 U	36 U
Aroclor-1254	2000	55.5	96.7 J	41.5 J	96.9 J	35 J	44	33 U	36 U	36 U	36 U
Aroclor-1260	2000	13.1	24 J	10.8 J	24 J	40 U	40 U	33 U	36 U	36 U	36 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1221415F	SB1240910F	SB1250910F	SB1390006I	SB1390203F	SB1430006I	SB1430102F	SB1520006I	SB1520102F	SB-501-0305F	FD001-011305	SB-502-0507F
Upper Depth (in.)		168	108	108	0	24	0	12	0	12	36	60	60
Lower Depth (in.)		180	120	120	6	36	6	24	6	24	60	84	84
Date Sampled	MCP S-1	10/28/2003	10/28/2003	10/28/2003	10/23/2003	10/23/2003	10/16/2003	10/16/2003	10/15/2003	10/15/2003	1/20/2005	1/13/2005	1/13/2005
PCBs (µg/Kg)													
Aroclor-1248	2000	36 U	36 U	33 U	40 U	36 U	33 U	33 U	33 U				
Aroclor-1254	2000	36 U	36 U	33 U	40 U	36 U	36 U	120	55	36 U	33 U	33 U	33 U
Aroclor-1260	2000	36 U	36 U	33 U	40 U	36 U	33 U	33 U	33 U				

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-503-0507F	SB-504-0507F	SB-505-0810F	SB-505-1012F	SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I	SB-555-0002	SB-555-0204	SB-555-0406	SB-555-0608
Upper Depth (in.)		60	60	96	120	120	156	0	0	0	24	48	72
Lower Depth (in.)		84	84	120	132	144	180	6	6	24	48	72	96
Date Sampled	MCP S-1	1/13/2005	1/13/2005	1/24/2005	1/24/2005	1/20/2005	1/20/2005	2/2/2005	2/2/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
PCBs (µg/Kg)													
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	33 U	33 U	120	33 U	40	43	33 U	33 U	33 U	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-555-0810	FD-001-010805	SB-556-0002	SB-556-0204	SB-556-0406	SB-556-0608	SB-556-0810	SB-557-0002	SB-557-0204	SB-557-0406	SB-557-0608	SB-557-0810	SB-558-0002
Upper Depth (in.)		96	48	0	24	48	72	96	0	24	48	72	96	0
Lower Depth (in.)		120	72	24	48	72	96	120	24	48	72	96	120	24
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
PCBs (µg/Kg)														
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-558-0204	SB-558-0406	SB-558-0608	SB-558-0810	SB-559-0002	SB-559-0204	SB-559-0406	SB-559-0608	SB-559-0810	SB-560-0002	SB-560-0204	SB-560-0406	SB-560-0608
Upper Depth (in.)		24	48	72	96	0	24	48	72	96	0	24	48	72
Lower Depth (in.)		48	72	96	120	24	48	72	96	120	24	48	72	96
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005
PCBs (µg/Kg)														
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-560-0810	FD002-010805	SB-561-0002	SB-561-0204	SB-561-0406	SB-561-0608	SB-561-0810	SB-562-0002	SB-562-0204	SB-562-0406	SB-562-0608	SB-562-0810	SB595-0003I
Upper Depth (in.)		96	0	0	24	48	72	96	0	24	48	72	96	0
Lower Depth (in.)		120	24	24	48	72	96	120	24	48	72	96	120	3
Date Sampled	MCP S-1	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	1/8/2005	6/8/2005
PCBs (µg/Kg)														
Aroclor-1248	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	10.4 U
Aroclor-1254	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	21.9
Aroclor-1260	2000	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	5.73 J

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB596-0003I	SB597-0003I	SB598-0003I	SB645-0003I	SB646-0003I	SB647-0003I	SB648-0003I	SB650-0003I	SB651-0003I	SB652-0003I-051905	SB652-0003I-072705
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	6/8/2005	6/8/2005	6/8/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	5/19/2005	5/19/2005	5/19/2005	7/27/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	9.7 U	10.7 U	10.2 U	9.96 U	9.6 U	10 U	9.85 U	9.79 U	9.96 U	10.4 U	9.9 U
Aroclor-1254	2000	4.85 J	12.8	7.64 J	9.96 U	9.6 U	37.5	98.4	9.79 U	9.96 U	10.4 U	46
Aroclor-1260	2000	9.7 U	10.7 U	3.05 J	9.96 U	9.6 U	10 U	9.85 U	9.79 U	9.96 U	10.4 U	9.9 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB653-0003I-051905	SB653-0003I-072705	SB655-0003I	SB656-0003I	SB657-0003I	SB658-0003I	SB660-0003I	FD001-051905	SB661-0003I	SB662-0003I	SB663-0003I	SB665-0003I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	5/19/2005	7/27/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005	5/19/2005
PCBs (µg/Kg)													
Aroclor-1248	2000	9.7 U	9.96 U	9.99 U	9.8 U	9.78 U	9.92 U	9.89 U	9.72 U	9.86 U	9.96 U	9.91 U	9.76 U
Aroclor-1254	2000	26.7	27.9	14	81.7	39.6	41.1	15.8	9.72 U	9.86 U	9.96 U	103	24.9
Aroclor-1260	2000	13.6	9.96 U	11	14.2	10.5	19.3	10.9	9.72 U	9.86 U	9.96 U	18.3	9.76 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB666-0003I	SB670-0003I	SB671-0003I	SB672-0003I	SB673-0003I	SB674-0003I	SB719-0003I	SB720-0003I	FD001-072705	SB721-0003I	SB722-0003I	SB723-0003I	SB724-0003I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	5/19/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005	7/27/2005
PCBs (µg/Kg)														
Aroclor-1248	2000	9.77 U	9.94 U	9.56 U	9.98 U	9.6 U	9.96 U	9.99 U	9.82 U	9.87 U	9.85 U	10 U	9.9 U	9.93 U
Aroclor-1254	2000	9.77 U	9.94 U	9.56 U	18.4	20.1	37.3	9.99 U	9.82 U	9.87 U	9.85 U	10 U	9.9 U	9.93 U
Aroclor-1260	2000	9.77 U	9.94 U	9.56 U	9.98 U	9.6 U	9.96 U	9.99 U	9.82 U	9.87 U	9.85 U	10 U	9.9 U	9.93 U

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		FD001-113005	SB-BLK01-A	SB-BLK02-A	SB-BLK03-A	FD001-121205	ST-PCSA-001	ST-PCSA-002	ST-PCSA-003	ST-PCSA-004	ST-PCSA-005	ST-PCSA-006
Upper Depth (in.)												
Lower Depth (in.)												
Date Sampled	MCP S-1	11/30/2005	11/30/2005	11/30/2005	11/30/2005	12/12/2005	12/12/2005	12/12/2005	12/12/2005	12/12/2005	12/12/2005	12/12/2005
PCBs (µg/Kg)												
Aroclor-1248	2000	10.9 U	11.1 U	10.4 U	11.3 U	9.94 U	10.2 U	9.83 U	10.5 U	9.85 U	9.67 U	9.77 U
Aroclor-1254	2000	10.9 U	11.1 U	10.4 U	11.3 U	51.7	31.5	78	75.8	33.5	19.3	17.1
Aroclor-1260	2000	10.9 U	11.1 U	10.4 U	11.3 U	18.4	18.8	28	30.3	16.7	12.6	12.7

Appendix Table A.1.10
 Soil Sample Results - PCBs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		YRDTS-050A 0-2 in	YRDTS-050B 2-4 in
Upper Depth (in.)		0	2
Lower Depth (in.)		2	4
Date Sampled	MCP S-1	11/5/2002	11/5/2002
PCBs (µg/Kg)			
Aroclor-1248	2000	36 U	36 U
Aroclor-1254	2000	100	46
Aroclor-1260	2000	36 U	36 U

Sample ID		SB0680809F	SB1140006I	SB1140203F	SB1150006I	SB1150102F	SB1221415F	SB1240910F	SB1250910F	SB1390006I
Upper Depth (in.)		96	0	24	0	12	168	108	108	0
Lower Depth (in.)		108	6	36	6	24	180	120	120	6
Date Sampled	MCP S-1	10/29/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/28/2003	10/28/2003	10/28/2003	10/23/2003
SVOC (µg/Kg)										
Acenaphthene	1000000	360 U	360 UJ	360 UJ	360 UJ	360 UJ	360 U	350 U	330 U	400 U
Acenaphthylene	100000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Anthracene	1000000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzo(a)anthracene	7000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzo(a)pyrene	2000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzo(b)fluoranthene	7000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzo(g,h,i)perylene	1000000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzo(k)fluoranthene	70000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Benzoic acid		1800 U	1800 UJ	1800 UJ	1800 UJ	1800 UJ	1700 U	1700 U	1600 U	1900 U
Butyl benzyl phthalate		360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Carbazole		360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Chrysene	7000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Dibenzo(a,h)anthracene	700	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
Fluoranthene	1000000	360 U	360 U	83 J	360 U	360 U	360 U	350 U	330 U	400 U
Fluorene	1000000	360 U	360 UJ	360 UJ	360 UJ	360 UJ	360 U	350 U	330 U	400 U
Indeno(1,2,3-cd)pyrene	7000	360 U	360 U	360 U	360 U	360 U	360 U	350 U	330 U	400 U
N-Nitrosodimethylamine		730 U	730 UJ	730 UJ	730 UJ	730 UJ	710 U	690 U	670 U	790 U
Phenanthrene	1000000	360 U	360 UJ	360 UJ	360 UJ	360 UJ	360 U	350 U	330 U	400 U
Pyrene	1000000	360 U	360 UJ	76 J	360 UJ	360 UJ	360 U	350 U	330 U	400 U

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - SVOCs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1390203F	SB1430006I	SB1430102F	SB1520006I	SB1520102F	SB-501-0305F	FD001-011305	SB-502-0507F	SB-503-0507F	SB-504-0507F	SB-505-0810F
Upper Depth (in.)		24	0	12	0	12	36	60	60	60	60	96
Lower Depth (in.)		36	6	24	6	24	60	84	84	84	84	120
Date Sampled	MCP S-1	10/23/2003	10/16/2003	10/16/2003	10/15/2003	10/15/2003	1/20/2005	1/13/2005	1/13/2005	1/13/2005	1/13/2005	1/24/2005
SVOC (µg/Kg)												
Acenaphthene	1000000	370 U	360 UJ	360 UJ	370 U	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U
Acenaphthylene	100000	370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Anthracene	1000000	370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Benzo(a)anthracene	7000	370 U	360 U	76 J	130 J	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U
Benzo(a)pyrene	2000	370 U	360 U	360 U	85 J	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Benzo(b)fluoranthene	7000	370 U	360 U	360 U	80 J	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Benzo(g,h,i)perylene	1000000	370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Benzo(k)fluoranthene	70000	370 U	360 U	360 U	81 J	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Benzoic acid		1800 U	1800 UJ	1800 UJ	1800 U	1800 UJ	1900 U	1700 U	1700 U	1800 U	1800 U	1800 U
Butyl benzyl phthalate		370 U	500	360 U	370 U	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U
Carbazole		370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Chrysene	7000	370 U	360 U	85 J	110 J	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Dibenzo(a,h)anthracene	700	370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Fluoranthene	1000000	370 U	360 U	140 J	260 J	360 U	380 U	350 U	350 U	370 U	360 U	370 U
Fluorene	1000000	370 U	360 UJ	360 UJ	370 U	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U
Indeno(1,2,3-cd)pyrene	7000	370 U	360 U	360 U	370 U	360 U	380 U	350 U	350 U	370 U	360 U	370 U
N-Nitrosodimethylamine		730 U	730 UJ	730 UJ	730 U	730 U	770 U	700 U	710 U	72	730 U	740 U
Phenanthrene	1000000	370 U	360 UJ	360 UJ	170 J	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U
Pyrene	1000000	370 U	360 UJ	120 J	200 J	360 UJ	380 U	350 U	350 U	370 U	360 U	370 U

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - SVOCs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-505-1012F	SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I	SB540A-0006I	FD001-071905	SB540B-0006I	SB540B-0712I	SB540C-0006I	SB540D-0006I
Upper Depth (in.)		120	120	156	0	0	0	0	0	7	0	0
Lower Depth (in.)		132	144	180	6	6	6	6	6	12	6	6
Date Sampled	MCP S-1	1/24/2005	1/20/2005	1/20/2005	2/2/2005	2/2/2005	7/19/2005	7/19/2005	7/19/2005	7/19/2005	7/19/2005	7/19/2005
SVOC (µg/Kg)												
Acenaphthene	1000000	360 U	360 U	350 U	390 U	240 J	312 U	163 U	172 U	138 U	192 U	209 U
Acenaphthylene	100000	360 U	360 U	350 U	390 U	220 J	356	266	230	187	118 J	209 U
Anthracene	1000000	360 U	360 U	350 U	390 U	610	136 J	106 J	134 J	68.3 J	75.7 J	209 U
Benzo(a)anthracene	7000	360 U	360 U	350 U	390 U	1900	492	368	439	217	442	209 U
Benzo(a)pyrene	2000	360 U	360 U	350 U	390 U	1200	218 J	173	240	113 J	171 J	209 U
Benzo(b)fluoranthene	7000	360 U	360 U	350 U	390 U	2100	265 J	249	260	146	194	209 U
Benzo(g,h,i)perylene	1000000	360 U	360 U	350 U	390 U	980	136 J	99.1 J	280	66.9 J	87.3 J	209 U
Benzo(k)fluoranthene	70000	360 U	360 U	350 U	390 U	1400	202 J	208	314	144	175 J	209 U
Benzoic acid		1700 U	1700 U	1700 U	150 J	2800 U						
Butyl benzyl phthalate		360 U	360 U	350 U	390 U	580 U						
Carbazole		360 U	360 U	350 U	390 U	350 J						
Chrysene	7000	360 U	360 U	350 U	390 U	1900	514	393	486	224	423	209 U
Dibenzo(a,h)anthracene	700	360 U	360 U	350 U	390 U	400 J	312 U	163 U	66.2 J	138 U	192 U	209 U
Fluoranthene	1000000	360 U	360 U	350 U	390 U	3400	1020	722	782	436	869	209 U
Fluorene	1000000	360 U	360 U	350 U	390 U	150 J	312 U	163 U	172 U	138 U	192 U	209 U
Indeno(1,2,3-cd)pyrene	7000	360 U	360 U	350 U	390 U	750	312 U	163 U	327	76.6 J	111 J	209 U
N-Nitrosodimethylamine		720 U	710 U	710 U	780 U	1200 U						
Phenanthrene	1000000	360 U	360 U	350 U	390 U	1600	91.4 J	64.4 J	67.9 J	33.4 J	105 J	209 U
Pyrene	1000000	360 U	360 U	350 U	390 U	3200	773	456	758	223	658	209 U

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - SVOCs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB540D-1218I	SB540R-0006I
Upper Depth (in.)		12	0
Lower Depth (in.)		18	6
Date Sampled	MCP S-1	7/19/2005	7/19/2005
SVOC (µg/Kg)			
Acenaphthene	1000000	171 U	359 J
Acenaphthylene	100000	171 U	339 J
Anthracene	1000000	171 U	791
Benzo(a)anthracene	7000	171 U	2790
Benzo(a)pyrene	2000	171 U	2570
Benzo(b)fluoranthene	7000	171 U	2370
Benzo(g,h,i)perylene	1000000	171 U	1230
Benzo(k)fluoranthene	70000	171 U	2430
Benzoic acid			
Butyl benzyl phthalate			
Carbazole			
Chrysene	7000	171 U	2850
Dibenzo(a,h)anthracene	700	171 U	658 U
Fluoranthene	1000000	171 U	5860
Fluorene	1000000	171 U	658 U
Indeno(1,2,3-cd)pyrene	7000	171 U	1440
N-Nitrosodimethylamine			
Phenanthrene	1000000	171 U	2430
Pyrene	1000000	171 U	5200

> MCP S-1

Appendix Table A.1.10
 Soil Sample Results - TPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB0680006I	SB0680203F	SB0680809F	FD-201-102003	SB1130006I	SB1130102F	SB1140006I	SB1140203F	SB1150006I
Upper Depth (in.)		0	24	96	0	0	12	0	24	0
Lower Depth (in.)		6	36	108	6	6	24	6	36	6
Date Sampled	MCP S-1	10/29/2003	10/29/2003	10/29/2003	10/20/2003	10/20/2003	10/20/2003	10/16/2003	10/16/2003	10/16/2003
TPH (mg/Kg)										
TPH-DRO	800	12 J	2.2 U	35	11	8.8	9.4	2.2	3	2.2 U

Appendix Table A.1.10
 Soil Sample Results - TPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1150102F	SB1220006I	SB1220203F	SB1221415F	SB1240006I	SB1240203F	SB1240910F	SB1250006I	SB1250203F	SB1250910F	SB1360006I
Upper Depth (in.)		12	0	24	168	0	24	108	0	24	108	0
Lower Depth (in.)		24	6	36	180	6	36	120	6	36	120	6
Date Sampled	MCP S-1	10/16/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/28/2003	10/23/2003
TPH (mg/Kg)												
TPH-DRO	800	4	2.6	2.3	2.2 U	20	7.1	2.2 U	3.1	2.2 U	2 U	6

Appendix Table A.1.10
 Soil Sample Results - TPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1360102F	SB1370006I	SB1370102F	SB1390006I	SB1390203F	SB1400006I	SB1400203F	SB1420006I	SB1420102F	SB1430006I	SB1430102F	SB1510006I	SB1510102F
Upper Depth (in.)		12	0	12	0	24	0	24	0	12	0	12	0	12
Lower Depth (in.)		24	6	24	6	36	6	36	6	24	6	24	6	24
Date Sampled	MCP S-1	10/23/2003	10/16/2003	10/16/2003	10/23/2003	10/23/2003	10/23/2003	10/23/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/15/2003	10/15/2003
TPH (mg/Kg)														
TPH-DRO	800	2.2 U	6.5	6.4	22 J	2.2 U	15	5.9	19 J	4.7	11	19 J	3.7	8.4

Appendix Table A.1.10
 Soil Sample Results - TPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB1520006I	SB1520102F
Upper Depth (in.)		0	12
Lower Depth (in.)		6	24
Date Sampled	MCP S-1	10/15/2003	10/15/2003
TPH (mg/Kg)			
TPH-DRO	800	11	7.1

Appendix Table A.1.10
 Soil Sample Results - VOCs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-501-0305F	FD001-011305	SB-502-0507F	SB-503-0507F	SB-504-0507F	SB-505-0810F	SB-505-1012F	SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I
Upper Depth (in.)		36	60	60	60	60	96	120	120	156	0	0
Lower Depth (in.)		60	84	84	84	84	120	132	144	180	6	6
Date Sampled	MCP S-1	1/20/2005	1/13/2005	1/13/2005	1/13/2005	1/13/2005	1/24/2005	1/24/2005	1/20/2005	1/20/2005	2/2/2005	2/2/2005
VOC (µg/Kg)												
Acetone	500000	100 J	14 U	12 U	35	48	16 UJ	42 J	49 J	12 UJ	17 U	18 U
2-Butanone	500000	3.6 J	14 U	12 U	1.8 J	3.3 J	16 UJ	14 UJ	2.6 J	12 UJ	12 U	18 U
Carbon disulfide		23	7 U	6 U	2.8 J	1.8 J	8 U	2.4 J	1.2 J	6 U	6 U	9 U
Diethyl Ether		1.3 J	14 U	12 U	10 U	16 U	16 U	14 U	10 U	12 U	12 U	18 U
Toluene	500000	71	7 U	7.1	0.49 J	2.3 J	230	90	85	22	32 U	46

Appendix Table A.1.10
 Soil Sample Results - VPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-04A	EX-BARK-04B	EX-BARK-04R	EX-BARK-05R	EX-BARK-06	EX-BARK-25	SB-501-0305F	FD001-011305	SB-502-0507F	SB-503-0507F
Upper Depth (in.)								36	60	60	60
Lower Depth (in.)								60	84	84	84
Date Sampled	MCP S-1	9/20/2006	9/20/2006	9/20/2006	9/20/2006	9/7/2006	9/7/2006	1/20/2005	1/13/2005	1/13/2005	1/13/2005
VPH (mg/Kg)											
Adjusted C9-C12 Aliphatics		3.21	0.189 U	7.7	0.232 U	0.477	0.332				
Unadjusted C5-C8 Aliphatics	100	0.968	0.509 J	1.92	0.682 J	0.643 J	0.571 J	16	9.8 U	13 U	7.8 U
Unadjusted C9-C12 Aliphatics	1000	6.19	0.181 J	14.8	0.195 J	1.01	1.01	43	9.8 U	13 U	7.8 U
Adjusted C9-C10 Aromatics	100	2.98	0.189 U	7.12	0.232 U	0.53 U	0.679 U	23	9.8 U	13 U	7.8 U
Ethylbenzene		0.0199 J	0.0377 U	0.0358 J	0.0464 U	0.0469 U	0.0407 U	1.3 U	0.98 U	1.3 U	0.78 U
Naphthalene		0.142	0.0377 U	0.318	0.0464 U	0.0469 U	0.0407 U	2.7 U	2 U	2.6 U	1.6 U
Toluene		0.0481	0.0377 U	0.0393 J	0.0464 U	0.0469 U	0.0407 U	3.1	0.98 U	1.3 U	0.78 U
Total VPH								43	9.8 U	13 U	7.8 U
o-Xylene		0.0298 J	0.0377 U	0.0663	0.0464 U	0.0469 U	0.0407 U	1.3 U	0.98 U	1.3 U	0.78 U
m+p-Xylenes		0.0413 J	0.0754 U	0.14	0.0928 U	0.0938 U	0.0814 U	1.3 U	0.98 U	1.3 U	0.78 U

Appendix Table A.1.10
 Soil Sample Results - VPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID		SB-504-0507F	SB-505-0810F	SB-505-1012F	SB-506-1012F	SB-506-1315F	SB-507-0006I	SB-540-0006I
Upper Depth (in.)		60	96	120	120	156	0	0
Lower Depth (in.)		84	120	132	144	180	6	6
Date Sampled	MCP S-1	1/13/2005	1/24/2005	1/24/2005	1/20/2005	1/20/2005	2/2/2005	2/2/2005
VPH (mg/Kg)								
Adjusted C9-C12 Aliphatics								
Unadjusted C5-C8 Aliphatics	100	9.2 U	13.3 U	10.7 U	11 U	28	9.44 U	17 U
Unadjusted C9-C12 Aliphatics	1000	9.2 U	13.3 U	10.7 U	11 U	8.9 U	9.44 U	17 U
Adjusted C9-C10 Aromatics	100	9.2 U			11 U	8.9 U		
Ethylbenzene		0.92 U			1.1 U	0.89 U		
Naphthalene		1.8 U			2.3 U	1.8 U		
Toluene		0.92 U			1.1 U	12		
Total VPH		9.2 U			11 U	16		
o-Xylene		0.92 U			1.1 U	0.89 U		
m+p-Xylenes		0.92 U			1.1 U	0.89 U		

Appendix Table A.1.11
 Summary Statistics of All Soil Sample Results --
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Soil Samples from TransCanada Property Inside the BUD Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds cont. (µg/Kg)</i>						
1,2-Dichlorobenzene	0	3	0%		398.33	
1,3-Dichlorobenzene	0	3	0%		398.33	
1,4-Dichlorobenzene	0	3	0%		398.33	
3,3'-Dichlorobenzidine	0	3	0%		778.33	
2,4-Dichlorophenol	0	3	0%		398.33	
Diethyl phthalate	0	3	0%		398.33	
Dimethyl phthalate	0	3	0%		398.33	
2,4-Dimethylphenol	0	3	0%		398.33	
Di-n-butyl phthalate	0	3	0%		398.33	
2,4-Dinitrophenol	0	3	0%		1,900.00	
2,4-Dinitrotoluene	0	3	0%		398.33	
2,6-Dinitrotoluene	0	3	0%		398.33	
Di-n-octyl phthalate	0	3	0%		398.33	
Fluoranthene	0	3	0%		398.33	
Fluorene	0	3	0%		398.33	
Hexachlorobenzene	0	3	0%		398.33	
Hexachlorobutadiene	0	3	0%		398.33	
Hexachlorocyclopentadiene	0	3	0%		398.33	
Hexachloroethane	0	3	0%		398.33	
Indeno(1,2,3-cd)pyrene	0	3	0%		398.33	
Isophorone	0	3	0%		398.33	
4,6-Dinitro-2-methylphenol	0	3	0%		1,900.00	
2-Methylnaphthalene	0	3	0%		398.33	
3+4-Methylphenol	0	3	0%		398.33	
2-Methylphenol	0	3	0%		398.33	
Naphthalene	0	3	0%		398.33	
2-Nitroaniline	0	3	0%		1,900.00	
3-Nitroaniline	0	3	0%		1,900.00	
4-Nitroaniline	0	3	0%		1,900.00	
Nitrobenzene	0	3	0%		398.33	
2-Nitrophenol	0	3	0%		398.33	
4-Nitrophenol	0	3	0%		1,900.00	
N-Nitroso-di-n-propylamine	0	3	0%		398.33	
N-Nitrosodiphenylamine	0	3	0%		398.33	
N-Nitrosodimethylamine	0	3	0%		778.33	
Pentachlorophenol	0	3	0%		1,900.00	
Phenanthrene	0	3	0%		398.33	
Phenol	0	3	0%		398.33	
Pyrene	0	3	0%		398.33	
1,2,4-Trichlorobenzene	0	3	0%		398.33	
2,4,5-Trichlorophenol	0	3	0%		398.33	
2,4,6-Trichlorophenol	0	3	0%		398.33	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	6	11	55%	2.50	14.06	71.00
TPH-GRO	0	6	0%		1.25	
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	2	0%		0.25	
Adjusted C9-C12 Aliphatics	1	2	50%	0.27	0.17	0.27
Unadjusted C5-C8 Aliphatics	2	2	100%	0.46	0.47	0.48
Unadjusted C9-C12 Aliphatics	2	2	100%	0.12	0.45	0.78
Adjusted C9-C10 Aromatics	0	2	0%		0.17	
Benzene	0	2	0%		0.016	
Ethylbenzene	0	2	0%		0.016	
Methyl-t-butyl ether	0	2	0%		0.016	
Naphthalene	0	2	0%		0.016	
Toluene	0	2	0%		0.016	
o-Xylene	0	2	0%		0.016	
m+p-Xylenes	0	2	0%		0.033	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.12
 Soil Sample Results - EPHs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-09	EX-BARK-11	SB-034 0006I	SB-034 0203F
Upper Depth (in.)				0	24
Lower Depth (in.)				6	36
Date Sampled	MCP S-1	9/7/2006	9/7/2006	9/8/2004	9/8/2004
EPH (mg/Kg)					
Unadjusted C19-C36 Aliphatics	3000	30.3 UJ	32.7 UJ	14.3	7.66 UJ

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-SBG-013	EX-SBG-014	EX-SBG-015	EX-SBG-016	EX-SBG-017	EX-SBG-018	EX-SBG-019	EX-SBG-033	EX-SBG-101	EX-SBG-102
Upper Depth (in.)											
Lower Depth (in.)											
Date Sampled	MCP S-1	11/21/2005	11/21/2005	11/21/2005	11/21/2005	11/21/2005	11/21/2005	11/21/2005	11/29/2005	6/13/2006	6/13/2006
Inorganics (mg/Kg)											
Arsenic	20										
Beryllium	0.7										
Boron											
Chromium	30										
Copper											
Lead	300	15.3	63.9	57	31.5	11.6	144	6.96	62.4	5.84 J	50.1 J
Lithium											
Mercury	20										
Nickel	20										
Selenium	400										
Zinc	2500										

> MCP S-1

Sample ID		EX-SBG-103	EX-SBG-104	EX-SBG-106	EX-SBG-107R	FD002-062906	EX-SBG-108	EX-SBG-109R	FD003-062906	FD004-062906	EX-SBG-110R2	EX-SBG-111	EX-SBG-112
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	6/13/2006	6/13/2006	6/13/2006	6/29/2006	6/29/2006	6/13/2006	6/29/2006	6/29/2006	6/29/2006	7/18/2006	6/13/2006	6/13/2006
Inorganics (mg/Kg)													
Arsenic	20												
Beryllium	0.7												
Boron													
Chromium	30												
Copper													
Lead	300	195 J	199 J	42.6 J	6.25 J	11.1 J	6.9 J	4.05 J	2.96 J	143 J	4.81 J	8.83 J	173 J
Lithium													
Mercury	20												
Nickel	20												
Selenium	400												
Zinc	2500												

> MCP S-1

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-SBG-113	EX-SBG-114	EX-SBG-115	EX-SBG-116R	EX-SBG-117R	EX-SBG-118	EX-SBG-119	EX-SBG-122	EX-SBG-123	EX-SBG-124	EX-SBG-125	EX-SBG-126	EX-SBG-128
Upper Depth (in.)														
Lower Depth (in.)														
Date Sampled	MCP S-1	6/13/2006	6/13/2006	6/13/2006	6/29/2006	6/29/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006
Inorganics (mg/Kg)														
Arsenic	20													
Beryllium	0.7													
Boron														
Chromium	30													
Copper														
Lead	300	9.55 J	53.1 J	278 J	79.7 J	121 J	32.4 J	186 J	27 J	105 J	148 J	35.5 J	5.79 J	299 J
Lithium														
Mercury	20													
Nickel	20													
Selenium	400													
Zinc	2500													

> MCP S-1

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-SBG-129	EX-SBG-130	EX-SBG-131	EX-SBG-132	EX-SBG-133	EX-SBG-134R	EX-SBG-135	EX-SBG-243R	EX-SBG-246R	EX-SBG-250R2	EX-SBG-256R	EX-SBG-257R
Upper Depth (in.)													
Lower Depth (in.)													
Date Sampled	MCP S-1	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/13/2006	6/29/2006	6/13/2006	7/18/2006	7/18/2006	7/26/2006	7/18/2006	7/18/2006
Inorganics (mg/Kg)													
Arsenic	20												
Beryllium	0.7												
Boron													
Chromium	30												
Copper													
Lead	300	194 J	29.9 J	92.8 J	102 J	37.9 J	7 J	11.8 J	62.1 J	168 J	24.3 J	28.6 J	47.2 J
Lithium													
Mercury	20												
Nickel	20												
Selenium	400												
Zinc	2500												

> MCP S-1

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-SBG-259R	EX-SBG-260	EX-SBG-261	EX-SBG-262	EX-SBG-263	EX-SBG-264	EX-SBG-265	EX-SBG-266	EX-SBG-267	EX-SBG-268	SB-034 0006I	SB-034 0203F	SB0540006I
Upper Depth (in.)												0	24	0
Lower Depth (in.)												6	36	6
Date Sampled	MCP S-1	7/18/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	9/8/2004	9/8/2004	10/30/2003
Inorganics (mg/Kg)														
Arsenic	20											2.9 J	3.9 J	1.2 J
Beryllium	0.7											0.5 U	0.5 U	0.73 U
Boron														
Chromium	30											13 J	11 J	13
Copper												14 UJ	11 UJ	15
Lead	300	191 J	6.98 J	90 J	41.6 J	85.3 J	64.4 J	171 J	40 J	47.7 J	5.79 J	13 J	R	R
Lithium														
Mercury	20											0.5 U	0.5 U	0.009 J
Nickel	20											10 U	10 U	16
Selenium	400											10 U	10 U	6.4
Zinc	2500											150 U	150 U	45

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate chemical not analyzed

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB0540203F	SB0541415F	SB0590006I	SB0590203F	SB0591415F	SB0600006I	SB0600203F	SB0620506F	SB1110006I	SB1110102F	SB111-A0006I	SB111-A0102F
Upper Depth (in.)		24	168	0	24	168	0	24	60	0	12	0	12
Lower Depth (in.)		36	180	6	36	180	6	36	72	6	24	6	24
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/20/2003	10/20/2003	7/7/2004	7/7/2004
Inorganics (mg/Kg)													
Arsenic	20	1.2 J	0.86 J	2	1.3	3.1	2.5 J	1.2 J	1.7 J	0.96 J	0.98 J		
Beryllium	0.7	0.73 U	0.76 U	0.76 U	0.82 U	0.87 U	0.78 U	0.79 U	0.79 U	0.8 U	2	0.5 U	0.5 U
Boron							140	240					
Chromium	30	20	4.5	20	14	25	18	14	13	8.9	25		
Copper		23	4.4	15	17	23	29	42	18	17	350		
Lead	300	0.85 J	R	0.44 J	R	0.54 J	5.6 J	1.7 J	1 J	5 J	230 J		
Lithium							13	12					
Mercury	20	0.007 J	0.009 J	0.006 U	0.014	0.009	0.011 J	0.012 J	0.01 J	0.56 U	0.4 U		
Nickel	20	14	5.6	15	15	22	17	24	14	12	230		
Selenium	400	7.6	9.3	6.6	6.6	12	5.3	5.9	5.6	2.4 U	2.3 U		
Zinc	2500	61	57	47	48	86	87	200	58	68	1200		

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate chemical not analyzed

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB111-B0006I	SB111-B0203F	SB111-C0006I	SB111-C0203F	SB111-D0006I	SB111-D0102F	FD007-0006I-070704	SB111-R0006I	SB111-R0203F	SBG 238	SBG 239	SBG 240
Upper Depth (in.)		0	24	0	24	0	12	0	0	24			
Lower Depth (in.)		6	36	6	36	6	24	6	6	36			
Date Sampled	MCP S-1	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	7/7/2004	6/27/2006	6/27/2006	6/27/2006
Inorganics (mg/Kg)													
Arsenic	20												
Beryllium	0.7	0.5 U	0.5 U	0.5 U									
Boron													
Chromium	30												
Copper													
Lead	300										19.7 J	6.15 J	73 J
Lithium													
Mercury	20												
Nickel	20												
Selenium	400												
Zinc	2500												

> MCP S-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate chemical not analyzed

Appendix Table A.1.12
 Soil Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SBG 241	SBG 242	SBG 244	SBG 245	SBG 247	SBG 248	SBG 249	SBG 251	SBG 252	SBG 253	SBG 254	SBG 255	SBG 258	YRDTS-002
Upper Depth (in.)															0
Lower Depth (in.)															2
Date Sampled	MCP S-1	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	6/27/2006	10/18/2000
Inorganics (mg/Kg)															
Arsenic	20														
Beryllium	0.7														
Boron															
Chromium	30														
Copper															
Lead	300	176 J	14.8 J	44.6 J	5.29 J	181 J	64.4 J	140 J	34.7 J	66.8 J	296 J	57.6 J	120 J	77 J	14
Lithium															
Mercury	20														
Nickel	20														
Selenium	400														
Zinc	2500														

> MCP S-1

Appendix Table A.1.12
 Soil Sample Results - PCBs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB-034 0006I	SB-034 0203F	SB0540006I	SB0540203F	SB0541415F	SB0590006I	SB0600006I	SB0600203F	SB 1104 0003I	SB 1104 0102F
Upper Depth (in.)		0	24	0	24	168	0	0	24	0	12
Lower Depth (in.)		6	36	6	36	180	6	6	36	3	24
Date Sampled	MCP S-1	9/8/2004	9/8/2004	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	3/2/2005	3/2/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	36 J	38 U	33 U	33 U	33 U	33 U	190	200	20.6 U	19.1 U
Aroclor-1260	2000	35 U	38 U	33 U	33 U	33 U	33 U	120	140	20.6 U	19.1 U

Appendix Table A.1.12
 Soil Sample Results - PCBs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB 1104 0203F	SB 1104 0304F	SB 1108 0003I	SB 1108 0102F	SB 1108 0203F	SB 1108 0304F	SB1110006I	FD002-051405	SB690-0003I	SB691-0003I	SB692-0003I	SB693-0003I
Upper Depth (in.)		24	36	0	12	24	36	0	0	0	0	0	0
Lower Depth (in.)		36	48	3	24	36	48	6	3	3	3	3	3
Date Sampled	MCP S-1	3/2/2005	3/2/2005	3/3/2005	3/3/2005	3/3/2005	3/3/2005	10/20/2003	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005
PCBs (µg/Kg)													
Aroclor-1254	2000	19 U	19.6 U	35.3	15.6 J	20.7 U	20.4 U	50	9.95 UJ	52.8 J	26.8	178	91.2
Aroclor-1260	2000	19 U	19.6 U	9.63 J	20.8 U	20.7 U	20.4 U	36 U	9.95 U	9.98 U	9.92 U	9.97 U	17.6

Appendix Table A.1.12
 Soil Sample Results - PCBs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB694-0003I	SB696-0003I	SB697-0003I	SB698-0003I	SB699-0003I	SB700-0003I	SB701-0003I	SB704-0003I	SB705-0003I	SB706-0003I	SB707-0003I	SB708-003I	SB713-003I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	58.1	9.99 U	75.6	56.4	26.3	45.5	145	108	15.7	21.2	43.2	81.7	286
Aroclor-1260	2000	13.9	9.99 U	9.83 U	10.1 U	9.92 U	12.4	28.8	25.3	9.83 U	10.1 U	10.4 U	17.3	52.2

Appendix Table A.1.12
 Soil Sample Results - PCBs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB714-003I	ST-133-01	ST-37-001	YRDTS-002	YRDTS-047A 0-2 in	YRDTS-047B 2-4 in	YRDTS-048A 0-2 in	YRDTS-048B 2-4 in	YRDTS-049A 0-2 in	YRDTS-049B 2-4 in
Upper Depth (in.)		0			0		2	0	2	0	2
Lower Depth (in.)		3			2		4	2	4	2	4
Date Sampled	MCP S-1	5/14/2005	4/25/2006	10/18/2005	10/18/2000	11/11/2002	11/11/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002
PCBs (µg/Kg)											
Aroclor-1254	2000	111	23	75.3	200	33 U	400	36 U	36 U	56	36 U
Aroclor-1260	2000	38.4	15.8	28.6	200 U	250	360 U	36 U	36 U	43 U	36 U

Appendix Table A.1.12
 Soil Sample Results - TPHs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		SB0540006I	SB0540203F	SB0541415F	SB0590006I	SB0590203F	SB0591415F	SB0600006I	SB0600203F	SB0620506F	SB1110006I	SB1110102F
Upper Depth (in.)		0	24	168	0	24	168	0	24	60	0	12
Lower Depth (in.)		6	36	180	6	36	180	6	36	72	6	24
Date Sampled	MCP S-1	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/30/2003	10/20/2003	10/20/2003
TPH (mg/Kg)												
TPH-DRO	800	71 J	2 U	2.2 U	2 U	2.5	2.2 U	17 J	16 J	19	24	2 U

Appendix Table A.1.12
 Soil Sample Results - VPHs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-10	EX-BARK-12
Date Sampled	MCP S-1	9/7/2006	9/7/2006
VPH (mg/Kg)			
Adjusted C9-C12 Aliphatics		0.155 U	0.271
Unadjusted C5-C8 Aliphatics	100	0.456 J	0.478 J
Unadjusted C9-C12 Aliphatics	1000	0.116 J	0.783

Appendix Table A.1.13
 Summary Statistics of Soil Sample Results --
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	Soil Sample Results from TransCanada Shoreline Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	2	10	20%	0.16	0.49	3.85
Acenaphthylene	1	10	10%	0.03	0.13	0.03
Unadjusted C19-C36 Aliphatics	0	13	0%		15.60	
Unadjusted C9-C18 Aliphatics	2	13	15%	44.60	29.11	180.00
Anthracene	2	10	20%	0.10	0.46	3.67
Adjusted C11-C22 Aromatics	1	7	14%	31.90	18.44	31.90
Unadjusted C11-C22 Aromatics	4	13	31%	31.90	94.95	647.00
Benzo(a)anthracene	3	10	30%	0.35	2.06	17.30
Benzo(a)pyrene	3	10	30%	0.33	1.37	11.20
Benzo(b)fluoranthene	3	10	30%	0.54	3.38	30.00
Benzo(g,h,i)perylene	3	10	30%	0.22	0.86	6.80
Benzo(k)fluoranthene	3	10	30%	0.79	1.39	11.60
Chrysene	3	10	30%	0.76	2.71	23.70
Dibenzo(a,h)anthracene	0	10	0%		0.13	
Fluoranthene	3	10	30%	0.93	4.10	34.90
Fluorene	2	10	20%	0.13	0.48	3.77
Indeno(1,2,3-cd)pyrene	3	10	30%	0.23	0.93	7.46
2-Methylnaphthalene	2	10	20%	0.15	0.40	3.01
Naphthalene	2	10	20%	0.65	1.14	9.85
Phenanthrene	3	10	30%	0.28	1.68	14.50
Pyrene	3	10	30%	1.11	2.54	20.10
Adjusted TPH	4	10	40%	32.70	91.96	638.00
Unadjusted TPH	4	10	40%	53.70	115.08	842.00
<i>Inorganics (mg/Kg)</i>						
Arsenic	13	14	93%	0.68	1.33	2.10
Beryllium	0	14	0%		0.41	
Cadmium	0	14	0%		0.39	
Chromium	14	14	100%	6.00	11.24	16.00
Copper	13	14	93%	2.00	14.48	26.00
Lead	16	16	100%	0.76	2.52	15.00
Mercury	0	14	0%		0.29	
Nickel	14	14	100%	5.00	10.91	16.00
Selenium	0	14	0%		1.23	
Silver	0	14	0%		0.12	
Thallium	0	14	0%		0.29	
Zinc	14	14	100%	33.00	61.43	120.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	17	0%		5.10	
Aroclor-1268	0	17	0%		5.10	
Aroclor-1016	0	28	0%		13.29	
Aroclor-1221	0	28	0%		13.29	
Aroclor-1232	0	28	0%		13.29	
Aroclor-1242	0	28	0%		13.29	
Aroclor-1248	0	28	0%		13.29	
Aroclor-1254	20	28	71%	5.96	122.84	892.00
Aroclor-1260	12	28	43%	13.80	51.36	580.00
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	2	18	11%	620.00	321.89	2400.00
Acenaphthylene	2	18	11%	200.00	199.11	610.00
Aniline	0	14	0%		180.00	
Anthracene	2	18	11%	1600.00	476.33	4200.00
Azobenzene	0	14	0%		180.00	
Benzidine	0	14	0%		1800.00	
Benzo(a)anthracene	2	18	11%	1100.00	387.44	3100.00
Benzo(a)pyrene	2	18	11%	620.00	294.11	1900.00
Benzo(b)fluoranthene	2	18	11%	730.00	311.33	2100.00
Benzo(g,h,i)perylene	3	18	17%	108.00	214.61	780.00
Benzo(k)fluoranthene	2	18	11%	620.00	283.00	1700.00
Benzoic acid	0	14	0%		878.57	
Benzyl alcohol	0	14	0%		362.14	
Bis(2-chloroethoxy)methane	0	14	0%		180.00	
Bis(2-chloroethyl)ether	0	14	0%		180.00	
Bis(2-ethylhexyl)phthalate	0	14	0%		180.00	
4-Bromophenyl phenyl ether	0	14	0%		180.00	
Butyl benzyl phthalate	0	14	0%		180.00	
Carbazole	2	17	12%	420.00	237.35	910.00
4-Chloro-3-methylphenol	0	14	0%		362.14	
4-Chloroaniline	0	14	0%		362.14	
Bis(2-chloroisopropyl) ether	0	14	0%		362.14	
2-Chloronaphthalene	0	17	0%		181.18	
2-Chlorophenol	0	14	0%		180.00	
4-Chlorophenyl phenyl ether	0	14	0%		180.00	
Chrysene	2	18	11%	1400.00	409.67	3200.00
Dibenzo(a,h)anthracene	1	18	6%	210.00	175.78	210.00
Dibenzofuran	0	14	0%		180.00	
1,2-Dichlorobenzene	0	2	0%		180.00	
1,3-Dichlorobenzene	0	2	0%		180.00	
1,4-Dichlorobenzene	0	2	0%		180.00	
3,3'-Dichlorobenzidine	0	14	0%		362.14	
2,4-Dichlorophenol	0	14	0%		180.00	
Diethyl phthalate	0	14	0%		180.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.13
 Summary Statistics of Soil Sample Results --
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	Soil Sample Results from TransCanada Shoreline Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds cont. (mg/Kg)</i>						
Dimethyl phthalate	0	14	0%		180.00	
2,4-Dimethylphenol	0	14	0%		180.00	
Di-n-butyl phthalate	0	14	0%		180.00	
2,4-Dinitrophenol	0	14	0%		878.57	
2,4-Dinitrotoluene	0	14	0%		180.00	
2,6-Dinitrotoluene	0	14	0%		180.00	
Di-n-octyl phthalate	0	14	0%		180.00	
Fluoranthene	3	18	17%	87.00	1082.00	13000.00
Fluorene	2	18	11%	970.00	396.89	3400.00
Hexachlorobenzene	0	14	0%		180.00	
Hexachlorobutadiene	0	14	0%		180.00	
Hexachlorocyclopentadiene	0	12	0%		180.00	
Hexachloroethane	0	14	0%		180.00	
Indeno(1,2,3-cd)pyrene	2	18	11%	320.00	216.33	800.00
Isophorone	0	14	0%		180.00	
4,6-Dinitro-2-methylphenol	0	12	0%		875.00	
1-Methylnaphthalene	0	1	0%		69.00	
2-Methylnaphthalene	2	18	11%	550.00	290.22	1900.00
3+4-Methylphenol	0	14	0%		180.00	
2-Methylphenol	0	14	0%		180.00	
Naphthalene	2	18	11%	580.00	319.67	2400.00
2-Nitroaniline	0	14	0%		878.57	
3-Nitroaniline	0	14	0%		878.57	
4-Nitroaniline	0	14	0%		878.57	
Nitrobenzene	0	14	0%		180.00	
2-Nitrophenol	0	14	0%		180.00	
4-Nitrophenol	0	14	0%		878.57	
N-Nitroso-di-n-propylamine	0	14	0%		180.00	
N-Nitrosodiphenylamine	0	14	0%		180.00	
N-Nitrosodimethylamine	0	14	0%		362.14	
Pentachlorophenol	0	14	0%		878.57	
Phenanthrene	2	18	11%	3700.00	1248.56	16000.00
Phenol	0	14	0%		180.00	
Pyrene	2	18	11%	2300.00	809.67	9500.00
1,2,4-Trichlorobenzene	0	2	0%		180.00	
2,4,5-Trichlorophenol	0	14	0%		180.00	
2,4,6-Trichlorophenol	0	14	0%		180.00	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	8	14	57%	2.30	10.89	46.00
TPH-GRO	0	2	0%		1.25	
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	1	2	50%	49.00	332.00	49.00
Acrylonitrile	0	2	0%		17.88	
Allyl Chloride	0	1	0%		2.50	
t-Amyl methyl ether	0	1	0%		30.75	
Benzene	0	2	0%		16.63	
Bromobenzene	0	2	0%		16.63	
Bromochloromethane	0	2	0%		16.63	
Bromodichloromethane	0	2	0%		16.63	
Bromoform	0	2	0%		16.63	
Bromomethane	0	2	0%		34.50	
2-Butanone	1	1	100%	1.40	1.40	1.40
n-Butylbenzene	0	2	0%		16.63	
sec-Butylbenzene	0	2	0%		16.63	
tert-Butylbenzene	0	2	0%		16.63	
Carbon Disulfide	0	2	0%		78.00	
Carbon Tetrachloride	0	2	0%		17.88	
Chlorobenzene	0	2	0%		16.63	
1-Chlorobutane	0	1	0%		2.50	
Chloroethane	0	2	0%		34.50	
2-Chloroethylvinyl Ether	0	1	0%		7.50	
Chloroform	0	2	0%		19.13	
Chloromethane	0	2	0%		32.00	
2-Chlorotoluene	0	2	0%		16.63	
4-Chlorotoluene	0	2	0%		16.63	
1,2-Dibromo-3-Chloropropane	0	2	0%		32.00	
Dibromochloromethane	0	2	0%		16.63	
1,2-Dibromoethane	0	2	0%		16.63	
Dibromomethane	0	2	0%		16.63	
1,2-Dichlorobenzene	0	2	0%		16.63	
1,3-Dichlorobenzene	0	2	0%		16.63	
1,4-Dichlorobenzene	0	2	0%		16.63	
Dichlorodifluoromethane	0	2	0%		32.00	
1,1-Dichloroethane	0	2	0%		16.63	
1,2-Dichloroethane	0	2	0%		16.63	
cis-1,2-Dichloroethene	0	2	0%		16.63	
trans-1,2-Dichloroethene	0	2	0%		16.63	
1,1-Dichloroethene	0	2	0%		16.63	
1,3-Dichloropropane	0	2	0%		16.63	
2,2-Dichloropropane	0	2	0%		16.63	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.13
 Summary Statistics of Soil Sample Results --
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	Soil Sample Results from TransCanada Shoreline Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons cont. (µg/Kg)</i>						
1,2-Dichloropropane	0	2	0%		16.63	
1,1-Dichloropropene	0	2	0%		16.63	
cis-1,3-Dichloropropene	0	2	0%		16.63	
trans-1,3-Dichloropropene	0	2	0%		16.63	
Diethyl Ether	0	2	0%		17.88	
Diisopropyl ether	0	1	0%		30.75	
1,4-Dioxane	0	1	0%		615.00	
Ethyl Methacrylate	0	1	0%		2.50	
Ethylbenzene	0	2	0%		16.63	
Ethyl-t-butyl ether	0	2	0%		16.63	
Hexachlorobutadiene	0	1	0%		30.75	
2-Hexanone	0	2	0%		155.00	
Iodomethane	0	1	0%		2.50	
Isopropylbenzene	0	2	0%		16.63	
4-Isopropyltoluene	2	2	100%	73.00	412.50	752.00
Methacrylonitrile	0	1	0%		2.50	
Methyl Methacrylate	0	1	0%		2.50	
4-Methyl-2-Pentanone	0	2	0%		155.00	
Methylene Chloride	0	2	0%		157.50	
Methyl-t-butyl ether	0	2	0%		19.13	
Naphthalene	1	1	100%	489.00	489.00	489.00
2-Nitropropane	0	1	0%		5.00	
Pentachloroethane	0	1	0%		2.50	
Propionitrile	0	1	0%		25.00	
n-Propylbenzene	0	2	0%		16.63	
Styrene	0	2	0%		16.63	
1,1,1,2-Tetrachloroethane	0	2	0%		16.63	
1,1,2,2-Tetrachloroethane	0	2	0%		16.63	
Tetrachloroethene	0	2	0%		16.63	
Tetrahydrofuran	0	2	0%		156.25	
Toluene	1	2	50%	1.90	16.33	1.90
trans-1,4-Dichloro-2-Butene	0	1	0%		2.50	
1,2,3-Trichlorobenzene	0	2	0%		16.63	
1,2,4-Trichlorobenzene	0	2	0%		16.63	
1,1,1-Trichloroethane	0	2	0%		17.88	
1,1,2-Trichloroethane	0	2	0%		16.63	
Trichloroethene	0	2	0%		16.63	
Trichlorofluoromethane	0	2	0%		16.63	
1,2,3-Trichloropropane	0	2	0%		16.63	
1,1,2-Trichlorotrifluoroethane	0	1	0%		30.75	
1,2,4-Trimethylbenzene	0	2	0%		16.63	
1,3,5-Trimethylbenzene	0	2	0%		16.63	
Vinyl Acetate	0	1	0%		7.50	
Vinyl Chloride	0	2	0%		16.63	
o-Xylene	0	2	0%		16.63	
m+p-Xylenes	1	2	50%	2.70	32.10	2.70
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	1	0%		0.36	
Adjusted C9-C12 Aliphatics	1	1	100%	3.91	3.91	3.91
Unadjusted C5-C8 Aliphatics	1	1	100%	0.70	0.70	0.70
Unadjusted C9-C12 Aliphatics	1	1	100%	9.16	9.16	9.16
Adjusted C9-C10 Aromatics	1	1	100%	5.25	5.25	5.25
Benzene	0	1	0%		0.024	
Ethylbenzene	0	1	0%		0.024	
Methyl-t-butyl ether	0	1	0%		0.024	
Naphthalene	1	1	100%	0.24	0.24	0.24
Toluene	0	1	0%		0.024	
o-Xylene	0	1	0%		0.024	
m+p-Xylenes	1	1	100%	0.042	0.042	0.042

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.1.14
 Soil Sample Results - EPHs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-07	FD001-011205-1	SB105M-0203F	SB105M-0304F	SB105M-0405F	SB105M-0608F	SB105M-0709F	SB105M-0810F	SB-RRBed-01-0003F
Upper Depth (in.)			96	24	36	48	72	84	96	0
Lower Depth (in.)			120	36	48	60	96	108	120	36
Date Sampled	MCP S-1	9/7/2006	1/12/2005	4/25/2005	4/25/2005	4/25/2005	1/12/2005	1/12/2005	1/12/2005	6/6/2006
EPH (mg/Kg)										
Acenaphthene		0.159 U		0.379 U	3.85	0.375 U				0.157 U
Acenaphthylene		0.159 U		0.379 U	0.817 U	0.375 U				0.157 U
Unadjusted C9-C18 Aliphatics	1000	44.6 J	6.8 U	30.6 U	180	30.3 U	7.09 U	37.9 U	7.41 U	31.6 U
Anthracene		0.159 U		0.379 U	3.67	0.375 U				0.157 U
Adjusted C11-C22 Aromatics		31.9								31.6 U
Unadjusted C11-C22 Aromatics	800	31.9	6.8 U	30.6 U	647	53.7	7.09 U	382	7.41 U	31.6 U
Benzo(a)anthracene		0.159 U		0.379 U	17.3	2.26				0.157 U
Benzo(a)pyrene		0.159 U		0.379 U	11.2	1.52				0.157 U
Benzo(b)fluoranthene		0.159 U		0.379 U	30	2.56				0.157 U
Benzo(g,h,i)perylene		0.159 U		0.379 U	6.8	0.945				0.157 U
Benzo(k)fluoranthene		0.159 U		0.379 U	11.6	0.824				0.157 U
Chrysene		0.159 U		0.379 U	23.7	1.99				0.157 U
Fluoranthene		0.159 U		0.379 U	34.9	4.51				0.157 U
Fluorene		0.159 U		0.379 U	3.77	0.375 U				0.157 U
Indeno(1,2,3-cd)pyrene		0.159 U		0.379 U	7.46	0.934				0.157 U
2-Methylnaphthalene		0.159 U		0.379 U	3.01	0.375 U				0.157 U
Naphthalene		0.159 UJ		0.379 U	9.85	0.375 U				0.157 U
Phenanthrene		0.159 U		0.379 U	14.5	1.34				0.157 U
Pyrene		0.159 U		0.379 U	20.1	3.54				0.157 U
Adjusted TPH		96.6		30.6 U	638	32.7				31.6 U
Unadjusted TPH		96.6		30.6 U	842	53.7				31.6 U

Appendix Table A.1.14
 Soil Sample Results - EPHs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB-RRBed-01-0407F	SB-RRBed-01-0708F	SB-RRBed-105-0003F	SB-RRBed-105-0710F	TP-RRBed-0809F
Upper Depth (in.)		48	84	0	84	96
Lower Depth (in.)		84	96	36	120	108
Date Sampled	MCP S-1	6/6/2006	6/6/2006	6/6/2006	6/6/2006	6/6/2006
EPH (mg/Kg)						
Acenaphthene		0.155 J	0.16 U	0.141 U	0.149 U	0.205 U
Acenaphthylene		0.0281 J	0.16 U	0.141 U	0.149 U	0.205 U
Unadjusted C9-C18 Aliphatics	1000	31.3 U	32.1 U	28.4 U	29.9 U	41.1 U
Anthracene		0.1 J	0.16 U	0.141 U	0.149 U	0.205 U
Adjusted C11-C22 Aromatics		31.3 U	32.1 U	28.4 U	29.9 U	41.1 U
Unadjusted C11-C22 Aromatics	800	31.3 U	32.1 U	28.4 U	29.9 U	41.1 U
Benzo(a)anthracene		0.345	0.16 U	0.141 U	0.149 U	0.205 U
Benzo(a)pyrene		0.33	0.16 U	0.141 U	0.149 U	0.205 U
Benzo(b)fluoranthene		0.544	0.16 U	0.141 U	0.149 U	0.205 U
Benzo(g,h,i)perylene		0.219	0.16 U	0.141 U	0.149 U	0.205 U
Benzo(k)fluoranthene		0.786	0.16 U	0.141 U	0.149 U	0.205 U
Chrysene		0.758	0.16 U	0.141 U	0.149 U	0.205 U
Fluoranthene		0.933	0.16 U	0.141 U	0.149 U	0.205 U
Fluorene		0.133 J	0.16 U	0.141 U	0.149 U	0.205 U
Indeno(1,2,3-cd)pyrene		0.228	0.16 U	0.141 U	0.149 U	0.205 U
2-Methylnaphthalene		0.153 J	0.16 U	0.141 U	0.149 U	0.205 U
Naphthalene		0.652	0.16 U	0.141 U	0.149 U	0.205 U
Phenanthrene		0.278	0.16 U	0.141 U	0.149 U	0.205 U
Pyrene		1.11	0.16 U	0.141 U	0.149 U	0.205 U
Adjusted TPH		55.4	32.1 U	28.4 U	29.9 U	41.1 U
Unadjusted TPH		61.6	32.1 U	28.4 U	29.9 U	41.1 U

Appendix Table A.1.14
 Soil Sample Results - Inorganics
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB0310006I	SB0310102F	SB1060006I	SB1060102F	SB1070006I	SB1070102F	SB1080006I	SB1080203F	SB1090006I	SB1090102F
Upper Depth (in.)		0	12	0	12	0	12	0	24	0	12
Lower Depth (in.)		6	24	6	24	6	24	6	36	6	24
Date Sampled	MCP S-1	10/22/2003	10/22/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/20/2003	10/20/2003
Inorganics (mg/Kg)											
Arsenic	20	1.2	0.22 U	1.9 J	2 J	1.9 J	1.4 J	0.68 J	0.94 J	1.2 J	1.3 J
Chromium	30	9.5	9.7	12	15	13	13	9.7	16	6	11
Copper		2	1.5 U	19	19	16	16	11	15	12	26
Lead	300	2 J	0.76 J	2.8 J	1.7 J	3.3 J	1.5 J	1.2 J	1.2 J	1.2 J	1 J
Nickel	20	5.7	5	12	14	15	16	10	14	7.8	12
Zinc	2500	54	79	65	59	120	51	60	62	64	56

Appendix Table A.1.14
 Soil Sample Results - Inorganics
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB1100006I	SB1100102F	SB1120006I	SB1120102F	SBG 105R	YRDTS-001
Upper Depth (in.)		0	12	0	12		0
Lower Depth (in.)		6	24	6	24		2
Date Sampled	MCP S-1	10/20/2003	10/20/2003	10/20/2003	10/20/2003	6/27/2006	10/18/2000
Inorganics (mg/Kg)							
Arsenic	20	1.1 J	1.3 J	2.1 J	1.5 J		
Chromium	30	8.5	12	11	11		
Copper		23	16	12	15		
Lead	300	1.8 J	1.3 J	0.97 J	1 J	3.57 J	15
Nickel	20	9.7	12	9.6	9.9		
Zinc	2500	64	54	39	33		

Appendix Table A.1.14
 Soil Sample Results - PCBs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB0310006I	SB1060006I	SB1070006I	SB1080006I	SB1090006I	SB1090102F	SB1100006I	SB1120006I	SB607-0003I	FD001-060805
Upper Depth (in.)		0	0	0	0	0	12	0	0	0	0
Lower Depth (in.)		6	6	6	6	6	24	6	6	3	3
Date Sampled	MCP S-1	10/22/2003	10/21/2003	10/21/2003	10/21/2003	10/20/2003	10/20/2003	10/20/2003	10/20/2003	6/8/2005	6/8/2005
PCBs (µg/Kg)											
Aroclor-1254	2000	180	150	84	36 U	36 U	36 U	94	36 U	5.96 J	186
Aroclor-1260	2000	43 U	40 U	36 U	36 U	36 U	36 U	36 U	36 U	9.94 U	78.4

Appendix Table A.1.14
 Soil Sample Results - PCBs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB608-0003I	SB609-0003I	SB610-0003I	SB611-0003I	SB695-0003I	FD001-051405	SB702-0003I	SB703-0003I	SB709-003I	SB710-003I	SB711-003I	SB712-003I	SB715-003I
Upper Depth (in.)		0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)		3	3	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	MCP S-1	6/8/2005	6/8/2005	6/8/2005	6/8/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005	5/14/2005
PCBs (µg/Kg)														
Aroclor-1254	2000	166	9.94 U	33.8	96.6	78.1	26.8 J	98.8 J	449	55.5	103	52.3	63.9	10 U
Aroclor-1260	2000	59.4	9.94 U	78.4	35.9	10.2 U	9.74 UJ	20 J	75.4	13.8	15	9.96 U	9.99 U	10 U

Appendix Table A.1.14
 Soil Sample Results - PCBs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB716-003I	SB717R-0003I	SB718-0003I	SD600R5-0003I	YRDTS-001	YRDTS-051A 0-2 in	YRDTS-051B 2-4 in
Upper Depth (in.)		0	0	0	0	0	0	2
Lower Depth (in.)		3	3	3	3	2	2	4
Date Sampled	MCP S-1	5/14/2005	9/28/2005	5/14/2005	8/3/2006	10/18/2000	11/11/2002	11/11/2002
PCBs (µg/Kg)								
Aroclor-1254	2000	90.6	892	103	346	200 U	97	36 U
Aroclor-1260	2000	22	170	14.4	56.4	200 U	36 U	580

Appendix Table A.1.14
 Soil Sample Results - SVOCs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB105-J0006I	SB105-J0102F	SB105-J2-0103F	FD001-011205-2	SB105M-0608F	SB105M-0709F	SB105M-0810F	SB-105-T 01F	SB-105-T 02F	SB-105-T 03F
Upper Depth (in.)		0	12	12	84	72	84	96	0	0	0
Lower Depth (in.)		6	24	36	108	96	108	120	12	24	36
Date Sampled	MCP S-1	7/12/2004	7/12/2004	6/22/2005	1/12/2005	1/12/2005	1/12/2005	1/12/2005	1/5/2005	1/5/2005	1/5/2005
SVOC (µg/Kg)											
Acenaphthene	1000000	350 U	340 U	138 U	11000	370 U	2400	620	380 U	370 U	370 U
Acenaphthylene	100000	350 U	340 U	138 U	2600	370 U	610	200 J	380 U	370 U	370 U
Anthracene	1000000	350 U	340 U	138 U	23000	370 U	4200	1600	380 U	370 U	370 U
Benzo(a)anthracene	7000	350 U	340 U	138 U	16000	370 U	3100	1100	380 U	370 U	370 U
Benzo(a)pyrene	2000	350 U	340 U	138 U	8400	370 U	1900	620	380 U	370 U	370 U
Benzo(b)fluoranthene	7000	350 U	340 U	138 U	8600	370 U	2100	730	380 U	370 U	370 U
Benzo(g,h,i)perylene	1000000	350 U	340 U	108 J	3300	370 U	780	270 J	380 U	370 U	370 U
Benzo(k)fluoranthene	70000	350 U	340 U	138 U	8100	370 U	1700	620	380 U	370 U	370 U
Carbazole		350 U	340 U		4700	370 U	910	420	380 U	370 U	370 U
Chrysene	7000	350 U	340 U	138 U	18000	370 U	3200	1400	380 U	370 U	370 U
Dibenzo(a,h)anthracene	700	350 U	340 U	138 U	1400	370 U	210 J	360 U	380 U	370 U	370 U
Fluoranthene	1000000	350 U	340 U	138 U	47000	370 U	13000	3800	380 U	370 U	87 J
Fluorene	1000000	350 U	340 U	138 U	16000	370 U	3400	970	380 U	370 U	370 U
Indeno(1,2,3-cd)pyrene	7000	350 U	340 U	138 U	3400	370 U	800	320 J	380 U	370 U	370 U
2-Methylnaphthalene	500000	350 U	340 U	138 U	10000	370 U	1900	550	380 U	370 U	370 U
Naphthalene	500000	350 U	340 U	138 U	17000	370 U	2400	580	380 U	370 U	370 U
Phenanthrene	1000000	350 U	340 U	138 U	58000	370 U	16000	3700	380 U	370 U	370 U
Pyrene	1000000	350 U	340 U	138 U	39000	370 U	9500	2300	380 U	370 U	370 U

> MCP S-1

Appendix Table A.1.14
 Soil Sample Results - SVOCs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB-105-T 04F	SB-105-T 05F	SB-105-U 01F	SB-105-U 02F	SB-105-U 03F	SB-105-U 04F	SB-105-U 05F	SB1090006I	SB1090102F
Upper Depth (in.)		0	0	0	0	0	0	0	0	12
Lower Depth (in.)		48	60	12	24	36	48	60	6	24
Date Sampled	MCP S-1	1/5/2005	1/5/2005	1/5/2005	1/5/2005	1/5/2005	1/5/2005	1/5/2005	10/20/2003	10/20/2003
SVOC (µg/Kg)										
Acenaphthene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Acenaphthylene	100000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Anthracene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Benzo(a)anthracene	7000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Benzo(a)pyrene	2000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Benzo(b)fluoranthene	7000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Benzo(g,h,i)perylene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Benzo(k)fluoranthene	70000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Carbazole		350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Chrysene	7000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Dibenzo(a,h)anthracene	700	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Fluoranthene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Fluorene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Indeno(1,2,3-cd)pyrene	7000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
2-Methylnaphthalene	500000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Naphthalene	500000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Phenanthrene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U
Pyrene	1000000	350 U	360 U	370 U	350 U	350 U	370 U	360 U	360 U	360 U

> MCP S-1

Appendix Table A.1.14
 Soil Sample Results - TPHs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB0310006I	SB0310102F	SB1060006I	SB1060102F	SB1070006I	SB1070102F	SB1080006I	SB1080203F	SB1090006I
Upper Depth (in.)		0	12	0	12	0	12	0	24	0
Lower Depth (in.)		6	24	6	24	6	24	6	36	6
Date Sampled	MCP S-1	10/22/2003	10/22/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/21/2003	10/20/2003
TPH (mg/Kg)										
TPH-DRO	800	39	26	12 U	12 U	46 J	2.2 U	3.4	2.2 U	4.6

Appendix Table A.1.14
 Soil Sample Results - TPHs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB1090102F	SB1100006I	SB1100102F	SB1120006I	SB1120102F
Upper Depth (in.)		12	0	12	0	12
Lower Depth (in.)		24	6	24	6	24
Date Sampled	MCP S-1	10/20/2003	10/20/2003	10/20/2003	10/20/2003	10/20/2003
TPH (mg/Kg)						
TPH-DRO	800	2.2 U	12	2.8	2.3	2.2 U

Appendix Table A.1.14
 Soil Sample Results - VOCs
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		SB105-J0006I	SB-RRBed-01-0407F
Upper Depth (in.)		0	48
Lower Depth (in.)		6	84
Date Sampled	MCP S-1	7/12/2004	6/6/2006
VOC (µg/Kg)			
Acetone	500000	49 B	1230 UJ
2-Butanone	500000	1.4 J	R
4-Isopropyltoluene		73	752 J
Naphthalene	500000		489
Toluene	500000	1.9 JB	61.5 U
m+p-Xylenes		2.7 J,B	123 U

Appendix Table A.1.14
 Soil Sample Results - VPH
 TransCanada Shoreline Study Area
 YNPS Rowe, MA

Sample ID		EX-BARK-08
Date Sampled	MCP S-1	9/7/2006
VPH (mg/Kg)		
Adjusted C9-C12 Aliphatics		3.91
Unadjusted C5-C8 Aliphatics	100	0.7 J
Unadjusted C9-C12 Aliphatics	1000	9.16
Adjusted C9-C10 Aromatics	100	5.25
Naphthalene		0.241
m+p-Xylenes		0.0422 J

Appendix Table A.2.1
 Summary Statistics of All Sediment Sample Results -
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	6	0%		0.11	
Acenaphthylene	4	6	67%	0.092	0.12	0.17
Unadjusted C19-C36 Aliphatics	0	6	0%		21.11	
Unadjusted C9-C18 Aliphatics	0	6	0%		21.11	
Anthracene	2	6	33%	0.064	0.088	0.082
Adjusted C11-C22 Aromatics	0	6	0%		21.11	
Unadjusted C11-C22 Aromatics	0	6	0%		21.11	
Benzo(a)anthracene	1	6	17%	0.085	0.100	0.085
Benzo(a)pyrene	2	6	33%	0.063	0.093	0.11
Benzo(b)fluoranthene	4	6	67%	0.020	0.058	0.073
Benzo(g,h,i)perylene	1	6	17%	0.080	0.099	0.080
Benzo(k)fluoranthene	1	6	17%	0.13	0.11	0.13
Chrysene	3	6	50%	0.031	0.091	0.15
Dibenzo(a,h)anthracene	0	6	0%		0.11	
Fluoranthene	3	6	50%	0.039	0.13	0.32
Fluorene	0	6	0%		0.11	
Indeno(1,2,3-cd)pyrene	1	6	17%	0.066	0.097	0.066
2-Methylnaphthalene	0	6	0%		0.11	
Naphthalene	0	6	0%		0.11	
Phenanthrene	2	6	33%	0.080	0.091	0.084
Pyrene	2	6	33%	0.160	0.134	0.265
Adjusted TPH	0	6	0%		21.11	
Unadjusted TPH	0	6	0%		21.11	
<i>Inorganics (mg/Kg)</i>						
Antimony	0	6	0%		0.31	
Arsenic	5	12	42%	1.60	1.11	2.80
Beryllium	6	12	50%	0.15	0.49	0.36
Boron	6	6	100%	2.30	2.98	4.91
Cadmium	6	12	50%	0.17	0.51	0.63
Chromium	12	12	100%	3.77	9.95	21.00
Copper	12	12	100%	4.38	19.18	45.00
Hexavalent Chromium	0	6	0%		2.17	
Lead	12	12	100%	0.65	5.20	19.60
Lithium	6	6	100%	4.71	6.72	12.10
Mercury	6	12	50%	0.04	0.06	0.21
Nickel	12	12	100%	2.81	12.14	28.00
Selenium	2	11	18%	3.90	1.89	4.90
Silver	1	12	8%	0.40	0.45	0.40
Thallium	0	12	0%		0.75	
Uranium	10	12	83%	1.30	1.56	2.90
Zinc	12	12	100%	23.60	108.39	270.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	6	0%		5.42	
Aroclor-1268	0	6	0%		5.42	
Aroclor-1016	0	24	0%		75.98	
Aroclor-1221	0	24	0%		75.98	
Aroclor-1232	0	24	0%		75.98	
Aroclor-1242	0	24	0%		75.98	
Aroclor-1248	0	24	0%		75.98	
Aroclor-1254	0	24	0%		75.98	
Aroclor-1260	1	24	4%	6.97	76.04	6.97

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.1
 Summary Statistics of All Sediment Sample Results -
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	1	12	8%	21.50	252.75	21.50
Acenaphthylene	1	12	8%	59.10	255.88	59.10
Aniline	0	12	0%		263.67	
Anthracene	3	12	25%	16.10	230.20	124.00
Atrazine	0	6	0%		169.00	
Azobenzene	0	12	0%		263.67	
Benzidine	0	6	0%		3583.33	
Benzo(a)anthracene	7	12	58%	19.50	170.73	200.00
Benzo(a)pyrene	6	12	50%	13.60	196.62	230.00
Benzo(b)fluoranthene	2	12	17%	220.00	251.63	268.00
Benzo(g,h,i)perylene	3	12	25%	13.90	228.38	101.00
Benzo(k)fluoranthene	6	12	50%	13.60	190.36	220.00
Benzoic acid	0	12	0%		947.00	
Benzyl alcohol	0	12	0%		445.33	
Bis(2-chloroethoxy)methane	0	12	0%		263.67	
Bis(2-chloroethyl)ether	0	12	0%		263.67	
Bis(2-ethylhexyl)phthalate	0	12	0%		263.67	
4-Bromophenyl phenyl ether	0	12	0%		263.67	
Butyl benzyl phthalate	0	12	0%		263.67	
Carbazole	1	12	8%	80.00	257.63	80.00
4-Chloro-3-methylphenol	0	12	0%		445.33	
4-Chloroaniline	0	12	0%		445.33	
Bis(2-chloroisopropyl) ether	0	12	0%		445.33	
2-Chloronaphthalene	0	12	0%		263.67	
2-Chlorophenol	0	12	0%		263.67	
4-Chlorophenyl phenyl ether	0	12	0%		263.67	
Chrysene	8	12	67%	19.30	168.19	273.00
3+4-Methylphenol	2	12	17%	12.30	234.07	230.00
Dibenzo(a,h)anthracene	1	12	8%	24.60	253.01	24.60
Dibenzofuran	1	12	8%	36.30	253.98	36.30
1,2-Dichlorobenzene	0	12	0%		263.67	
1,3-Dichlorobenzene	0	12	0%		263.67	
1,4-Dichlorobenzene	0	12	0%		263.67	
3,3'-Dichlorobenzidine	0	12	0%		445.33	
2,4-Dichlorophenol	0	12	0%		263.67	
Diethyl phthalate	0	12	0%		263.67	
Dimethyl phthalate	0	12	0%		263.67	
2,4-Dimethylphenol	0	12	0%		263.67	
Di-n-butyl phthalate	1	12	8%	20.90	252.70	20.90
2,4-Dinitrophenol	0	12	0%		947.00	
2,4-Dinitrotoluene	0	12	0%		263.67	
2,6-Dinitrotoluene	0	12	0%		263.67	
Di-n-octyl phthalate	3	12	25%	14.80	221.46	37.40
Fluoranthene	10	12	83%	15.40	236.59	651.00
Fluorene	1	12	8%	48.60	255.01	48.60
Hexachlorobenzene	0	12	0%		263.67	
Hexachlorobutadiene	0	12	0%		263.67	
Hexachlorocyclopentadiene	0	12	0%		263.67	
Hexachloroethane	0	12	0%		263.67	
Indeno(1,2,3-cd)pyrene	3	12	25%	13.90	228.80	106.00
Isophorone	0	12	0%		263.67	
4,6-Dinitro-2-methylphenol	0	12	0%		947.00	
1-Methylnaphthalene	1	6	17%	35.10	149.43	35.10
2-Methylnaphthalene	1	12	8%	20.90	252.70	20.90
2-Methylphenol	1	12	8%	150.00	249.92	150.00
Naphthalene	0	12	0%		263.67	
2-Nitroaniline	0	12	0%		947.00	
3-Nitroaniline	0	12	0%		947.00	
4-Nitroaniline	0	12	0%		1200.42	
Nitrobenzene	0	12	0%		263.67	
2-Nitrophenol	0	12	0%		263.67	
4-Nitrophenol	0	12	0%		1200.42	
N-Nitroso-di-n-propylamine	0	12	0%		263.67	
N-Nitrosodiphenylamine	0	12	0%		263.67	
N-Nitrosodimethylamine	0	12	0%		445.33	
Pentachlorophenol	0	12	0%		1200.42	
Phenanthrene	6	12	50%	16.40	262.74	777.00
Phenol	0	12	0%		263.67	
Pyrene	9	12	75%	28.40	226.97	592.00
Pyridine	0	6	0%		169.00	
1,2,4-Trichlorobenzene	0	12	0%		263.67	
2,4,5-Trichlorophenol	0	12	0%		263.67	
2,4,6-Trichlorophenol	0	12	0%		263.67	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.1
Summary Statistics of All Sediment Sample Results -
Background Area
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	5	6	83%	19.00	31.75	80.00
TPH-GRO	0	6	0%		1.79	
<i>Volatile Organic Carbons (μg/Kg)</i>						
Acetone	6	12	50%	42.00	220.33	943.00
Acrylonitrile	0	12	0%		9.43	
Allyl Chloride	0	6	0%		3.67	
Benzene	0	12	0%		7.55	
Bromobenzene	0	12	0%		7.55	
Bromochloromethane	0	12	0%		7.55	
Bromodichloromethane	0	12	0%		7.55	
Bromoform	0	12	0%		7.55	
Bromomethane	0	12	0%		16.98	
2-Butanone	6	7	86%	11.00	37.69	91.30
n-Butylbenzene	0	12	0%		7.55	
sec-Butylbenzene	0	12	0%		7.55	
tert-Butylbenzene	0	12	0%		7.55	
Carbon Disulfide	0	12	0%		30.40	
Carbon Tetrachloride	0	12	0%		9.43	
Chlorobenzene	0	12	0%		7.55	
1-Chlorobutane	0	6	0%		3.67	
Chloroethane	0	12	0%		16.98	
2-Chloroethylvinyl Ether	0	1	0%		10.50	
Chloroform	0	12	0%		11.26	
Chloromethane	0	12	0%		13.27	
2-Chlorotoluene	0	12	0%		7.55	
4-Chlorotoluene	0	12	0%		7.55	
1,2-Dibromo-3-Chloropropane	0	12	0%		13.27	
Dibromochloromethane	0	12	0%		7.55	
1,2-Dibromoethane	0	12	0%		7.55	
Dibromomethane	0	12	0%		7.55	
1,2-Dichlorobenzene	0	12	0%		7.55	
1,3-Dichlorobenzene	0	12	0%		7.55	
1,4-Dichlorobenzene	0	12	0%		7.55	
Dichlorodifluoromethane	0	12	0%		13.27	
1,1-Dichloroethane	0	12	0%		7.55	
1,2-Dichloroethane	0	12	0%		7.55	
cis-1,2-Dichloroethene	0	12	0%		7.55	
trans-1,2-Dichloroethene	0	12	0%		7.55	
1,1-Dichloroethene	5	12	42%	15.00	14.51	24.00
1,3-Dichloropropane	0	12	0%		7.55	
2,2-Dichloropropane	0	12	0%		7.55	
1,2-Dichloropropane	0	12	0%		7.55	
1,1-Dichloropropene	0	12	0%		7.55	
cis-1,3-Dichloropropene	0	12	0%		7.55	
trans-1,3-Dichloropropene	0	12	0%		7.55	
Diethyl Ether	0	12	0%		9.43	
Diisopropyl ether	0	6	0%		11.43	
Dimethyl sulfide	1	1	100%	43.50	43.50	43.50
Ethyl Methacrylate	0	6	0%		3.67	
Ethylbenzene	0	12	0%		7.55	
Ethyl-t-butyl ether	0	6	0%		11.43	
Hexachlorobutadiene	0	12	0%		7.55	
Hexachloroethane	0	6	0%		3.67	
2-Hexanone	0	12	0%		59.02	
Iodomethane	0	5	0%		3.70	
Isopropylbenzene	0	12	0%		7.55	
4-Isopropyltoluene	0	12	0%		7.55	
Methacrylonitrile	0	6	0%		3.67	
Methyl Methacrylate	0	6	0%		3.67	
4-Methyl-2-Pentanone	0	12	0%		7.55	
Methylene Chloride	0	12	0%		62.73	
Methyl-t-butyl ether	0	12	0%		11.26	
Naphthalene	0	12	0%		7.55	
Nitrobenzene	0	6	0%		18.50	
2-Nitropropane	0	6	0%		7.42	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.2.1
 Summary Statistics of All Sediment Sample Results -
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (mg/Kg) cont.</i>						
Pentachloroethane	0	6	0%		3.67	
Propionitrile	0	6	0%		36.67	
n-Propylbenzene	0	12	0%		7.55	
Styrene	0	12	0%		7.55	
1,1,1,2-Tetrachloroethane	0	12	0%		7.55	
1,1,2,2-Tetrachloroethane	0	12	0%		7.55	
Tetrachloroethene	0	12	0%		7.55	
Tetrahydrofuran	0	12	0%		60.89	
Toluene	6	12	50%	12.00	16.13	31.00
trans-1,4-Dichloro-2-Butene	0	6	0%		3.67	
1,2,3-Trichlorobenzene	0	12	0%		7.55	
1,2,4-Trichlorobenzene	0	12	0%		7.55	
1,1,1-Trichloroethane	0	12	0%		9.43	
1,1,2-Trichloroethane	0	12	0%		7.55	
Trichloroethene	0	12	0%		7.55	
Trichlorofluoromethane	0	12	0%		7.55	
1,2,3-Trichloropropane	0	12	0%		7.55	
1,1,2-Trichlorotrifluoroethane	0	6	0%		11.43	
1,2,4-Trimethylbenzene	0	12	0%		7.55	
1,3,5-Trimethylbenzene	0	12	0%		7.55	
<i>Volatile Organic Carbons (μg/Kg) cont.</i>						
Vinyl Acetate	0	1	0%		10.50	
Vinyl Chloride	0	12	0%		7.55	
o-Xylene	0	12	0%		7.55	
m+p-Xylenes	0	12	0%		13.27	
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	5	0%		0.356	
Adjusted C9-C12 Aliphatics	2	5	40%	0.044	0.12	0.18
Unadjusted C5-C8 Aliphatics	5	5	100%	0.24	0.60	1.27
Unadjusted C9-C12 Aliphatics	5	5	100%	0.13	0.26	0.45
Adjusted C9-C10 Aromatics	1	5	20%	0.35	0.15	0.35
Benzene	0	5	0%		0.024	
Ethylbenzene	1	5	20%	0.064	0.027	0.064
Methyl-t-butyl ether	0	5	0%		0.024	
Naphthalene	1	5	20%	0.060	0.027	0.060
Toluene	1	5	20%	0.056	0.026	0.056
o-Xylene	0	5	0%		0.024	
m+p-Xylenes	1	5	20%	0.108	0.051	0.108
<i>Wet Chemistry (mg/Kg)</i>						
Total Organic Carbon	2	2	100%	1630.000	12265.000	22,900.000

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.2
 Sediment Sample Results - EPH
 Background Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-407	SD-FD-003-060206	SD-408	SD-409	SD-410	SD-411	SD-412
Date Sampled	Screening Benchmark	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
EPH (mg/Kg)								
Acenaphthylene	0.15	0.188 U	0.194 U	0.228 U	0.112 J	0.115 J	0.166 J	0.0921 J
Anthracene	0.0572	0.188 U	0.194 U	0.0639 J	0.219 U	0.195 U	0.0815 J	0.161 U
Benzo(a)anthracene	0.11	0.188 U	0.194 U	0.0845 J	0.219 U	0.195 U	0.271 U	0.161 U
Benzo(a)pyrene	0.15	0.188 U	0.194 U	0.112 J	0.219 U	0.195 U	0.0625 J	0.161 U
Benzo(b)fluoranthene	0.037	0.188 U	0.194 U	0.073 J	0.0197 J	0.0254 J	0.057 J	0.161 U
Benzo(g,h,i)perylene	0.15	0.188 U	0.194 U	0.0799 J	0.219 U	0.195 U	0.271 U	0.161 U
Benzo(k)fluoranthene	0.037	0.188 U	0.194 U	0.13 J	0.219 U	0.195 U	0.271 U	0.161 U
Chrysene	0.17	0.188 UJ	0.0136 J	0.148 J	0.219 U	0.0313 J	0.0815 J	0.161 U
Fluoranthene	0.423	0.188 U	0.194 U	0.317	0.219 U	0.0391 J	0.16 J	0.161 U
Indeno(1,2,3-cd)pyrene	0.03	0.188 U	0.194 U	0.0662 J	0.219 U	0.195 U	0.271 U	0.161 U
Phenanthrene	0.204	0.188 U	0.194 U	0.0799 J	0.219 U	0.195 U	0.0842 J	0.161 U
Pyrene	0.2	0.188 U	0.194 U	0.265	0.219 U	0.195 U	0.16 J	0.161 U

> Sediment Screen

Appendix Table A.2.2
Sediment Sample Results - Inorganics
Background Area
YNPS Rowe, MA

Sample ID		SD-401-00-04-I	SD-402-00-04-I	SD-403-00-04-I	SD-404-00-04-I	SD-405-00-04-I	SD-406-00-04-I	SD-407	SD-407-REP	SD-FD-003-060206	SD-FD-003-060206-REP
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0				
Lower Depth (in.)	Screening	4	4	4	4	4	4				
Date Sampled	Benchmark	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	6/2/2006	6/2/2006	6/2/2006	6/2/2006
Inorganics (mg/Kg)											
Arsenic	33	1.6	2 J	0.21 UJ	1.7 J	2.8	1.6	0.78 U		1.14 U	
Beryllium		1.3 U	1.9 U	0.96 U	1.7 U	2.1 U	1.4 U	0.146 J		0.118 J	
Boron								2.54		2.34	
Cadmium	5	1.3 U	1.8 U	0.91 U	1.6 U	2 U	1.3 U	0.225 J		0.212 J	
Chromium	110	9.8	19	4.5	17	21	16	5.44		4.78	
Copper	150	21	37	6.4	35	45	42	4.38		4.4	
Lead	130	2.7 J	2.8 J	0.65 J	2.8 J	5.2 J	2.7 J	3.68		3.96	
Lithium								6.36		4.46	
Mercury	0.18	0.072	0.1	0.03 U	0.11	0.21	0.071	0.0603 U		0.0591 U	
Nickel	49	11	25	12	20	28	23	4.98		6.32	
Selenium	0.1	3.9 J	5.7 UJ	2.8 UJ	4.9 J	UJ	4.1 UJ	1.68 U		1.77 U	
Silver	4.5	0.4 J	0.58 UJ	0.29 UJ	0.5 UJ	0.64 UJ	0.42 UJ	1.12 U		1.18 U	
Uranium								1.5	1.3	1.6	1.5
Zinc	460	130	270	49	170	250	200	33		29.1	

>SD Benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blanks indicate not analyzed

Appendix Table A.2.2
 Sediment Sample Results - Inorganics
 Background Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-408	SD-408-REP	SD-409	SD-409-REP	SD-410	SD-410-REP	SD-411	SD-411-REP	SD-412	SD-412-REP
Upper Depth (in.)	Screening										
Lower Depth (in.)	Benchmark	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
Date Sampled											
Inorganics (mg/Kg)											
Arsenic	33	1.22 U		0.95 U		0.977 U		1.83 U		1.19 U	
Beryllium		0.201 J		0.146 J		0.145 J		0.358		0.163 J	
Boron		2.66		2.76		2.71		4.91		2.3	
Cadmium	5	0.252 J		0.207 J		0.223 J		0.633		0.168 J	
Chromium	110	4.47		3.77		4.35		10		4.08	
Copper	150	6.58		5.52		5		15.9		6.33	
Lead	130	6.8		5.89		4.73		19.6		4.9	
Lithium		5.51		4.71		5.37		12.1		6.26	
Mercury	0.18	0.0673 U		0.0642 U		0.0646 U		0.043 J		0.0545 U	
Nickel	49	3.93		2.81		3.09		8.51		3.41	
Selenium	0.1	1.94 U		1.83 U		1.81 U		2.5 U		1.58 U	
Silver	4.5	1.29 U		1.22 U		1.21 U		1.67 U		1.05 U	
Uranium		1.28 U	1.16 U	1.6	2.9	1.6	1.9	2.2	1.7	1.5	1.3
Zinc	460	35.7		30.7		30.7		78		23.6	

>SD Benchmark

Appendix Table A.2.2
 Sediment Sample Results - PCB
 Background Area
 YNPS Rowe, MA

Sample ID		SD-401-00-04-I	SD-402-00-04-I	SD-403-00-04-I	SD-404-00-04-I	SD-405-00-04-I	SD-406-00-04-I	SD-407	SD-408	SD-409	SD-410	SD-411	SD-412
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0						
Lower Depth (in.)	Screening	4	4	4	4	4	4						
Date Sampled	Benchmark	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
PCBs (µg/Kg)													
Aroclor-1260	60	59 U	89 U	43 U	76 U	1900 UJ	1300 UJ	9.91 U	10.9 UJ	6.97 J	11.2 UJ	11.4 UJ	10.4 U

Appendix Table A.2.2
 Sediment Sample Results - PCB
 Background Area
 YNPS Rowe, MA

Sample ID		SH 1A 0-2in	SH 1B 2-4in	SH 2A 0-2in	SH 2B 2-4in	SH 3A 0-2in	SH 3B 0-2in	SN 1A 0-2in	SN 1B 2-4in	SN 2A 0-2in	SN 2B 2-4in	SN 3A 0-2in	SN 3B 2-4in
Upper Depth (in.)	Sediment (SD)	0	2	0	2	0	0	0	2	0	2	0	2
Lower Depth (in.)	Screening	2	4	2	4	2	2	2	4	2	4	2	4
Date Sampled	Benchmark	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002	11/13/2002
PCBs (µg/Kg)													
Aroclor-1260	60	11 U	11 U	9.9 U	9.2 U	11 U	11 U	9.9 UJ	7.9 U	8.6 U	7.9 U	9.2 U	8.6 U

Appendix Table A.2.2
Sediment Sample Results - SVOC
Background Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-401-00-04-I	SD-402-00-04-I	SD-403-00-04-I	SD-404-00-04-I	SD-405-00-04-I	SD-406-00-04-I	SD-407	SD-FD-003-060206	SD-408	SD-409	SD-410	SD-411	SD-412
Upper Depth (in.)	Screening	0	0	0	0	0	0							
Lower Depth (in.)	Benchmark	4	4	4	4	4	4							
Date Sampled		8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
SVOC (µg/Kg)														
Acenaphthene	150	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	21.5 J	293 U	290 U	560 U	305 U
Acenaphthylene	150	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	59.1 J	293 U	290 U	560 U	305 U
Anthracene	57.2	630 U	890 U	430 U	760 U	960 U	630 U	16.1 J	270 U	124 J	293 U	290 U	28.3 J	305 U
Benzo(a)anthracene	110	630 U	180 J	430 U	760 U	200 J	630 U	32.7 J	270 U	158 J	19.5 J	19.9 J	61.1 J	305 U
Benzo(a)pyrene	150	630 U	890 U	430 U	760 U	230 J	630 U	21.1 J	270 U	197 J	13.6 J	15.2 J	60 J	305 U
Benzo(b)fluoranthene	37	630 U	890 U	430 U	760 U	220 J	630 U	275 U	270 U	268 J	293 U	290 U	560 U	305 U
Benzo(g,h,i)perylene	150	630 U	890 U	430 U	760 U	960 U	630 U	13.9 J	270 U	101 J	293 U	290 U	31.7 J	305 U
Benzo(k)fluoranthene	37	630 U	890 U	430 U	760 U	220 J	630 U	22.2 J	270 U	141 J	13.6 J	14.1 J	50.9 J	305 U
Carbazole		630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	80 J	293 U	290 U	560 U	305 U
Chrysene	170	630 U	200 J	430 U	170 J	230 J	630 U	36.6 J	270 U	273 J	19.5 J	19.3 J	72.4 J	305 U
3+4-Methylphenol		630 U	230 J	430 U	760 U	960 U	630 U	275 U	270 U	305 U	293 U	290 U	560 U	12.3 J
Dibenzo(a,h)anthracene	33	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	24.6 J	293 U	290 U	560 U	305 U
Dibenzofuran	5100	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	36.3 J	293 U	290 U	560 U	305 U
Di-n-butyl phthalate		630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	20.9 J	293 U	290 U	560 U	305 U
Di-n-octyl phthalate		630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	20.3 J	14.8 J	290 U	37.4 J	305 U
Fluoranthene	423	630 U	380 J	170 J	320 J	430 J	630 U	54.9 J	270 U	651	29 J	32.8 J	126 J	15.4 J
Fluorene	77.4	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	48.6 J	293 U	290 U	560 U	305 U
Indeno(1,2,3-cd)pyrene	30	630 U	890 U	430 U	760 U	960 U	630 U	13.9 J	270 U	106 J	293 U	290 U	31.7 J	305 U
1-Methylnaphthalene								275 U	270 U	35.1 J	293 U	290 U	560 U	305 U
2-Methylnaphthalene	150	630 U	890 U	430 U	760 U	960 U	630 U	275 U	270 U	20.9 J	293 U	290 U	560 U	305 U
2-Methylphenol		150 J	890 U	430 U	760 U	960 U	630 U	275 U	270 U	305 U	293 U	290 U	560 U	305 U
Phenanthrene	204	630 U	890 U	140 J	760 U	960 U	630 U	36.1 J	270 U	777	20.1 J	16.4 J	75.8 J	305 U
Pyrene	200	630 U	320 J	130 J	280 J	380 J	630 U	50.5 J	270 U	592	28.4 J	32.2 J	128 J	305 U

>SD Benchmark

Appendix Table A.2.2
 Sediment Sample Results - TPH
 Background Area
 YNPS Rowe, MA

Sample ID	SD-401-00-04-I	SD-402-00-04-I	SD-403-00-04-I	SD-404-00-04-I	SD-405-00-04-I	SD-406-00-04-I
Upper Depth (in.)	0	0	0	0	0	0
Lower Depth (in.)	4	4	4	4	4	4
Date Sampled	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003
TPH (mg/Kg)						
TPH-DRO	27	34	13 UJ	24 J	80 J	19 J

Appendix Table A.2.2
 Sediment Sample Results - VOC
 Background Area
 YNPS Rowe, MA

Sample ID		SD-401-00-04-I	SD-402-00-04-I	SD-403-00-04-I	SD-404-00-04-I	SD-405-00-04-I	SD-406-00-04-I	SD-407	SD-FD-003-060206	SD-408	SD-409	SD-410	SD-411	SD-412
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0							
Lower Depth (in.)	Screening	4	4	4	4	4	4							
Date Sampled	Benchmark	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
VOC (µg/Kg)														
Acetone	57.1	110 J	19 UJ	42 J	76 J	280	190 J	169 U	282 U	410 U	371 U	378 U	659 U	943
2-Butanone	27000	30 J	21 UJ	11 J	22 J	67	32 J	R	R	R	R	R	R	91.3 J
1,1-Dichloroethene	5900	23 J	24 J	15 J	19 J	21	7 UJ	8.4 UJ	14.1 U	20.5 U	18.6 U	18.9 U	33 U	37.8 U
Dimethyl sulfide														43.5 TIC, J
Toluene	130000	21 J	31 J	12 J	27 J	20	14	8.4 U	14.1 U	20.5 U	18.6 U	18.9 U	33 U	37.8 U

>SD Benchmark

Appendix Table A.2.2
 Sediment Sample Results - VPH
 Background Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-407	SD-FD-003-060206	SD-408	SD-409	SD-410	SD-411
Date Sampled	Screening Benchmark	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
VPH (mg/Kg)							
Adjusted C9-C12 Aliphatics		0.142 U	0.139 UJ	0.0444	0.194 U	0.179	0.454 U
Unadjusted C5-C8 Aliphatics		0.235 J	0.365 J	0.419 J	0.538 J	0.523 J	1.27 J
Unadjusted C9-C12 Aliphatics		0.133 J	0.136 J	0.205 J	0.158 J	0.451	0.367 J
Adjusted C9-C10 Aromatics		0.142 U	0.139 U	0.206 U	0.194 U	0.272 U	0.346 J
Ethylbenzene		0.0285 U	0.0278 U	0.0411 U	0.0388 U	0.0383 U	0.064 J
Naphthalene	0.176	0.0285 U	0.0278 U	0.0411 U	0.0388 U	0.0383 U	0.0597 J
Toluene	130	0.0285 U	0.0278 U	0.0411 U	0.0388 U	0.0383 U	0.0559 J
m+p-Xylenes		0.057 UJ	0.0555 U	0.0823 U	0.0776 U	0.0766 U	0.108 J

Appendix Table A.2.2
 Sediment Sample Results - Wet Chemistry
 Background Area
 YNPS Rowe, MA

Sample ID	SD-401-00-04-I	SD-403-00-04-I
Upper Depth (in.)	0	0
Lower Depth (in.)	4	4
Date Sampled	8/14/2003	8/14/2003
WET CHEMISTRY (mg/Kg)		
Total Organic Carbon	22900	1630

Appendix Table A.2.3
Summary Statistics of All Sediment Sample Results --
Deerfield River Adjacent to Site
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Inorganics (mg/Kg)</i>						
Antimony	0	18	0%		0.61	
Arsenic	16	24	67%	0.64	1.48	6.22
Beryllium	18	24	75%	0.11	0.29	0.43
Boron	6	18	33%	3.58	2.71	5.53
Cadmium	18	24	75%	0.15	0.38	0.59
Chromium	24	24	100%	4.74	8.84	18.40
Copper	24	24	100%	5.15	19.73	150.00
Hexavalent Chromium	0	6	0%		1.32	
Lead	23	24	96%	1.00	6.65	14.00
Lithium	18	18	100%	5.51	10.82	17.40
Mercury	8	24	33%	0.03	0.05	0.14
Nickel	24	24	100%	2.94	9.21	17.00
Selenium	4	24	17%	0.81	1.17	3.50
Silver	3	24	13%	1.13	0.61	2.22
Thallium	2	24	8%	0.37	0.72	0.44
Uranium	2	17	12%	1.90	1.61	2.10
Zinc	24	24	100%	22.80	54.70	210.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	9	0%		5.97	
Aroclor-1268	0	9	0%		5.97	
Aroclor-1016	0	31	0%		17.26	
Aroclor-1221	0	31	0%		17.26	
Aroclor-1232	0	31	0%		17.26	
Aroclor-1242	0	31	0%		17.26	
Aroclor-1248	0	31	0%		17.26	
Aroclor-1254	15	31	48%	16.00	107.04	820.00
Aroclor-1260	4	31	13%	2.79	33.28	200.00
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	0	6	0%		215.00	
Acenaphthylene	0	6	0%		215.00	
Aniline	0	6	0%		215.00	
Anthracene	0	6	0%		215.00	
Azobenzene	0	6	0%		215.00	
Benzo(a)anthracene	1	6	17%	330.00	234.17	330.00
Benzo(a)pyrene	3	6	50%	83.00	186.33	320.00
Benzo(b)fluoranthene	3	6	50%	79.00	185.67	310.00
Benzo(g,h,i)perylene	1	6	17%	210.00	214.17	210.00
Benzo(k)fluoranthene	2	6	33%	78.00	213.83	330.00
Benzoic acid	0	6	0%		1041.67	
Benzyl alcohol	0	6	0%		427.50	
Bis(2-chloroethoxy)methane	0	6	0%		215.00	
Bis(2-chloroethyl)ether	0	6	0%		215.00	
Bis(2-ethylhexyl)phthalate	1	6	17%	120.00	199.17	120.00
4-Bromophenyl phenyl ether	0	6	0%		215.00	
Butyl benzyl phthalate	0	6	0%		215.00	
Carbazole	0	6	0%		215.00	
4-Chloro-3-methylphenol	0	6	0%		427.50	
4-Chloroaniline	0	6	0%		427.50	
Bis(2-chloroisopropyl) ether	0	6	0%		427.50	
2-Chloronaphthalene	0	6	0%		215.00	
2-Chlorophenol	0	6	0%		215.00	
4-Chlorophenyl phenyl ether	0	6	0%		215.00	
Chrysene	3	6	50%	90.00	197.50	380.00
Dibenzo(a,h)anthracene	0	6	0%		215.00	
Dibenzofuran	0	6	0%		215.00	
1,2-Dichlorobenzene	0	6	0%		215.00	
1,3-Dichlorobenzene	0	6	0%		215.00	
1,4-Dichlorobenzene	0	6	0%		215.00	
3,3'-Dichlorobenzidine	0	6	0%		427.50	
2,4-Dichlorophenol	0	6	0%		215.00	
Diethyl phthalate	0	6	0%		215.00	
Dimethyl phthalate	0	6	0%		215.00	
2,4-Dimethylphenol	0	6	0%		215.00	
Di-n-butyl phthalate	0	6	0%		215.00	
2,4-Dinitrophenol	0	6	0%		1041.67	
2,4-Dinitrotoluene	0	6	0%		215.00	
2,6-Dinitrotoluene	0	6	0%		215.00	
Di-n-octyl phthalate	0	6	0%		215.00	
Fluoranthene	3	6	50%	150.00	269.17	670.00
Fluorene	0	6	0%		215.00	
Hexachlorobenzene	0	6	0%		215.00	
Hexachlorobutadiene	0	6	0%		215.00	
Hexachlorocyclopentadiene	0	6	0%		215.00	
Hexachloroethane	0	6	0%		215.00	
Indeno(1,2,3-cd)pyrene	1	6	17%	200.00	212.50	200.00
Isophorone	0	6	0%		215.00	
4,6-Dinitro-2-methylphenol	0	6	0%		1041.67	
2-Methylnaphthalene	0	6	0%		215.00	
3+4-Methylphenol	0	6	0%		215.00	
2-Methylphenol	0	6	0%		215.00	
Naphthalene	0	6	0%		215.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.2.3
Summary Statistics of All Sediment Sample Results --
Deerfield River Adjacent to Site
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds cont. (µg/Kg)</i>						
2-Nitroaniline	0	6	0%		1041.67	
3-Nitroaniline	0	6	0%		1041.67	
4-Nitroaniline	0	5	0%		1070.00	
Nitrobenzene	0	6	0%		215.00	
2-Nitrophenol	0	6	0%		215.00	
4-Nitrophenol	0	6	0%		1041.67	
N-Nitroso-di-n-propylamine	0	6	0%		215.00	
N-Nitrosodiphenylamine	0	6	0%		215.00	
N-Nitrosodimethylamine	0	6	0%		427.50	
Pentachlorophenol	0	6	0%		1041.67	
Phenanthrene	2	6	33%	80.00	215.83	340.00
Phenol	0	6	0%		215.00	
Pyrene	3	6	50%	120.00	237.50	540.00
1,2,4-Trichlorobenzene	0	6	0%		215.00	
2,4,5-Trichlorophenol	0	6	0%		215.00	
2,4,6-Trichlorophenol	0	6	0%		215.00	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	5	6	83%	2.20	22.40	62.00
TPH-GRO	0	6	0%		1.25	
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	1	6	17%	76.00	23.33	76.00
Acrylonitrile	0	6	0%		5.17	
Allyl Chloride	0	6	0%		2.58	
Benzene	0	6	0%		2.58	
Bromobenzene	0	6	0%		2.58	
Bromochloromethane	0	6	0%		2.58	
Bromodichloromethane	0	6	0%		2.58	
Bromoform	0	6	0%		2.58	
Bromomethane	0	6	0%		7.75	
2-Butanone	1	6	17%	12.00	6.50	12.00
n-Butylbenzene	0	6	0%		2.58	
sec-Butylbenzene	0	6	0%		2.58	
tert-Butylbenzene	0	6	0%		2.58	
Carbon Disulfide	0	6	0%		2.58	
Carbon Tetrachloride	0	6	0%		5.17	
Chlorobenzene	0	6	0%		2.58	
1-Chlorobutane	0	6	0%		2.58	
Chloroethane	0	6	0%		7.75	
Chloroform	0	6	0%		7.75	
Chloromethane	1	6	17%	1.20	2.05	1.20
2-Chlorotoluene	0	6	0%		2.58	
4-Chlorotoluene	0	6	0%		2.58	
1,2-Dibromo-3-Chloropropane	0	6	0%		2.58	
Dibromochloromethane	0	6	0%		2.58	
1,2-Dibromoethane	0	6	0%		2.58	
Dibromomethane	0	6	0%		2.58	
1,2-Dichlorobenzene	0	6	0%		2.58	
1,3-Dichlorobenzene	0	6	0%		2.58	
1,4-Dichlorobenzene	0	6	0%		2.58	
Dichlorodifluoromethane	0	6	0%		2.58	
1,1-Dichloroethane	0	6	0%		2.58	
1,2-Dichloroethane	0	6	0%		2.58	
cis-1,2-Dichloroethene	0	6	0%		2.58	
trans-1,2-Dichloroethene	0	6	0%		2.58	
1,1-Dichloroethene	0	6	0%		14.92	
1,3-Dichloropropane	0	6	0%		2.58	
2,2-Dichloropropane	0	6	0%		2.58	
1,2-Dichloropropane	0	6	0%		2.58	
1,1-Dichloropropene	0	6	0%		2.58	
cis-1,3-Dichloropropene	0	6	0%		2.58	
trans-1,3-Dichloropropene	0	6	0%		2.58	
Diethyl Ether	0	6	0%		5.17	
Ethyl Methacrylate	0	6	0%		2.58	
Ethylbenzene	0	6	0%		2.58	
Hexachlorobutadiene	0	6	0%		2.58	
Hexachloroethane	0	6	0%		2.58	
2-Hexanone	0	6	0%		2.58	
Isopropylbenzene	0	6	0%		2.58	
4-Isopropyltoluene	1	6	17%	2.00	2.50	2.00
Methacrylonitrile	0	6	0%		2.58	
Methyl Methacrylate	0	6	0%		2.58	
4-Methyl-2-Pentanone	0	6	0%		2.58	
Methylene Chloride	0	6	0%		10.92	
Methyl-t-butyl ether	0	6	0%		7.75	
Naphthalene	0	6	0%		2.58	
Nitrobenzene	0	6	0%		12.92	
2-Nitropropane	0	6	0%		5.17	
Pentachloroethane	0	6	0%		2.58	
Propionitrile	0	6	0%		25.83	
n-Propylbenzene	0	6	0%		2.58	
Styrene	0	6	0%		2.58	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.2.3
Summary Statistics of All Sediment Sample Results --
Deerfield River Adjacent to Site
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (μg/Kg)</i>						
1,1,1,2-Tetrachloroethane	0	6	0%		2.58	
1,1,2,2-Tetrachloroethane	0	6	0%		2.58	
Tetrachloroethene	0	6	0%		2.58	
Tetrahydrofuran	0	6	0%		5.17	
Toluene	0	6	0%		2.95	
trans-1,4-Dichloro-2-Butene	0	6	0%		2.58	
1,2,3-Trichlorobenzene	0	6	0%		2.58	
1,2,4-Trichlorobenzene	0	6	0%		2.58	
1,1,1-Trichloroethane	0	6	0%		5.17	
1,1,2-Trichloroethane	0	6	0%		2.58	
Trichloroethene	0	6	0%		2.58	
Trichlorofluoromethane	0	6	0%		2.58	
1,2,3-Trichloropropane	0	6	0%		2.58	
1,2,4-Trimethylbenzene	0	6	0%		2.58	
1,3,5-Trimethylbenzene	0	6	0%		2.58	
Vinyl Chloride	0	6	0%		2.58	
o-Xylene	0	6	0%		2.58	
m+p-Xylenes	0	6	0%		2.58	
<i>Wet Chemistry (mg/Kg)</i>						
Total Organic Carbon	2	2	100%	1230.00	3565.00	5900.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Sample ID	Sediment (SD)	SD-201-00-04-I	DUP-04-092403	SD-202-00-04-I	SD-203-00-04-I	SD-204-00-04-I	SD-205-00-04-I	SD-206-00-04-I	SD-220	SD-221	SD-222	SD-223	SD-224	SD-225
Upper Depth (in.)	Screening	0	0	0	0	0	0	0						
Lower Depth (in.)	Benchmark	4	4	4	4	4	4	4						
Date Sampled	Benchmark	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	5/24/2006	5/24/2006	5/24/2006	7/24/2006	7/24/2006	7/24/2006
Inorganics (mg/Kg)														
Arsenic	33	0.19 U	0.52	0.17 U	1	2.5	1.4	1.6	24.5 J	1.76 J	1.95	2.65	1.57 J	1.86
Beryllium		0.86 U	0.76 U	0.72 U	0.91 U	0.91 U	0.78 U	1.3 U	0.491 J	0.288 U	0.298 U	0.231 J	0.107 J	0.16 J
Boron									R	8.47 UJ	18.2 UJ	0.643 U	0.564 U	0.571 U
Cadmium	5	0.82 U	0.72 U	0.69 U	0.87 U	0.86 U	0.74 U	1.2 U	R	0.347 J	0.454	0.225 J	0.147 J	0.194 J
Chromium	110	9.2	6.6	7.4	7.6	17	12	11	14.1 J	4.65	4.55	9.36 J	4.74 J	6.24 J
Copper	150	11	7.6	9.7	11	150	28	43	34.5 J	6.45	9.32	21	7.21	12.6
Lead	130	2.6	1.9	1	2.6	13	8.4	10	8.23 J	11.5	7.69	6.76 J	2.93 J	3.91 J
Lithium									R	7.56	7.21	13.6	6.46	7.51
Mercury	0.18	0.11 U	0.07 U	0.08 U	0.09 U	0.12	0.09 U	0.12 U	0.2 J	0.0822 U	0.0421 J	0.0615 J	0.061 U	0.0604 U
Nickel	49	13	8.8	9.3	9.4	17	11	13	R	6.29	9.64	8.98 J	5 J	5.84 J
Selenium	0.1	2.6 U	2.2 U	2.1 U	2.7 U	3.5	2.8	3.7 U	R	2.54 U	1.95 U	1.93 U	1.69 U	1.71 U
Silver	4.5	0.26 U	0.23 U	0.22 U	0.27 U	0.27 U	0.24 U	0.38 U	R	1.69 UJ	1.3 UJ	2.22 J	1.13 UJ	1.13 J
Thallium		0.6 U	0.53 U	0.53 U	0.64 U	0.66 U	0.59 U	0.88 U	R	2.54 U	1.95 U	1.93 U	1.69 U	1.71 U
Uranium									3.9	3	1.22 U	5.71 U	5.82 U	
Zinc	460	37	38	29	39	210	56	90	153 J	29.7	49.7	43.5	22.8	27.6

> SD benchmark

Sample ID	Sediment (SD)	SD-226	SD-227	SD-228	SD-229	SD-230	SD-231	SD-232	SD-FD-002-072406	SD-233	SD-234	SD-235	SD-236	SD-237	SD-238	SD-239	SD-240
Upper Depth (in.)	Screening																
Lower Depth (in.)	Benchmark																
Date Sampled		6/14/2006	6/14/2006	6/14/2006	7/24/2006	6/20/2006	6/20/2006	7/24/2006	7/24/2006	6/19/2006	6/19/2006	7/24/2006	6/15/2006	6/19/2006	6/19/2006	6/15/2006	6/15/2006
Inorganics (mg/Kg)																	
Arsenic	9.79	1.76 U	2.94 U	3.2 U	1.54 J	1.07 J	0.965 J	6.22	2.46 J	1.51 J	1.24 J	2.72	1.55 U	0.635 J	0.724 J	1.72 U	1.14 U
Beryllium		0.175	0.195	0.193	0.169 J	0.43	0.23 J	0.264 J	0.224 J	0.267	0.296	0.298	0.249	0.28	0.317	0.133 J	0.168 J
Boron		4.28	5.18	4.35	0.806 U	3.58 U	8.72 U	0.85 U	0.322 U	5.2 U	6.1 U	0.678 U	5.53	7.75 U	8.83 U	3.58	3.71
Cadmium	5	0.489	0.589	0.567	0.169 J	0.251 J	0.355	0.315 J	0.295 J	0.566	0.488	0.285 J	0.482	0.4	0.444	0.317	0.324
Chromium	110	7.87	11.6	9.32	5.88 J	8.06	6.57	18.4 J	7.65 J	7.08	6.16	7.68 J	9.29	9.76	6.56	5.1	8.3
Copper	150	9.47	17.2	15.2	8.4	13.5	5.15	19.9	17.1	20.3	10.9	12.2	12.1	10.5	8.24	7.09	9.91
Lead	130	8.78	7.08	7.33	6.34 J	10.7	6.28	6.44 J	11.6 J	10	9.16	14 J	4.85	4.33	4.77	6.52	3.66 U
Lithium		9.4	13	11.1	8.68	17.4	10.6	17.2	8.86	8.22	7.53	10.3	12.5	15.5	10.9	5.51	9.29
Mercury	0.18	0.0526 U	0.0386 J	0.0316 J	0.0587 J	0.0544 U	0.0622 U	0.0417 J	0.0913 U	0.128	0.0517 U	0.144	0.0545 U	0.0601 U	0.0613 U	0.0558 U	0.0581 U
Nickel	49	6.82	13.8	10.8	5.87 J	9.43	7.8	15.2 J	6.86 J	10.3	9.83	6.08 J	6.75	10.1	9.13	2.94	3.64
Selenium	0.1	1.6 UJ	1.72 UJ	1.81 UJ	2.42 U	1.53 U	1.87 U	2.55 U	2.69 U	0.845 J	0.813 J	2.03 U	1.49 UJ	1.5 U	1.83 U	1.67 UJ	1.8 UJ
Silver	4.5	1.06 UJ	1.14 UJ	1.21 UJ	1.61 UJ	1.02 UJ	1.25 UJ	1.7 UJ	1.79 UJ	1.3 UJ	1.16 UJ	1.36 J	0.994 UJ	1 UJ	1.22 UJ	1.11 UJ	1.2 UJ
Thallium		1.6 U	1.72 U	1.81 U	2.42 U	1.53 U	1.87 U	2.55 U	2.69 U	0.436 J	0.366 J	2.03 U	1.49 U	1.5 U	1.83 U	1.67 U	1.8 U
Uranium		1.9	1.31 U	1.27 U	8.46 U	1.08 U	1.79 U	6.61 U	7.17 U	1.42 U	1.28 U	7.72 U	1.07 U	1.09 U	1.1 U	1.14 U	2.1
Zinc	460	57.7 J	94.1 J	90.9 J	32.9	25.2 J	33.1 J	52.3	51.9	96.6 J	32.3 J	41.2	60.6 J	37.8 J	35.7 J	27.1 J	40.3 J

> SD benchmark

Appendix Table A.2.4
 Sediment Sample Results - PCBs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID		SD-201-00-04-I	DUP-04-092403	SD-202-00-04-I	SD-203-00-04-I	SD-204-00-04-I	FD006-00-04I	FD008-072204	SD-205-00-04-I	SD-205R-00-04I	SD-205R2	SD-206-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0		0	0		0
Lower Depth (in.)	Screening	4	4	4	4	4	4		4	4		4
Date Sampled	Benchmark	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	7/9/2004	7/22/2004	9/24/2003	7/9/2004	7/22/2004	9/24/2003
PCBs (µg/Kg)												
Aroclor-1254	60	40 U	33 U	36 U	43 U	520	15 J	36 U	820	28 J	36 U	220
Aroclor-1260	60	40 U	33 U	36 U	43 U	190	33 U	36 U	200	41 U	36 U	180

> SD benchmark

Appendix Table A.2.4
 Sediment Sample Results - PCBs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-207-00-04I	SD-208-00-04I	SD-209-00-04I	SD-210-00-04I	SD-211	SD-212	SD-213	SD-214	SD-232	SD-FD-002-072406
Upper Depth (in.)	0	0	0	0	0						
Lower Depth (in.)	4	4	4	4	4						
Date Sampled	Benchmark	7/9/2004	7/9/2004	7/9/2004	7/9/2004	7/22/2004	7/22/2004	7/22/2004	7/22/2004	7/24/2006	7/24/2006
PCBs (µg/Kg)											
Aroclor-1254	60	170 J	82	40 U	86 J	36 U	38 U	39	300 J	11.2 UJ	12.5 UJ
Aroclor-1260	60	39 U	41 U	40 U	41 U	36 U	38 U	37 U	39 U	11.2 UJ	12.5 UJ

> SD benchmark

Appendix Table A.2.4
 Sediment Sample Results - PCBs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID		SD-233	SD-234	SD-235	SD-236	SD-237	SD-238	SD-239	SD-240	WSD-017A II	WSD-017B II	WSD-018A II
Upper Depth (in.)	Sediment (SD)											
Lower Depth (in.)	Screening											
Date Sampled	Benchmark	6/19/2006	6/19/2006	7/24/2006	6/15/2006	6/19/2006	6/19/2006	6/15/2006	6/15/2006	10/29/2002	10/29/2002	10/29/2002
PCBs (µg/Kg)												
Aroclor-1254	60	19.6 UJ	11.9 UJ	13 UJ	10.2 U	10.1 U	10.7 UJ	10.3 U	10.4 U	220	200	130
Aroclor-1260	60	19.6 UJ	11.9 UJ	13 UJ	10.2 U	10.1 U	10.7 UJ	2.79 J	10.4 U	79 U	79 U	73 U

> SD benchmark

Appendix Table A.2.4
 Sediment Sample Results - PCBs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID		WSD-018B II	WSD-019A II	WSD-019B II
Upper Depth (in.)	Sediment (SD)			
Lower Depth (in.)	Screening			
Date Sampled	Benchmark	10/29/2002	10/29/2002	10/29/2002
PCBs (µg/Kg)				
Aroclor-1254	60	280	19	16 J
Aroclor-1260	60	66 U	8.6 U	7.9 UJ

> SD benchmark

Appendix Table A.2.4
 Sediment Sample Results - SVOCs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID		SD-201-00-04-I	DUP-04-092403	SD-202-00-04-I	SD-203-00-04-I	SD-204-00-04-I	SD-205-00-04-I	SD-206-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	4	4	4	4	4	4
Date Sampled	Benchmark	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003
SVOC (µg/Kg)								
Benzo(a)anthracene	110	400 U	360 U	360 U	430 U	330 J	400 U	560 U
Benzo(a)pyrene	150	400 U	360 U	360 U	430 U	320 J	83 J	120 J
Benzo(b)fluoranthene	37	400 U	360 U	360 U	430 U	310 J	79 J	130 J
Benzo(g,h,i)perylene	150	400 U	360 U	360 U	430 U	210 J	400 U	560 U
Benzo(k)fluoranthene	37	400 U	360 U	360 U	430 U	330 J	78 J	560 U
bis(2-Ethylhexyl)phthalate	13300	400 U	360 U	360 U	430 U	120 J	400 U	560 U
Chrysene	170	400 U	360 U	360 U	430 U	380 J	90 J	120 J
Fluoranthene	423	400 U	360 U	360 U	430 U	670	150 J	200 J
Indeno(1,2,3-cd)pyrene	30	400 U	360 U	360 U	430 U	200 J	400 U	560 U
Phenanthrene	204	400 U	360 U	360 U	430 U	340 J	80 J	560 U
Pyrene	200	400 U	360 U	360 U	430 U	540	120 J	170 J

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.2.4
 Sediment Sample Results - TPHs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID	SD-201-00-04-I	DUP-04-092403	SD-202-00-04-I	SD-203-00-04-I	SD-204-00-04-I	SD-205-00-04-I	SD-206-00-04-I
Upper Depth (in.)	0	0	0	0	0	0	0
Lower Depth (in.)	4	4	4	4	4	4	4
Date Sampled	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003
TPH (mg/Kg)							
TPH-DRO	2.4 U	2.2 U	2.2 J	6 J	62 J	14 J	49 J

Appendix Table A.2.4
 Sediment Sample Results - VOCs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID		SD-201-00-04-I	DUP-04-092403	SD-202-00-04-I	SD-203-00-04-I	SD-204-00-04-I	SD-205-00-04-I	SD-206-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	4	4	4	4	4	4
Date Sampled	Benchmark	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003	9/24/2003
VOC (µg/Kg)								
Acetone	57.1	10 UJ	28 UJ	10 UJ	10 UJ	10 UJ	76 J	88 UJ
2-Butanone	27000	10 UJ	10 UJ	10 UJ	10 UJ	12 UJ	12 J	12 UJ
Chloromethane		1.2 J	5 UJ	5 UJ	1.2 UJ	5 UJ	5 UJ	6 UJ
4-Isopropyltoluene		5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	2 J	6 UJ

> SD benchmark

Appendix Table A.2.4
Sediment Sample Results - Wet Chemistry
Deerfield River Adjacent to Site
YNPS Rowe, MA

Sample ID	SD-201-00-04-I	SD-203-00-04-I
Upper Depth (in.)	0	0
Lower Depth (in.)	4	4
Date Sampled	9/24/2003	9/24/2003
WET CHEMISTRY (mg/Kg)		
Total Organic Carbon	1230	5900

Appendix Table A.2.5
 Summary Statistics of All Sediment Sample Results --
 Deerfield River Downstream from Site
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Deerfield Downriver from Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Inorganics (mg/Kg)</i>						
Antimony	0	2	0%		1.12	
Arsenic	3	9	33%	1.76	3.86	24.50
Beryllium	7	9	78%	0.12	0.21	0.49
Boron	6	8	75%	2.84	4.73	5.53
Cadmium	8	8	100%	0.25	0.33	0.48
Chromium	9	9	100%	4.55	8.55	14.10
Copper	9	9	100%	6.45	13.34	34.50
Lead	7	9	78%	4.29	7.00	15.30
Lithium	8	8	100%	7.17	10.46	14.60
Mercury	2	9	22%	0.04	0.05	0.20
Nickel	8	8	100%	4.42	7.43	11.00
Selenium	0	8	0%		1.03	
Silver	0	8	0%		0.68	
Thallium	0	8	0%		1.03	
Uranium	7	11	64%	1.10	2.01	4.40
Zinc	9	9	100%	29.70	58.77	153.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	6	0%		5.28	
Aroclor-1268	0	6	0%		5.28	
Aroclor-1016	0	6	0%		5.28	
Aroclor-1221	0	6	0%		5.28	
Aroclor-1232	0	6	0%		5.28	
Aroclor-1242	0	6	0%		5.28	
Aroclor-1248	1	6	17%	641.00	111.27	641.00
Aroclor-1254	1	6	17%	17.60	7.31	17.60
Aroclor-1260	1	6	17%	3.25	4.98	3.25

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.6
 Sediment Sample Results - Inorganics
 Deerfield River Downstream from Site
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-241	SD-242	SD-243	SD-244	SD-245	SD-246	SD-247	SD-250
Date Sampled	Screening Benchmark	6/15/2006	6/15/2006	6/15/2006	6/15/2006	6/15/2006	6/15/2006		
Inorganics (mg/Kg)									
Beryllium		0.134 J	0.279	0.302	0.134 J	0.162 J	0.124 J		
Boron		2.84	5.53	4.45	3.44	5.31	2.96		
Cadmium	5	0.248 J	0.484	0.327 J	0.273	0.277 J	0.259 J		
Chromium	110	6.28	9.32	9.93	8.66	11.3	8.13		
Copper	150	7.65	20.8	12.8	8.28	11.3	8.98		
Lead	130	3.87 U	15.3	8.01	4.33	4.29	3.43 U		
Lithium		7.17	12.4	14.5	11.7	14.6	8.54		
Nickel	49	4.42	8.59	7.5	5.98	11	6		
Uranium		1.1	1.25 U	1.52 U	1.5	3.1	4.4	2.22 U	2
Zinc	460	38.2 J	62.4 J	60.9 J	46.1 J	46.8 J	42.1 J		

Appendix Table A.2.6
 Sediment Sample Results - PCBs
 Deerfield River Downstream from Site
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-241	SD-242	SD-243	SD-244	SD-245	SD-246
Date Sampled	Screening Benchmark	6/15/2006	6/15/2006	6/15/2006	6/15/2006	6/15/2006	6/15/2006
PCBs (µg/Kg)							
Aroclor-1248		10.5 UJ	10.9 UJ	11 UJ	10.6 UJ	641	10.2 U
Aroclor-1254	60	10.5 UJ	17.6 J	11 UJ	10.6 UJ	10.2 U	10.2 U
Aroclor-1260	60	10.5 UJ	10.9 UJ	11 UJ	10.6 UJ	3.25 J	10.2 U

Appendix Table A.2.7
 Summary Statistics of All Sediment Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	11	0%		0.244	
Acenaphthylene	0	11	0%		0.244	
Unadjusted C19-C36 Aliphatics	0	11	0%		48.005	
Unadjusted C9-C18 Aliphatics	0	11	0%		48.005	
Anthracene	1	11	9%	0.060	0.228	0.060
Adjusted C11-C22 Aromatics	0	8	0%		25.881	
Unadjusted C11-C22 Aromatics	0	12	0%		49.254	
Benzo(a)anthracene	1	11	9%	0.143	0.236	0.143
Benzo(a)pyrene	1	11	9%	0.098	0.231	0.098
Benzo(b)fluoranthene	3	11	27%	0.079	0.152	0.114
Benzo(g,h,i)perylene	0	11	0%		0.244	
Benzo(k)fluoranthene	1	11	9%	0.124	0.234	0.124
Chrysene	4	11	36%	0.090	0.172	0.199
Dibenzo(a,h)anthracene	0	11	0%		0.244	
Fluoranthene	6	11	55%	0.076	0.193	0.444
Fluorene	0	11	0%		0.244	
Indeno(1,2,3-cd)pyrene	0	11	0%		0.244	
2-Methylnaphthalene	0	11	0%		0.244	
Naphthalene	0	11	0%		0.244	
Phenanthrene	1	11	9%	0.154	0.237	0.154
Pyrene	3	11	27%	0.075	0.250	0.353
Adjusted TPH	0	11	0%		48.005	
Unadjusted TPH	0	11	0%		48.005	
<i>Hydrazine (μg/Kg)</i>						
Hydrazine	0	3	0%		161.667	
<i>Inorganics (mg/Kg)</i>						
Antimony	3	27	11%	1.700	1.030	3.900
Arsenic	40	54	74%	0.730	2.268	17.200
Beryllium	16	53	30%	0.185	0.771	1.550
Boron	5	19	26%	0.545	6.750	10.900
Cadmium	14	53	26%	0.437	1.159	6.700
Chromium	57	58	98%	2.600	14.599	34.000
Copper	56	58	97%	6.600	71.245	570.000
Hexavalent Chromium	0	37	0%		1.768	
Lead	52	57	91%	0.510	15.052	80.800
Lithium	19	19	100%	8.370	15.739	29.200
Mercury	26	58	45%	0.024	0.157	2.100
Nickel	57	58	98%	5.100	20.825	55.000
Selenium	8	52	15%	2.900	2.308	6.400
Silver	5	52	10%	0.300	0.542	2.220
Thallium	4	52	8%	1.700	0.907	6.060
Uranium	2	13	15%	2.400	1.788	2.500
Zinc	56	58	97%	30.000	162.134	790.000
<i>Polychlorinated Biphenyls (μg/Kg)</i>						
Aroclor-1262	0	22	0%		7.275	
Aroclor-1268	0	22	0%		7.275	
Aroclor-1016	0	174	0%		41.345	
Aroclor-1221	0	174	0%		41.345	
Aroclor-1232	0	174	0%		41.345	
Aroclor-1242	0	174	0%		41.345	
Aroclor-1248	1	174	1%	171.000	42.292	171.000
Aroclor-1254	91	177	51%	34.800	228.905	3,400.000
Aroclor-1260	11	174	6%	4.620	46.645	382.000

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.7
 Summary Statistics of All Sediment Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	2	26	8%	25.500	292.423	160.000
Acenaphthylene	0	26	0%		298.615	
Aniline	0	26	0%		298.615	
Anthracene	3	26	12%	36.200	287.381	240.000
Atrazine	0	11	0%		335.364	
Azobenzene	0	26	0%		298.615	
Benzidine	0	23	0%		1904.435	
Benzo(a)anthracene	5	26	19%	38.500	282.792	320.000
Benzo(a)pyrene	3	26	12%	25.400	294.250	270.000
Benzo(b)fluoranthene	0	26	0%		297.308	
Benzo(g,h,i)perylene	2	26	8%	30.300	293.396	120.000
Benzo(k)fluoranthene	2	26	8%	17.200	291.469	86.000
Benzoic acid	0	26	0%		901.500	
Benzyl alcohol	0	26	0%		457.654	
Bis(2-chloroethoxy)methane	0	26	0%		298.615	
Bis(2-chloroethyl)ether	0	26	0%		298.615	
Bis(2-ethylhexyl)phthalate	2	26	8%	140.000	293.423	140.000
4-Bromophenyl phenyl ether	0	26	0%		298.615	
Butyl benzyl phthalate	0	26	0%		298.615	
Carbazole	0	26	0%		298.615	
4-Chloro-3-methylphenol	0	26	0%		457.654	
4-Chloroaniline	0	26	0%		457.654	
Bis(2-chloroisopropyl) ether	0	26	0%		457.654	
2-Chloronaphthalene	0	26	0%		298.615	
2-Chlorophenol	0	26	0%		298.615	
4-Chlorophenyl phenyl ether	0	26	0%		298.615	
Chrysene	6	26	23%	27.900	259.377	290.000
Dibenzo(a,h)anthracene	0	26	0%		298.615	
Dibenzofuran	1	26	4%	120.000	295.538	120.000
1,2-Dichlorobenzene	0	26	0%		298.615	
1,3-Dichlorobenzene	0	26	0%		298.615	
1,4-Dichlorobenzene	0	26	0%		298.615	
3,3'-Dichlorobenzidine	0	26	0%		457.654	
2,4-Dichlorophenol	0	26	0%		298.615	
Diethyl phthalate	0	26	0%		298.615	
Dimethyl phthalate	0	26	0%		298.615	
2,4-Dimethylphenol	0	26	0%		298.615	
Di-n-butyl phthalate	0	26	0%		298.615	
2,4-Dinitrophenol	0	26	0%		901.500	
2,4-Dinitrotoluene	0	26	0%		298.615	
2,6-Dinitrotoluene	1	26	4%	25.400	291.785	25.400
Di-n-octyl phthalate	1	26	4%	320.000	302.654	320.000
Fluoranthene	12	26	46%	13.600	259.615	700.000
Fluorene	3	26	12%	14.800	280.815	180.000
Hexachlorobenzene	0	26	0%		298.615	
Hexachlorobutadiene	0	26	0%		298.615	
Hexachlorocyclopentadiene	0	26	0%		298.615	
Hexachloroethane	0	26	0%		298.62	
Indeno(1,2,3-cd)pyrene	2	26	8%	31.70	293.07	110.00
Isophorone	0	26	0%		298.62	
4,6-Dinitro-2-methylphenol	0	26	0%		901.50	
1-Methylnaphthalene	0	11	0%		335.36	
2-Methylnaphthalene	0	26	0%		298.62	
3+4-Methylphenol	1	26	4%	698.00	301.42	698.00
2-Methylphenol	0	26	0%		298.62	
Naphthalene	0	26	0%		298.62	
2-Nitroaniline	0	26	0%		901.50	
3-Nitroaniline	0	26	0%		901.50	
4-Nitroaniline	0	26	0%		1327.67	
Nitrobenzene	0	26	0%		298.62	
2-Nitrophenol	0	26	0%		298.62	
4-Nitrophenol	0	26	0%		1327.67	
N-Nitroso-di-n-propylamine	0	26	0%		298.62	
N-Nitrosodiphenylamine	0	26	0%		298.62	
N-Nitrosodimethylamine	0	26	0%		457.65	
Pentachlorophenol	0	26	0%		1147.67	
Phenanthrene	5	26	19%	18.40	300.94	740.00
Phenol	0	26	0%		298.62	
Pyrene	8	26	31%	55.80	280.76	520.00
Pyridine	0	11	0%		335.36	
1,2,4-Trichlorobenzene	0	26	0%		298.62	
2,4,5-Trichlorophenol	0	26	0%		298.62	
2,4,6-Trichlorophenol	0	26	0%		298.62	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	31	41	76%	2.50	45.96	250.00
TPH-GRO	0	15	0%		1.25	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.7
 Summary Statistics of All Sediment Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (μg/Kg)</i>						
Acetone	11	15	73%	3.00	86.43	270.00
Acrylonitrile	0	15	0%		5.73	
Allyl Chloride	0	15	0%		2.87	
Benzene	0	15	0%		2.87	
Bromobenzene	0	15	0%		2.87	
Bromochloromethane	0	15	0%		2.87	
Bromodichloromethane	0	15	0%		2.87	
Bromoform	0	15	0%		2.87	
Bromomethane	0	15	0%		8.60	
2-Butanone	10	15	67%	2.60	28.27	140.00
n-Butylbenzene	0	13	0%		2.62	
sec-Butylbenzene	0	15	0%		2.87	
tert-Butylbenzene	0	15	0%		2.87	
Carbon Disulfide	2	15	13%	5.20	3.33	8.80
Carbon Tetrachloride	0	15	0%		5.73	
Chlorobenzene	0	15	0%		2.87	
1-Chlorobutane	0	15	0%		2.87	
Chloroethane	0	15	0%		8.60	
2-Chloroethylvinyl Ether	0	13	0%		8.77	
Chloroform	0	15	0%		8.60	
Chloromethane	0	15	0%		2.87	
2-Chlorotoluene	0	15	0%		2.87	
4-Chlorotoluene	0	15	0%		2.87	
1,2-Dibromo-3-Chloropropane	0	13	0%		2.62	
Dibromochloromethane	0	15	0%		2.87	
1,2-Dibromoethane	0	15	0%		2.87	
Dibromomethane	0	15	0%		2.87	
1,2-Dichlorobenzene	0	13	0%		2.62	
1,3-Dichlorobenzene	0	13	0%		2.62	
1,4-Dichlorobenzene	0	13	0%		2.62	
Dichlorodifluoromethane	0	15	0%		2.87	
1,1-Dichloroethane	0	15	0%		2.87	
1,2-Dichloroethane	0	15	0%		2.87	
cis-1,2-Dichloroethene	0	15	0%		2.87	
trans-1,2-Dichloroethene	0	15	0%		2.87	
1,1-Dichloroethene	8	15	53%	3.50	10.00	40.00
1,3-Dichloropropane	0	15	0%		2.87	
2,2-Dichloropropane	0	15	0%		2.87	
1,2-Dichloropropane	0	15	0%		2.87	
1,1-Dichloropropene	0	15	0%		2.87	
cis-1,3-Dichloropropene	0	15	0%		2.87	
trans-1,3-Dichloropropene	0	15	0%		2.87	
Diethyl Ether	0	15	0%		5.73	
Ethyl Methacrylate	0	15	0%		2.87	
Ethylbenzene	0	15	0%		2.87	
Hexachlorobutadiene	0	13	0%		2.62	
Hexachloroethane	0	13	0%		2.62	
2-Hexanone	0	15	0%		2.87	
Iodomethane	0	12	0%		2.96	
Isopropylbenzene	0	15	0%		2.87	
4-Isopropyltoluene	0	15	0%		2.87	
Methacrylonitrile	0	15	0%		2.87	
Methyl Methacrylate	0	15	0%		2.87	
4-Methyl-2-Pentanone	1	15	7%	2.80	2.89	2.80
Methylene Chloride	0	15	0%		8.60	
Methyl-t-butyl ether	0	15	0%		8.60	
Naphthalene	0	13	0%		2.62	
Nitrobenzene	0	13	0%		13.08	
2-Nitropropane	0	15	0%		5.73	
Pentachloroethane	0	15	0%		2.87	
Propionitrile	0	15	0%		28.67	
n-Propylbenzene	0	15	0%		2.87	
Styrene	0	15	0%		2.87	
1,1,1,2-Tetrachloroethane	0	15	0%		2.87	
1,1,2,2-Tetrachloroethane	0	15	0%		2.87	
Tetrachloroethene	0	15	0%		2.87	
Tetrahydrofuran	0	15	0%		5.73	
Toluene	6	15	40%	11.00	14.56	52.00
trans-1,4-Dichloro-2-Butene	0	15	0%		2.87	
1,2,3-Trichlorobenzene	0	13	0%		2.62	
1,2,4-Trichlorobenzene	0	13	0%		2.62	
1,1,1-Trichloroethane	0	15	0%		5.73	
1,1,2-Trichloroethane	0	15	0%		2.87	
Trichloroethene	0	15	0%		2.87	
Trichlorofluoromethane	0	15	0%		2.87	
1,2,3-Trichloropropane	0	15	0%		2.87	
1,2,4-Trimethylbenzene	1	15	7%	4.20	2.98	4.20
1,3,5-Trimethylbenzene	0	15	0%		2.87	
Vinyl Acetate	0	13	0%		8.77	
Vinyl Chloride	0	15	0%		2.87	
o-Xylene	0	15	0%		2.87	
m+p-Xylenes	0	15	0%		2.87	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.7
Summary Statistics of All Sediment Sample Results --
Sherman Reservoir Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	8	0%		0.398	
Adjusted C9-C12 Aliphatics	4	8	50%	0.057	0.12	0.12
Unadjusted C5-C8 Aliphatics	12	12	100%	0.36	1.79	6.44
Unadjusted C9-C12 Aliphatics	12	12	100%	0.11	0.62	1.98
Adjusted C9-C10 Aromatics	3	11	27%	0.77	0.37	1.19
Benzene	0	11	0%		0.070	
Ethylbenzene	0	11	0%		0.070	
Methyl-t-butyl ether	1	11	9%	0.12	0.074	0.12
Naphthalene	3	11	27%	0.036	0.086	0.36
Toluene	1	11	9%	0.20	0.082	0.20
o-Xylene	0	11	0%		0.070	
m+p-Xylenes	2	11	18%	0.082	0.12	0.330
<i>Wet Chemistry (mg/Kg)</i>						
Total Organic Carbon	4	4	100%	851.00	86062.75	278000.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.8
 Sediment Sample Results - EPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-FD-001-061606	SD-008R	SD-008R2	SD-009R	SD-011R	SD-012R	SD-041R	SD-054	SD-055	SD-055R	SD-056	SD-057	SD-057R
Date Sampled	Screening Benchmark	6/16/2006	6/16/2006	7/31/2006	7/7/2006	6/14/2006	6/22/2006	6/12/2006	7/7/2006	6/16/2006	7/31/2006	7/7/2006	6/16/2006	7/31/2006
EPH (mg/Kg)														
Anthracene	0.0572	0.871 U	1.06 U	0.2 UJ	0.242 U	0.0602 J	0.207 U	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ
Benzo(a)anthracene	0.11	0.871 U	1.06 U	0.2 UJ	0.242 U	0.143 J	0.207 U	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ
Benzo(a)pyrene	0.15	0.871 U	1.06 U	0.2 UJ	0.242 U	0.0978 J	0.207 U	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ
Benzo(b)fluoranthene	0.037	0.871 U	1.06 U	0.2 UJ	0.242 UJ	0.079 J	0.207 UJ	R	0.207 UJ	0.108 J	0.182 UJ	0.478 UJ	0.114 J	0.171 UJ
Benzo(k)fluoranthene	0.037	0.871 U	1.06 U	0.2 UJ	0.242 U	0.124 J	0.207 U	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ
Chrysene	0.17	0.148 J	1.06 U	0.0902 J	0.242 U	0.199 J	0.207 U	R	0.207 U	0.156 J	0.182 UJ	0.478 UJ	0.171 J	0.171 UJ
Fluoranthene	0.423	0.183 J	1.06 U	0.0762 J	0.242 U	0.444 J	0.0769 J	R	0.207 U	0.228 J	0.182 UJ	0.163 J	0.2 J	0.171 UJ
Phenanthrene	0.204	0.871 U	1.06 U	0.2 UJ	0.242 U	0.154 J	0.207 U	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ
Pyrene	0.2	0.871 U	1.06 U	0.0802 J	0.242 U	0.353 J	0.0748 J	R	0.207 U	1.2 U	0.182 UJ	0.478 UJ	0.949 U	0.171 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - Inorganics
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	ESD-025	ESD-029	SD-002-00-04-I	SD-004-00-04-I	SD-008-00-04-I	SD-FD-001-061606	SD-008R	SD-008R2	SD-009-00-04-I	SD-009R
Upper Depth (in.)	Screening	0	0	0	0	0				0	
Lower Depth (in.)	Benchmark	6	6	4	4	4				4	
Date Sampled		7/25/2000	7/25/2000	8/14/2003	8/14/2003	8/12/2003	6/16/2006	6/16/2006	7/31/2006	8/12/2003	7/7/2006
Inorganics (mg/Kg)											
Antimony	64			R	R	0.67 U	6.84 U	2.21 J	0.967 UJ	0.6 U	1.45 UJ
Arsenic	33			0.22 U	0.22 U	3.2	4.4 J	4.96 J	4.44	3.3	2.76 J
Barium	20										
Beryllium				0.97 U	0.98 U	1 U	1.37	1.5	0.395	2.3 U	0.414
Boron				11 U	14 U	28 U	34.2 U	39.4 U	0.636 U		1.02 U
Cadmium	5			0.92 U	0.93 U	6.7	3.67	4.31	1.85	3.1	0.325 U
Chromium	110			5.7	6.5	32	18	20.8	11.3	14	8.32 J
Copper	150			29	52	570	152	176	282 J	300	39.4 J
Lead	130	57	30	2.7 J	2.5 J	6.5 J	38.7	47	64.9 J	15 J	3.81 J
Lithium				12	14	23	18	22.2	8.37		10.7
Mercury	0.18			0.17	0.26	2.1	0.243	0.249 J	0.374	0.19	0.106
Nickel	49			8.8	12	55	37.8	46.9	19.2 J	42	10.7 J
Selenium	0.1			2.9 J	2.9 J	4.6	3.33 J	3.23 J	1.91 U	6.8 U	1.91 U
Silver	4.5			0.29 UJ	0.3 J	0.31 UJ	4.56 U	5.25 U	2.22 J	0.69 UJ	1.27 UJ
Thallium				0.68 U	0.69 U	1.7	2.42 J	2.76 J	9.6 U	0.6 U	1.91 U
Uranium							7.16 U	3.99 U			1.28 U
Zinc	460			72	99	790	327	398	197 J	370	59.5 J

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - Inorganics
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-010-00-04-I	SD-011-00-04-I	SD-011-05-09-I	SD-011R	SD-012-00-04-I	SD-012R
Upper Depth (in.)	Screening	0	0	5		0	
Lower Depth (in.)	Benchmark	4	4	9		4	
Date Sampled		8/12/2003	8/12/2003	8/12/2003	6/14/2006	8/12/2003	6/22/2006
Inorganics (mg/Kg)							
Antimony	64	0.56 U	0.42 U	0.41 U	0.415 UJ	0.43 U	0.911 U
Arsenic	33	1.1 J	1 UJ	0.74 J	1.64 J	1.4 J	2.51
Barium	20						
Beryllium		2.2 U	1.8 U	1.7 U	0.806	1.6 U	0.392
Boron					7.18 U		7.73 U
Cadmium	5	2.1 U	1.7 U	1.6 U	0.878	1.5 U	0.242 U
Chromium	110	11	6.4	7.8	11.5	2.6	8.58 J
Copper	150	16 J	13 UJ	61	51.4	10 J	58.4 J
Lead	130	6.4 J	34 J	18 J	34.4	17 J	45.3 UJ
Lithium					16.2		12.4
Mercury	0.18	0.04 U	0.03 U	0.04 U	0.0497 J	0.04 U	0.0507 U
Nickel	49	12	9.7	34	24.1	6.6	27.4 J
Selenium	0.1	6.4 J	5.4 U	4.9 U	2.39 U	4.7 U	1.45 U
Silver	4.5	0.65 UJ	0.55 UJ	0.5 UJ	1.6 UJ	0.48 UJ	0.969 UJ
Thallium		0.56 U	0.42 U	0.41 U	2.39 U	0.43 U	1.45 U
Uranium					2.4		1.16 U
Zinc	460	77	94	250	241 J	45	231 J

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - Inorganics
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-013-00-04-I	SD-014-00-04-I	SD-014-06-12-I	SD-015-00-04-I	SD-016-00-04-I	SD-017-00-04-I	SD-017-04-08-I	SD-018-00-04-I	SD-019-00-04-I	SD-020-00-04-I
Upper Depth (in.)		0	0	6	0	0	0	4	0	0	0
Lower Depth (in.)	Screening	4	4	12	4	4	4	8	4	4	4
Date Sampled	Benchmark	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
Inorganics (mg/Kg)											
Antimony	64	R	R	R	R	R	R	1.7 J	R	R	R
Arsenic	33	R	R	R	R	0.21 UJ	1.2 J	0.2 UJ	0.88 J	1.2 J	0.34 UJ
Barium	20										
Beryllium		2.5 U	3 U	1.5 U	2 U	0.93 U	1.3 U	0.9 U	1.2 U	1.1 U	1.5 U
Boron											
Cadmium	5	2.3 UJ	2.8 UJ	1.4 UJ	1.9 U	0.88 U	1.2 U	0.86 U	1.1 U	1.1 U	1.5 U
Chromium	110	12	25	5.5	6.7	8.5	18	8.1	17	15	19
Copper	150	37 J	67 J	20 J	13	11	27	11	25	26	33
Lead	130	0.7 UJ	1.1 J	0.34 UJ	0.44 UJ	0.78 J	2.8 J	0.6 J	2.9 J	2.3 J	0.77 J
Lithium											
Mercury	0.18	0.07 U	0.084	0.05 U	0.04 U	0.04 U	0.05 U	0.05 U	0.07 U	0.06 U	0.1 U
Nickel	49	9.8	18	5.1	7.9	11	19	10	19	17	21
Selenium	0.1	7.3 U	8.8 U	4.3 U	5.9 UJ	2.8 UJ	3.9 UJ	2.7 UJ	3.5 U	3.3 UJ	4.5 UJ
Silver	4.5	0.74 UJ	0.89 UJ	0.44 UJ	0.6 U	0.28 UJ	0.39 UJ	0.27 UJ	0.36 UJ	0.33 UJ	0.46 UJ
Thallium		1.2 U	1.1 U	0.57 U	0.73 U	0.65 U	0.91 U	0.63 U	0.84 U	0.78 U	1.1 U
Uranium											
Zinc	460	68	150	37 U	72 J	43	100	33	96	120	140

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - Inorganics
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	FD002-081303	SD-021-00-04-I	SD-021-08-14-I	SD-023-00-04-I	SD-024-00-04-I	SD-024-12-18-I	SD-025-00-04-I	SD-026-00-04-I	SD-027-00-04-I	SD-027-08-14-I
Upper Depth (in.)	Screening	8	0	8	0	0	12	0	0	0	8
Lower Depth (in.)	Benchmark	14	4	14	4	4	18	4	4	4	14
Date Sampled		8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
Inorganics (mg/Kg)											
Antimony	64	R	R	R	R	R	R	R	R	R	R
Arsenic	33	1 J	1.5 J	0.9 J	0.3 UJ	0.45 UJ	1.4 J	0.37 UJ	0.19 UJ	0.73 J	1.6
Barium	20										
Beryllium		1.2 U	1.7 U	1.2 U	1.4 U	2 U	1.8 U	1.7 U	0.83 U	1 U	0.8 U
Boron											
Cadmium	5	1.1 U	1.7 U	1.1 U	1.3 U	1.9 U	1.7 U	1.6 U	0.79 U	0.99 U	0.76 U
Chromium	110	13	22	12	13	21	22	12	6.6	12	6.8
Copper	150	9.7	65	7.8	18	44	27	20	8.4	9.6	6.8
Lead	130	2.4 J	R	0.51 J	0.79 J	1.5 J	1.1 J	2.2 J	0.73 J	0.7 J	0.7 J
Lithium											
Mercury	0.18	0.07 U	0.09 U	0.06 U	0.08 U	0.06	0.063	0.08 U	0.05 U	0.03 U	0.01 U
Nickel	49	11	26	9.9	14	24	24	14	7.5	14	8.7
Selenium	0.1	3.4 UJ	5.2 UJ	3.5 UJ	4 UJ	6 UJ	5.4 J	4.9 U	2.5 U	3.1 UJ	2.4 UJ
Silver	4.5	0.35 UJ	0.52 UJ	0.35 UJ	0.41 UJ	0.61 UJ	0.55 UJ	0.5 UJ	0.25 UJ	0.31 UJ	0.24 UJ
Thallium		0.81 U	1.2 U	0.82 U	0.94 U	1.4 U	1.3 U	1.2 U	0.58 U	0.73 U	0.56 U
Uranium											
Zinc	460	61	220	56	92	160	140	100	36	62	36

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - Inorganics
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-028-00-04-I	SD-029-00-04-I	SD-029-08-14-I	SD-030-00-04-I	SD-031-00-04-I	SD-032-00-04-I	SD-033-00-04-I	SD-034-00-04-I	SD-035-00-04-I	SD-036-00-04-I
Upper Depth (in.)	Screening	0	0	8	0	0	0	0	0	0	0
Lower Depth (in.)	Benchmark	4	4	14	4	4	4	4	4	4	4
Date Sampled		8/13/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/13/2003	8/13/2003	8/13/2003
Inorganics (mg/Kg)											
Antimony	64	R	0.72 UJ	0.003 UJ	0.72 UJ	R	1.2 UJ	R	R	R	R
Arsenic	33	0.18 UJ	1.5 J	0.19 UJ	0.88 J	3.2 J	0.39 UJ	2.6 J	0.94 J	1.3 J	2.1 J
Barium	20										
Beryllium		0.79 U	1 U	0.87 U	1 U	R	3.2 U	R	1.3 U	1.6 U	2.2 U
Boron											
Cadmium	5	0.76 U	0.98 U	0.83 U	0.97 U	R	3 U	R	1.3 U	1.5 U	2.1 U
Chromium	110	8.2	9.8	7.8	9.8	27 J	20	8.6 J	18	16	23
Copper	150	6.6	13	9.2	11	120 J	40	20 J	26	28	42
Lead	130	0.95 J	R	R	0.76 J	3.8 J	1.4 J	3.6 J	3.2 J	5.5 J	7 J
Lithium											
Mercury	0.18	0.04 U	0.05 U	0.04 U	0.05 U	0.13 J	0.091	0.16 J	0.06 U	0.08 U	0.11 U
Nickel	49	8.2	13	8.2	11	31 J	22	9.2 J	21	19	27
Selenium	0.1	2.4 U	3.1 UJ	2.6 UJ	3 UJ	R	9.4 UJ	R	4 U	4.8 U	6.4 U
Silver	4.5	0.24 UJ	0.31 UJ	0.26 UJ	0.31 UJ	R	0.95 UJ	R	0.4 UJ	0.48 UJ	0.65 UJ
Thallium		0.56 U	0.72 U	0.01 U	0.72 U	R	1.2 U	R	0.93 U	1.1 U	1.5 U
Uranium											
Zinc	460	39	48	30	50	180 J	180	60 J	100	110	160

> SD benchmark

Appendix Table A.2.8
Sediment Sample Results - Inorganics
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-037-00-04-I	SD-038-00-04-I	SD-039-00-04-I	SD-040-00-04-I	SD-041-00-04-I	SD-041R	SD-050	SD-051	SD-052	SD-053	SD-054	SD-055
Upper Depth (in.)	Screening	0	0	0	0	0							
Lower Depth (in.)	Benchmark	4	4	4	4	4							
Date Sampled		8/13/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	6/12/2006	7/7/2006	7/7/2006	6/14/2006	6/22/2006	7/7/2006	6/16/2006
Inorganics (mg/Kg)													
Antimony	64	R	R	0.95 UJ	3.9 J	R	R	2.63 UJ	2.85 UJ	R	1.07 U	1.81 UJ	8.04 U
Arsenic	33	2.6	4.8 J	1.9	3.8 J	4.5 J	3.07 J	3.28 J	6.38 J	0.899 U	2.48	3.9 J	5.68 J
Barium	20												
Beryllium		2.2 U	R	1.4 U		R		0.957 J	0.569	0.999	1.11	0.185 J	0.428
Boron								10.9 J	1.17 J	0.545 J	10.2	0.639 U	0.965 U
Cadmium	5	2.1 U	R	1.3 U		R		1.44 J	0.531	1.77	0.437	0.102 U	0.983
Chromium	110	24	34 J	13	28 J	30 J	23.5 J	8.32 J	14 J	10.5	3.97 U	10.7 J	19.9
Copper	150	48	100 J	20	57 J	89 J	53.4 J	63.4 J	182 J	105	10 U	193 J	155
Lead	130	9.5 J	14 J	2.9 J	5.2 J	8.3 J	41.4 J	20.7 J	51.2 J	80.8	3.44 U	33.4 J	45.9
Lithium							25.2 J	10.9	16.8	9.06	8.52	16.3	21
Mercury	0.18	0.13	0.17 J	0.024	0.056 J	0.15 J	0.126 J	0.0776 U	0.0564 J	0.0657 U	0.0659 U	0.489	0.651
Nickel	49	28	41 J	13	31 J	35 J	17.8 J	17.8 J	30.7 J	42.7	5.33 U	18.3 J	42.6
Selenium	0.1	6.6 U	R	4 UJ		R		R	2.24 U	3.4 U	1.85 UJ	1.92 U	1.81 U
Silver	4.5	0.67 UJ	R	0.41 UJ		R		R	1.24 J	2.27 UJ	1.23 UJ	1.28 UJ	1.21 UJ
Thallium		1.6 U	R	0.95 U		R		R	2.24 U	3.4 U	1.85 U	1.92 U	1.81 U
Uranium							3.04 U	7.18 U	2.08 U	2.5	1.24 U	2.58 U	6.63 U
Zinc	460	190	300 J	80	220 J	260 J	196 J	142 J	315 J	459 J	49.6 U	152 J	382

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - Inorganics
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-055R	SD-056	SD-057	SD-057R
Upper Depth (in.)	Screening				
Lower Depth (in.)	Benchmark				
Date Sampled		7/31/2006	7/7/2006	6/16/2006	7/31/2006
Inorganics (mg/Kg)					
Antimony	64	1.32 UJ	2.43 UJ	7.07 U	2.33 UJ
Arsenic	33	4.02	17.2 J	5.61 J	2.67
Barium	20				
Beryllium		0.697	0.982	1.37	0.272
Boron		3.24 U	10.4	35.4 U	0.648 U
Cadmium	5	0.814	1.96	6.22	0.331 U
Chromium	110	9.76	31.3 J	20.5	10.4
Copper	150	146 J	206 J	245	20.3 J
Lead	130	58 J	33.6 J	41.5	1.56 J
Lithium		10.7	29.2	16.7	15.8
Mercury	0.18	0.835	1.11	0.244	0.231 U
Nickel	49	30.6 J	34 J	54.1	10.7 J
Selenium	0.1	1.94 U	3.98 U	3.39 J	1.94 U
Silver	4.5	1.09 J	2.66 UJ	4.71 U	1.12 J
Thallium		2 U	3.98 U	6.06 J	0.972 U
Uranium			2.58 U	4.93 U	
Zinc	460	223 J	304 J	479	54 J

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		ESD-005	ESD-006	ESD-009	ESD-014	ESD-025	ESD-025B	ESD-028B	DUP 3-100902	ESD-029	ESD-029B
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	6	6	2	0	6
Lower Depth (in.)	Screening	6	6	6	6	6	8	8	4	6	8
Date Sampled	Benchmark	4/6/2000	4/6/2000	4/6/2000	4/20/2000	7/25/2000	7/25/2000	7/25/2000	10/9/2002	7/25/2000	7/25/2000
PCBs (µg/Kg)											
Aroclor-1248		200 U	200 U	200 U	200 U	200 U	200 UJ	200 UJ	340 UJ	200 U	200 UJ
Aroclor-1254	60	440	830	320	200 U	790	200 UJ	800 J	340 UJ	500 J	400 J
Aroclor-1260	60	200 U	200 U	200 U	200 U	200 U	200 UJ	200 UJ	340 UJ	200 U	200 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		ESD-29A II	ESD-29B II	ESD-032	ESD-033	ESD-034	ESD-34A II	ESD-34B II	ESD-035	ESD-036	ESD-35A II	ESD-35B II	ESD-037
Upper Depth (in.)	Sediment (SD)	0	2	0	0	0	0	2	0	0	0	2	0
Lower Depth (in.)	Screening	2	4	6	6	6	2	4	6	6	2	4	6
Date Sampled	Benchmark	10/8/2002	10/8/2002	9/7/2000	9/7/2000	9/7/2000	10/8/2002	10/8/2002	9/7/2000	9/7/2000	10/8/2002	10/8/2002	9/7/2000
PCBs (µg/Kg)													
Aroclor-1248		36 UJ	260 UJ	200 UJ	200 U	200 U	240 UJ	170 U	200 U	200 U	360 UJ	240 UJ	200 U
Aroclor-1254	60	36 UJ	260 UJ	200 UJ	200 U	200 U	240 UJ	170 U	200 U	200 U	360 UJ	240 UJ	200 U
Aroclor-1260	60	36 UJ	260 UJ	200 UJ	200 U	200 U	240 UJ	170 U	200 U	200 U	360 UJ	240 UJ	200 U

 > SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		ESD-37A II	ESD-37B II	ESD-038	ESD-039	ESD-040	ESD-041	ESD-042	ESD-41A II	ESD-41B II	ESD-043	ESD-43A II	ESD-43B II	ESD-044
Upper Depth (in.)	Sediment (SD)	0	2	0	0	0	0	0	0	2	0	0	2	0
Lower Depth (in.)	Screening	2	4	6	6	5	6	6	2	4	6	2	4	6
Date Sampled	Benchmark	10/8/2002	10/8/2002	9/7/2000	9/7/2000	9/7/2000	9/7/2000	9/7/2000	10/8/2002	10/8/2002	9/7/2000	10/8/2002	10/8/2002	9/7/2000
PCBs (µg/Kg)														
Aroclor-1248		32 UJ	210 U	200 U	200 U	200 U	200 U	200 UJ	220 UJ	200 U	200 U	230 UJ	170 U	200 U
Aroclor-1254	60	32 UJ	210 U	200 U	200 U	200 U	200 U	200 UJ	550 J	200 U	200 U	230 UJ	170 U	200 U
Aroclor-1260	60	32 UJ	210 U	200 U	200 U	200 U	200 U	200 UJ	220 UJ	200 U	200 U	230 UJ	170 U	200 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		ESD-44A II	ESD-44B II	ESD-045B-6-8	ESD-046B-6-8	ESD-047B-6-8	ESD-048B-6-8	ESD-049B-6-8	ESD-50A II	ESD-50B II	ESD-51A II	ESD-51B II	ESD-52A II
Upper Depth (in.)	Sediment (SD)	0	2	6	6	6	6	6	0	2	0	2	0
Lower Depth (in.)	Screening	2	4	8	8	8	8	8	2	4	2	4	2
Date Sampled	Benchmark	10/8/2002	10/8/2002	12/5/2000	12/5/2000	12/5/2000	12/5/2000	12/5/2000	10/8/2002	10/8/2002	10/8/2002	10/8/2002	10/8/2002
PCBs (µg/Kg)													
Aroclor-1248		22 U	120 U	200 UJ	200 UJ	200 U	200 U	200 U	220 U	14 UJ	300 UJ	17 UJ	260 UJ
Aroclor-1254	60	52	120 U	300 J	400 J	200 U	200	200 U	910	68 J	300 UJ	17 UJ	260 UJ
Aroclor-1260	60	22 U	120 U	200 UJ	200 UJ	200 U	200 U	200 U	220 U	14 UJ	300 UJ	17 UJ	260 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		ESD-52B II	SD-002-00-04-I	SD-004-00-04-I	SD-008-00-04-I	SD-FD-001-061606	SD-008E	SD-008N	SD-008R	SD-008R2	SD-008R3	SD-008S	SD-008W
Upper Depth (in.)	Sediment (SD)	2	0	0	0								
Lower Depth (in.)	Screening	4	4	4	4								
Date Sampled	Benchmark	10/8/2002	8/14/2003	8/14/2003	8/12/2003	6/16/2006	8/30/2006	8/30/2006	6/16/2006	7/31/2006	8/30/2006	8/30/2006	8/30/2006
PCBs (µg/Kg)													
Aroclor-1248		200 U	43 U	46 U	63 U	28.1 U	16.4 UJ	18.6 UJ	24.7 U	10.7 UJ	14.5 UJ	17.5 UJ	16.1 UJ
Aroclor-1254	60	200 U	43 U	46 U	63 U	28.1 U	16.4 UJ	18.6 UJ	668	1660 J	14.5 UJ	17.5 UJ	16.1 UJ
Aroclor-1260	60	200 U	43 U	46 U	63 U	28.1 U	16.4 UJ	18.6 UJ	102	251 J	14.5 UJ	17.5 UJ	16.1 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-009-00-04-I	SD-009R	SD-010-00-04-I	SD-011-00-04-I	SD-011-05-09-I	SD-011R	SD-012-00-04-I	SD-012R	SD-012R2	SD-012RE	SD-012RN	SD-012RS
Upper Depth (in.)	Sediment (SD)	0		0	0	5		0					
Lower Depth (in.)	Screening	4		4	4	9		4					
Date Sampled	Benchmark	8/12/2003	7/7/2006	8/12/2003	8/12/2003	8/12/2003	6/14/2006	8/12/2003	6/22/2006	8/1/2006	8/1/2006	8/1/2006	8/1/2006
PCBs (µg/Kg)													
Aroclor-1248		59 U	13.3 UJ	53 U	40 U	40 U	10.6 UJ	43 U	171	9.98 U	11.4 UJ	10.4 U	10.6 UJ
Aroclor-1254	60	450	13.3 UJ	53 U	170	47	52 J	460	2200	226	371 J	449	603 J
Aroclor-1260	60	59 U	13.3 UJ	53 U	40 U	40 U	10.9 J	43 U	382	25.3	64.7 J	62.9	60.5 J

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-012RW	SD-013-00-04-I	SD-014-00-04-I	SD-014-06-12-I	SD-015-00-04-I	SD-016-00-04-I	SD-017-00-04-I	SD-017-04-08-I	SD-018-00-04-I	SD-019-00-04-I	SD-020-00-04-I
Upper Depth (in.)	Sediment (SD)		0	0	6	0	0	0	4	0	0	0
Lower Depth (in.)	Screening		4	4	12	4	4	4	8	4	4	4
Date Sampled	Benchmark	8/1/2006	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
PCBs (µg/Kg)												
Aroclor-1248		10.3 UJ	76 U	76 U	36 U	46 U	43 U	59 U	40 U	53 U	50 U	69 U
Aroclor-1254	60	156 J	76 U	76 U	36 U	46 U	43 U	59 U	40 U	98	570	69 U
Aroclor-1260	60	18.5 J	76 U	76 U	36 U	46 U	43 U	59 U	40 U	53 U	50 U	69 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		FD002-081303	SD-021-00-04-I	SD-021-08-14-I	SD-023-00-04-I	SD-024-00-04-I	SD-024-12-18-I	SD-025-00-04-I	SD-026-00-04-I	SD-027-00-04-I	SD-027-08-14-I	SD-028-00-04-I
Upper Depth (in.)	Sediment (SD)	8	0	8	0	0	12	0	0	0	8	0
Lower Depth (in.)	Screening	14	4	14	4	4	18	4	4	4	14	4
Date Sampled	Benchmark	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
PCBs (µg/Kg)												
Aroclor-1248		53 U	79 U	53 U	63 U	92 U	82 U	76 U	40 U	46 U	36 U	36 U
Aroclor-1254	60	53 U	290 J	53 U	63 U	92 U	190 J	430	40 U	46 U	36 U	36 U
Aroclor-1260	60	53 U	79 U	53 U	63 U	92 U	82 U	76 U	40 U	46 U	36 U	36 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-029-00-04-I	SD-029-08-14-I	SD-030-00-04-I	SD-031-00-04-I	SD-032-00-04-I	SD-033-00-04-I	SD-034-00-04-I	SD-035-00-04-I	SD-036-00-04-I	SD-037-00-04-I	SD-038-00-04-I
Upper Depth (in.)	Sediment (SD)	0	8	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	14	4	4	4	4	4	4	4	4	4
Date Sampled	Benchmark	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/14/2003
PCBs (µg/Kg)												
Aroclor-1248		46 U	40 U	46 U	R	79 U	R	59 U	76 U	99 U	100 U	R
Aroclor-1254	60	46 U	40 U	46 U	120 J	79 U	R	59 U	76 U	980 J	100 U	120 J
Aroclor-1260	60	46 U	40 U	46 U	R	79 U	R	59 U	76 U	99 U	100 U	R

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-039-00-04-I	SD-040-00-04-I	SD-041-00-04-I	SD-041R	SD-054	SD-055	SD-055R	SD-056	SD-057	SD-057R	SD-502 0003I	SD-503 0003I
Upper Depth (in.)	Sediment (SD)	0	0	0								0	0
Lower Depth (in.)	Screening	4	4	4								3	3
Date Sampled	Benchmark	8/14/2003	8/14/2003	8/14/2003	6/12/2006	7/7/2006	6/16/2006	7/31/2006	7/7/2006	6/16/2006	7/31/2006	9/30/2004	9/30/2004
PCBs (µg/Kg)													
Aroclor-1248		63 U	R	R	16.6 UJ	10 U	28.1 U	10.8 UJ	10.2 U	26.2 U	10.5 UJ	42 UJ	42 U
Aroclor-1254	60	63 U	R	97 J	16.6 UJ	10 U	28.1 U	51.7 J	10.2 U	26.2 U	34.8 J	45 J	68 J
Aroclor-1260	60	63 U	R	R	16.6 UJ	10 U	28.1 U	6.07 J	10.2 U	26.2 U	4.62 J	42 UJ	42 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-504 0003I	SD-505 0003I	SD-506 0003I	SD-507 0003I	SD-508 0003I	SD-509 0003I	FD002 0003I-093004	SD-510 0003I	SD-511 0003I	SD-512 0003I	SD-513 0003I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004	9/30/2004
PCBs (µg/Kg)												
Aroclor-1248		59 UJ	81 UJ	80 UJ	52 U	65 UJ	86 U	85 U	110 U	84 UJ	R	92 UJ
Aroclor-1254	60	380 J	120 J	110 J	52 U	78 J	58 J	170 J	110 U	120 J	R	92 UJ
Aroclor-1260	60	59 UJ	81 UJ	80 UJ	52 U	65 UJ	86 U	85 U	110 U	84 UJ	R	92 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-514 0003I	SD-515 0003I	SD-516 0003I	SD-517 0003I	SD-518 0003I	SD-519 0003I	SD-520 0003I	FD04 0003I-100104	SD-521 0003I	SD-522 0003I	SD-523 0003I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004	10/1/2004
PCBs (µg/Kg)												
Aroclor-1248		82 U	88 UJ	110 U	97 UJ	84 U	95 U	93 U	80 UJ	82 U	80 U	91 U
Aroclor-1254	60	74 J	84 J	110 U	160 J	53 J	280 J	330	240 J	250	270	380
Aroclor-1260	60	82 U	88 UJ	110 U	97 UJ	84 U	95 U	93 U	80 UJ	82 U	80 U	91 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-524 0003I	SD-538	SD-539	SD-540	SD-541	FD013-102804	SD-542	FD007-00-03I-112204	SD-601-00-03I	SD-602-00-03I	SD-603-00-03I	SD-604-00-03I
Upper Depth (in.)	Sediment (SD)	0					0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3					3	3	3	3	3	3	3
Date Sampled	Benchmark	10/1/2004	10/28/2004	10/28/2004	10/28/2004	10/28/2004	10/28/2004	10/28/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004
PCBs (µg/Kg)													
Aroclor-1248		110 U	33 U	33 U	33 U	33 U	33 U	34 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	60	500	33 U	110 J	110 J	45 J	180 J	250	1200 J	150 J	33 U	35 J	33 U
Aroclor-1260	60	110 U	33 U	33 U	33 U	33 U	33 U	34 U	33 U	33 U	33 U	33 U	33 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-605-00-03I	SD-606-00-03I	SD-607-00-03I	SD-608-00-03I	SD-609-00-03I	SD-610-00-03I	SD-611-00-03I	SD-612-00-03I	SD-613-00-03I	SD-614-00-03I	SD-615-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004
PCBs (µg/Kg)												
Aroclor-1248		33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U
Aroclor-1254	60	610 J	170 J	39	33 U	590	700 J	64	98 J	95	310	360
Aroclor-1260	60	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-616-00-03I	SD-617-00-03I	SD-618-00-03I	SD-619-00-03I	SD-620-00-03I	FD008-00-03I-112204	SD-621-00-03I	SD-622-00-03I	SD-623-00-03I	SD-624-00-03I	SD-625-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004
PCBs (µg/Kg)												
Aroclor-1248		33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	35 U	33 U
Aroclor-1254	60	310 J	220	380	360 J	600	68 J	430 J	64 J	52 J	35 U	760 J
Aroclor-1260	60	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	35 U	33 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-626-00-03I	SD-627-00-03I	SD-628-00-03I	SD-629-00-03I	SD-630-00-03I	SD-631-00-03I	SD-632-00-03I	SD-633-00-03I	SD-634-00-03I	SD-635-00-03I	SD-636-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004	11/22/2004
PCBs (µg/Kg)												
Aroclor-1248		130 U	34 U	33 U	33 U	33 U	34 U	33 U	33 U	33 U	40 U	54 U
Aroclor-1254	60	3400 J	480	33 U	33 U	160	1600	33 U	33 U	140 J	860	54 U
Aroclor-1260	60	130 U	34 U	33 U	33 U	33 U	34 U	33 U	33 U	33 U	40 U	54 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - PCBs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-637-00-03I	SD-638-00-03I	SD-639-00-03I	SD-640-00-03I	FD009-00-03I-112304	SD-641-00-03I	SD-642-00-03I	SD-643-00-03I	SD-750-00-03I	SD-750D-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	11/22/2004	11/22/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004	11/23/2004	12/15/2004	12/15/2004
PCBs (µg/Kg)											
Aroclor-1248		33 U	41 U	33 U	33 U	35 U	40 U	50 U	49 U	34 U	34 U
Aroclor-1254	60	33 U	86	140	33 U	780	640	650	49 U	940	1000
Aroclor-1260	60	33 U	41 U	33 U	33 U	35 U	40 U	50 U	49 U	34 U	34 U

> SD benchmark

Appendix Table A.2.8
Sediment Sample Results - SVOCs
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-002-00-04-I	SD-FD-001-061606	SD-008R	SD-008R2	SD-009R	SD-011-00-04-I	SD-011-05-09-I	SD-011R	SD-012R
Upper Depth (in.)	Screening	0					0	5		
Lower Depth (in.)	Benchmark	4					4	9		
Date Sampled	Benchmark	8/14/2003	6/16/2006	6/16/2006	7/31/2006	7/7/2006	8/12/2003	8/12/2003	6/14/2006	6/22/2006
SVOC (µg/Kg)										
Acenaphthene	150	460 U	2090 U	1140 U	305 U	293 U	430 U	160 J	406 U	172 U
Anthracene	57.2	460 U	2090 U	1140 U	305 U	293 U	430 U	240 J	406 U	36.2 J
Benzo(a)anthracene	110	460 U	2090 U	1140 U	305 U	293 U	430 U	320 J	38.5 J	100 J
Benzo(a)pyrene	150	460 U	2090 U	1140 U	305 U	293 U	430 U	270 J	25.4 J	80.1 J
Benzo(g,h,i)perylene	150	460 U	2090 U	1140 U	305 U	293 U	430 U	120 J	406 U	30.3 J
Benzo(k)fluoranthene	37	460 U	2090 U	1140 U	305 U	293 U	430 U	400 U	17.2 J	86 J
bis(2-Ethylhexyl)phthalate	13300	460 U	2090 U	1140 U	305 U	293 U	140 J	140 J	406 U	172 U
Chrysene	170	460 U	2090 U	1140 U	305 U	293 U	430 U	290 J	27.9 J	112 J
3+4-Methylphenol		460 U	2090 U	1140 U	305 U	293 U	430 U	400 U	406 U	172 U
Dibenzofuran	5100	460 U	2090 U	1140 U	305 U	293 U	430 U	120 J	406 U	172 U
2,6-Dinitrotoluene		460 U	2090 U	1140 U	305 U	293 U	430 U	400 U	25.4 J	172 U
Di-n-octyl phthalate		460 U	2090 U	1140 U	305 U	293 U	320 J	400 U	406 U	172 U
Fluoranthene	423	460 U	88.5 J	1140 U	305 U	293 U	120 J	700	50 J	231
Fluorene	77.4	460 U	2090 U	1140 U	305 U	293 U	430 U	180 J	406 U	172 U
Indeno(1,2,3-cd)pyrene	30	460 U	2090 U	1140 U	305 U	293 U	430 U	110 J	406 U	31.7 J
Phenanthrene	204	460 U	2090 U	1140 U	305 U	293 U	430 U	740	23.8 J	95.7 J
Pyrene	200	460 U	2090 U	1140 U	305 U	293 U	430 U	520	55.8 J	180

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - SVOCs
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-014-00-04-I	SD-014-06-12-I	SD-017-00-04-I	SD-017-04-08-I	FD002-081303	SD-021-00-04-I	SD-021-08-14-I	SD-024-00-04-I	SD-024-12-18-I
Upper Depth (in.)	Screening	0	6	0	4	8	0	8	0	12
Lower Depth (in.)	Benchmark	4	12	4	8	14	4	14	4	18
Date Sampled		8/12/2003	8/12/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
SVOC (µg/Kg)										
Acenaphthene	150	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Anthracene	57.2	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Benzo(a)anthracene	110	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Benzo(a)pyrene	150	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Benzo(g,h,i)perylene	150	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Benzo(k)fluoranthene	37	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
bis(2-Ethylhexyl)phthalate	13300	730 UJ	360 UJ	590 UJ	430 UJ	530 UJ	790 UJ	530 UJ	920 UJ	830 UJ
Chrysene	170	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
3+4-Methylphenol		730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Dibenzofuran	5100	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
2,6-Dinitrotoluene		730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Di-n-octyl phthalate		730 UJ	360 UJ	590 UJ	430 UJ	530 UJ	790 UJ	530 UJ	920 UJ	830 UJ
Fluoranthene	423	220 J	360 U	130 J	430 U	530 U	250 J	530 U	920 U	200 J
Fluorene	77.4	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Indeno(1,2,3-cd)pyrene	30	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Phenanthrene	204	730 U	360 U	590 U	430 U	530 U	790 U	530 U	920 U	830 U
Pyrene	200	180 J	360 U	120 J	430 U	530 U	190 J	530 U	920 U	830 U

> SD benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.2.8
Sediment Sample Results - SVOCs
Sherman Reservoir Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-027-00-04-I	SD-027-08-14-I	SD-029-00-04-I	SD-029-08-14-I	SD-041R	SD-054	SD-055	SD-055R	SD-056	SD-057	SD-057R
Upper Depth (in.)	Screening	0	8	0	8							
Lower Depth (in.)	Benchmark	4	14	4	14							
Date Sampled		8/13/2003	8/13/2003	8/14/2003	8/14/2003	6/12/2006	7/7/2006	6/16/2006	7/31/2006	7/7/2006	6/16/2006	7/31/2006
SVOC (µg/Kg)												
Acenaphthene	150	460 U	360 U	460 U	400 U		301 U	2280 U	25.5 J	680 U	1250 U	258 U
Anthracene	57.2	460 U	360 U	460 U	400 U		301 U	2280 U	293 U	57.7 J	1250 U	258 U
Benzo(a)anthracene	110	460 U	360 U	130 J	400 U	R	301 U	2280 U	293 U	59.1 J	1250 U	258 U
Benzo(a)pyrene	150	460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Benzo(g,h,i)perylene	150	460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Benzo(k)fluoranthene	37	460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
bis(2-Ethylhexyl)phthalate	13300	460 UJ	360 UJ	460 UJ	400 UJ	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Chrysene	170	460 U	360 U	120 J	400 U	R	301 U	2280 U	293 U	48.1 J	65.8 J	258 U
3+4-Methylphenol		460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	698 J	258 U
Dibenzofuran	5100	460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
2,6-Dinitrotoluene		460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Di-n-octyl phthalate		460 UJ	360 UJ	460 UJ	400 UJ	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Fluoranthene	423	460 U	360 U	330 J	400 U	R	301 U	2280 U	13.6 J	181 J	75.9 J	258 U
Fluorene	77.4	460 U	360 U	460 U	400 U	R	301 U	2280 U	14.8 J	28.9 J	1250 U	258 U
Indeno(1,2,3-cd)pyrene	30	460 U	360 U	460 U	400 U	R	301 U	2280 U	293 U	680 U	1250 U	258 U
Phenanthrene	204	460 U	360 U	460 U	400 U	R	301 U	2280 U	18.4 J	158 J	1250 U	258 U
Pyrene	200	460 U	360 U	250 J	400 U	R	301 U	2280 U	293 U	154 J	1250 U	258 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - TPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	SD-002-00-04-I	SD-008-00-04-I	SD-009-00-04-I	SD-010-00-04-I	SD-011-00-04-I	SD-011-05-09-I	SD-012-00-04-I	SD-013-00-04-I	SD-014-00-04-I	SD-014-06-12-I	SD-015-00-04-I
Upper Depth (in.)	0	0	0	0	0	5	0	0	0	6	0
Lower Depth (in.)	4	4	4	4	4	9	4	4	4	12	4
Date Sampled	8/14/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003
TPH (mg/Kg)											
TPH-DRO	2.6 U	40 U	36 J	32 U	24 UJ	5.2	26 UJ	86 J	48 J	2.5	28 UJ

Appendix Table A.2.8
 Sediment Sample Results - TPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	SD-016-00-04-I	SD-017-00-04-I	SD-017-04-08-I	SD-018-00-04-I	SD-019-00-04-I	SD-020-00-04-I	FD002-081303	SD-021-00-04-I	SD-021-08-14-I	SD-023-00-04-I	SD-024-00-04-I	SD-024-12-18-I
Upper Depth (in.)	0	0	4	0	0	0	8	0	8	0	0	12
Lower Depth (in.)	4	4	8	4	4	4	14	4	14	4	4	18
Date Sampled	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
TPH (mg/Kg)												
TPH-DRO	12 J	67 J	8.4	17 UJ	24 J	64 J	42 J	68	81 J	57 J	170 J	88 J

Appendix Table A.2.8
 Sediment Sample Results - TPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	SD-025-00-04-I	SD-026-00-04-I	SD-027-00-04-I	SD-027-08-14-I	SD-028-00-04-I	SD-029-00-04-I	SD-029-08-14-I	SD-030-00-04-I	SD-031-00-04-I	SD-032-00-04-I	SD-033-00-04-I	SD-034-00-04-I
Upper Depth (in.)	0	0	0	8	0	0	8	0	0	0	0	0
Lower Depth (in.)	4	4	4	14	4	4	14	4	4	4	4	4
Date Sampled	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003	8/13/2003
TPH (mg/Kg)												
TPH-DRO	71 J	2.4 U	24	4.4 U	5.9	30	2.4 U	32	64 J	28	52 J	30 J

Appendix Table A.2.8
 Sediment Sample Results - TPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	SD-035-00-04-I	SD-036-00-04-I	SD-037-00-04-I	SD-038-00-04-I	SD-039-00-04-I	SD-040-00-04-I	SD-041-00-04-I
Upper Depth (in.)	0	0	0	0	0	0	0
Lower Depth (in.)	4	4	4	4	4	4	4
Date Sampled	8/13/2003	8/13/2003	8/13/2003	8/14/2003	8/14/2003	8/14/2003	8/14/2003
TPH (mg/Kg)							
TPH-DRO	48 J	42	88 J	100 J	34	79 J	250 J

Appendix Table A.2.8
 Sediment Sample Results - VOCs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-002-00-04-I	SD-011-00-04-I	SD-011-05-09-I	SD-014-00-04-I	SD-014-06-12-I	SD-017-00-04-I	SD-017-04-08-I	FD002-081303	SD-021-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	5	0	6	0	4	8	0
Lower Depth (in.)	Screening	4	4	9	4	12	4	8	14	4
Date Sampled	Benchmark	8/14/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
VOC (µg/Kg)										
Acetone	57.1	10 UJ	35 J	73 J	240 UJ	10 UJ	190 J	3 J	120 J	120 J
2-Butanone	27000	10 UJ	5.4 J	6.6 J	10 UJ	10 U	28	10 U	13 J	29 J
Carbon disulfide	230	5 UJ	5 UJ	5 UJ	5 UJ	5 U	8.8	5 U	5.8 J	8 UJ
1,1-Dichloroethene	5900	5 UJ	5 UJ	5 UJ	5 UJ	5 U	40 J	7.3	28 J	24
4-Methyl-2-pentanone		5 UJ	5 UJ	5 UJ	5 UJ	5 U	2.8 J	5 U	3.2 J	8 UJ
Toluene	130000	11 J	5 UJ	5 UJ	24 UJ	13 U	22	5.2 U	25 J	34 J
1,2,4-Trimethylbenzene		5 UJ	5 UJ	4.2 J	5 UJ	5 U	5 U	5 U	5 UJ	8 UJ

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - VOCs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID		SD-021-08-14-I	SD-024-00-04-I	SD-024-12-18-I	SD-027-00-04-I	SD-027-08-14-I	SD-029-00-04-I	SD-029-08-14-I
Upper Depth (in.)	Sediment (SD)	8	0	12	0	8	0	8
Lower Depth (in.)	Screening	14	4	18	4	14	4	14
Date Sampled	Benchmark	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/14/2003	8/14/2003
VOC (µg/Kg)								
Acetone	57.1	270 J	190 J	220 J	20 J	21 J	17	15 UJ
2-Butanone	27000	140	59	120	2.6 J	10 U	5.6 J	2.8 J
Carbon disulfide	230	5 U	9 U	5.2 J	5 U	5 U	5 UJ	5 U
1,1-Dichloroethene	5900	5 U	11	31	3.5 J	8.2	8.6 UJ	5.7
4-Methyl-2-pentanone		5 U	9 U	9 U	5 U	5 U	5 UJ	5 U
Toluene	130000	5 U	47 J	52 J	5.9 U	11 U	14	2.6 U
1,2,4-Trimethylbenzene		5 UJ	9 UJ	9 UJ	5 U	5 U	5 U	5 U

> SD benchmark

Sample ID Date Sampled	Sediment (SD) Screening Benchmark	SD-FD-001-061606 6/16/2006	SD-008R 6/16/2006	SD-008R2 7/31/2006	SD-009R 7/7/2006	SD-011R 6/14/2006	SD-012R 6/22/2006	SD-041R 6/12/2006	SD-054 7/7/2006	SD-055 6/16/2006	SD-055R 7/31/2006	SD-056 7/7/2006	SD-057 6/16/2006	SD-057R 7/31/2006
VPH (mg/Kg)														
Adjusted C9-C12 Aliphatics				0.194 U	0.0906 J	0.12 J	0.149 U	R	0.156 U		0.0567 J	0.734 U		0.0639 J
Unadjusted C5-C8 Aliphatics		3.75 J	3.67 J	0.513 J	0.366 J	0.921 J	0.364 J	2.39 J	0.398 J	6.44 J	0.416 J	2.02 J	3.52 J	0.435 J
Unadjusted C9-C12 Aliphatics		1.05 J	1.58 J	0.167 J	0.159 J	0.356 J	0.136 J	0.914 J	0.114 J	1.98 J	0.162 J	0.565 J	1.16 J	0.142 J
Adjusted C9-C10 Aromatics		0.721 J	0.77 J	0.194 U	0.179 U	0.366 U	0.149 U	R	0.156 U	1.09 J	0.184 U	0.734 U	1.19 J	0.161 U
Methyl-t-butyl ether		0.304 U	0.358 U	0.0387 U	0.0359 U	0.0732 U	0.0299 U	R	0.0313 U	0.446 U	0.0367 U	0.119 J	0.307 U	0.0322 U
Naphthalene	0.176	0.214 J	0.358 U	0.0387 U	0.0359 U	0.0732 U	0.0299 U	R	0.0359	0.362 J	0.0367 U	0.0888 J	0.307 U	0.0322 U
Toluene	130	0.304 U	0.358 U	0.0387 U	0.0359 U	0.0732 U	0.0299 U	R	0.0313 U	0.446 U	0.0367 U	0.204	0.307 U	0.0322 U
m+p-Xylenes		0.607 U	0.716 U	0.0774 U	0.0717 U	0.146 U	0.0597 U	R	0.0626 U	0.33 J	0.0734 U	0.0822 J	0.613 U	0.0644 U

> SD benchmark

Appendix Table A.2.8
 Sediment Sample Results - Wet Chemistry
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	SD-002-00-04-I	SD-026-00-04-I	SD-033-00-04-I	SD-039-00-04-I
Upper Depth (in.)	0	0	0	0
Lower Depth (in.)	4	4	4	4
Date Sampled	8/14/2003	8/13/2003	8/14/2003	8/14/2003
WET CHEMISTRY (mg/Kg)				
Total Organic Carbon	1800	851	278000 J	63600

Appendix Table A.2.9
 Summary Statistics of All Sediment Sample Results --
 TransCanada WSD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>						
Acenaphthene	0	1	0%		0.084	
Acenaphthylene	0	1	0%		0.084	
Unadjusted C19-C36 Aliphatics	0	1	0%		16.90	
Unadjusted C9-C18 Aliphatics	0	1	0%		16.90	
Anthracene	0	1	0%		0.084	
Adjusted C11-C22 Aromatics	0	1	0%		16.90	
Unadjusted C11-C22 Aromatics	0	1	0%		16.90	
Benzo(a)anthracene	0	1	0%		0.084	
Benzo(a)pyrene	0	1	0%		0.084	
Benzo(b)fluoranthene	0	1	0%		0.084	
Benzo(g,h,i)perylene	0	1	0%		0.084	
Benzo(k)fluoranthene	0	1	0%		0.084	
Chrysene	0	1	0%		0.084	
Dibenzo(a,h)anthracene	0	1	0%		0.084	
Fluoranthene	0	1	0%		0.084	
Fluorene	0	1	0%		0.084	
Indeno(1,2,3-cd)pyrene	0	1	0%		0.084	
2-Methylnaphthalene	0	1	0%		0.084	
Naphthalene	0	1	0%		0.084	
Phenanthrene	0	1	0%		0.084	
Pyrene	0	1	0%		0.084	
Adjusted TPH	0	1	0%		16.90	
Unadjusted TPH	0	1	0%		16.90	
<i>Inorganics (mg/Kg)</i>						
Antimony	1	6	17%	1.60	0.49	1.60
Arsenic	7	7	100%	0.80	1.50	2.10
Beryllium	0	7	0%		0.97	
Boron	0	1	0%		7.65	
Cadmium	1	7	14%	0.24	0.94	0.24
Chromium	7	7	100%	4.40	8.96	23.00
Copper	7	7	100%	8.59	26.80	58.00
Hexavalent Chromium	0	6	0%		1.51	
Lead	11	11	100%	0.58	8.20	30.00
Lithium	1	1	100%	9.21	9.21	9.21
Mercury	0	7	0%		0.03	
Nickel	7	7	100%	5.03	11.52	27.00
Selenium	0	7	0%		2.95	
Silver	0	7	0%		0.37	
Thallium	0	7	0%		0.45	
Uranium	1	1	100%	3.10	3.10	3.10
Zinc	7	7	100%	70.00	125.14	310.00
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1262	0	14	0%		5.01	
Aroclor-1268	0	14	0%		5.01	
Aroclor-1016	0	57	0%		22.44	
Aroclor-1221	0	57	0%		22.44	
Aroclor-1232	0	57	0%		22.44	
Aroclor-1242	0	57	0%		22.44	
Aroclor-1248	0	57	0%		22.44	
Aroclor-1254	39	57	68%	14.00	139.83	950.00
Aroclor-1260	15	57	26%	14.70	34.60	240.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.9
Summary Statistics of All Sediment Sample Results --
TransCanada WSD Area
YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	3	12	25%	98.00	318.13	1,800.00
Acenaphthylene	0	12	0%		199.96	
Aniline	0	12	0%		199.96	
Anthracene	4	12	33%	120.00	353.71	2,200.00
Atrazine	0	1	0%		129.50	
Azobenzene	0	12	0%		199.96	
Benzidine	0	10	0%		2,070.00	
Benzo(a)anthracene	8	12	67%	130.00	773.29	6,600.00
Benzo(a)pyrene	8	12	67%	100.00	706.63	5,800.00
Benzo(b)fluoranthene	6	12	50%	130.00	679.13	5,600.00
Benzo(g,h,i)perylene	6	12	50%	100.00	429.13	2,900.00
Benzo(k)fluoranthene	7	12	58%	13.10	581.09	4,600.00
Benzoic acid	1	12	8%	130.00	850.79	130.00
Benzyl alcohol	0	12	0%		386.21	
Bis(2-chloroethoxy)methane	0	12	0%		199.96	
Bis(2-chloroethyl)ether	0	12	0%		199.96	
Bis(2-ethylhexyl)phthalate	6	12	50%	86.00	175.46	200.00
4-Bromophenyl phenyl ether	0	12	0%		199.96	
Butyl benzyl phthalate	0	12	0%		199.96	
Carbazole	1	12	8%	2,200.00	365.38	2,200.00
4-Chloro-3-methylphenol	0	12	0%		386.21	
4-Chloroaniline	0	12	0%		386.21	
Bis(2-chloroisopropyl) ether	0	12	0%		386.21	
2-Chloronaphthalene	0	12	0%		199.96	
2-Chlorophenol	0	12	0%		199.96	
4-Chlorophenyl phenyl ether	0	12	0%		199.96	
Chrysene	9	12	75%	13.10	738.59	6,200.00
Dibenzo(a,h)anthracene	1	12	8%	770.00	246.21	770.00
Dibenzofuran	1	12	8%	1,300.00	290.38	1,300.00
1,2-Dichlorobenzene	0	6	0%		190.75	
1,3-Dichlorobenzene	0	6	0%		190.75	
1,4-Dichlorobenzene	0	6	0%		190.75	
3,3'-Dichlorobenzidine	0	12	0%		369.54	
2,4-Dichlorophenol	0	12	0%		199.96	
Diethyl phthalate	0	12	0%		199.96	
Dimethyl phthalate	0	12	0%		199.96	
2,4-Dimethylphenol	0	12	0%		199.96	
Di-n-butyl phthalate	0	12	0%		199.96	
2,4-Dinitrophenol	0	12	0%		846.21	
2,4-Dinitrotoluene	0	12	0%		199.96	
2,6-Dinitrotoluene	0	12	0%		199.96	
Di-n-octyl phthalate	0	12	0%		199.96	
Fluoranthene	11	12	92%	15.70	1,583.81	14,000.00
Fluorene	2	12	17%	100.00	332.04	1,900.00
Hexachlorobenzene	0	12	0%		199.96	
Hexachlorobutadiene	0	12	0%		204.13	
Hexachlorocyclopentadiene	0	12	0%		199.96	
Hexachloroethane	0	12	0%		199.96	
Indeno(1,2,3-cd)pyrene	6	12	50%	93.00	417.71	2,900.00
Isophorone	0	12	0%		199.96	
4,6-Dinitro-2-methylphenol	0	12	0%		919.13	
1-Methylnaphthalene	0	1	0%		129.50	
2-Methylnaphthalene	1	12	8%	280.00	205.38	280.00
3+4-Methylphenol	0	12	0%		199.96	
2-Methylphenol	0	12	0%		199.96	
Naphthalene	1	12	8%	470.00	221.21	470.00
2-Nitroaniline	0	12	0%		919.13	
3-Nitroaniline	0	12	0%		919.13	
4-Nitroaniline	0	12	0%		951.67	
Nitrobenzene	0	12	0%		199.96	
2-Nitrophenol	0	12	0%		199.96	
4-Nitrophenol	0	12	0%		878.75	
N-Nitroso-di-n-propylamine	0	12	0%		199.96	
N-Nitrosodiphenylamine	0	12	0%		199.96	
N-Nitrosodimethylamine	0	12	0%		386.21	
Pentachlorophenol	0	12	0%		951.67	
Phenanthrene	8	12	67%	210.00	1391.63	13,000.00
Phenol	0	12	0%		199.96	
Pyrene	8	12	67%	240.00	1177.46	9,900.00
Pyridine	0	1	0%		129.50	
1,2,4-Trichlorobenzene	0	6	0%		190.75	
2,4,5-Trichlorophenol	0	12	0%		199.96	
2,4,6-Trichlorophenol	0	12	0%		199.96	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	2	5	40%	25.00	18.20	30.00
TPH-GRO	0	5	0%		1.25	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.2.9
 Summary Statistics of All Sediment Sample Results --
 TransCanada WSD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	0	5	0%		5.00	
Acrylonitrile	0	5	0%		5.00	
Allyl Chloride	0	5	0%		2.50	
Benzene	0	5	0%		2.50	
Bromobenzene	0	5	0%		2.50	
Bromochloromethane	0	5	0%		2.50	
Bromodichloromethane	0	5	0%		2.50	
Bromoform	0	5	0%		2.50	
Bromomethane	0	5	0%		7.50	
2-Butanone	0	5	0%		5.00	
n-Butylbenzene	0	5	0%		2.50	
sec-Butylbenzene	0	5	0%		2.50	
tert-Butylbenzene	0	5	0%		2.50	
Carbon Disulfide	0	5	0%		2.50	
Carbon Tetrachloride	0	5	0%		5.00	
Chlorobenzene	0	5	0%		2.50	
1-Chlorobutane	0	5	0%		2.50	
Chloroethane	0	5	0%		7.50	
2-Chloroethylvinyl Ether	0	5	0%		7.50	
Chloroform	0	5	0%		7.50	
Chloromethane	0	5	0%		2.50	
2-Chlorotoluene	0	5	0%		2.50	
4-Chlorotoluene	0	5	0%		2.50	
1,2-Dibromo-3-Chloropropane	0	5	0%		2.50	
Dibromochloromethane	0	5	0%		2.50	
1,2-Dibromoethane	0	5	0%		2.50	
Dibromomethane	0	5	0%		2.50	
1,2-Dichlorobenzene	0	5	0%		2.50	
1,3-Dichlorobenzene	0	5	0%		2.50	
1,4-Dichlorobenzene	0	5	0%		2.50	
Dichlorodifluoromethane	0	5	0%		2.50	
1,1-Dichloroethane	0	5	0%		2.50	
1,2-Dichloroethane	0	5	0%		2.50	
cis-1,2-Dichloroethene	0	5	0%		2.50	
trans-1,2-Dichloroethene	0	5	0%		2.50	
1,1-Dichloroethene	2	5	40%	11.00	7.90	21.00
1,3-Dichloropropane	0	5	0%		2.50	
2,2-Dichloropropane	0	5	0%		2.50	
1,2-Dichloropropane	0	5	0%		2.50	
1,1-Dichloropropene	0	5	0%		2.50	
cis-1,3-Dichloropropene	0	5	0%		2.50	
trans-1,3-Dichloropropene	0	5	0%		2.50	
Diethyl Ether	0	5	0%		5.00	
Ethyl Methacrylate	0	5	0%		2.50	
Ethylbenzene	0	5	0%		2.50	
Hexachlorobutadiene	0	5	0%		2.50	
Hexachloroethane	0	5	0%		2.50	
2-Hexanone	0	5	0%		2.50	
Iodomethane	0	2	0%		2.50	
Isopropylbenzene	0	5	0%		2.50	
4-Isopropyltoluene	0	5	0%		2.50	
Methacrylonitrile	0	5	0%		2.50	
Methyl Methacrylate	0	5	0%		2.50	
4-Methyl-2-Pentanone	0	5	0%		2.50	
Methylene Chloride	1	5	20%	1.10	6.22	1.10
Methyl-t-butyl ether	0	5	0%		7.50	
Naphthalene	1	5	20%	5.70	3.14	5.70
Nitrobenzene	0	5	0%		12.50	
2-Nitropropane	0	5	0%		5.00	
Pentachloroethane	0	5	0%		2.50	
Propionitrile	0	5	0%		25.00	
n-Propylbenzene	0	5	0%		2.50	
Styrene	0	5	0%		2.50	
1,1,1,2-Tetrachloroethane	0	5	0%		2.50	
1,1,2,2-Tetrachloroethane	0	5	0%		2.50	
Tetrachloroethene	0	5	0%		2.50	
Tetrahydrofuran	0	5	0%		5.00	
Toluene	0	5	0%		2.50	
trans-1,4-Dichloro-2-Butene	0	5	0%		2.50	
1,2,3-Trichlorobenzene	0	5	0%		2.50	
1,2,4-Trichlorobenzene	0	5	0%		2.50	
1,1,1-Trichloroethane	0	5	0%		5.00	
1,1,2-Trichloroethane	0	5	0%		2.50	
Trichloroethene	0	5	0%		2.50	
Trichlorofluoromethane	0	5	0%		2.50	
1,2,3-Trichloropropane	0	5	0%		2.50	
1,2,4-Trimethylbenzene	0	5	0%		2.50	
1,3,5-Trimethylbenzene	0	5	0%		2.50	
Vinyl Acetate	0	5	0%		7.50	
Vinyl Chloride	0	5	0%		2.50	
o-Xylene	0	5	0%		2.50	
m+p-Xylenes	0	5	0%		2.50	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.9
 Summary Statistics of All Sediment Sample Results --
 TransCanada WSD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>						
Adjusted C5-C8 Aliphatics	0	1	0%		0.26	
Adjusted C9-C12 Aliphatics	0	1	0%		0.086	
Unadjusted C5-C8 Aliphatics	1	1	100%	0.40	0.40	0.40
Unadjusted C9-C12 Aliphatics	1	1	100%	0.13	0.13	0.13
Adjusted C9-C10 Aromatics	0	1	0%		0.086	
Benzene	0	1	0%		0.017	
Ethylbenzene	0	1	0%		0.017	
Methyl-t-butyl ether	0	1	0%		0.017	
Naphthalene	1	1	100%	0.019	0.019	0.019
Toluene	0	1	0%		0.017	
o-Xylene	0	1	0%		0.017	
m+p-Xylenes	0	1	0%		0.034	
<i>Wet Chemistry (mg/Kg)</i>						
Total Organic Carbon	2	2	100%	9650.0	9925.0	10200.0

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.10
 Sediment Sample Results - Inorganics
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-301-00-04-I	SD-302-00-04-I	SD-303-00-04-I	FD-003-081203	SD-304-00-04-I	SD-304R	SD-305-00-04-I	WSD-013	WSD-014	WSD-015	WSD-016
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0		0				
Lower Depth (in.)	Screening	4	4	4	4	4		4				
Date Sampled	Benchmark	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	5/24/2006	8/12/2003	7/26/2000	7/26/2000	7/26/2000	7/26/2000
Inorganics (mg/Kg)												
Antimony	64	1.6	0.62 UJ	0.66 UJ	0.61 UJ	0.62 UJ	0.318 UJ	0.41 U				
Arsenic	33	1.4	1.6	1.4	1.4	1.5	0.802 J	1.7 J				
Barium	20											
Cadmium	5	4.1 U	1.5 U	1.7 U	1.6 U	1.6 U	0.239 J	1.7 U				
Chromium	110	13	7.2	4.9	4.2	5.6	4.6	4.4				
Copper	150	58	19	23	16	19	8.59	18				
Lead	130	30 J	3.7 J	2.7 J	17 J	0.58 J	3.96	13 J	2.9	14	4.5	7.9
Lithium							9.21					
Mercury	0.18	0.04 U	0.03 U	0.04 U	0.04 U	0.04 U	0.0641 U	0.03 U				
Nickel	49	20	7.7	9.2	8.4	6.4	5.03	5.3				
Uranium							3.1					
Zinc	460	310	86	83	59	86	70	81				

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-301-00-04-I	FD001-00-04I	SD-036-00-04-I	SD-302-00-04-I	SD-302R-00-04I	SD-303-00-04-I	FD-003-081203	SD-304-00-04-I	SD-304R	SD-305-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0		0
Lower Depth (in.)	Screening	4	4	4	4	4	4	4	4		4
Date Sampled	Benchmark	8/12/2003	6/21/2004		8/12/2003	6/21/2004	8/12/2003	8/12/2003	8/12/2003	5/24/2006	8/12/2003
PCBs (µg/Kg)											
Aroclor-1254	60	64	40 U	980 J	950	120 J	77	72	350	41.7	220
Aroclor-1260	60	40 U	40 U	99 U	40 U	41 UJ	43 U	40 U	40 U	16.3	40 U

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-306-00-04I	SD-307-00-04I MS/MSD	FD011-00-03I	SD-701-00-03I	SD-702-00-03I	SD-703R-00-03I	SD-704R-00-03I	SD-705-00-03I	SD-706-00-03I	SD-707-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	4	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	6/21/2004	6/21/2004	11/18/2004	11/18/2004	10/27/2004	11/18/2004	11/18/2004	10/27/2004	10/27/2004	10/28/2004
PCBs (µg/Kg)											
Aroclor-1254	60	480	280 J	82	65 J	190	81 J	39 J	500 J	64 J	380
Aroclor-1260	60	43 U	40 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	240 J

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-708-00-03I	SD-709-00-03I	SD-710 0003I	SD-711 0003I	SD-712 0003I	SD-713 0003I	SD-714 0003I	SD-715 0003I	SD-716-00-03I	SD-717-00-03I	SD-718-00-03I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0	0	0
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3	3	3
Date Sampled	Benchmark	10/28/2004	10/28/2004	11/1/2004	11/1/2004	11/1/2004	11/1/2004	11/1/2004	11/1/2004	11/2/2004	11/2/2004	11/2/2004
PCBs (µg/Kg)												
Aroclor-1254	60	33 U	33 U	33 U	190 J	84 J	33 U	33 U	290	310	33 U	46 J
Aroclor-1260	60	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-719-00-03I	SD-720-00-03I	FD012-00-03I	SD-721-00-03I	SD-722-00-03I	SD-723-00-03I	SD-724-00-03I	SD-725-00-03I	SD-726-00-03I	SD-727	SD-728	SD-729
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0	0	0	0			
Lower Depth (in.)	Screening	3	3	3	3	3	3	3	3	3			
Date Sampled	Benchmark	11/2/2004	11/2/2004	11/2/2004	11/2/2004	11/2/2004	11/2/2004	11/2/2004	11/3/2004	11/3/2004	10/6/2005	10/6/2005	10/6/2005
PCBs (µg/Kg)													
Aroclor-1254	60	33 U	33 U	33 U	33 U	33 U	47 J	60 J	33 U	33 U	219	163	74.6
Aroclor-1260	60	33 U	33 U	33 U	33 U	33 U	33 U	49 J	33 U	33 U	52.5	37.4	29.5

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-730 R	SD-731	SD-732	SD-733	SD-734	SD-735	SD-736	FD001-100605	SD-737	SD-738	SD-739	WSD	WSD-013
Upper Depth (in.)	Screening													
Lower Depth (in.)	Benchmark													
Date Sampled		10/12/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	3/13/2000	7/26/2000
PCBs (µg/Kg)														
Aroclor-1254	60	9.93 U	288	80.7	43.2	75.1	25.7	188	57.4	72	30.8	44.9	370	200 U
Aroclor-1260	60	9.93 U	86.9	72.3	23.1	23.9	16.7	63.5	17.5	23.7	14.7	41.9	200 U	200 U

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - PCBs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		WSD-014	WSD-015	WSD-015A II	WSD-015B II	WSD-016	WSD-016A II	WSD-016B II
Upper Depth (in.)	Sediment (SD)							
Lower Depth (in.)	Screening							
Date Sampled	Benchmark	7/26/2000	7/26/2000	10/28/2002	10/28/2002	7/26/2000	10/28/2002	10/28/2002
PCBs (µg/Kg)								
Aroclor-1254	60	620	200 U	73 U	66 U	200 U	160	14 J
Aroclor-1260	60	200 U	200 U	73 U	66 U	200 U	86 U	7.9 UJ

> SD Benchmark

Appendix Table A.2.10
Sediment Sample Results - SVOCs
TransCanada WSD Study Area
YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-301-00-04-I	SD-302-00-04-I	SD-302R-00-04I	FD002-00-04I-062104	SD-303-00-04-I	SD-303R-00-04I	FD-003-081203	SD-304-00-04-I	SD-304R
Upper Depth (in.)	Screening	0	0	0	0	0	0	0	0	
Lower Depth (in.)	Benchmark	4	4	4	4	4	4	4	4	
Date Sampled		8/12/2003	8/12/2003	6/21/2004	6/21/2004	8/12/2003	6/21/2004	8/12/2003	8/12/2003	5/24/2006
SVOC (µg/Kg)										
Acenaphthene	150	400 U	400 U	98 J	390 U	1800 J	390 U	400 UJ	400 U	259 U
Anthracene	57.2	120 J	160 J	410 U	390 U	2200 J	390 U	400 UJ	400 U	259 U
Benzo(a)anthracene	110	250 J	780	410 U	390 U	6600 J	390 U	400 UJ	130 J	259 U
Benzo(a)pyrene	150	260 J	830	410 U	390 U	5800 J	390 U	400 UJ	130 J	259 U
Benzo(b)fluoranthene	37	250 J	710	410 U	390 U	5600 J	390 U	400 UJ	400 U	259 U
Benzo(g,h,i)perylene	150	180 J	490	410 U	390 U	2900 J	390 U	400 UJ	400 U	259 U
Benzo(k)fluoranthene	37	240 J	640	410 U	390 U	4600 J	390 U	400 UJ	400 U	13.1 J
Benzoic acid		1900 U	1900 U	2000 UJ	1900 U	2100 U	1900 UJ	1900 U	1900 U	259 UJ
bis(2-Ethylhexyl)phthalate	13300	400 U	180 J	410 U	390 U	200 J	86 J	400 U	150 J	259 U
Carbazole		400 U	400 U	410 U	390 U	2200 J	390 U	400 UJ	400 U	259 U
Chrysene	170	280 J	760	410 U	390 U	6200 J	390 U	400 UJ	140 J	13.1 J
Dibenzo(a,h)anthracene	33	400 U	400 U	410 U	390 U	770	390 U	400 U	400 U	259 U
Dibenzofuran	5100	400 U	400 U	410 U	390 U	1300 J	390 U	400 UJ	400 U	259 U
Fluoranthene	423	730	1500	120 J	390 U	14000 J	100 J	400 UJ	310 J	15.7 J
Fluorene	77.4	400 U	400 U	410 UJ	390 UJ	1900 J	390 UJ	400 UJ	400 U	259 U
Indeno(1,2,3-cd)pyrene	30	150 J	460	410 UJ	390 UJ	2900 J	390 UJ	400 UJ	400 U	259 U
2-Methylnaphthalene	150	400 U	400 U	410 U	390 U	280 J	390 U	400 U	400 U	259 U
Naphthalene	176	400 U	400 U	410 U	390 U	470	390 U	400 U	400 U	259 U
Phenanthrene	204	530	730	410 U	390 U	13000 J	390 U	400 UJ	210 J	259 U
Pyrene	200	550	1300	410 UJ	390 UJ	9900 J	390 UJ	400 UJ	240 J	259 U

> SD Benchmark

Appendix Table A.2.10
 Sediment Sample Results - SVOCs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-305-00-04-I	SD-306-00-04I	SD-307-00-04I MS/MSD	SD-308-00-04I	SD-309-00-04I
Upper Depth (in.)	Screening	0	0	0	0	0
Lower Depth (in.)	Benchmark	4	4	4	4	4
Date Sampled		8/12/2003	6/21/2004	6/21/2004	6/21/2004	6/21/2004
SVOC (µg/Kg)						
Acenaphthene	150	140 J	440 U	400 U	450 U	420 U
Anthracene	57.2	180 J	440 U	400 U	450 U	420 U
Benzo(a)anthracene	110	340 J	130 J	150 J	160 J	420 U
Benzo(a)pyrene	150	340 J	100 J	130 J	150 J	420 U
Benzo(b)fluoranthene	37	400 U	130 J	140 J	180 J	420 U
Benzo(g,h,i)perylene	150	180 J	440 U	100 J	140 J	420 U
Benzo(k)fluoranthene	37	400 U	130 J	160 J	180 J	420 U
Benzoic acid		1900 U	2100 UJ	130 J	2200 U	2000 U
bis(2-Ethylhexyl)phthalate	13300	150 J	440 U	150 J	450 U	420 U
Carbazole		400 U	440 U	400 U	450 U	420 U
Chrysene	170	350 J	160 J	180 J	170 J	420 U
Dibenzo(a,h)anthracene	33	400 U	440 U	400 U	450 U	420 U
Dibenzofuran	5100	400 U	440 U	400 U	450 U	420 U
Fluoranthene	423	820	450	390 J	360 J	420 U
Fluorene	77.4	100 J	440 UJ	400 UJ	450 UJ	420 UJ
Indeno(1,2,3-cd)pyrene	30	140 J	440 UJ	93 J	110 J	420 UJ
2-Methylnaphthalene	150	400 U	440 U	400 U	450 U	420 U
Naphthalene	176	400 U	440 U	400 U	450 U	420 U
Phenanthrene	204	680	330 J	230 J	250 J	420 U
Pyrene	200	630	270 J	260 J	240 J	420 UJ

> SD Benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.2.10
 Sediment Sample Results - TPHs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID	SD-036-00-04-I	SD-301-00-04-I	SD-302-00-04-I	SD-303-00-04-I	FD-003-081203	SD-304-00-04-I	SD-305-00-04-I
Upper Depth (in.)	0	0	0	0	0	0	0
Lower Depth (in.)	4	4	4	4	4	4	4
Date Sampled	8/13/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003
TPH (mg/Kg)							
TPH							
TPH-DRO	42	25 J	24 UJ	30	24 UJ	24 UJ	24 UJ

..

Appendix Table A.2.10
 Sediment Sample Results - VOCs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID		SD-301-00-04-I	SD-302-00-04-I	SD-303-00-04-I	FD-003-081203	SD-304-00-04-I	SD-305-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	4	4	4	4	4
Date Sampled	Benchmark	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003	8/12/2003
VOC (µg/Kg)							
1,1-Dichloroethene	5900	5 U	21	11 J	5 UJ	5 UJ	5 UJ
Methylene chloride	7200	15 U	15 U	15 UJ	15 UJ	15 UJ	1.1 J
Naphthalene	176	5 U	5.7	5 UJ	5 UJ	5 UJ	5 UJ

Appendix Table A.2.10
 Sediment Sample Results - VPHs
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	SD-304R
Date Sampled	Screening Benchmark	5/24/2006
VPH (mg/Kg)		
Unadjusted C5-C8 Aliphatics		0.395 J
Unadjusted C9-C12 Aliphatics		0.128 J
Naphthalene	0.176	0.0191 J

Appendix Table A.2.10
 Sediment Sample Results - Wet Chemistry
 TransCanada WSD Study Area
 YNPS Rowe, MA

Sample ID	FD-003-081203	SD-304-00-04-I	SD-305-00-04-I
Upper Depth (in.)	0	0	0
Lower Depth (in.)	4	4	4
Date Sampled	8/12/2003	8/12/2003	8/12/2003
WET CHEMISTRY (mg/Kg)			
Total Organic Carbon	10300	10200	9650

Appendix Table A.2.11
 Summary Statistics of All Sediment Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Inorganics (mg/Kg)</i>						
Arsenic	0	3	0%		0.18	
Beryllium	0	5	0%		0.94	
Cadmium	0	5	0%		0.89	
Chromium	6	6	100%	5.00	7.53	9.80
Copper	0	5	0%		1.90	
Hexavalent Chromium	0	5	0%		1.37	
Lead	2	5	40%	0.44	0.57	1.10
Mercury	0	5	0%		0.02	
Nickel	5	6	83%	5.60	6.66	12.00
Selenium	0	5	0%		2.77	
Silver	0	5	0%		0.28	
Thallium	0	5	0%		0.32	
Zinc	0	5	0%		23.50	
<i>Polychlorinated Biphenyls (µg/Kg)</i>						
Aroclor-1016	0	11	0%		99.82	
Aroclor-1221	0	11	0%		99.82	
Aroclor-1232	0	11	0%		99.82	
Aroclor-1242	0	11	0%		99.82	
Aroclor-1248	0	11	0%		99.82	
Aroclor-1254	0	11	0%		99.82	
Aroclor-1260	0	11	0%		99.82	
<i>Semivolatile Organic Compounds (µg/Kg)</i>						
Acenaphthene	0	11	0%		281.82	
Acenaphthylene	0	11	0%		281.82	
Acetophenone	0	6	0%		1325.00	
4-Aminobiphenyl	0	6	0%		658.33	
Aniline	0	11	0%		461.36	
Anthracene	0	11	0%		281.82	
azobenzene	0	11	0%		281.82	
Benzidine	0	11	0%		2818.18	
Benzo(a)anthracene	0	11	0%		281.82	
Benzo(a)pyrene	0	11	0%		281.82	
Benzo(b)fluoranthene	0	11	0%		281.82	
Benzo(g,h,i)perylene	0	11	0%		281.82	
Benzo(k)fluoranthene	0	11	0%		281.82	
Benzoic acid	0	11	0%		2286.36	
Benzyl alcohol	0	11	0%		562.73	
bis(2-Chloroethoxy)methane	0	11	0%		281.82	
bis(2-Chloroethyl)ether	0	11	0%		281.82	
bis(2-Ethylhexyl)phthalate	0	11	0%		461.36	
4-Bromophenyl phenyl ether	0	11	0%		281.82	
Butyl benzyl phthalate	0	11	0%		281.82	
Carbazole	0	11	0%		281.82	
4-Chloro-3-methylphenol	0	5	0%		448.00	
4-Chloroaniline	0	11	0%		383.18	
Chlorobenzilate	0	6	0%		1325.00	
Bis(2-chloroisopropyl) ether	0	11	0%		383.18	
p-Chloro-m-cresol	0	6	0%		329.17	
2-Chloronaphthalene	0	11	0%		281.82	
1-Chloronaphthalene	0	6	0%		329.17	
2-Chlorophenol	0	11	0%		281.82	
4-Chlorophenyl phenyl ether	0	11	0%		281.82	
Chrysene	0	11	0%		281.82	
Dibenzo(a,h)anthracene	0	11	0%		281.82	
Dibenzofuran	0	11	0%		281.82	
1,2-Dichlorobenzene	0	11	0%		281.82	
1,3-Dichlorobenzene	0	11	0%		281.82	
1,4-Dichlorobenzene	0	11	0%		281.82	
3,3'-Dichlorobenzidine	0	11	0%		1999.09	
2,6-Dichlorophenol	0	6	0%		658.33	
2,4-Dichlorophenol	0	11	0%		461.36	
Diethyl phthalate	0	11	0%		281.82	
Dimethoate	0	6	0%		1325.00	
Dimethyl phthalate	0	11	0%		281.82	
p-Dimethylaminoazobenzene	0	6	0%		658.33	
7,12-Dimethylbenz(a)anthracene	0	6	0%		658.33	
a,a-Dimethylphenethylamine	0	6	0%		3291.67	
2,4-Dimethylphenol	0	11	0%		461.36	
Di-n-butyl phthalate	0	11	0%		281.82	
2,4-Dinitrophenol	0	11	0%		1213.64	
2,4-Dinitrotoluene	0	11	0%		281.82	
2,6-Dinitrotoluene	0	11	0%		281.82	
Di-n-octyl phthalate	0	11	0%		281.82	
Ethyl Methanesulfonate	0	6	0%		983.33	
Fluoranthene	0	11	0%		281.82	
Fluorene	0	11	0%		281.82	
Hexachlorobenzene	0	11	0%		281.82	
Hexachlorobutadiene	0	11	0%		461.36	
Hexachlorocyclopentadiene	0	11	0%		461.36	
Hexachloroethane	0	11	0%		281.82	
Hexachloropropene	0	6	0%		3291.67	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.11
 Summary Statistics of All Sediment Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds cont. (µg/Kg)</i>						
Indeno(1,2,3-cd)pyrene	0	11	0%		281.82	
Isodrin	0	6	0%		658.33	
Isophorone	0	11	0%		281.82	
Methyl methanesulfonate	0	6	0%		1325.00	
4,6-Dinitro-2-methylphenol	0	11	0%		1213.64	
3-Methylcholanthrene	0	6	0%		1325.00	
1-Methylnaphthalene	0	6	0%		329.17	
2-Methylnaphthalene	0	11	0%		281.82	
3+4-Methylphenol	0	11	0%		281.82	
2-Methylphenol	0	11	0%		281.82	
Naphthalene	0	11	0%		281.82	
a-Naphthylamine	0	6	0%		1325.00	
b-Naphthylamine	0	6	0%		1325.00	
NDPA/DPA	0	6	0%		329.17	
2-Nitroaniline	0	11	0%		670.45	
3-Nitroaniline	0	11	0%		670.45	
4-Nitroaniline	0	11	0%		670.45	
Nitrobenzene	0	11	0%		281.82	
2-Nitrophenol	0	11	0%		461.36	
4-Nitrophenol	0	11	0%		850.00	
N-Nitroso-di-n-propylamine	0	11	0%		281.82	
N-Nitrosodiphenylamine	0	5	0%		225.00	
Nitrosodipiperidine	0	6	0%		1325.00	
N-Nitrosodimethylamine	0	11	0%		1999.09	
N-Nitrosodi-n-butylamine	0	6	0%		658.33	
Pentachlorobenzene	0	6	0%		1325.00	
Pentachloronitrobenzene	0	6	0%		658.33	
Pentachlorophenol	0	11	0%		1213.64	
Phenacetin	0	6	0%		658.33	
Phenanthrene	0	11	0%		281.82	
Phenol	0	11	0%		281.82	
2-Picoline	0	6	0%		1325.00	
Pronamide	0	6	0%		1325.00	
Pyrene	0	11	0%		281.82	
Pyridine	0	6	0%		3291.67	
1,2,4,5-Tetrachlorobenzene	0	6	0%		1325.00	
1,2,4-Trichlorobenzene	0	11	0%		281.82	
2,4,5-Trichlorophenol	0	11	0%		281.82	
2,4,6-Trichlorophenol	0	11	0%		281.82	
<i>Total Petroleum Hydrocarbons (mg/Kg)</i>						
TPH-DRO	4	6	67%	2.90	10.33	45.00
TPH-GRO	0	5	0%		1.25	
<i>Volatile Organic Carbons (µg/Kg)</i>						
Acetone	2	6	33%	18.00	42.00	190.00
Acrylonitrile	0	5	0%		5.00	
Allyl Chloride	0	5	0%		2.50	
Benzene	0	5	0%		2.50	
Bromobenzene	0	5	0%		2.50	
Bromochloromethane	0	5	0%		2.50	
Bromodichloromethane	0	5	0%		2.50	
Bromoform	0	5	0%		2.50	
Bromomethane	0	5	0%		7.50	
2-Butanone	2	5	40%	2.40	6.28	14.00
n-Butylbenzene	0	5	0%		2.50	
sec-Butylbenzene	0	5	0%		2.50	
tert-Butylbenzene	0	5	0%		2.50	
Carbon Disulfide	0	5	0%		2.50	
Carbon Tetrachloride	0	5	0%		5.00	
Chlorobenzene	0	5	0%		2.50	
1-Chlorobutane	0	5	0%		2.50	
Chloroethane	0	5	0%		7.50	
2-Chloroethylvinyl Ether	0	5	0%		7.50	
Chloroform	0	5	0%		7.50	
Chloromethane	0	5	0%		2.50	
2-Chlorotoluene	0	5	0%		2.50	
4-Chlorotoluene	0	5	0%		2.50	
1,2-Dibromo-3-Chloropropane	0	5	0%		2.50	
Dibromochloromethane	0	5	0%		2.50	
1,2-Dibromoethane	0	5	0%		2.50	
Dibromomethane	0	5	0%		2.50	
1,2-Dichlorobenzene	0	5	0%		2.50	
1,3-Dichlorobenzene	0	5	0%		2.50	
1,4-Dichlorobenzene	0	5	0%		2.50	
Dichlorodifluoromethane	0	5	0%		2.50	
1,1-Dichloroethane	0	5	0%		2.50	
1,2-Dichloroethane	0	5	0%		2.50	
cis-1,2-Dichloroethene	0	5	0%		2.50	
trans-1,2-Dichloroethene	0	5	0%		2.50	
1,1-Dichloroethene	1	5	20%	3.30	2.66	3.30
1,3-Dichloropropane	0	5	0%		2.50	
2,2-Dichloropropane	0	5	0%		2.50	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.11
 Summary Statistics of All Sediment Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Sediment Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons cont. (μg/Kg)</i>						
1,2-Dichloropropane	0	5	0%		2.50	
1,1-Dichloropropene	0	5	0%		2.50	
cis-1,3-Dichloropropene	0	5	0%		2.50	
trans-1,3-Dichloropropene	0	5	0%		2.50	
Diethyl Ether	0	5	0%		5.00	
Ethyl Methacrylate	0	5	0%		2.50	
Ethylbenzene	0	5	0%		2.50	
Hexachlorobutadiene	0	5	0%		2.50	
Hexachloroethane	0	5	0%		2.50	
2-Hexanone	0	5	0%		2.50	
Isopropylbenzene	0	5	0%		2.50	
4-Isopropyltoluene	0	5	0%		2.50	
Methacrylonitrile	0	5	0%		2.50	
Methyl Methacrylate	0	5	0%		2.50	
4-Methyl-2-Pentanone	0	5	0%		2.50	
Methylene Chloride	0	5	0%		7.50	
Methyl-t-butyl ether	0	5	0%		7.50	
Naphthalene	0	5	0%		2.50	
Nitrobenzene	0	5	0%		12.50	
2-Nitropropane	0	5	0%		5.00	
Pentachloroethane	0	5	0%		2.50	
Propionitrile	0	5	0%		25.00	
n-Propylbenzene	0	5	0%		2.50	
Styrene	0	5	0%		2.50	
1,1,1,2-Tetrachloroethane	0	5	0%		2.50	
1,1,2,2-Tetrachloroethane	0	5	0%		2.50	
Tetrachloroethene	0	5	0%		2.50	
Tetrahydrofuran	0	5	0%		5.00	
Toluene	0	5	0%		2.77	
trans-1,4-Dichloro-2-Butene	0	5	0%		2.50	
1,2,3-Trichlorobenzene	0	5	0%		2.50	
1,2,4-Trichlorobenzene	0	5	0%		2.50	
1,1,1-Trichloroethane	0	5	0%		5.00	
1,1,2-Trichloroethane	0	5	0%		2.50	
Trichloroethene	0	5	0%		2.50	
Trichlorofluoromethane	0	5	0%		2.50	
1,2,3-Trichloropropane	0	5	0%		2.50	
1,2,4-Trimethylbenzene	0	5	0%		2.50	
1,3,5-Trimethylbenzene	0	5	0%		2.50	
Vinyl Acetate	0	5	0%		7.50	
Vinyl Chloride	0	5	0%		2.50	
o-Xylene	0	5	0%		2.50	
m+p-Xylenes	0	5	0%		2.50	
<i>Wet Chemistry (mg/Kg)</i>						
Total Organic Carbon	2	2	100%	5570.00	7885.00	10200.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.2.12
 Sediment Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	Sediment (SD)	1S	2S	3S	3SA	4S	5S	SD-101-00-04-I	SD-102-00-04-I	SD-103-00-04-I	SD-104-00-04-I
Upper Depth (in.)	Screening							0	0	0	0
Lower Depth (in.)	Benchmark							4	4	4	4
Date Sampled		9/28/1998	9/28/1998	9/28/1998	9/28/1998	9/28/1998	9/28/1998	8/13/2003	8/13/2003	8/13/2003	8/13/2003
Inorganics (mg/Kg)											
Barium	20	36	76	41	24	47	44				
Chromium	110	6.6	10	8.1	5.5	8	6.8	7.7	7.2	9.8 J	5
Lead	130	4.9	5.9	3.5	3	4.6	3.6	1.8 UJ	0.44 J	R	1.1 J
Mercury	0.18	0.046	0.02 U	0.04 U	0.03 U	R	0.05 U				
Nickel	49							6.7	7.6	12 J	4.1 U

> SD Benchmark

Appendix Table A.2.12
 Sediment Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SD-105-00-04-I	SD-106-00-04-I
Upper Depth (in.)	0	0
Lower Depth (in.)	4	4
Date Sampled	8/13/2003	8/13/2003
Inorganics (mg/Kg)		
Barium		
Chromium	9.4	6.1
Lead	0.42 UJ	0.44 UJ
Mercury	0.04 U	0.04 U
Nickel	6	5.6

Appendix Table A.2.12
 Sediment Sample Results - TPHs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SD-101-00-04-I	SD-102-00-04-I	SD-103-00-04-I	SD-104-00-04-I	SD-105-00-04-I	SD-106-00-04-I
Upper Depth (in.)	0	0	0	0	0	0
Lower Depth (in.)	4	4	4	4	4	4
Date Sampled	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
TPH (mg/Kg)						
TPH-DRO	2.8 U	2.6 U	45 J	2.9	8.2	3.2

Appendix Table A.2.12
 Sediment Sample Results - VOCs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		SD-101-00-04-I	SD-102-00-04-I	SD-103-00-04-I	SD-104-00-04-I	SD-105-00-04-I	SD-106-00-04-I
Upper Depth (in.)	Sediment (SD)	0	0	0	0	0	0
Lower Depth (in.)	Screening	4	4	4	4	4	4
Date Sampled	Benchmark	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003	8/13/2003
VOC (µg/Kg)							
Acetone	57.1	39 UJ	29 UJ	190 J	18 J	10 UJ	10 UJ
2-Butanone	27000	10 U	10 U	R	2.4 J	14	10 U
1,1-Dichloroethene	5900	5 U	5 U	R	5 UJ	5 U	3.3 J

> SD Benchmark

Appendix Table A.2.12
 Sediment Sample Results - Wet Chemistry
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SD-101-00-04-I	SD-103-00-04-I
Upper Depth (in.)	0	0
Lower Depth (in.)	4	4
Date Sampled	8/13/2003	8/13/2003
WET CHEMISTRY (mg/Kg)		
Total Organic Carbon	5570	10200

Appendix Table A.3.1
Summary Statistics of All Surface Water Sample Results --
Background Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	3	0%		2.72	
Acenaphthylene	0	3	0%		2.72	
Unadjusted C19-C36 Aliphatics	0	3	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	3	0%		100.00	
Anthracene	0	3	0%		2.72	
Adjusted C11-C22 Aromatics	0	3	0%		100.00	
Unadjusted C11-C22 Aromatics	0	3	0%		100.00	
Benzo(a)anthracene	0	3	0%		2.72	
Benzo(a)pyrene	0	3	0%		2.72	
Benzo(b)fluoranthene	0	3	0%		2.72	
Benzo(g,h,i)perylene	0	3	0%		2.72	
Benzo(k)fluoranthene	0	3	0%		2.72	
Chrysene	0	3	0%		2.72	
Dibenzo(a,h)anthracene	0	3	0%		2.72	
Fluoranthene	0	3	0%		2.72	
Fluorene	0	3	0%		2.72	
Indeno(1,2,3-cd)pyrene	0	3	0%		2.72	
2-Methylnaphthalene	0	3	0%		2.72	
Naphthalene	0	3	0%		2.72	
Phenanthrene	0	3	0%		2.72	
Pyrene	0	3	0%		2.72	
Adjusted TPH	0	3	0%		100.00	
Unadjusted TPH	0	3	0%		100.00	
<i>Inorganics (mg/L)</i>						
Antimony	0	3	0%		0.0030	
Arsenic	0	3	0%		0.0020	
Beryllium	0	3	0%		0.0010	
Boron	3	3	100%	0.0034	0.0038	0.0040
Cadmium	1	3	33%	0.000090	0.000042	0.000090
Chromium	0	3	0%		0.0025	
Copper	0	3	0%		0.0019	
Lead	1	3	33%	0.0022	0.0012	0.0022
Lithium	0	3	0%		0.0017	
Mercury	0	3	0%		0.00010	
Nickel	0	3	0%		0.0025	
Selenium	0	3	0%		0.000040	
Silver	2	3	67%	0.00080	0.0011	0.0023
Thallium	0	3	0%		0.000014	
Zinc	0	3	0%		0.0055	
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	3	0%		0.10	
Aroclor-1268	0	3	0%		0.10	
Aroclor-1016	0	3	0%		0.10	
Aroclor-1221	0	3	0%		0.10	
Aroclor-1232	0	3	0%		0.10	
Aroclor-1242	0	3	0%		0.10	
Aroclor-1248	0	3	0%		0.10	
Aroclor-1254	0	3	0%		0.10	
Aroclor-1260	0	3	0%		0.10	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.1
Summary Statistics of All Surface Water Sample Results --
Background Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	3	0%		0.10	
Acenaphthylene	0	3	0%		0.10	
Aniline	0	3	0%		2.54	
Anthracene	0	3	0%		0.10	
Atrazine	0	3	0%		2.54	
Azobenzene	0	3	0%		2.54	
Benzidine	0	3	0%		2.54	
Benzo(a)anthracene	0	3	0%		0.10	
Benzo(a)pyrene	0	3	0%		0.10	
Benzo(b)fluoranthene	0	3	0%		0.10	
Benzo(g,h,i)perylene	0	3	0%		0.10	
Benzo(k)fluoranthene	0	3	0%		0.10	
Benzoic acid	0	3	0%		2.54	
Benzyl alcohol	0	3	0%		2.54	
Bis(2-chloroethoxy)methane	0	3	0%		2.54	
Bis(2-chloroethyl)ether	0	3	0%		2.54	
Bis(2-ethylhexyl)phthalate	0	3	0%		2.54	
4-Bromophenyl phenyl ether	0	3	0%		2.54	
Butyl benzyl phthalate	0	3	0%		2.54	
Carbazole	0	3	0%		2.54	
4-Chloro-3-methylphenol	0	3	0%		2.54	
4-Chloroaniline	0	3	0%		2.54	
Bis(2-chloroisopropyl) ether	0	3	0%		2.54	
2-Chloronaphthalene	0	3	0%		2.54	
2-Chlorophenol	0	3	0%		2.54	
4-Chlorophenyl phenyl ether	0	3	0%		2.54	
Chrysene	0	3	0%		0.10	
3+4-Methylphenol	0	3	0%		5.08	
Dibenzo(a,h)anthracene	0	3	0%		0.10	
Dibenzofuran	0	3	0%		2.54	
3,3'-Dichlorobenzidine	0	3	0%		2.54	
2,4-Dichlorophenol	0	3	0%		2.54	
Diethyl phthalate	0	3	0%		2.54	
Dimethyl phthalate	0	3	0%		2.54	
2,4-Dimethylphenol	0	3	0%		2.54	
Di-n-butyl phthalate	0	3	0%		2.54	
2,4-Dinitrophenol	0	3	0%		2.54	
2,4-Dinitrotoluene	0	3	0%		2.54	
2,6-Dinitrotoluene	0	3	0%		2.54	
Di-n-octyl phthalate	0	3	0%		2.54	
Fluoranthene	0	3	0%		0.10	
Fluorene	0	3	0%		0.10	
Hexachlorobenzene	0	3	0%		0.50	
Hexachlorobutadiene	0	3	0%		0.10	
Hexachlorocyclopentadiene	0	3	0%		2.54	
Hexachloroethane	0	3	0%		2.54	
Indeno(1,2,3-cd)pyrene	0	3	0%		0.10	
Isophorone	0	3	0%		2.54	
4,6-Dinitro-2-methylphenol	0	3	0%		2.54	
1-Methylnaphthalene	0	3	0%		2.54	
2-Methylnaphthalene	0	3	0%		2.54	
2-Methylphenol	0	3	0%		2.54	
Naphthalene	0	3	0%		2.54	
2-Nitroaniline	0	3	0%		2.54	
3-Nitroaniline	0	3	0%		2.54	
4-Nitroaniline	0	3	0%		10.18	
Nitrobenzene	0	3	0%		2.54	
2-Nitrophenol	0	3	0%		2.54	
4-Nitrophenol	0	3	0%		10.18	
N-Nitroso-di-n-propylamine	0	3	0%		2.54	
N-Nitrosodiphenylamine	0	3	0%		2.54	
N-Nitrosodimethylamine	0	3	0%		2.54	
Pentachlorophenol	0	3	0%		0.50	
Phenanthrene	0	3	0%		0.10	
Phenol	0	3	0%		2.54	
Pyrene	0	3	0%		0.10	
Pyridine	0	3	0%		2.54	
2,4,5-Trichlorophenol	0	3	0%		2.54	
2,4,6-Trichlorophenol	0	3	0%		2.54	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.1
 Summary Statistics of All Surface Water Sample Results --
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	0	1	0%		5.00	
Acrylonitrile	0	3	0%		0.50	
t-Amyl methyl ether	0	2	0%		0.50	
Benzene	0	3	0%		0.50	
Bromobenzene	0	3	0%		0.50	
Bromochloromethane	0	3	0%		0.50	
Bromodichloromethane	0	3	0%		0.50	
Bromoform	0	3	0%		0.50	
Bromomethane	0	3	0%		1.00	
2-Butanone	0	2	0%		5.00	
tert-Butyl Alcohol	0	1	0%		5.00	
n-Butylbenzene	0	3	0%		0.50	
sec-Butylbenzene	0	3	0%		0.50	
tert-Butylbenzene	0	3	0%		0.50	
Carbon disulfide	0	3	0%		2.50	
Carbon Tetrachloride	0	3	0%		0.50	
Chlorobenzene	0	3	0%		0.50	
Chloroethane	0	3	0%		1.00	
Chloroform	0	3	0%		0.50	
Chloromethane	0	3	0%		1.00	
2-Chlorotoluene	0	3	0%		0.50	
4-Chlorotoluene	0	3	0%		0.50	
1,2-Dibromo-3-chloropropane	0	3	0%		1.00	
Dibromochloromethane	0	3	0%		0.50	
1,2-Dibromoethane	0	3	0%		0.25	
Dibromomethane	0	3	0%		0.50	
1,2-Dichlorobenzene	0	3	0%		0.50	
1,3-Dichlorobenzene	0	3	0%		0.50	
1,4-Dichlorobenzene	0	3	0%		0.50	
Dichlorodifluoromethane	0	3	0%		1.00	
1,1-Dichloroethane	0	3	0%		0.50	
1,2-Dichloroethane	0	3	0%		0.50	
cis-1,2-Dichloroethene	0	3	0%		0.50	
trans-1,2-Dichloroethene	0	3	0%		0.50	
1,1-Dichloroethene	0	3	0%		0.50	
1,3-Dichloropropane	0	3	0%		0.50	
2,2-Dichloropropane	0	3	0%		0.50	
1,2-Dichloropropane	0	3	0%		0.50	
1,1-Dichloropropene	0	3	0%		0.25	
cis-1,3-Dichloropropene	0	3	0%		0.25	
trans-1,3-Dichloropropene	0	3	0%		0.25	
Diethyl Ether	0	3	0%		0.50	
Diisopropyl ether	0	3	0%		0.50	
1,4-Dioxane	0	1	0%		10.00	
Ethylbenzene	0	3	0%		0.50	
Ethyl-t-butyl ether	0	3	0%		0.50	
2-Hexanone	0	3	0%		5.00	
Isopropylbenzene	0	3	0%		0.50	
4-Isopropyltoluene	0	3	0%		0.50	
4-Methyl-2-Pentanone	0	3	0%		5.00	
Methylene Chloride	0	3	0%		5.00	
Methyl-t-butyl ether	0	3	0%		0.50	
n-Propylbenzene	0	3	0%		0.50	
Styrene	0	3	0%		0.50	
1,1,1,2-Tetrachloroethane	0	3	0%		0.50	
1,1,2,2-Tetrachloroethane	0	3	0%		0.50	
Tetrachloroethene	0	3	0%		0.50	
Tetrahydrofuran	0	3	0%		5.00	
Toluene	0	3	0%		0.50	
1,2,3-Trichlorobenzene	0	3	0%		0.50	
1,2,4-Trichlorobenzene	0	3	0%		0.50	
1,1,1-Trichloroethane	0	3	0%		0.50	
1,1,2-Trichloroethane	0	3	0%		0.50	
Trichloroethene	0	3	0%		0.50	
Trichlorofluoromethane	0	3	0%		0.50	
1,2,3-Trichloropropane	0	3	0%		0.50	
1,1,2-Trichlorotrifluoroethane	0	3	0%		0.50	
1,2,4-Trimethylbenzene	0	3	0%		0.50	
1,3,5-Trimethylbenzene	0	3	0%		0.50	
Vinyl Chloride	0	3	0%		0.50	
o-Xylene	0	3	0%		0.50	
m+p-Xylenes	0	3	0%		1.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.1
 Summary Statistics of All Surface Water Sample Results --
 Background Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Background Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	3	0%		37.50	
Adjusted C9-C12 Aliphatics	0	3	0%		12.50	
Unadjusted C5-C8 Aliphatics	0	3	0%		37.50	
Unadjusted C9-C12 Aliphatics	0	3	0%		12.50	
Adjusted C9-C10 Aromatics	0	3	0%		12.50	
Benzene	0	3	0%		2.50	
Ethylbenzene	0	3	0%		2.50	
Methyl-t-butyl ether	0	3	0%		2.50	
Naphthalene	0	3	0%		2.50	
Toluene	0	3	0%		2.50	
o-Xylene	0	3	0%		2.50	
m+p-Xylenes	0	3	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.2
 Surface Water Sample Results - Inorganic
 Background Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-407	SW-408	SW-409
Date Sampled	Screening Benchmark	5/17/2006	5/17/2006	5/17/2006
Inorganics (mg/L)				
Boron	0.75	0.004 J	0.0034 J	0.0039 J
Cadmium	0.00025	0.00009 J	0.00004 U	0.00003 U
Lead	0.0025	0.0013 U	0.0022 J	0.0013 U
Silver	0.00012	0.0001 UJ	0.0023 J	0.0008 J

> SW Benchmark

Appendix Table A.3.3
Summary Statistics of All Surface Water Sample Results --
Deerfield River Adjacent to Site Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	5	0%		2.64	
Acenaphthylene	0	5	0%		2.64	
Unadjusted C19-C36 Aliphatics	0	5	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	5	0%		100.00	
Anthracene	0	5	0%		2.64	
Adjusted C11-C22 Aromatics	0	5	0%		100.00	
Unadjusted C11-C22 Aromatics	0	5	0%		100.00	
Benzo(a)anthracene	0	5	0%		2.64	
Benzo(a)pyrene	0	5	0%		2.64	
Benzo(b)fluoranthene	0	5	0%		2.64	
Benzo(g,h,i)perylene	0	5	0%		2.64	
Benzo(k)fluoranthene	0	5	0%		2.64	
Chrysene	3	5	60%	0.128	1.16	0.211
Dibenzo(a,h)anthracene	0	5	0%		2.64	
Fluoranthene	2	5	40%	0.168	1.67	0.255
Fluorene	0	5	0%		2.64	
Indeno(1,2,3-cd)pyrene	0	5	0%		2.64	
2-Methylnaphthalene	0	5	0%		2.64	
Naphthalene	0	5	0%		2.64	
Phenanthrene	0	5	0%		2.64	
Pyrene	0	5	0%		2.64	
Adjusted TPH	0	5	0%		100.00	
Unadjusted TPH	0	5	0%		100.00	
<i>Inorganics (mg/L)</i>						
Antimony	1	9	11%	0.003	0.00	0.003
Arsenic	2	9	22%	0.002	0.00	0.003
Beryllium	0	9	0%		0.00	
Boron	8	9	89%	0.003	0.02	0.044
Cadmium	1	9	11%	0.000	0.00	0.000
Chromium	0	9	0%		0.00	
Copper	1	9	11%	0.002	0.00	0.002
Lead	0	9	0%		0.00	
Lithium	0	9	0%		0.00	
Mercury	0	9	0%		0.00	
Nickel	0	9	0%		0.00	
Selenium	4	9	44%	0.000	0.00	0.000
Silver	5	9	56%	0.000	0.00	0.002
Thallium	1	9	11%	0.003	0.00	0.003
Zinc	0	9	0%		0.01	
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	5	0%		0.11	
Aroclor-1268	0	5	0%		0.11	
Aroclor-1016	0	7	0%		0.10	
Aroclor-1221	0	7	0%		0.10	
Aroclor-1232	0	7	0%		0.10	
Aroclor-1242	0	7	0%		0.10	
Aroclor-1248	0	7	0%		0.10	
Aroclor-1254	0	7	0%		0.10	
Aroclor-1260	0	7	0%		0.10	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.3
Summary Statistics of All Surface Water Sample Results --
Deerfield River Adjacent to Site Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	5	0%		0.10	
Acenaphthylene	0	5	0%		0.10	
Aniline	0	5	0%		2.59	
Anthracene	0	5	0%		0.10	
Atrazine	0	5	0%		2.59	
Azobenzene	0	5	0%		2.59	
Benzidine	0	5	0%		2.59	
Benzo(a)anthracene	0	5	0%		0.10	
Benzo(a)pyrene	0	5	0%		0.10	
Benzo(b)fluoranthene	0	5	0%		0.10	
Benzo(g,h,i)perylene	1	5	20%	0.060	0.09	0.060
Benzo(k)fluoranthene	0	5	0%		0.10	
Benzoic acid	0	5	0%		2.59	
Benzyl alcohol	0	5	0%		2.59	
Bis(2-chloroethoxy)methane	0	5	0%		2.59	
Bis(2-chloroethyl)ether	0	5	0%		2.59	
Bis(2-ethylhexyl)phthalate	0	5	0%		2.59	
4-Bromophenyl phenyl ether	0	5	0%		2.59	
Butyl benzyl phthalate	0	5	0%		2.59	
Carbazole	0	5	0%		2.59	
4-Chloro-3-methylphenol	0	5	0%		2.59	
4-Chloroaniline	0	5	0%		2.59	
Bis(2-chloroisopropyl) ether	0	5	0%		2.59	
2-Chloronaphthalene	0	5	0%		2.59	
2-Chlorophenol	0	5	0%		2.59	
4-Chlorophenyl phenyl ether	0	5	0%		2.59	
Chrysene	0	5	0%		0.10	
Dibenzo(a,h)anthracene	0	5	0%		0.10	
Dibenzofuran	0	5	0%		2.59	
3,3'-Dichlorobenzidine	0	5	0%		2.59	
2,4-Dichlorophenol	0	5	0%		2.59	
Diethyl phthalate	0	5	0%		2.59	
Dimethyl phthalate	0	5	0%		2.59	
2,4-Dimethylphenol	0	5	0%		2.59	
Di-n-butyl phthalate	0	5	0%		2.59	
2,4-Dinitrophenol	0	5	0%		2.59	
2,4-Dinitrotoluene	0	5	0%		2.59	
2,6-Dinitrotoluene	0	5	0%		2.59	
Di-n-octyl phthalate	0	5	0%		2.59	
Fluoranthene	1	5	20%	0.042	0.09	0.042
Fluorene	0	5	0%		0.10	
Hexachlorobenzene	0	3	0%		0.50	
Hexachlorobutadiene	0	3	0%		0.10	
Hexachlorocyclopentadiene	0	5	0%		2.59	
Hexachloroethane	0	5	0%		2.59	
Indeno(1,2,3-cd)pyrene	0	5	0%		0.10	
Isophorone	0	5	0%		2.59	
4,6-Dinitro-2-methylphenol	0	5	0%		2.59	
1-Methylnaphthalene	0	5	0%		1.58	
2-Methylnaphthalene	0	5	0%		1.58	
3+4-Methylphenol	0	5	0%		5.18	
2-Methylphenol	0	5	0%		2.59	
Naphthalene	0	5	0%		1.58	
2-Nitroaniline	0	5	0%		2.59	
3-Nitroaniline	0	5	0%		2.59	
4-Nitroaniline	0	5	0%		10.38	
Nitrobenzene	0	5	0%		2.59	
2-Nitrophenol	0	5	0%		2.59	
4-Nitrophenol	0	5	0%		10.38	
N-Nitroso-di-n-propylamine	0	5	0%		2.59	
N-Nitrosodiphenylamine	0	5	0%		2.59	
N-Nitrosodimethylamine	0	5	0%		2.59	
Pentachlorophenol	0	3	0%		0.50	
Phenanthrene	1	5	20%	0.042	0.09	0.042
Phenol	0	5	0%		2.59	
Pyrene	2	5	40%	0.020	0.07	0.032
Pyridine	0	5	0%		2.59	
2,4,5-Trichlorophenol	0	5	0%		2.59	
2,4,6-Trichlorophenol	0	5	0%		2.59	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.3
Summary Statistics of All Surface Water Sample Results --
Deerfield River Adjacent to Site Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acrylonitrile	0	5	0%		0.50	
t-Amyl methyl ether	0	5	0%		0.50	
Benzene	0	5	0%		0.50	
Bromobenzene	0	5	0%		0.50	
Bromochloromethane	0	5	0%		0.50	
Bromodichloromethane	0	5	0%		0.50	
Bromoform	0	5	0%		0.50	
Bromomethane	0	5	0%		1.00	
2-Butanone	0	5	0%		5.00	
n-Butylbenzene	0	5	0%		0.50	
sec-Butylbenzene	0	5	0%		0.50	
tert-Butylbenzene	0	5	0%		0.50	
Carbon disulfide	0	5	0%		2.50	
Carbon Tetrachloride	0	5	0%		0.50	
Chlorobenzene	0	5	0%		0.50	
Chloroethane	0	5	0%		1.00	
Chloroform	0	5	0%		0.50	
Chloromethane	0	5	0%		1.00	
2-Chlorotoluene	0	5	0%		0.50	
4-Chlorotoluene	0	5	0%		0.50	
1,2-Dibromo-3-chloropropane	0	5	0%		1.00	
Dibromochloromethane	0	5	0%		0.50	
1,2-Dibromoethane	0	5	0%		0.25	
Dibromomethane	0	5	0%		0.50	
1,2-Dichlorobenzene	0	5	0%		0.50	
1,3-Dichlorobenzene	0	5	0%		0.50	
1,4-Dichlorobenzene	0	5	0%		0.50	
Dichlorodifluoromethane	0	5	0%		1.00	
1,1-Dichloroethane	0	5	0%		0.50	
1,2-Dichloroethane	0	5	0%		0.50	
cis-1,2-Dichloroethene	0	5	0%		0.50	
trans-1,2-Dichloroethene	0	5	0%		0.50	
1,1-Dichloroethene	0	5	0%		0.50	
1,3-Dichloropropane	0	5	0%		0.50	
2,2-Dichloropropane	0	5	0%		0.50	
1,2-Dichloropropane	0	5	0%		0.50	
1,1-Dichloropropene	0	5	0%		0.25	
cis-1,3-Dichloropropene	0	5	0%		0.25	
trans-1,3-Dichloropropene	0	5	0%		0.25	
Diethyl Ether	0	5	0%		0.50	
Diisopropyl ether	0	5	0%		0.50	
Ethylbenzene	0	5	0%		0.50	
Ethyl-t-butyl ether	0	5	0%		0.50	
2-Hexanone	0	5	0%		5.00	
Isopropylbenzene	0	5	0%		0.50	
4-Isopropyltoluene	0	5	0%		0.50	
4-Methyl-2-Pentanone	0	5	0%		5.00	
Methylene Chloride	0	5	0%		5.00	
Methyl-t-butyl ether	0	5	0%		0.50	
n-Propylbenzene	0	5	0%		0.50	
Styrene	0	5	0%		0.50	
1,1,1,2-Tetrachloroethane	0	5	0%		0.50	
1,1,2,2-Tetrachloroethane	0	5	0%		0.50	
Tetrachloroethene	0	5	0%		0.50	
Tetrahydrofuran	0	5	0%		5.00	
Toluene	0	5	0%		0.50	
1,2,3-Trichlorobenzene	0	5	0%		0.50	
1,2,4-Trichlorobenzene	0	5	0%		0.50	
1,1,1-Trichloroethane	0	5	0%		0.50	
1,1,2-Trichloroethane	0	5	0%		0.50	
Trichloroethene	0	5	0%		0.50	
Trichlorofluoromethane	0	5	0%		0.50	
1,2,3-Trichloropropane	0	5	0%		0.50	
1,1,2-Trichlorotrifluoroethane	0	5	0%		0.50	
1,2,4-Trimethylbenzene	0	5	0%		0.50	
1,3,5-Trimethylbenzene	0	5	0%		0.50	
Vinyl Chloride	0	5	0%		0.50	
o-Xylene	0	5	0%		0.50	
m+p-Xylenes	0	5	0%		1.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.3
Summary Statistics of All Surface Water Sample Results --
Deerfield River Adjacent to Site Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield River Adjacent to Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	5	0%		37.50	
Adjusted C9-C12 Aliphatics	0	5	0%		12.50	
Unadjusted C5-C8 Aliphatics	0	5	0%		37.50	
Unadjusted C9-C12 Aliphatics	0	5	0%		12.50	
Adjusted C9-C10 Aromatics	0	5	0%		12.50	
Benzene	0	5	0%		2.50	
Ethylbenzene	0	5	0%		2.50	
Methyl-t-butyl ether	0	5	0%		2.50	
Naphthalene	0	5	0%		2.50	
Toluene	0	5	0%		2.50	
o-Xylene	0	5	0%		2.50	
m+p-Xylenes	0	5	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.4
 Surface Water Sample Results - EPHs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-223	SW-229	SW-232	SW-FD-002-061906	SW-235	SW-238
Date Sampled	Screening Benchmark	6/14/2006	6/19/2006	6/19/2006	6/19/2006	6/19/2006	6/15/2006
EPH (µg/L)							
Chrysene	17	5.32 UJ	0.211 J	0.128 J	0.105 J	0.147 J	5.26 UJ
Fluoranthene	39.8	5.32 UJ	0.168 J	0.255 J	0.126 J	5.26 U	5.26 UJ

Appendix Table A.3.4
 Surface Water Sample Results - Inorganics
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-220	SW-221	SW-222	SW-223	SW-226	SW-229	SW-232	SW-FD-002-061906	SW-235	SW-238
Date Sampled	Screening Benchmark	5/19/2006	5/19/2006	5/19/2006	6/14/2006	6/14/2006	6/19/2006	6/19/2006	6/19/2006	6/19/2006	6/15/2006
Inorganics (mg/L)											
Antimony	0.3	0.0031 J	0.012 U	0.0036 U	0.015 U	0.015 U	0.006 U	0.006 U	0.0032 U	0.006 U	0.015 U
Arsenic	0.15	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.0024 J	0.004 U	0.0026 J	0.004 U
Boron	0.75	0.0442	0.027	0.0249	0.0032 J	0.0034 J	0.0066 J	0.0058 J	0.0042 J	0.0036 J	0.05 U
Cadmium	0.00025	0.00003 U	0.00004 U	0.0001 J	0.00005 U	0.00008 U	0.00008 U	0.00007 U	0.00008 U	0.00006 U	0.00006 U
Copper	0.009	0.005 U	0.0024 J	0.005 U	0.0045 U	0.006 U	0.0016 U	0.0013 U	0.0014 U	0.0019 U	0.0068 U
Selenium	0.005	0.0002 U	0.0002 U	0.0012 U	0.0001 J	0.0001 J	0.0005 U	0.0005 U	0.0002 J	0.0002 J	0.0001 J
Silver	0.00012	0.00004 UJ	0.0001 UJ	0.0004 J	0.0012 J	0.0002 UJ	0.001 J	0.0021 J	0.0014 J	0.0004 UJ	0.0016 J
Thallium	0.11	0.00006 U	0.0001 U	0.003 J	0.01 U	0.01 U	0.0035 U	0.0078 U	0.0035 U	0.0102 U	0.01 U

> SW Benchmark

Appendix Table A.3.4
 Surface Water Sample Results - SVOCs
 Deerfield River Adjacent to Site
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-223	SW-229	SW-232	SW-FD-002-061906	SW-235	SW-238
Date Sampled	Screening Benchmark	6/14/2006	6/19/2006	6/19/2006	6/19/2006	6/19/2006	6/15/2006
SVOC (µg/L)							
Benzo(a)anthracene	17	0.2 U	0.2 U	0.2 U	0.13 J	0.2 U	0.2 U
Benzo(a)pyrene	17	0.2 U	0.2 U	0.2 U	0.05 J	0.2 U	0.2 U
Benzo(b)fluoranthene	17	0.2 U	0.2 U	0.2 U	0.06 J	0.2 U	0.2 U
Benzo(g,h,i)perylene	17	0.2 U	0.06 J	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	17	0.2 U	0.2 U	0.2 U	0.08 J	0.2 U	0.2 U
Chrysene	17	0.2 U	0.2 U	0.2 U	0.1 J	0.2 U	0.2 U
Fluoranthene	39.8	0.2 U	0.2 U	0.042 J	0.1 J	0.2 U	0.2 U
Phenanthrene	17	0.2 U	0.2 U	0.042 J	0.04 J	0.2 U	0.2 U
Pyrene	17	0.2 U	0.02 J	0.032 J	0.07 J	0.2 U	0.2 U

Appendix Table A.3.5
Summary Statistics of All Surface Water Sample Results --
Deerfield River Downstream from Site Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield Downriver from Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (μg/L)</i>						
Acenaphthene	0	1	0%		2.66	
Acenaphthylene	0	1	0%		2.66	
Unadjusted C19-C36 Aliphatics	0	1	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	1	0%		100.00	
Anthracene	0	1	0%		2.66	
Adjusted C11-C22 Aromatics	0	1	0%		100.00	
Unadjusted C11-C22 Aromatics	0	1	0%		100.00	
Benzo(a)anthracene	0	1	0%		2.66	
Benzo(a)pyrene	0	1	0%		2.66	
Benzo(b)fluoranthene	0	1	0%		2.66	
Benzo(g,h,i)perylene	0	1	0%		2.66	
Benzo(k)fluoranthene	0	1	0%		2.66	
Chrysene	0	1	0%		2.66	
Dibenzo(a,h)anthracene	0	1	0%		2.66	
Fluoranthene	0	1	0%		2.66	
Fluorene	0	1	0%		2.66	
Indeno(1,2,3-cd)pyrene	0	1	0%		2.66	
2-Methylnaphthalene	0	1	0%		2.66	
Naphthalene	1	1	100%	0.23	0.23	0.23
Phenanthrene	0	1	0%		2.66	
Pyrene	0	1	0%		2.66	
Adjusted TPH	0	1	0%		100.00	
Unadjusted TPH	0	1	0%		100.00	
<i>Inorganics (mg/L)</i>						
Antimony	0	2	0%		0.0075	
Arsenic	0	2	0%		0.0020	
Beryllium	0	2	0%		0.0010	
Boron	0	2	0%		0.025	
Cadmium	0	2	0%		0.00004	
Chromium	0	2	0%		0.0025	
Copper	0	2	0%		0.0034	
Lead	0	2	0%		0.0001	
Lithium	0	2	0%		0.0028	
Mercury	0	2	0%		0.0001	
Nickel	0	2	0%		0.0025	
Selenium	2	2	100%	0.0001	0.0001	0.0002
Silver	1	2	50%	0.0007	0.0005	0.0007
Thallium	0	2	0%		0.0050	
Zinc	0	2	0%		0.0086	
<i>Polychlorinated Biphenyls (μg/L)</i>						
Aroclor-1262	0	2	0%		0.11	
Aroclor-1268	0	2	0%		0.11	
Aroclor-1016	0	2	0%		0.11	
Aroclor-1221	0	2	0%		0.11	
Aroclor-1232	0	2	0%		0.11	
Aroclor-1242	0	2	0%		0.11	
Aroclor-1248	0	2	0%		0.11	
Aroclor-1254	0	2	0%		0.11	
Aroclor-1260	0	2	0%		0.11	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.5
Summary Statistics of All Surface Water Sample Results --
Deerfield River Downstream from Site Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield Downriver from Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	1	0%		0.10	
Acenaphthylene	0	1	0%		0.10	
Aniline	0	1	0%		2.78	
Anthracene	0	1	0%		0.10	
Atrazine	0	1	0%		2.78	
Azobenzene	0	1	0%		2.78	
Benzidine	0	1	0%		2.78	
Benzo(a)anthracene	0	1	0%		0.10	
Benzo(a)pyrene	0	1	0%		0.10	
Benzo(b)fluoranthene	0	1	0%		0.10	
Benzo(g,h,i)perylene	0	1	0%		0.10	
Benzo(k)fluoranthene	0	1	0%		0.10	
Benzoic acid	0	1	0%		2.78	
Benzyl alcohol	0	1	0%		2.78	
Bis(2-chloroethoxy)methane	0	1	0%		2.78	
Bis(2-chloroethyl)ether	0	1	0%		2.78	
Bis(2-ethylhexyl)phthalate	0	1	0%		2.78	
4-Bromophenyl phenyl ether	0	1	0%		2.78	
Butyl benzyl phthalate	0	1	0%		2.78	
Carbazole	0	1	0%		2.78	
4-Chloro-3-methylphenol	0	1	0%		2.78	
4-Chloroaniline	0	1	0%		2.78	
Bis(2-chloroisopropyl) ether	0	1	0%		2.78	
2-Chloronaphthalene	0	1	0%		2.78	
2-Chlorophenol	0	1	0%		2.78	
4-Chlorophenyl phenyl ether	0	1	0%		2.78	
Chrysene	0	1	0%		0.10	
Dibenzo(a,h)anthracene	0	1	0%		0.10	
Dibenzofuran	0	1	0%		2.78	
3,3'-Dichlorobenzidine	0	1	0%		2.78	
2,4-Dichlorophenol	0	1	0%		2.78	
Diethyl phthalate	0	1	0%		2.78	
Dimethyl phthalate	0	1	0%		2.78	
2,4-Dimethylphenol	0	1	0%		2.78	
Di-n-butyl phthalate	0	1	0%		2.78	
2,4-Dinitrophenol	0	1	0%		2.78	
2,4-Dinitrotoluene	0	1	0%		2.78	
2,6-Dinitrotoluene	0	1	0%		2.78	
Di-n-octyl phthalate	0	1	0%		2.78	
Fluoranthene	0	1	0%		0.10	
Fluorene	0	1	0%		0.10	
Hexachlorocyclopentadiene	0	1	0%		2.78	
Hexachloroethane	0	1	0%		2.78	
Indeno(1,2,3-cd)pyrene	0	1	0%		0.10	
Isophorone	0	1	0%		2.78	
4,6-Dinitro-2-methylphenol	0	1	0%		2.78	
1-Methylnaphthalene	1	1	100%	0.58	0.58	0.58
2-Methylnaphthalene	1	1	100%	0.48	0.48	0.48
3+4-Methylphenol	0	1	0%		5.55	
2-Methylphenol	0	1	0%		2.78	
Naphthalene	0	1	0%		0.10	
2-Nitroaniline	0	1	0%		2.78	
3-Nitroaniline	0	1	0%		2.78	
4-Nitroaniline	0	1	0%		11.10	
Nitrobenzene	0	1	0%		2.78	
2-Nitrophenol	0	1	0%		2.78	
4-Nitrophenol	0	1	0%		11.10	
N-Nitroso-di-n-propylamine	0	1	0%		2.78	
N-Nitrosodiphenylamine	0	1	0%		2.78	
N-Nitrosodimethylamine	0	1	0%		2.78	
Phenanthrene	0	1	0%		0.10	
Phenol	0	1	0%		2.78	
Pyrene	0	1	0%		0.10	
Pyridine	0	1	0%		2.78	
2,4,5-Trichlorophenol	0	1	0%		2.78	
2,4,6-Trichlorophenol	0	1	0%		2.78	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.5
Summary Statistics of All Surface Water Sample Results --
Deerfield River Downstream from Site Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield Downriver from Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acrylonitrile	0	1	0%		0.50	
t-Amyl methyl ether	1	1	100%	2.60	2.60	2.60
Benzene	1	1	100%	1.20	1.20	1.20
Bromobenzene	0	1	0%		0.50	
Bromochloromethane	0	1	0%		0.50	
Bromodichloromethane	0	1	0%		0.50	
Bromoform	0	1	0%		0.50	
Bromomethane	0	1	0%		1.00	
2-Butanone	0	1	0%		5.00	
n-Butylbenzene	0	1	0%		0.50	
sec-Butylbenzene	0	1	0%		0.50	
tert-Butylbenzene	0	1	0%		0.50	
Carbon disulfide	0	1	0%		2.50	
Carbon Tetrachloride	0	1	0%		0.50	
Chlorobenzene	0	1	0%		0.50	
Chloroethane	0	1	0%		1.00	
Chloroform	0	1	0%		0.50	
Chloromethane	0	1	0%		1.00	
2-Chlorotoluene	0	1	0%		0.50	
4-Chlorotoluene	0	1	0%		0.50	
1,2-Dibromo-3-chloropropane	0	1	0%		1.00	
Dibromochloromethane	0	1	0%		0.50	
1,2-Dibromoethane	0	1	0%		0.25	
Dibromomethane	0	1	0%		0.50	
1,2-Dichlorobenzene	0	1	0%		0.50	
1,3-Dichlorobenzene	0	1	0%		0.50	
1,4-Dichlorobenzene	0	1	0%		0.50	
Dichlorodifluoromethane	0	1	0%		1.00	
1,1-Dichloroethane	0	1	0%		0.50	
1,2-Dichloroethane	0	1	0%		0.50	
cis-1,2-Dichloroethene	0	1	0%		0.50	
trans-1,2-Dichloroethene	0	1	0%		0.50	
1,1-Dichloroethene	0	1	0%		0.50	
1,3-Dichloropropane	0	1	0%		0.50	
2,2-Dichloropropane	0	1	0%		0.50	
1,2-Dichloropropane	0	1	0%		0.50	
1,1-Dichloropropene	0	1	0%		0.25	
cis-1,3-Dichloropropene	0	1	0%		0.25	
trans-1,3-Dichloropropene	0	1	0%		0.25	
Diethyl Ether	0	1	0%		0.50	
Diisopropyl ether	0	1	0%		0.50	
Ethylbenzene	1	1	100%	1.60	1.60	1.60
Ethyl-t-butyl ether	0	1	0%		0.50	
2-Hexanone	0	1	0%		5.00	
Isopropylbenzene	0	1	0%		0.50	
4-Isopropyltoluene	0	1	0%		0.50	
4-Methyl-2-Pentanone	0	1	0%		5.00	
Methylene Chloride	0	1	0%		5.00	
Methyl-t-butyl ether	1	1	100%	15.30	15.30	15.30
n-Propylbenzene	0	1	0%		0.50	
Styrene	0	1	0%		0.50	
1,1,1,2-Tetrachloroethane	0	1	0%		0.50	
1,1,2,2-Tetrachloroethane	0	1	0%		0.50	
Tetrachloroethene	0	1	0%		0.50	
Tetrahydrofuran	0	1	0%		5.00	
Toluene	1	1	100%	6.10	6.10	6.10
1,2,3-Trichlorobenzene	0	1	0%		0.50	
1,2,4-Trichlorobenzene	0	1	0%		0.50	
1,1,1-Trichloroethane	0	1	0%		0.50	
1,1,2-Trichloroethane	0	1	0%		0.50	
Trichloroethene	0	1	0%		0.50	
Trichlorofluoromethane	0	1	0%		0.50	
1,2,3-Trichloropropane	0	1	0%		0.50	
1,1,2-Trichlorotrifluoroethane	0	1	0%		0.50	
1,2,4-Trimethylbenzene	1	1	100%	1.90	1.90	1.90
1,3,5-Trimethylbenzene	1	1	100%	0.60	0.60	0.60
Vinyl Chloride	0	1	0%		0.50	
o-Xylene	1	1	100%	2.10	2.10	2.10
m+p-Xylenes	1	1	100%	4.80	4.80	4.80

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.5
Summary Statistics of All Surface Water Sample Results --
Deerfield River Downstream from Site Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Deerfield Downriver from Site					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	1	1	100%	39.60	39.60	39.60
Adjusted C9-C12 Aliphatics	1	1	100%	24.30	24.30	24.30
Unadjusted C5-C8 Aliphatics	1	1	100%	39.60	39.60	39.60
Unadjusted C9-C12 Aliphatics	1	1	100%	24.30	24.30	24.30
Adjusted C9-C10 Aromatics	1	1	100%	14.50	14.50	14.50
Benzene	0	1	0%		2.50	
Ethylbenzene	0	1	0%		2.50	
Methyl-t-butyl ether	1	1	100%	11.50	11.50	11.50
Naphthalene	0	1	0%		2.50	
Toluene	1	1	100%	4.70	4.70	4.70
o-Xylene	1	1	100%	1.90	1.90	1.90
m+p-Xylenes	1	1	100%	4.40	4.40	4.40

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.6
Surface Water Sample Results - EPH
Deerfield River Downstream from Site
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-244
Date Sampled	Screening Benchmark	6/15/2006
EPH (µg/L)		
Naphthalene	62	0.234 J

Appendix Table A.3.6

Surface Water Sample Results - Inorganics
Deerfield River Downstream from Site
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-241	SW-244
Date Sampled	Screening Benchmark	6/15/2006	6/15/2006
Inorganics (mg/L)			
Selenium	0.005	0.0002 J	0.00009 J
Silver	0.00012	0.0007 J	0.0004 UJ

> SW Benchmark

Appendix Table A.3.6
Surface Water Sample Results - SVOCs
Deerfield River Downstream from Site
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-244
Date Sampled	Screening Benchmark	6/15/2006
SVOC (µg/L)		
1-Methylnaphthalene		0.578
2-Methylnaphthalene	17	0.478

Appendix Table A.3.6
Surface Water Sample Results - VOCs
Deerfield River Downstream from Site
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-244
Date Sampled	Screening Benchmark	6/15/2006
VOC (µg/L)		
t-Amyl methyl ether		2.6
Benzene		1.2
Ethylbenzene		1.6
Methyl-t-butyl ether		15.3
Toluene	175	6.1
1,2,4-Trimethylbenzene		1.9
1,3,5-Trimethylbenzene		0.6 J
o-Xylene		2.1
m+p-Xylenes		4.8

Appendix Table A.3.6
Surface Water Sample Results - VPHs
Deerfield River Downstream from Site
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-244
Date Sampled	Screening Benchmark	6/15/2006
VPH (µg/L)		
Adjusted C5-C8 Aliphatics		39.6 J
Adjusted C9-C12 Aliphatics		24.3 J
Unadjusted C5-C8 Aliphatics	250	39.6 J
Unadjusted C9-C12 Aliphatics		24.3 J
Adjusted C9-C10 Aromatics	540	14.5 J
Methyl-t-butyl ether		11.5
Toluene	175	4.7 J
o-Xylene		1.9 J
m+p-Xylenes		4.4 J

Appendix Table A.3.7
 Summary Statistics of All Surface Water Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	3	0%		2.71	
Acenaphthylene	0	3	0%		2.71	
Unadjusted C19-C36 Aliphatics	0	3	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	3	0%		100.00	
Anthracene	1	3	33%	0.20	1.84	0.20
Adjusted C11-C22 Aromatics	0	3	0%		100.00	
Unadjusted C11-C22 Aromatics	0	3	0%		100.00	
Benzo(a)anthracene	0	3	0%		2.71	
Benzo(a)pyrene	0	3	0%		2.71	
Benzo(b)fluoranthene	0	3	0%		2.71	
Benzo(g,h,i)perylene	0	3	0%		2.71	
Benzo(k)fluoranthene	0	3	0%		2.71	
Chrysene	0	3	0%		2.71	
Dibenzo(a,h)anthracene	0	3	0%		2.71	
Fluoranthene	0	3	0%		2.71	
Fluorene	0	3	0%		2.71	
Indeno(1,2,3-cd)pyrene	0	3	0%		2.71	
2-Methylnaphthalene	0	3	0%		2.71	
Naphthalene	0	3	0%		2.71	
Phenanthrene	0	3	0%		2.71	
Pyrene	0	3	0%		2.71	
Adjusted TPH	0	3	0%		100.00	
Unadjusted TPH	0	3	0%		100.00	
<i>Inorganics (mg/L)</i>						
Antimony	0	3	0%		0.0030	
Arsenic	0	3	0%		0.0020	
Beryllium	0	3	0%		0.0010	
Boron	2	3	67%	0.0033	0.0042	0.0042
Cadmium	3	3	100%	0.000050	0.000067	0.000090
Chromium	0	3	0%		0.0025	
Copper	0	3	0%		0.0012	
Lead	0	3	0%		0.0006	
Lithium	0	3	0%		0.0010	
Mercury	0	3	0%		0.00010	
Nickel	0	3	0%		0.0025	
Selenium	0	3	0%		0.000035	
Silver	1	3	33%	0.00050	0.00019	0.00050
Thallium	0	3	0%		0.000050	
Zinc	1	3	33%	0.026	0.015	0.026
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	3	0%		0.10	
Aroclor-1268	0	3	0%		0.10	
Aroclor-1016	0	4	0%		0.11	
Aroclor-1221	0	4	0%		0.11	
Aroclor-1232	0	4	0%		0.11	
Aroclor-1242	0	4	0%		0.11	
Aroclor-1248	0	4	0%		0.11	
Aroclor-1254	0	4	0%		0.11	
Aroclor-1260	0	4	0%		0.11	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.7
 Summary Statistics of All Surface Water Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	3	0%		0.10	
Acenaphthylene	0	3	0%		0.10	
Aniline	0	3	0%		2.57	
Anthracene	0	3	0%		0.10	
Atrazine	0	3	0%		2.57	
Azobenzene	0	3	0%		2.57	
Benzidine	0	3	0%		2.57	
Benzo(a)anthracene	0	3	0%		0.10	
Benzo(a)pyrene	0	3	0%		0.10	
Benzo(b)fluoranthene	0	3	0%		0.10	
Benzo(g,h,i)perylene	0	3	0%		0.10	
Benzo(k)fluoranthene	0	3	0%		0.10	
Benzoic acid	0	3	0%		2.57	
Benzyl alcohol	0	3	0%		2.57	
Bis(2-chloroethoxy)methane	0	3	0%		2.57	
Bis(2-chloroethyl)ether	0	3	0%		2.57	
Bis(2-ethylhexyl)phthalate	0	3	0%		2.57	
4-Bromophenyl phenyl ether	0	3	0%		2.57	
Butyl benzyl phthalate	0	3	0%		2.57	
Carbazole	0	3	0%		2.57	
4-Chloro-3-methylphenol	0	3	0%		2.57	
4-Chloroaniline	0	3	0%		2.57	
Bis(2-chloroisopropyl) ether	0	3	0%		2.57	
2-Chloronaphthalene	0	3	0%		2.57	
2-Chlorophenol	0	3	0%		2.57	
4-Chlorophenyl phenyl ether	0	3	0%		2.57	
Chrysene	0	3	0%		0.10	
Dibenzo(a,h)anthracene	0	3	0%		0.10	
Dibenzofuran	0	3	0%		2.57	
3,3'-Dichlorobenzidine	0	3	0%		2.57	
2,4-Dichlorophenol	0	3	0%		2.57	
Diethyl phthalate	0	3	0%		2.57	
Dimethyl phthalate	0	3	0%		2.57	
2,4-Dimethylphenol	0	3	0%		2.57	
Di-n-butyl phthalate	0	3	0%		2.57	
2,4-Dinitrophenol	0	3	0%		2.57	
2,4-Dinitrotoluene	0	3	0%		2.57	
2,6-Dinitrotoluene	0	3	0%		2.57	
Di-n-octyl phthalate	0	3	0%		2.57	
Fluoranthene	0	3	0%		0.10	
Fluorene	0	3	0%		0.10	
Hexachlorobenzene	0	3	0%		0.50	
Hexachlorobutadiene	0	3	0%		0.10	
Hexachlorocyclopentadiene	0	3	0%		2.57	
Hexachloroethane	0	3	0%		2.57	
Indeno(1,2,3-cd)pyrene	0	3	0%		0.10	
Isophorone	0	3	0%		2.57	
4,6-Dinitro-2-methylphenol	0	3	0%		2.57	
1-Methylnaphthalene	0	3	0%		2.57	
2-Methylnaphthalene	0	3	0%		2.57	
3+4-Methylphenol	0	3	0%		5.13	
2-Methylphenol	0	3	0%		2.57	
Naphthalene	0	3	0%		2.57	
2-Nitroaniline	0	3	0%		2.57	
3-Nitroaniline	0	3	0%		2.57	
4-Nitroaniline	0	3	0%		10.27	
Nitrobenzene	0	3	0%		2.57	
2-Nitrophenol	0	3	0%		2.57	
4-Nitrophenol	0	3	0%		10.27	
N-Nitroso-di-n-propylamine	0	3	0%		2.57	
N-Nitrosodiphenylamine	0	3	0%		2.57	
N-Nitrosodimethylamine	0	3	0%		2.57	
Pentachlorophenol	0	3	0%		0.50	
Phenanthrene	0	3	0%		0.10	
Phenol	0	3	0%		2.57	
Pyrene	0	3	0%		0.10	
Pyridine	0	3	0%		2.57	
2,4,5-Trichlorophenol	0	3	0%		2.57	
2,4,6-Trichlorophenol	0	3	0%		2.57	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.7
 Summary Statistics of All Surface Water Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acrylonitrile	0	3	0%		0.50	
t-Amyl methyl ether	0	3	0%		0.50	
Benzene	0	3	0%		0.50	
Bromobenzene	0	3	0%		0.50	
Bromochloromethane	0	3	0%		0.50	
Bromodichloromethane	0	3	0%		0.50	
Bromoform	0	3	0%		0.50	
Bromomethane	0	3	0%		1.00	
2-Butanone	0	3	0%		5.00	
n-Butylbenzene	0	3	0%		0.50	
sec-Butylbenzene	0	3	0%		0.50	
tert-Butylbenzene	0	3	0%		0.50	
Carbon disulfide	0	3	0%		2.50	
Carbon Tetrachloride	0	3	0%		0.50	
Chlorobenzene	0	3	0%		0.50	
Chloroethane	0	3	0%		1.00	
Chloroform	0	3	0%		0.50	
Chloromethane	0	3	0%		1.00	
2-Chlorotoluene	0	3	0%		0.50	
4-Chlorotoluene	0	3	0%		0.50	
1,2-Dibromo-3-chloropropane	0	3	0%		1.00	
Dibromochloromethane	0	3	0%		0.50	
1,2-Dibromoethane	0	3	0%		0.25	
Dibromomethane	0	3	0%		0.50	
1,2-Dichlorobenzene	0	3	0%		0.50	
1,3-Dichlorobenzene	0	3	0%		0.50	
1,4-Dichlorobenzene	0	3	0%		0.50	
Dichlorodifluoromethane	0	3	0%		1.00	
1,1-Dichloroethane	0	3	0%		0.50	
1,2-Dichloroethane	0	3	0%		0.50	
cis-1,2-Dichloroethene	0	3	0%		0.50	
trans-1,2-Dichloroethene	0	3	0%		0.50	
1,1-Dichloroethene	0	3	0%		0.50	
1,3-Dichloropropane	0	3	0%		0.50	
2,2-Dichloropropane	0	3	0%		0.50	
1,2-Dichloropropane	0	3	0%		0.50	
1,1-Dichloropropene	0	3	0%		0.25	
cis-1,3-Dichloropropene	0	3	0%		0.25	
trans-1,3-Dichloropropene	0	3	0%		0.25	
Diethyl Ether	0	3	0%		0.50	
Diisopropyl ether	0	3	0%		0.50	
Ethylbenzene	0	3	0%		0.50	
Ethyl-t-butyl ether	0	3	0%		0.50	
2-Hexanone	0	3	0%		5.00	
Isopropylbenzene	0	3	0%		0.50	
4-Isopropyltoluene	0	3	0%		0.50	
4-Methyl-2-Pentanone	0	3	0%		5.00	
Methylene Chloride	0	3	0%		5.00	
Methyl-t-butyl ether	0	3	0%		0.50	
n-Propylbenzene	0	3	0%		0.50	
Styrene	0	3	0%		0.50	
1,1,1,2-Tetrachloroethane	0	3	0%		0.50	
1,1,2,2-Tetrachloroethane	0	3	0%		0.50	
Tetrachloroethene	0	3	0%		0.50	
Tetrahydrofuran	0	3	0%		5.00	
Toluene	0	3	0%		0.50	
1,2,3-Trichlorobenzene	0	3	0%		0.50	
1,2,4-Trichlorobenzene	0	3	0%		0.50	
1,1,1-Trichloroethane	0	3	0%		0.50	
1,1,2-Trichloroethane	0	3	0%		0.50	
Trichloroethene	0	3	0%		0.50	
Trichlorofluoromethane	0	3	0%		0.50	
1,2,3-Trichloropropane	0	3	0%		0.50	
1,1,2-Trichlorotrifluoroethane	0	3	0%		0.50	
1,2,4-Trimethylbenzene	0	3	0%		0.50	
1,3,5-Trimethylbenzene	0	3	0%		0.50	
Vinyl Chloride	0	3	0%		0.50	
o-Xylene	0	3	0%		0.50	
m+p-Xylenes	0	3	0%		1.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.7
 Summary Statistics of All Surface Water Sample Results --
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Sherman Reservoir					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	3	0%		37.50	
Adjusted C9-C12 Aliphatics	0	3	0%		12.50	
Unadjusted C5-C8 Aliphatics	0	3	0%		37.50	
Unadjusted C9-C12 Aliphatics	0	3	0%		12.50	
Adjusted C9-C10 Aromatics	0	3	0%		12.50	
Benzene	0	3	0%		2.50	
Ethylbenzene	0	3	0%		2.50	
Methyl-t-butyl ether	0	3	0%		2.50	
Naphthalene	0	3	0%		2.50	
Toluene	0	3	0%		2.50	
o-Xylene	0	3	0%		2.50	
m+p-Xylenes	0	3	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.8
 Surface Water Sample Results - EPHs
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-008	SW-FD001-051806	SW-009	SW-011
Date Sampled	Screening Benchmark	5/18/2006	5/18/2006	5/18/2006	5/18/2006
EPH (µg/L)					
Anthracene	17	5.32 U	5.43 U	5.32 U	0.202 J

Appendix Table A.3.8
 Surface Water Sample Results - Inorganics
 Sherman Reservoir Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	Surface Water (SW) Screening Benchmark	SW-008 5/18/2006	SW-FD001-051806 5/18/2006	SW-009 5/18/2006	SW-011 5/18/2006
Inorganics (mg/L)					
Boron	0.75	0.0033 J	0.0037 J	0.0042 J	0.01 U
Cadmium	0.00025	0.00006 J	0.00005 J	0.00009 J	0.00005 J
Lead	0.0025	0.0009 U	0.0017 U	0.0011 U	0.0015 U
Silver	0.00012	0.0001 UJ	0.0016 J	0.0005 J	0.00005 UJ
Zinc	0.12	0.0161 U	0.021 U	0.0261	0.0224 U

> SW Benchmark

**Appendix Table A.3.9
Summary Statistics of All Surface Water Sample Results --
TransCanada WSD Area
YNPS Rowe, MA**

Oil or Hazardous Material	All Surface Water Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	1	0%		2.66	
Acenaphthylene	0	1	0%		2.66	
Unadjusted C19-C36 Aliphatics	0	1	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	1	0%		100.00	
Anthracene	0	1	0%		2.66	
Adjusted C11-C22 Aromatics	0	1	0%		100.00	
Unadjusted C11-C22 Aromatics	0	1	0%		100.00	
Benzo(a)anthracene	0	1	0%		2.66	
Benzo(a)pyrene	0	1	0%		2.66	
Benzo(b)fluoranthene	0	1	0%		2.66	
Benzo(g,h,i)perylene	0	1	0%		2.66	
Benzo(k)fluoranthene	0	1	0%		2.66	
Chrysene	0	1	0%		2.66	
Dibenzo(a,h)anthracene	0	1	0%		2.66	
Fluoranthene	0	1	0%		2.66	
Fluorene	0	1	0%		2.66	
Indeno(1,2,3-cd)pyrene	0	1	0%		2.66	
2-Methylnaphthalene	0	1	0%		2.66	
Naphthalene	0	1	0%		2.66	
Phenanthrene	0	1	0%		2.66	
Pyrene	0	1	0%		2.66	
Adjusted TPH	0	1	0%		100.00	
Unadjusted TPH	0	1	0%		100.00	
<i>Inorganics (mg/L)</i>						
Antimony	0	1	0%		0.003	
Arsenic	0	1	0%		0.002	
Beryllium	0	1	0%		0.001	
Boron	1	1	100%	0.009	0.009	0.009
Cadmium	1	1	100%	0.000050	0.000050	0.000050
Chromium	0	1	0%		0.003	
Copper	0	1	0%		0.001	
Lead	0	1	0%		0.001	
Lithium	0	1	0%		0.002	
Mercury	0	1	0%		0.00010	
Nickel	0	1	0%		0.003	
Selenium	0	1	0%		0.00015	
Silver	0	1	0%		0.000035	
Thallium	0	1	0%		0.000035	
Zinc	0	1	0%		0.010	
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	1	0%		0.11	
Aroclor-1268	0	1	0%		0.11	
Aroclor-1016	0	1	0%		0.11	
Aroclor-1221	0	1	0%		0.11	
Aroclor-1232	0	1	0%		0.11	
Aroclor-1242	0	1	0%		0.11	
Aroclor-1248	0	1	0%		0.11	
Aroclor-1254	0	1	0%		0.11	
Aroclor-1260	0	1	0%		0.11	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.

Appendix Table A.3.9
 Summary Statistics of All Surface Water Sample Results --
 TransCanada WSD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	1	0%		0.10	
Acenaphthylene	0	1	0%		0.10	
Aniline	0	1	0%		2.50	
Anthracene	0	1	0%		0.10	
Atrazine	0	1	0%		2.50	
Azobenzene	0	1	0%		2.50	
Benzidine	0	1	0%		2.50	
Benzo(a)anthracene	0	1	0%		0.10	
Benzo(a)pyrene	0	1	0%		0.10	
Benzo(b)fluoranthene	0	1	0%		0.10	
Benzo(g,h,i)perylene	0	1	0%		0.10	
Benzo(k)fluoranthene	0	1	0%		0.10	
Benzoic acid	0	1	0%		2.50	
Benzyl alcohol	0	1	0%		2.50	
Bis(2-chloroethoxy)methane	0	1	0%		2.50	
Bis(2-chloroethyl)ether	0	1	0%		2.50	
Bis(2-ethylhexyl)phthalate	0	1	0%		2.50	
4-Bromophenyl phenyl ether	0	1	0%		2.50	
Butyl benzyl phthalate	0	1	0%		2.50	
Carbazole	0	1	0%		2.50	
4-Chloro-3-methylphenol	0	1	0%		2.50	
4-Chloroaniline	0	1	0%		2.50	
Bis(2-chloroisopropyl) ether	0	1	0%		2.50	
2-Chloronaphthalene	0	1	0%		2.50	
2-Chlorophenol	0	1	0%		2.50	
4-Chlorophenyl phenyl ether	0	1	0%		2.50	
Chrysene	0	1	0%		0.10	
3+4-Methylphenol	0	1	0%		5.00	
Dibenzo(a,h)anthracene	0	1	0%		0.10	
Dibenzofuran	0	1	0%		2.50	
3,3'-Dichlorobenzidine	0	1	0%		2.50	
2,4-Dichlorophenol	0	1	0%		2.50	
Diethyl phthalate	0	1	0%		2.50	
Dimethyl phthalate	0	1	0%		2.50	
2,4-Dimethylphenol	0	1	0%		2.50	
Di-n-butyl phthalate	0	1	0%		2.50	
2,4-Dinitrophenol	0	1	0%		2.50	
2,4-Dinitrotoluene	0	1	0%		2.50	
2,6-Dinitrotoluene	0	1	0%		2.50	
Di-n-octyl phthalate	0	1	0%		2.50	
Fluoranthene	0	1	0%		0.10	
Fluorene	0	1	0%		0.10	
Hexachlorobenzene	0	1	0%		0.50	
Hexachlorobutadiene	0	1	0%		0.10	
Hexachlorocyclopentadiene	0	1	0%		2.50	
Hexachloroethane	0	1	0%		2.50	
Indeno(1,2,3-cd)pyrene	0	1	0%		0.10	
Isophorone	0	1	0%		2.50	
4,6-Dinitro-2-methylphenol	0	1	0%		2.50	
1-Methylnaphthalene	0	1	0%		2.50	
2-Methylnaphthalene	0	1	0%		2.50	
2-Methylphenol	0	1	0%		2.50	
Naphthalene	0	1	0%		2.50	
2-Nitroaniline	0	1	0%		2.50	
3-Nitroaniline	0	1	0%		2.50	
4-Nitroaniline	0	1	0%		10.00	
Nitrobenzene	0	1	0%		2.50	
2-Nitrophenol	0	1	0%		2.50	
4-Nitrophenol	0	1	0%		10.00	
N-Nitroso-di-n-propylamine	0	1	0%		2.50	
N-Nitrosodiphenylamine	0	1	0%		2.50	
N-Nitrosodimethylamine	0	1	0%		2.50	
Pentachlorophenol	0	1	0%		0.50	
Phenanthrene	0	1	0%		0.10	
Phenol	0	1	0%		2.50	
Pyrene	0	1	0%		0.10	
Pyridine	0	1	0%		2.50	
2,4,5-Trichlorophenol	0	1	0%		2.50	
2,4,6-Trichlorophenol	0	1	0%		2.50	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.

Appendix Table A.3.9
Summary Statistics of All Surface Water Sample Results --
TransCanada WSD Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	0	1	0%		5.00	
Acrylonitrile	0	1	0%		0.50	
Benzene	0	1	0%		0.50	
Bromobenzene	0	1	0%		0.50	
Bromochloromethane	0	1	0%		0.50	
Bromodichloromethane	0	1	0%		0.50	
Bromoform	0	1	0%		0.50	
Bromomethane	0	1	0%		1.00	
tert-Butyl Alcohol	0	1	0%		5.00	
n-Butylbenzene	0	1	0%		0.50	
sec-Butylbenzene	0	1	0%		0.50	
tert-Butylbenzene	0	1	0%		0.50	
Carbon disulfide	1	1	100%	0.60	0.60	0.60
Carbon Tetrachloride	0	1	0%		0.50	
Chlorobenzene	0	1	0%		0.50	
Chloroethane	0	1	0%		1.00	
Chloroform	0	1	0%		0.50	
Chloromethane	0	1	0%		1.00	
2-Chlorotoluene	0	1	0%		0.50	
4-Chlorotoluene	0	1	0%		0.50	
1,2-Dibromo-3-chloropropane	0	1	0%		1.00	
Dibromochloromethane	0	1	0%		0.50	
1,2-Dibromoethane	0	1	0%		0.25	
Dibromomethane	0	1	0%		0.50	
1,2-Dichlorobenzene	0	1	0%		0.50	
1,3-Dichlorobenzene	0	1	0%		0.50	
1,4-Dichlorobenzene	0	1	0%		0.50	
Dichlorodifluoromethane	0	1	0%		1.00	
1,1-Dichloroethane	0	1	0%		0.50	
1,2-Dichloroethane	0	1	0%		0.50	
cis-1,2-Dichloroethene	0	1	0%		0.50	
trans-1,2-Dichloroethene	0	1	0%		0.50	
1,1-Dichloroethene	0	1	0%		0.50	
1,3-Dichloropropane	0	1	0%		0.50	
2,2-Dichloropropane	0	1	0%		0.50	
1,2-Dichloropropane	0	1	0%		0.50	
1,1-Dichloropropene	0	1	0%		0.25	
cis-1,3-Dichloropropene	0	1	0%		0.25	
trans-1,3-Dichloropropene	0	1	0%		0.25	
Diethyl Ether	0	1	0%		0.50	
Diisopropyl ether	0	1	0%		0.50	
1,4-Dioxane	0	1	0%		10.00	
Ethylbenzene	0	1	0%		0.50	
Ethyl-t-butyl ether	0	1	0%		0.50	
2-Hexanone	0	1	0%		5.00	
Isopropylbenzene	0	1	0%		0.50	
4-Isopropyltoluene	0	1	0%		0.50	
4-Methyl-2-Pentanone	0	1	0%		5.00	
Methylene Chloride	0	1	0%		5.00	
Methyl-t-butyl ether	0	1	0%		0.50	
n-Propylbenzene	0	1	0%		0.50	
Styrene	0	1	0%		0.50	
1,1,1,2-Tetrachloroethane	0	1	0%		0.50	
1,1,2,2-Tetrachloroethane	0	1	0%		0.50	
Tetrachloroethene	0	1	0%		0.50	
Tetrahydrofuran	0	1	0%		5.00	
Toluene	0	1	0%		0.50	
1,2,3-Trichlorobenzene	0	1	0%		0.50	
1,2,4-Trichlorobenzene	0	1	0%		0.50	
1,1,1-Trichloroethane	0	1	0%		0.50	
1,1,2-Trichloroethane	0	1	0%		0.50	
Trichloroethene	0	1	0%		0.50	
Trichlorofluoromethane	0	1	0%		0.50	
1,2,3-Trichloropropane	0	1	0%		0.50	
1,1,2-Trichlorotrifluoroethane	0	1	0%		0.50	
1,2,4-Trimethylbenzene	0	1	0%		0.50	
1,3,5-Trimethylbenzene	0	1	0%		0.50	
Vinyl Chloride	0	1	0%		0.50	
o-Xylene	0	1	0%		0.50	
m+p-Xylenes	0	1	0%		1.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.

Appendix Table A.3.9
Summary Statistics of All Surface Water Sample Results --
TransCanada WSD Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from TransCanada West Storm Drain					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	1	0%		37.50	
Adjusted C9-C12 Aliphatics	0	1	0%		12.50	
Unadjusted C5-C8 Aliphatics	0	1	0%		37.50	
Unadjusted C9-C12 Aliphatics	0	1	0%		12.50	
Adjusted C9-C10 Aromatics	0	1	0%		12.50	
Benzene	0	1	0%		2.50	
Ethylbenzene	0	1	0%		2.50	
Methyl-t-butyl ether	0	1	0%		2.50	
Naphthalene	0	1	0%		2.50	
Toluene	0	1	0%		2.50	
o-Xylene	0	1	0%		2.50	
m+p-Xylenes	0	1	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.

Appendix Table A.3.10
Surface Water Sample Results - Inorganics
TransCanada WSD Study Area
YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-304
Date Sampled	Screening Benchmark	5/18/2006
Inorganics (mg/L)		
Boron	0.75	0.0094 J
Cadmium	0.00025	0.00005 J

Appendix Table A.3.10
Surface Water Sample Results - VOCs
TransCanada WSD Study Area
YNPS Rowe, MA

Sample ID	SW-304
Date Sampled	5/18/2006
VOC (µg/L)	
Carbon disulfide	0.6 J

Appendix Table A.3.11
 Summary Statistics of All Surface Water Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	6	0%		2.66	
Acenaphthylene	0	6	0%		2.66	
Unadjusted C19-C36 Aliphatics	0	6	0%		100.00	
Unadjusted C9-C18 Aliphatics	0	6	0%		100.00	
Anthracene	0	6	0%		2.66	
Adjusted C11-C22 Aromatics	0	6	0%		100.00	
Unadjusted C11-C22 Aromatics	0	6	0%		100.00	
Benzo(a)anthracene	0	6	0%		2.66	
Benzo(a)pyrene	0	6	0%		2.66	
Benzo(b)fluoranthene	0	6	0%		2.66	
Benzo(g,h,i)perylene	0	6	0%		2.66	
Benzo(k)fluoranthene	0	6	0%		2.66	
Chrysene	0	6	0%		2.66	
Dibenzo(a,h)anthracene	0	6	0%		2.66	
Fluoranthene	0	6	0%		2.66	
Fluorene	0	6	0%		2.66	
Indeno(1,2,3-cd)pyrene	0	6	0%		2.66	
2-Methylnaphthalene	0	6	0%		2.66	
Naphthalene	0	6	0%		2.66	
Phenanthrene	0	6	0%		2.66	
Pyrene	0	6	0%		2.66	
Adjusted TPH	1	6	17%	200.00	116.67	200.00
Unadjusted TPH	1	6	17%	200.00	116.67	200.00
<i>Inorganics (mg/L)</i>						
Antimony	4	26	15%	0.00080	0.0031	0.0017
Arsenic	0	31	0%		0.0033	
Barium	25	25	100%	0.013	0.018	0.039
Beryllium	0	26	0%		0.0013	
Boron	0	6	0%		0.050	
Cadmium	14	31	45%	0.000030	0.00072	0.00020
Calcium	5	5	100%	2.50	3.13	3.73
Chromium	1	31	3%	0.00080	0.0031	0.00080
Copper	15	31	48%	0.00080	0.0082	0.0300
Cyanide	0	10	0%		0.0050	
Iron	25	25	100%	0.032	1.98	16.00
Lead	11	31	35%	0.00060	0.0018	0.0038
Lithium	0	6	0%		0.0014	
Manganese	24	25	96%	0.0021	0.20	0.82
Mercury	11	31	35%	0.000060	0.00011	0.00032
Nickel	1	26	4%	0.00080	0.0032	0.00080
Selenium	8	31	26%	0.000090	0.010	0.00020
Silver	5	31	16%	0.000050	0.002	0.001
Sodium	5	5	100%	0.88	1.04	1.11
Thallium	7	26	27%	0.000010	0.0018	0.0018
Zinc	15	31	48%	0.0034	0.013	0.012
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	6	0%		0.10	
Aroclor-1268	0	6	0%		0.10	
Aroclor-1016	0	6	0%		0.10	
Aroclor-1221	0	6	0%		0.10	
Aroclor-1232	0	6	0%		0.10	
Aroclor-1242	0	6	0%		0.10	
Aroclor-1248	0	6	0%		0.10	
Aroclor-1254	0	6	0%		0.10	
Aroclor-1260	0	6	0%		0.10	
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	6	25	24%	3.00	5.51	14.00
Acrylonitrile	0	31	0%		1.95	
Allyl Chloride	0	10	0%		0.50	
t-Amyl methyl ether	0	21	0%		0.50	
Benzene	0	31	0%		0.50	
Bromobenzene	0	31	0%		1.15	
Bromochloromethane	0	31	0%		1.15	
Bromodichloromethane	0	31	0%		0.50	
Bromoform	0	31	0%		0.50	
Bromomethane	0	31	0%		1.00	
2-Butanone	0	31	0%		5.00	
tert-Butyl Alcohol	1	15	7%	7.60	5.17	7.60
n-Butylbenzene	0	31	0%		1.15	
sec-Butylbenzene	0	31	0%		1.15	
tert-Butylbenzene	0	31	0%		1.15	
Carbon disulfide	1	31	3%	0.83	2.45	0.83
Carbon Tetrachloride	0	31	0%		0.50	
Chlorobenzene	0	31	0%		1.15	
1-Chlorobutane	0	10	0%		2.50	
Chloroethane	0	31	0%		2.29	
2-Chloroethylvinyl Ether	0	10	0%		2.50	
Chloroform	0	31	0%		0.50	
Chloromethane	4	31	13%	0.43	1.34	3.70
2-Chlorotoluene	0	31	0%		1.15	
4-Chlorotoluene	0	31	0%		1.15	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.11
Summary Statistics of All Surface Water Sample Results --
Wheeler Brook Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
1,2-Dibromo-3-chloropropane	0	31	0%		1.48	
Dibromochloromethane	0	31	0%		0.50	
1,2-Dibromoethane	0	31	0%		0.40	
Dibromomethane	0	31	0%		1.15	
1,2-dichlorobenzene	0	31	0%		1.15	
1,3-Dichlorobenzene	0	31	0%		1.15	
1,4-Dichlorobenzene	0	31	0%		0.50	
Dichlorodifluoromethane	0	31	0%		1.48	
1,1-Dichloroethane	0	31	0%		1.15	
1,2-Dichloroethane	0	31	0%		0.50	
cis-1,2-Dichloroethene	0	31	0%		1.15	
trans-1,2-Dichloroethene	0	31	0%		1.15	
1,1-Dichloroethene	0	31	0%		0.66	
1,3-Dichloropropane	0	31	0%		1.15	
2,2-Dichloropropane	0	31	0%		1.15	
1,2-Dichloropropane	0	31	0%		0.50	
1,1-Dichloropropene	0	31	0%		1.01	
cis-1,3-Dichloropropene	0	31	0%		0.36	
trans-1,3-Dichloropropene	0	31	0%		0.36	
Diethyl Ether	0	31	0%		1.15	
Diisopropyl ether	0	21	0%		0.50	
1,4-Dioxane	0	15	0%		10.00	
Ethyl Methacrylate	0	10	0%		2.50	
Ethylbenzene	0	31	0%		1.15	
Ethyl-t-butyl ether	0	21	0%		0.50	
Hexachlorobutadiene	0	26	0%		0.41	
Hexachloroethane	0	5	0%		1.00	
2-Hexanone	1	31	3%	0.80	4.06	0.80
Iodomethane	0	10	0%		2.50	
Isopropylbenzene	0	31	0%		1.15	
4-Isopropyltoluene	0	31	0%		1.15	
Methacrylonitrile	0	10	0%		2.50	
Methyl methacrylate	0	10	0%		2.50	
4-Methyl-2-Pentanone	2	31	6%	0.60	3.92	0.80
Methylene chloride	5	31	16%	0.84	3.70	0.95
Methyl-t-butyl ether	0	31	0%		1.15	
Naphthalene	0	26	0%		0.88	
Nitrobenzene	0	5	0%		12.50	
2-Nitropropane	0	10	0%		2.50	
Pentachloroethane	0	10	0%		2.50	
Propionitrile	0	10	0%		25.00	
n-Propylbenzene	0	31	0%		1.15	
Styrene	0	31	0%		1.15	
1,1,1,2-Tetrachloroethane	0	31	0%		0.50	
1,1,2,2-Tetrachloroethane	0	31	0%		0.50	
Tetrachloroethene	0	31	0%		0.50	
Tetrahydrofuran	0	31	0%		4.19	
Toluene	1	31	3%	6.60	1.34	6.60
trans-1,4-Dichloro-2-Butene	0	10	0%		2.50	
1,2,3-Trichlorobenzene	0	31	0%		1.15	
1,2,4-Trichlorobenzene	0	31	0%		1.15	
1,1,1-Trichloroethane	0	31	0%		1.15	
1,1,2-Trichloroethane	0	31	0%		0.50	
Trichloroethene	0	31	0%		0.66	
Trichlorofluoromethane	0	31	0%		1.15	
1,2,3-Trichloropropane	0	31	0%		1.15	
1,1,2-Trichlorotrifluoroethane	0	11	0%		0.50	
1,2,4-Trimethylbenzene	0	31	0%		1.15	
1,3,5-Trimethylbenzene	0	31	0%		1.15	
Vinyl Acetate	0	10	0%		7.50	
Vinyl Chloride	0	31	0%		0.66	
o-Xylene	0	31	0%		1.15	
m+p-Xylenes	0	31	0%		1.48	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.3.11
 Summary Statistics of All Surface Water Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Surface Water Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	6	0%		37.50	
Adjusted C9-C12 Aliphatics	0	6	0%		12.50	
Unadjusted C5-C8 Aliphatics	0	6	0%		37.50	
Unadjusted C9-C12 Aliphatics	0	6	0%		12.50	
Adjusted C9-C10 Aromatics	0	6	0%		12.50	
Benzene	0	6	0%		2.50	
Ethylbenzene	0	6	0%		2.50	
Methyl-t-butyl ether	0	6	0%		2.50	
Naphthalene	0	6	0%		2.50	
Toluene	0	6	0%		2.50	
o-Xylene	0	6	0%		2.50	
m+p-Xylenes	0	6	0%		5.00	
<i>Wet Chemistry (mg/L)</i>						
Chemical Oxygen Demand	7	25	28%	7.00	6.20	20.40
Chloride	15	25	60%	0.52	0.90	1.13
Cyanide	0	15	0%		0.005	
Hardness	1	1	100%	6.20	6.20	6.20
Nitrate	8	25	32%	0.030	0.49	0.57
Sulfate	25	25	100%	4.54	6.04	11.00
Total Alkalinity	25	25	100%	1.20	10.23	27.00
Total Dissolved Solids	19	25	76%	4.00	21.48	54.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.3.12
 Surface Water Sample Results - EPHs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SW-101	SW-102	SW-103	SW-104	SW-105	SW-106
Date Sampled	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
EPH (µg/L)						
Adjusted TPH	200 U	200 U	200 U	200	200 U	200 U
Unadjusted TPH	200 U	200 U	200 U	200	200 U	200 U

Appendix Table A.3.12
 Surface Water Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-1-031507	SW-1-081403	SW-1-081504	SW-1-082405	SW-1-091406	SW-101	SW-102	SW-103	SW-104	SW-105	SW-106
Date Sampled	Screening Benchmark	3/15/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
Inorganics (mg/L)												
Antimony	0.3		0.005 U	0.005 U	0.006 U	0.0008 J	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.0066 U
Barium	41	0.013	0.017	0.017	0.0144	0.0155						
Beryllium	0.0073		0.002 U	0.002 U	0.001 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Cadmium	0.00025	0.0025 U	0.003 U	0.003 U	0.0002 J	0.00003 J	0.00005 J	0.00006 J	0.00005 J	0.00004 U	0.00006 J	0.00006 J
Calcium		2.5										
Chromium	0.074	0.005 U	0.01 U	0.01 U	0.0025 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Copper	0.009	0.005 U	0.016	0.03	0.0025 U	0.0009 J	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Iron	1	0.055 J	0.21	0.63	0.213	0.123 J						
Lead	0.0025	0.0033 J	0.005 U	0.005 U	0.0038 U	0.001 J	0.001 U	0.0005 U	0.0015 U	0.0013 U	0.0004 U	0.0017 U
Manganese		0.0162	0.038	0.086	0.02	0.0119						
Mercury	0.00077	0.0002 U	0.0002 U	0.0002 U	0.00008 J	0.00024	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ
Nickel	0.052		0.01 U	0.01 U	0.0025 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Selenium	0.005	0.015 U	0.05 U	0.05 U	0.0075 U	0.0002 J	0.00009 J	0.0001 J	0.0005 U	0.0005 U	0.0005 U	0.00009 J
Silver	0.00012	0.005 U	0.005 U	0.005 U	0.005 U	0.0013	0.00008 UJ	0.0001 UJ	0.00008 UJ	0.0002 UJ	0.00003 UJ	0.00005 UJ
Sodium		0.878										
Thallium	0.11		0.00125 U	0.00125 U	0.005 U	0.00003 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Zinc	0.12	0.0091	0.05 U	0.05 U	0.0049	0.0095 J	0.0088 U	0.009 U	0.01 U	0.011 U	0.0098 U	0.0118 U

> SW Benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Surface Water Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	FD 002-081504	SW-2-030707	SW-2-081403	SW-2-081504	SW-2-082405	SW-2-091406	SW-3-030707	SW-3-081403	SW-3-081504	SW-3-082405
Date Sampled	Screening Benchmark	8/15/2004	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	3/7/2007	8/14/2003	8/15/2004	8/24/2005
Inorganics (mg/L)											
Antimony	0.3	0.005 U		0.005 U	0.005 U	0.006 U	0.0011 J		0.005 U	0.005 U	0.006 U
Barium	41	0.016	0.018	0.019	0.015	0.0151	0.0163	0.0157	0.039	0.016	0.018
Beryllium	0.0073	0.002 U		0.002 U	0.002 U	0.001 U	0.004 U		0.002 U	0.002 U	0.001 U
Cadmium	0.00025	0.003 U	0.0002 J	0.003 U	0.003 U	0.0002 J	0.00005 J	0.0025 U	0.003 U	0.003 U	0.0012 U
Calcium			3.02					2.99			
Chromium	0.074	0.01 U	0.005 U	0.01 U	0.01 U	0.0025 U	0.005 U	0.005 U	0.01 U	0.01 U	0.0025 U
Copper	0.009	0.018	0.005 U	0.017	0.028	0.0025 U	0.0008 J	0.005 U	0.014	0.025	0.0025 U
Iron	1	0.22	0.552	0.17	0.072	0.056 J	0.0318 J	0.361	16	0.86	1.26
Lead	0.0025	0.005 U	0.0031 J	0.005 U	0.005 U	0.0038 U	0.0006 J	0.0038 J	0.005 U	0.005 U	0.0038 U
Manganese		0.017	0.0293	0.029	0.01 U	0.0021	0.0079	0.0528	0.82	0.13	0.221
Mercury	0.00077	0.0002 U	0.00009 J	0.0002 U	0.0002 U	0.00011 J	0.0002 U	0.00006 J	0.0002 U	0.0002 U	0.0001 J
Nickel	0.052	0.01 U		0.01 U	0.01 U	0.0025 U	0.0008 J		0.01 U	0.01 U	0.0025 U
Selenium	0.005	0.05 U	0.015 U	0.05 U	0.05 U	0.0075 U	0.0001 J	0.015 U	0.05 U	0.05 U	0.0075 U
Silver	0.00012	0.005	0.005 U	0.005 U	0.005 U	0.005 U	0.0009	0.005 U	0.005 U	0.005 U	0.005 U
Sodium			1.11					1.06			
Thallium	0.11	0.00125 U		0.00125 U	0.00125 U	0.005 U	0.00002 J		0.00125 U	0.00125 U	0.005 U
Zinc	0.12	0.05 U	0.0096	0.05 U	0.05 U	0.0034	0.0094 J	0.0085	0.05 U	0.05 U	0.0071

> SW Benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Surface Water Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-3-091406	SW-4-030707	SW-4-081403	SW-4-081504	SW-4-082405	SW-4-091406	FD002-082405	FD002-091406	SW-5-030707	SW-5-081403
Date Sampled	Screening Benchmark	9/14/2006	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	8/24/2005	9/14/2006	3/7/2007	8/14/2003
Inorganics (mg/L)											
Antimony	0.3	0.006 U		0.005 U	0.005 U	0.006 U	0.0014 J	0.006 U	0.005 J		0.005 U
Barium	41	0.0168	0.0163	0.019	0.016	0.0214	0.0192	0.0214	0.0189	0.0162	0.019
Beryllium	0.0073	0.004 U		0.002 U	0.002 U	0.001 U	0.004 U	0.001 U	0.0002 J		0.002 U
Cadmium	0.00025	0.00003 J	0.0025 U	0.003 U	0.003 U	0.0002 J	0.00003 J	0.0003 J	0.00004 J	0.0025 U	0.003 U
Calcium			3.43							3.73	
Chromium	0.074	0.0008 J	0.005 U	0.01 U	0.01 U	0.0025 U	0.005 U	0.0025 U	0.005 U	0.005 U	0.01 U
Copper	0.009	0.0012 J	0.005 U	0.021	0.022	0.0025 U	0.0008 J	0.0025 U	0.0006 J	0.005 U	0.024
Iron	1	1.65	1.36	0.25	2	4.24	6.62	2.82	7.14	1.9	0.28
Lead	0.0025	0.0009 J	0.0024 J	0.005 U	0.005 U	0.0012 J	0.0006 J	0.0038 U	0.0011 J	0.0075 U	0.005 U
Manganese		0.13	0.203	0.054	0.34	0.688	0.34	0.762	0.353	0.296	0.057
Mercury	0.00077	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00012 J	0.00006 J	0.00012 J	0.0002 U	0.00006 J	0.0002 U
Nickel	0.052	0.005 U		0.01 U	0.01 U	0.0025 U	0.005 U	0.0025 U	0.005 U		0.01 U
Selenium	0.005	0.0001 J	0.015 U	0.05 U	0.05 U	0.0075 U	0.0001 J	0.0075 U	0.0001 J	0.015 U	0.05 U
Silver	0.00012	0.0002	0.005 U	0.005 U	0.005 U	0.005 U	0.00005 J	0.005 U	0.0002	0.005 U	0.005 U
Sodium			1.05							1.08	
Thallium	0.11	0.00002 J		0.00125 U	0.00125 U	0.0013 J	0.00001 J	0.0022 J	0.00008 J		0.00125 U
Zinc	0.12	0.0085 J	0.0071	0.05 U	0.05 U	0.0116	0.0072 J	0.0035	0.005 J	0.0087	0.05 U

> SW Benchmark

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Surface Water Sample Results - Inorganics
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	Surface Water (SW)	SW-5-081504	SW-5-082405	SW-5-091406
Date Sampled	Screening Benchmark	8/15/2004	8/24/2005	9/14/2006
Inorganics (mg/L)				
Antimony	0.3	0.005 U	0.006 U	0.0017 J
Barium	41	0.017	0.0216	0.0173
Beryllium	0.0073	0.002 U	0.001 U	0.004 U
Cadmium	0.00025	0.003 U	0.0012 U	0.00003 J
Calcium				
Chromium	0.074	0.01 U	0.0025 U	0.005 U
Copper	0.009	0.018	0.0025 U	0.001 J
Iron	1	2.8	2.98	4.76
Lead	0.0025	0.005 U	0.0012 J	0.0007 J
Manganese		0.23	0.766	0.327
Mercury	0.00077	0.0002 U	0.00012 J	0.00032
Nickel	0.052	0.01 U	0.0025 U	0.005 U
Selenium	0.005	0.05 U	0.0075 U	0.0001 J
Silver	0.00012	0.005 U	0.005 U	0.0013
Sodium				
Thallium	0.11	0.00125 U	0.0018 J	0.00004 J
Zinc	0.12	0.05 U	0.0046	0.0066 J

> SW Benchmark

Appendix Table A.3.12
 Surface Water Sample Results - VOCs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	Surface Water (SW) Screening Benchmark	SW-1-031507 3/15/2007	SW-1-081403 8/14/2003	SW-1-081504 8/15/2004	SW-1-082405 8/24/2005	SW-1-091406 9/14/2006	SW-101 5/12/2006	SW-102 5/12/2006	SW-103 5/12/2006	SW-104 5/12/2006	SW-105 5/12/2006	SW-106 5/12/2006	FD 002-081504 8/15/2004
VOC (µg/L)													
Acetone	1500	10 U	10 U	9.7 J,B	10 U	10 U	R	R	R	R	R	R	3.4 J,B
tert-Butyl Alcohol		10 U			10 U	10 U	R	R	R	R	R	R	
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane		2 U	5 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	5 U
2-Hexanone		10 U	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
4-Methyl-2-pentanone		10 U	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Methylene chloride	1930	10 U	0.94 j	2 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Toluene	175	1 U	5 U	5 U	6.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.41 J

Appendix Table A.3.12
 Surface Water Sample Results - VOCs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	Surface Water (SW) Screening Benchmark	SW-2-030707 3/7/2007	SW-2-081403 8/14/2003	SW-2-081504 8/15/2004	SW-2-082405 8/24/2005	SW-2-091406 9/14/2006	SW-3-030707 3/7/2007	SW-3-081403 8/14/2003	SW-3-081504 8/15/2004	SW-3-082405 8/24/2005	SW-3-091406 9/14/2006	SW-4-030707 3/7/2007
VOC (µg/L)												
Acetone	1500	10 U	10 U	14 B	10 U	5.5 J	10 U	10 U	7 J,B	10 U	10 U	10 U
tert-Butyl Alcohol		10 U			7.6 J	10 U	10 U			10 U	10 U	10 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane		2 U	0.53 J	5 U	2 U	2 U	2 U	3.7 J	0.87 J	2 U	2 U	2 U
2-Hexanone		10 U	5 U	5 U	0.8 J	10 U	10 U	5 U	5 U	10 U	10 U	10 U
4-Methyl-2-pentanone		10 U	5 U	5 U	0.8 J	10 U	10 U	5 U	5 U	10 U	10 U	10 U
Methylene chloride	1930	10 U	0.92 j	2 U	10 U	10 U	10 U	0.95 j	2 U	10 U	10 U	10 U
Toluene	175	1 U	5 U	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U

Appendix Table A.3.12
 Surface Water Sample Results - VOCs
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	Surface Water (SW) Screening Benchmark	SW-4-081403 8/14/2003	SW-4-081504 8/15/2004	SW-4-082405 8/24/2005	SW-4-091406 9/14/2006	FD002-082405 8/24/2005	FD002-091406 9/14/2006	SW-5-030707 3/7/2007	SW-5-081403 8/14/2003	SW-5-081504 8/15/2004	SW-5-082405 8/24/2005	SW-5-091406 9/14/2006
VOC (µg/L)												
Acetone	1500	10 U	3.5 J,B	10 U	3 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U
tert-Butyl Alcohol				10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide		0.83 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane		5 U	0.43 J	2 U	2 U	2 U	2 U	2 U	5 U	5 U	2 U	2 U
2-Hexanone		5 U	5 U	10 U	10 U	10 U	10 U	10 U	5 U	5 U	10 U	10 U
4-Methyl-2-pentanone		5 U	5 U	0.6 J	10 U	10 U	10 U	10 U	5 U	5 U	10 U	10 U
Methylene chloride	1930	0.84 j	2 U	10 U	10 U	10 U	10 U	10 U	0.93 j	2 U	10 U	10 U
Toluene	175	5 U	5 U	1 U	1 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U

Appendix Table A.3.12
 Surface Water Sample Results - Wet Chemistry
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SW-1-031507	SW-1-081403	SW-1-081504	SW-1-082405	SW-1-091406	FD 002-081504	SW-2-030707	SW-2-081403	SW-2-081504	SW-2-082405	SW-2-091406
Date Sampled	3/15/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	8/15/2004	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006
WET CHEMISTRY (mg/L)											
Chemical Oxygen Demand	20.4	16	10 U	5 U	7	10 U	5 U	10	10 U	5 U	5 U
Chloride	0.52 J	2 U	2 U	0.67 J	0.83 J	2 U	0.75 J	2 U	2 U	0.6 J	0.72 J
Hardness	6.2										
Nitrate	0.57	2 U	2 U	0.1 U	0.03 J	2 U	0.32	2 U	2 U	0.1 U	0.1 U
Sulfate	4.54	6.7	7.1	7.41	6.24	6.5	5.84	7.1	11	6.19	5.36
Total Alkalinity	2.95	6.5	8.1	10	4	5.6	5.05	2	1.2	8	12
Total Dissolved Solids	18	1 U	17	40	26	5	33	1 U	8	42	19

Appendix Table A.3.12
 Surface Water Sample Results - Wet Chemistry
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	SW-3-030707	SW-3-081403	SW-3-081504	SW-3-082405	SW-3-091406	SW-4-030707	SW-4-081403	SW-4-081504	SW-4-082405	SW-4-091406	FD002-082405
Date Sampled	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006	8/24/2005
WET CHEMISTRY (mg/L)											
Chemical Oxygen Demand	5 U	18	10 U	5 U	5 U	5 U	14	10 U	5 U	5 U	5 U
Chloride	0.81 J	2 U	2 U	0.7 J	0.94 J	0.87 J	2 U	2 U	0.84 J	1.05	1.12
Hardness											
Nitrate	0.26	2 U	2 U	0.1 U	0.1 U	0.4	2 U	2 U	0.1 U	0.1 U	0.04 HT-3, J
Sulfate	5.71	5.6	6.3	5.94	5.41	5.62	5	6.1	5.56	5.37	5.11
Total Alkalinity	5.39	5.9	6.9	10	22	7.25	3.2	27	22	22	23
Total Dissolved Solids	32	1 U	4	37	29	36	1 U	5	49	24	47

Appendix Table A.3.12
 Surface Water Sample Results - Wet Chemistry
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID	FD002-091406	SW-5-030707	SW-5-081403	SW-5-081504	SW-5-082405	SW-5-091406
Date Sampled	9/14/2006	3/7/2007	8/14/2003	8/15/2004	8/24/2005	9/14/2006
WET CHEMISTRY (mg/L)						
Chemical Oxygen Demand	5 U	5 U	12	10 U	5 U	5 U
Chloride	1.08	0.96 J	2 U	2 U	1.13	1.07
Hardness						
Nitrate	0.03 J	0.25	2 U	2 U	0.05 J	0.03 J
Sulfate	5.2	5.46	5.2	5.8	5.19	5.28
Total Alkalinity	22	8.65	3.2	6.4	23	23
Total Dissolved Solids	30	28	1 U	1 U	54	33

Appendix Table A.4.1
Summary Statistics of All Groundwater Sample Results -- YAEC RUA --
Plant Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Alcohols (mg/L)</i>						
sec-Butyl Alcohol	0	6	0%		1.00	
n-Butyl Alcohol	0	11	0%		0.77	
tert-Butyl Alcohol	0	11	0%		0.77	
Ethyl Alcohol	0	11	0%		0.77	
iso-Butyl Alcohol	0	11	0%		0.77	
iso-Propyl Alcohol	1	11	9%	140.00	13.41	140.00
Methyl Alcohol	0	11	0%		0.77	
n-Propyl Alcohol	0	11	0%		0.77	
<i>Extractable Petroleum Hydrocarbons (μg/L)</i>						
Acenaphthene	0	11	0%		1.07	
Acenaphthylene	0	11	0%		1.07	
Unadjusted C19-C36 Aliphatics	4	33	12%	205.00	104.39	555.00
Unadjusted C9-C18 Aliphatics	0	33	0%		66.38	
Anthracene	0	11	0%		1.07	
Adjusted C11-C22 Aromatics	0	9	0%		100.00	
Unadjusted C11-C22 Aromatics	3	33	9%	120.00	84.77	408.00
Benzo(a)anthracene	0	11	0%		1.07	
Benzo(a)pyrene	0	11	0%		0.78	
Benzo(b)fluoranthene	0	11	0%		1.07	
Benzo(g,h,i)perylene	0	11	0%		1.07	
Benzo(k)fluoranthene	0	11	0%		1.07	
Chrysene	2	11	18%	0.09	1.00	0.15
Dibenzo(a,h)anthracene	0	11	0%		0.89	
Fluoranthene	1	11	9%	0.21	1.05	0.21
Fluorene	0	11	0%		1.07	
Indeno(1,2,3-cd)pyrene	0	11	0%		0.89	
2-Methylnaphthalene	0	11	0%		1.07	
Naphthalene	1	11	9%	0.88	1.11	0.88
Phenanthrene	1	11	9%	0.28	1.05	0.28
Pyrene	0	11	0%		1.07	
Adjusted TPH	0	11	0%		100.00	
Unadjusted TPH	0	11	0%		100.00	
<i>Herbicide (μg/L)</i>						
2,4-D	0	16	0%		1.09	
2,4-DB	0	40	0%		3.69	
Dicamba	0	6	0%		0.50	
Dichloroprop	0	41	0%		3.66	
Dinoseb	0	18	0%		0.50	
2,4,5-T	0	41	0%		0.73	
2,4,5-TP (Silvex)	0	40	0%		0.74	
<i>Inorganics (mg/L)</i>						
Antimony	4	73	5%	0.00080	0.0027	0.0051
Arsenic	21	109	19%	0.0022	0.0045	0.034
Beryllium	3	72	4%	0.00010	0.00090	0.00020
Boron	73	141	52%	0.0067	0.10	0.59
Cadmium	3	72	4%	0.00020	0.0013	0.00040
Chromium	11	72	15%	0.0020	0.0056	0.088
Copper	19	72	26%	0.0017	0.0096	0.093
Lead	9	75	12%	0.0024	0.0037	0.037
Lithium	0	32	0%		0.25	
Mercury	8	72	11%	0.000040	0.00010	0.00030
Nickel	21	72	29%	0.0018	0.0071	0.053
Selenium	2	71	3%	0.0050	0.017	0.050
Silver	4	68	6%	0.0008	0.0030	0.0078
Thallium	2	72	3%	0.000050	0.00042	0.00040
Zinc	19	72	26%	0.0052	0.034	0.83
<i>Polychlorinated Biphenyls (μg/L)</i>						
Aroclor-1262	0	12	0%		0.099	
Aroclor-1268	0	12	0%		0.099	
Aroclor-1016	0	87	0%		0.10	
Aroclor-1221	0	87	0%		0.10	
Aroclor-1232	0	87	0%		0.10	
Aroclor-1242	0	87	0%		0.10	
Aroclor-1248	0	87	0%		0.10	
Aroclor-1254	16	87	18%	0.38	0.55	5.50
Aroclor-1260	0	87	0%		0.10	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.1
Summary Statistics of All Groundwater Sample Results -- YAEC RUA --
Plant Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	2	58	3%	0.060	0.52	0.16
Acenaphthylene	2	58	3%	0.17	0.53	0.38
Aniline	0	55	0%		4.41	
Anthracene	3	58	5%	0.10	0.52	0.15
Atrazine	0	14	0%		2.69	
Azobenzene	0	55	0%		19.32	
Benzidine	0	55	0%		8.14	
Benzo(a)anthracene	1	58	2%	0.15	0.52	0.15
Benzo(a)pyrene	1	58	2%	0.13	0.52	0.13
Benzo(b)fluoranthene	2	58	3%	0.13	0.52	0.16
Benzo(g,h,i)perylene	2	58	3%	0.13	0.52	0.13
Benzo(k)fluoranthene	1	58	2%	0.15	0.52	0.15
Benzoic acid	0	32	0%		3.99	
Benzyl alcohol	0	55	0%		4.41	
Bis(2-chloroethoxy)methane	0	55	0%		4.41	
Bis(2-chloroethyl)ether	0	55	0%		4.41	
bis(2-Ethylhexyl)phthalate	6	55	11%	3.00	4.35	7.90
4-Bromophenyl phenyl ether	0	55	0%		4.41	
Butyl benzyl phthalate	0	55	0%		4.41	
Carbazole	0	55	0%		4.41	
4-Chloro-3-methylphenol	0	51	0%		7.99	
4-Chloroaniline	0	55	0%		4.41	
Bis(2-chloroisopropyl) ether	0	55	0%		4.41	
2-Chloronaphthalene	0	55	0%		4.41	
2-Chlorophenol	0	51	0%		4.37	
4-Chlorophenyl phenyl ether	0	55	0%		4.41	
Chrysene	1	58	2%	0.15	0.52	0.15
Dibenzo(a,h)anthracene	1	58	2%	0.11	0.52	0.11
Dibenzofuran	0	55	0%		4.41	
1,2-Dichlorobenzene	0	45	0%		4.54	
1,3-Dichlorobenzene	0	45	0%		4.54	
1,4-Dichlorobenzene	0	45	0%		4.54	
3,3'-Dichlorobenzidine	0	55	0%		8.14	
2,4-Dichlorophenol	0	50	0%		4.35	
Diethyl phthalate	1	55	2%	3.50	4.38	3.50
Dimethyl phthalate	0	49	0%		4.34	
2,4-Dimethylphenol	0	50	0%		4.35	
Di-n-butyl phthalate	0	55	0%		4.59	
2,4-Dinitrophenol	0	50	0%		18.75	
2,4-Dinitrotoluene	0	55	0%		4.41	
2,6-Dinitrotoluene	0	55	0%		4.41	
Di-n-octyl phthalate	0	55	0%		4.41	
Fluoranthene	5	58	9%	0.11	0.53	0.22
Fluorene	2	58	3%	0.060	0.52	0.10
Hexachlorobenzene	0	55	0%		3.85	
Hexachlorobutadiene	0	55	0%		3.75	
Hexachlorocyclopentadiene	0	55	0%		4.41	
Hexachloroethane	0	55	0%		4.41	
Indeno(1,2,3-cd)pyrene	1	58	2%	0.12	0.52	0.12
Isophorone	0	55	0%		4.41	
4,6-Dinitro-2-methylphenol	0	50	0%		18.75	
1-Methylnaphthalene	0	14	0%		2.69	
2-Methylnaphthalene	0	55	0%		4.41	
3+4-Methylphenol	0	50	0%		5.10	
2-Methylphenol	0	51	0%		4.37	
Naphthalene	5	58	9%	0.060	1.15	0.20
2-Nitroaniline	0	55	0%		4.41	
3-Nitroaniline	0	55	0%		19.32	
4-Nitroaniline	0	55	0%		21.38	
Nitrobenzene	0	55	0%		4.41	
2-Nitrophenol	0	50	0%		4.35	
4-Nitrophenol	0	45	0%		20.57	
N-Nitroso-di-n-propylamine	0	55	0%		4.41	
N-Nitrosodiphenylamine	0	55	0%		4.41	
N-Nitrosodimethylamine	0	55	0%		4.41	
Pentachlorophenol	4	57	7%	2.10	2.62	14.00
Phenanthrene	8	58	14%	0.042	0.53	0.18
Phenol	2	50	4%	2.20	4.31	5.70
Pyrene	7	58	12%	0.033	0.53	0.30
Pyridine	0	14	0%		2.69	
1,2,4-Trichlorobenzene	0	46	0%		4.50	
2,4,5-Trichlorophenol	0	50	0%		4.35	
2,4,6-Trichlorophenol	0	50	0%		4.35	
<i>Total Petroleum Hydrocarbons (µg/L)</i>						
TPH-DRO	21	33	64%	32.00	95.79	720.00
TPH-GRO	3	31	10%	15.00	6.90	43.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.1
Summary Statistics of All Groundwater Sample Results -- YAEC RUA --
Plant Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	33	78	42%	3.20	535.32	14000.00
Acrylonitrile	0	87	0%		5.82	
Allyl Chloride	0	47	0%		0.50	
t-Amyl methyl ether	0	52	0%		2.12	
Benzene	3	98	3%	0.60	1.17	1.50
Bromobenzene	0	98	0%		3.17	
Bromochloromethane	0	98	0%		3.17	
Bromodichloromethane	0	98	0%		1.15	
Bromoform	0	98	0%		1.96	
Bromomethane	0	95	0%		2.35	
2-Butanone	20	96	21%	2.40	56.24	2320.00
tert-Butyl Alcohol	0	10	0%		34.00	
n-Butylbenzene	1	98	1%	0.71	2.07	0.71
sec-Butylbenzene	0	98	0%		2.09	
tert-Butylbenzene	0	98	0%		3.17	
Carbon disulfide	6	98	6%	0.50	7.18	19.00
Carbon Tetrachloride	0	98	0%		1.15	
Chlorobenzene	0	98	0%		2.09	
1-Chlorobutane	0	47	0%		2.50	
Chloroethane	0	98	0%		4.18	
2-Chloroethylvinyl Ether	0	31	0%		2.50	
Chloroform	5	98	5%	0.54	1.32	2.00
Chloromethane	7	98	7%	0.36	3.73	2.30
2-Chlorotoluene	0	98	0%		3.17	
4-Chlorotoluene	0	98	0%		3.17	
1,2-Dibromo-3-chloropropane	0	61	0%		4.62	
Dibromochloromethane	0	98	0%		1.15	
1,2-Dibromoethane	0	98	0%		1.65	
Dibromomethane	0	98	0%		4.53	
1,2-dichlorobenzene	0	98	0%		3.17	
1,3-Dichlorobenzene	0	98	0%		3.17	
1,4-Dichlorobenzene	0	98	0%		2.23	
Dichlorodifluoromethane	5	98	5%	0.60	5.32	9.90
1,1-Dichloroethane	26	98	27%	0.60	2.57	7.40
1,2-Dichloroethane	0	98	0%		1.15	
cis-1,2-Dichloroethene	0	98	0%		2.09	
trans-1,2-Dichloroethene	0	98	0%		2.23	
1,1-Dichloroethene	10	98	10%	0.70	1.44	2.60
1,3-Dichloropropane	0	98	0%		3.17	
2,2-Dichloropropane	0	98	0%		3.17	
1,2-Dichloropropane	0	98	0%		1.86	
1,1-Dichloropropene	0	98	0%		2.86	
cis-1,3-Dichloropropene	0	98	0%		0.84	
trans-1,3-Dichloropropene	0	98	0%		0.84	
Diethyl Ether	0	98	0%		3.17	
Diisopropyl ether	0	53	0%		2.08	
1,4-Dioxane	8	23	35%	8.40	367.21	36.60
Ethyl Methacrylate	0	53	0%		7.17	
Ethylbenzene	4	98	4%	0.50	2.08	2.40
Ethyl-t-butyl ether	0	53	0%		2.08	
Hexachlorobutadiene	0	81	0%		1.08	
Hexachloroethane	0	38	0%		1.00	
2-Hexanone	1	94	1%	1.00	10.65	1.00
Iodomethane	1	47	2%	1.20	7.74	1.20
Isopropylbenzene	1	98	1%	0.74	2.07	0.74
4-Isopropyltoluene	3	98	3%	0.33	2.04	1.10
Methacrylonitrile	0	44	0%		2.50	
Methyl methacrylate	0	42	0%		14.52	
4-Methyl-2-Pentanone	4	98	4%	0.70	10.27	5.00
Methylene chloride	1	98	1%	2.00	9.67	2.00
Methyl-t-butyl ether	21	98	21%	0.60	2.50	14.00
Naphthalene	4	81	5%	1.10	2.90	3.90
2-Nitropropane	0	38	0%		2.50	
Pentachloroethane	0	47	0%		2.50	
Propionitrile	0	7	0%		25.00	
n-Propylbenzene	2	98	2%	0.58	2.06	1.40
Styrene	0	98	0%		2.09	
1,1,1,2-Tetrachloroethane	0	98	0%		1.15	
1,1,2,2-Tetrachloroethane	0	98	0%		1.15	
Tetrachloroethene	0	98	0%		1.15	
Tetrahydrofuran	32	82	39%	1.20	124.12	4470.00
Toluene	7	98	7%	0.60	2.79	43.30
trans-1,4-Dichloro-2-Butene	0	51	0%		4.78	
1,2,3-Trichlorobenzene	0	98	0%		3.17	
1,2,4-Trichlorobenzene	0	98	0%		3.17	
1,1,1-Trichloroethane	1	98	1%	2.40	2.11	2.40
1,1,2-Trichloroethane	0	98	0%		1.29	
Trichloroethene	0	98	0%		1.39	
Trichlorofluoromethane	0	98	0%		3.17	
1,2,3-Trichloropropane	0	98	0%		4.53	
1,1,2-Trichlorotrifluoroethane	0	37	0%		0.82	
1,2,4-Trimethylbenzene	4	98	4%	0.80	3.25	8.80
1,3,5-Trimethylbenzene	3	98	3%	0.71	3.15	2.90
Vinyl Acetate	0	51	0%		11.76	
Vinyl Chloride	0	98	0%		1.66	
o-Xylene	4	98	4%	1.40	2.13	5.00
m+p-Xylenes	4	98	4%	2.60	2.93	10.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.1
Summary Statistics of All Groundwater Sample Results -- YAEC RUA --
Plant Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	6	7	86%	10.40	35.54	71.40
Adjusted C9-C12 Aliphatics	3	7	43%	5.49	10.62	10.20
Unadjusted C5-C8 Aliphatics	9	35	26%	10.40	193.52	3470.00
Unadjusted C9-C12 Aliphatics	5	37	14%	9.86	42.39	76.30
Adjusted C9-C10 Aromatics	0	8	0%		12.50	
Unadjusted C9-C10 Aromatics	1	29	3%	45.00	48.79	45.00
Benzene	0	8	0%		2.50	
Ethylbenzene	0	8	0%		2.50	
Methyl-t-butyl ether	2	8	25%	2.20	2.46	2.50
Naphthalene	0	8	0%		2.50	
Toluene	0	8	0%		2.50	
o-Xylene	0	8	0%		2.50	
m+p-Xylenes	0	8	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.2
 Groundwater Sample Results - Alcohols
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	FD001-111404	FD003-031907	FD004-091406	MW-101C-031907	MW-101C-091406	MW-101C-111404	MW-102C-111404	MW-105A-041906	MW-105A-071206	MW-105C-041906	MW-107C-111904
Date Sampled	11/14/2004	3/19/2007	9/14/2006	3/19/2007	9/14/2006	11/14/2004	11/14/2004	4/19/2006	7/12/2006	4/19/2006	11/19/2004
Alcohols (mg/L)											
iso-Propyl Alcohol	140	1 U	1 U	1 U	1 U	140	2 U	1 U	1 U	1 U	2 U

Appendix Table A.4.2
 Groundwater Sample Results - Alcohols
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MW-107D-111904	MW-109C-110204	MW-109D-110304
Date Sampled	11/19/2004	11/2/2004	11/3/2004
Alcohols (mg/L)			
iso-Propyl Alcohol	2 U	2 U	2 U

Appendix Table A.4.2
 Groundwater Sample Results - EPH
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-3 FD-002-030804 3/8/2004	CB-3-030804 3/8/2004	CB-3-050306 5/3/2006	FD003-050306 5/3/2006	CB-9-031504 3/15/2004	CB-9-052104 5/21/2004	CW-2-052604 5/26/2004	CW-5R-101006 10/10/2006	FD001-101006 10/10/2006	MW-100A-060704 6/7/2004	MW-100B-060704 6/7/2004
EPH (µg/L)												
Acenaphthene	20			1 U	1 UJ				5.15 U	0.337 J		
Unadjusted C19-C36 Aliphatics	14000	100 U	100 U	200 U	200 U	238	100 U	100 U	200 U	200 U	100 U	100 U
Anthracene	2000			1 UJ	1 UJ				5.15 U	0.968 J		
Unadjusted C11-C22 Aromatics	200	100 U	100 U	200 U	200 UJ	95.2 U	100 U	100 U	200 U	200 U	100 U	100 U
Benzo(a)anthracene	1			1 U	1 UJ				5.15 U	0.968 J		
Chrysene	2			0.0879 J	1 UJ				5.15 U	1.07 J		
Fluoranthene	90			1 UJ	1 UJ				5.15 U	1.28 J		
Fluorene	300			1 U	1 UJ				5.15 U	0.674 J		
Naphthalene	140			1 UJ	1 UJ				5.15 U	5.26 U		
Phenanthrene	300			1 UJ	1 UJ				5.15 U	0.989 J		
Pyrene	80			1 UJ	1 UJ				5.15 U	1.22 J		

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - EPH
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	FD002-031507 3/15/2007	FD005-091406 9/14/2006	MW-101B-031507 3/15/2007	MW-101B-050106 5/1/2006	MW-101B-052204 5/22/2004	MW-101B-091406 9/14/2006	FD-002-052204 5/22/2004	MW-101C-030304 3/3/2004	MW-101C-052204 5/22/2004	MW-102A-030204 3/2/2004
EPH (µg/L)											
Acenaphthene	20	1 U	5.21 U	1 U	1 U		5.21 UJ				
Unadjusted C19-C36 Aliphatics	14000	200 U	200 U	200 U	200 UJ	555	200 U	100 U	205	100 U	100 U
Anthracene	2000	1 U	5.21 U	1 U	1 UJ		5.21 UJ				
Unadjusted C11-C22 Aromatics	200	200 U	200 U	200 U	200 U	408	200 UJ	100 U	120	100 U	100 U
Benzo(a)anthracene	1	1 U	5.21 U	1 U	1 U		5.21 UJ				
Chrysene	2	1 U	5.21 U	1 U	0.147 J		5.21 UJ				
Fluoranthene	90	1 U	5.21 U	1 U	0.211 J		5.21 UJ				
Fluorene	300	1 U	5.21 U	1 U	1 U		5.21 UJ				
Naphthalene	140	1 U	5.21 UJ	1 U	1 UJ		5.21 UJ				
Phenanthrene	300	1 U	5.21 U	1 U	1 UJ		5.21 UJ				
Pyrene	80	1 U	5.21 U	1 U	1 UJ		5.21 UJ				

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - EPH
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-102C-030204 3/2/2004	MW-104B-031104 3/11/2004	MW-104B-060304 6/3/2004	MW-104B-FD001-031104 3/11/2004	MW-104C-031604 3/16/2004	MW-105B-042006 4/20/2006	MW-105C-041906 4/19/2006	MW-107B-031304 3/13/2004	MW-107C-042606 4/26/2006
EPH (µg/L)										
Acenaphthene	20						1 U	1 U		1 U
Unadjusted C19-C36 Aliphatics	14000	100 U	95.2 U	100 UJ	95.2 U	100 U	200 U	200 U	95.2 U	200 U
Anthracene	2000						1 UJ	1 UJ		1 UJ
Unadjusted C11-C22 Aromatics	200	100 U	95.2 U	100 U	95.2 U	100 U	200 U	200 U	95.2 U	200 U
Benzo(a)anthracene	1						1 U	1 U		1 U
Chrysene	2						1 U	1 U		1 U
Fluoranthene	90						1 UJ	1 UJ		1 UJ
Fluorene	300						1 UJ	1 UJ		1 U
Naphthalene	140						1 UJ	0.884 J		1 U
Phenanthrene	300						1 UJ	1 UJ		1 UJ
Pyrene	80						1 UJ	1 UJ		1 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - EPH
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-107D-031304 3/13/2004	MW-109B-090704 9/7/2004	MW-109C-090704 9/7/2004	MW-109D-090704 9/7/2004	MW-2-052204 5/22/2004	FD-001-052204 5/22/2004	MW-5-052204 5/22/2004	MW-6-030404 3/4/2004	MW-6R-031407 3/14/2007	MW-6R-101206 10/12/2006	MW-6R-120506 12/5/2006
EPH (µg/L)												
Acenaphthene	20									1 U	5.21 U	1 U
Unadjusted C19-C36 Aliphatics	14000	95.2 U	100 U	100 U	100 U	100 U	100 U	100 U	454	200 U	200 U	200 U
Anthracene	2000									1 U	5.21 U	1 U
Unadjusted C11-C22 Aromatics	200	95.2 U	100 U	100 U	100 U	100 U	100 U	100 U		200 U	200 U	200 U
Benzo(a)anthracene	1									1 U	5.21 U	1 U
Chrysene	2									1 U	5.21 U	1 U
Fluoranthene	90									1 U	5.21 U	1 U
Fluorene	300									1 U	5.21 U	1 U
Naphthalene	140									1 U	5.21 U	1 U
Phenanthrene	300									1 U	5.21 U	0.277 J
Pyrene	80									1 U	5.21 U	1 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	B-1-030804	B-1-052504	B-1-071603	CB-1-030504	CB-1-052304	CB-1-072103	CB-10-032404	CB-10-061104	CB-10-072903	CB-11A-052204
Date Sampled	GW-1	3/8/2004	5/25/2004	7/16/2003	3/5/2004	5/23/2004	7/21/2003	3/24/2004	6/11/2004	7/29/2003	5/22/2004
Inorganics (mg/L)											
Antimony	0.006			0.005 U			0.005 U			0.003 U	
Arsenic	0.01			0.01 U			0.01 U			0.01 U	
Beryllium	0.004			0.01 U			0.002 U			0.002 U	
Boron		0.16	0.26	0.27	0.44	0.4	0.49	0.59	0.21	0.26	0.15
Cadmium	0.005			0.003 U			0.003 U			0.003 U	
Chromium	0.1			0.01 UJ			0.01 U			0.01 UJ	
Copper				0.01 U			0.01 U			0.01 UJ	
Lead	0.015			0.0066 U			0.0063			0.005 U	
Mercury	0.002			0.0002 U			0.0003 J			0.0002 U	
Nickel	0.1			0.01 U			0.01 U			0.01 UJ	
Selenium	0.05			0.05 U			R			0.05 UJ	
Silver	0.1			0.005 U			0.005 U			0.005 UJ	
Thallium	0.002			0.00125 UJ			0.00125 UJ			0.00125 U	
Zinc	5			0.05 U			0.05 U			0.05 U	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-11A-072403 7/24/2003	FD002-072403 7/24/2003	CB-12-030204 3/2/2004	CB-12-052704 5/27/2004	CB-12-072903 7/29/2003	CB-2-030204 3/2/2004	CB-2-031805 3/18/2005	CB-2-052404 5/24/2004	CB-2-071403 7/14/2003	CB-3-030804 3/8/2004	CB-3-050306 5/3/2006
Inorganics (mg/L)												
Antimony	0.006	0.005 U	0.005 U			0.003 U				0.005 U		0.0062 UJ
Arsenic	0.01	0.01 U	0.01 U			0.01 U				0.01 U		0.004 U
Beryllium	0.004	0.002 U	0.002 U			0.002 U				0.002 U		0.0006 U
Boron		0.1 U	0.1 U	0.05 U	0.21	0.1 U	0.1	0.248	0.22	0.13	0.05 U	0.0067 J
Cadmium	0.005	0.003 U	0.003 U			0.003 U				0.003 U		0.0004 J
Chromium	0.1	0.01 U	0.01 U			0.01 UJ				0.01 UJ		0.005 U
Copper		0.01 U	0.01 U			0.01 UJ				0.01 U		0.008
Lead	0.015	0.005 U	0.005 U			0.005 U				0.0052 U		0.0075 U
Mercury	0.002	0.0002 U	0.0002 U			0.0002 U				0.0002 U		0.00011 U
Nickel	0.1	0.01 U	0.01 U			0.01 UJ				0.003 U		0.0032 J
Selenium	0.05	0.05 U	0.05 U			0.05 UJ				0.05		0.015 U
Silver	0.1	0.005 U	0.005 U			0.005 UJ				0.005 U		R
Thallium	0.002	0.00125 U	0.00125 U			0.00125 U				0.00125 UJ		0.00005 U
Zinc	5	0.05 U	0.01 U			0.05 U				0.05 U		0.0336 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-3-052604 5/26/2004	CB-3-071603 7/16/2003	CB-3-FD004-030804 3/8/2004	FD003-050306 5/3/2006	CB-7-030804 3/8/2004	CB-7-052704 5/27/2004	CB-7-072303 7/23/2003	CB-8-030204 3/2/2004	CB-8-030707 3/7/2007	CB-8-052504 5/25/2004	CB-8-072303 7/23/2003	CB-9-031504 3/15/2004
Inorganics (mg/L)													
Antimony	0.006		0.005 U		0.0026 UJ			0.005 U				0.005 U	
Arsenic	0.01		0.01 U		0.004 U			0.01 U		0.004 U		0.01 U	
Beryllium	0.004		0.002 U		0.0001 U			0.002 U				0.002 U	
Boron		0.16	0.1 U	0.05 U	0.0036 J	0.05 U	0.16	0.1 U	0.05 U		0.1 U		0.33
Cadmium	0.005		0.003 U		0.0025 U			0.003 U				0.003 U	
Chromium	0.1		0.01 UJ		0.005 U			0.01 U				0.01 U	
Copper			0.012 J		0.0098			0.026 U				0.01 U	
Lead	0.015		0.005 U		0.0075 U			0.005 U				0.005 U	
Mercury	0.002		0.0002 U		0.00013 U			0.0002 U				0.0002 U	
Nickel	0.1		0.021		0.0037 J			0.015 U				0.011 U	
Selenium	0.05		0.05 U		0.015 U			0.05 U				0.05 U	
Silver	0.1		0.005 UJ		R			0.005 UJ				0.005 UJ	
Thallium	0.002		0.00125 UJ		0.00005 U			0.00125 UJ				0.00125 UJ	
Zinc	5		0.83		0.0352 U			0.05 U				0.05 U	

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-9-052104 5/21/2004	CB-9-072403 7/24/2003	CW-11-052204 5/22/2004	CW-11-072503 7/25/2003	CW-2-030304 3/3/2004	CW-2-052604 5/26/2004	CW-2-072403 7/24/2003	CW-2-112003 11/20/2003	CW-2-112003-F 11/20/2003	CW-3-030904 3/9/2004	CW-3-052504 5/25/2004
Inorganics (mg/L)												
Antimony	0.006		0.005 U		0.005 U			0.005 U				
Arsenic	0.01		0.01 U		0.01 UJ			0.01 U				
Beryllium	0.004		0.002 U		0.002 U			0.002 U				
Boron		0.15	0.13	0.23	0.17	0.05 U	0.11	0.11			0.05 U	0.21
Cadmium	0.005		0.003 U		0.003 U			0.003 U				
Chromium	0.1		0.01 U		0.01 U			0.01 U				
Copper			0.01 U		0.01 U			0.01 U				
Lead	0.015		0.005 U		R			0.005 U				
Mercury	0.002		0.0002 U		0.0002 U			0.0002 U				
Nickel	0.1		0.01 U		0.01 U			0.01 U				
Selenium	0.05		0.05 U		0.05 U			0.05 U				
Silver	0.1		0.005 U		0.005 U	0.005 U		0.014 U	0.005 U	0.01 U		
Thallium	0.002		0.00125 UJ		0.00125 U			0.00125 U				
Zinc	5		0.05 U		0.05 U			0.01 U				

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CW-3-072303 7/23/2003	CW-4-030304 3/3/2004	CW-4-052604 5/26/2004	CW-4-072403 7/24/2003	CW-5-052504 5/25/2004	CW-5-072103 7/21/2003	CW-6-031605 3/16/2005	CW-6-031904 3/19/2004	CW-6-060204 6/2/2004	CW-6-071503 7/15/2003	FD001-071503 7/15/2003
Inorganics (mg/L)												
Antimony	0.006	0.005 U			0.005 U		0.005 U				0.005 U	0.005 U
Arsenic	0.01	0.01 U			0.01 U		0.01 U				0.01 U	0.01 U
Beryllium	0.004	0.002 U			0.002 U		0.002 U				0.002 U	0.002 U
Boron		0.1 U	0.14	0.22	0.1 U	0.1 U	0.1 U	0.0973	0.1 U	0.1 U	0.1 U	0.12
Cadmium	0.005	0.003 U			0.003 U		0.003 U				0.003 U	0.003 U
Chromium	0.1	0.01 U			0.01 U		0.01 U				0.01 UJ	0.01 UJ
Copper		0.039 U			0.018 U		0.026 U				0.01 U	0.01 U
Lead	0.015	0.005 U			0.005 U		0.005 U				0.005 U	0.0052 U
Mercury	0.002	0.0002 U			0.0002 U		0.0002 U				0.0002 U	0.0002 U
Nickel	0.1	0.011 U			0.01 U		0.01 U				0.01 U	0.01 U
Selenium	0.05	0.05 U			0.05 U		0.05 U				0.05 U	0.05 U
Silver	0.1	0.005 UJ			0.005 UJ		0.005 UJ				0.005 U	0.005 U
Thallium	0.002	0.00125 UJ			0.00125 UJ		0.00125 U				0.00125 UJ	0.00125 UJ
Zinc	5	0.01 U			0.01 U		0.01 U				0.05 U	0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CW-7-030804 3/8/2004	CW-7-032005 3/20/2005	CW-7-060204 6/2/2004	CW-7-071503 7/15/2003	CW-8-031904 3/19/2004	CW-8-071503 7/15/2003	MW-1-031004 3/10/2004	MW-1-052404 5/24/2004	MW-1-072303 7/23/2003	MW-100A-030607 3/6/2007	MW-100A-060704 6/7/2004
Inorganics (mg/L)												
Antimony	0.006				0.005 U		0.005 U			0.005 U		
Arsenic	0.01				0.01 U		0.01 U			0.01 U	0.004 U	
Beryllium	0.004				0.002 U		0.002 U			0.002 U		
Boron		0.067	0.0828	0.1 U	0.12	0.12	0.19	0.05 U	0.1 U	0.1 U		0.1 UJ
Cadmium	0.005				0.003 U		0.003 U			0.003 U		
Chromium	0.1				0.01 UJ		0.01 UJ			0.01 U		
Copper					0.01 U		0.01 U			0.023 U		
Lead	0.015				0.0075 U		0.005 U			0.005 U		
Mercury	0.002				0.0002 U		0.0002 U			0.0002 U		
Nickel	0.1				0.01 U		0.01 U			0.025 U		
Selenium	0.05				0.05 U		0.05 U			0.05 U		
Silver	0.1				0.005 U		0.005 U			0.005 UJ		
Thallium	0.002				0.00125 UJ		0.00125 UJ			0.00125 UJ		
Zinc	5				0.05 U		0.05 U			0.16		

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-100A-091103 9/11/2003	MW-100B-030607 3/6/2007	MW-100B-060704 6/7/2004	MW-100B-091103 9/11/2003	208/MW101A-062806 6/28/2006	MW-101A-031407 3/14/2007	MW-101A-091406 9/14/2006	MW-101A-121406 12/14/2006	FD002-031507 3/15/2007
Inorganics (mg/L)										
Antimony	0.006	0.005 U			0.005 U	0.004 U		0.0034 U	0.015 U	
Arsenic	0.01	0.01 U	0.004 U		0.01 U	0.0141	0.0092	0.0161	0.012	0.004 U
Beryllium	0.004	0.002 U			0.002 U	0.002 U		0.004 U	0.002 U	
Boron		0.12 U		0.1 UJ	0.1 U	0.0688		0.0805	0.029 J	
Cadmium	0.005	0.003 U			0.003 U	0.0025 U		0.005 U	0.0025 U	
Chromium	0.1	0.01 UJ			0.01 UJ	0.005 U		0.005 U	0.0033 J	
Copper		0.01 U			0.01 UJ	0.093		0.0241	0.0229	
Lead	0.015	0.005 U			0.005 UJ	0.0075 U		0.0075 U	0.0075 U	
Mercury	0.002	0.0002 U			0.0002 U	0.00008 J		0.00032 U	0.0002 U	
Nickel	0.1	0.01 U			0.01 UJ	0.0178		0.0191	0.0264	
Selenium	0.05	0.05 UJ			0.05 UJ	0.015 U		0.005 J	0.015 U	
Silver	0.1	0.005 UJ			0.005 UJ	0.0046 U		0.0051 J	0.0008 J	
Thallium	0.002	0.00125 UJ			0.00125 U	0.00003 U		0.00002 U	0.0004	
Zinc	5	0.05 U			0.05 U	0.0153 U		0.0146 U	0.0347	

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-101B-030404 3/4/2004	MW-101B-031507 3/15/2007	MW-101B-050106 5/1/2006	MW-101B-052204 5/22/2004	MW-101B-091203 9/12/2003	FD-002-052204 5/22/2004	MW-101C-030304 3/3/2004	MW-101C-031907 3/19/2007	MW-101C-052204 5/22/2004
Inorganics (mg/L)										
Antimony	0.006			0.006 U		0.005 U				
Arsenic	0.01		0.004 U	0.004 U		0.01 U			0.004 U	
Beryllium	0.004			0.0002 J		0.002 U				
Boron		0.19		0.05 U	0.1 U	0.05 U	0.1 U	0.05 U		0.1 U
Cadmium	0.005			0.0025 U		0.003 U				
Chromium	0.1			0.0028 J		0.01 UJ				
Copper				0.0093 U		0.01 UJ				
Lead	0.015			0.0042 J		0.005 UJ				
Mercury	0.002			0.0002 UJ		0.0002 U				
Nickel	0.1			0.005 U		0.01 UJ				
Selenium	0.05			0.015 U		0.05 UJ				
Silver	0.1			R		0.005 UJ				
Thallium	0.002			0.00002 U		0.00125 U				
Zinc	5			0.0572		0.05 U				

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-101C-091603 9/16/2003	MW-102A-030204 3/2/2004	MW-102A-030707 3/7/2007	MW-102A-052104 5/21/2004	MW-102A-091003 9/10/2003	MW-102B-030807 3/8/2007	MW-102B-052104 5/21/2004	MW-102B-091003 9/10/2003	MW-102C-030204 3/2/2004
Inorganics (mg/L)										
Antimony	0.006	0.005 U				0.005 U			0.005 U	
Arsenic	0.01	0.01 U		0.004 U		0.01 U	0.004 U		0.01 U	
Beryllium	0.004	0.002 U				0.002 U			0.002 U	
Boron		0.05 U	0.05 U		0.1 U	0.22 U		0.1 U	0.17	0.05 U
Cadmium	0.005	0.001 U				0.003 U			0.003 U	
Chromium	0.1	0.01 UJ				0.01 UJ			0.01 U	
Copper		0.01 UJ				0.01 U			0.01 U	
Lead	0.015	0.005 UJ				0.005 U			0.005 U	0.005 U
Mercury	0.002	0.0002 U				0.0002 U			0.0002 U	
Nickel	0.1	0.01 UJ				0.01 U			0.01 U	
Selenium	0.05	0.05 UJ				0.05 UJ			0.05 UJ	
Silver	0.1	0.005 UJ				0.005 UJ			0.005 U	
Thallium	0.002	0.00125 U				0.00125 UJ			0.00125 UJ	
Zinc	5	0.05 U				0.05 U			0.05 U	

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-102C-030707 3/7/2007	MW-102C-042406 4/24/2006	MW-102C-052104 5/21/2004	MW-102C-091003 9/10/2003	MW-102-C-111203 11/12/2003	MW-102-C-111203-F 11/12/2003	FD001-042506 4/25/2006	MW-102D-031307 3/13/2007	MW-102D-042506 4/25/2006
Inorganics (mg/L)										
Antimony	0.006		0.006 U		0.005 U			0.006 U		0.006 U
Arsenic	0.01	0.004 U	0.004 U		0.034			0.0062	0.004 U	0.0054
Beryllium	0.004		0.002 U		0.002 U			0.0004 U		0.0002 U
Boron			0.0604	0.1 U	0.13 U			0.159		0.166
Cadmium	0.005		0.0025 U		0.003 U			0.0025 U		0.0025 U
Chromium	0.1		0.005 U		0.012			0.005 U		0.003 J
Copper			0.005 U		0.01 U			0.0067		0.0108
Lead	0.015	0.0028 J	0.0075 U		0.037	0.003 U	0.003 U	0.0075 U		0.0075 U
Mercury	0.002		0.0002 U		0.0002 U			0.0002 U		0.00013 J
Nickel	0.1		0.0018 J		0.01			0.0088		0.009
Selenium	0.05		0.015 U		0.05 UJ			0.015 U		0.015 U
Silver	0.1		0.007 UJ		0.005 UJ			0.007 U		0.007 U
Thallium	0.002		0.00002 U		0.00125 UJ			0.00003 U		0.00003 U
Zinc	5		0.0408 J		0.05 U			0.0106 U		0.011 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-104A-031307 3/13/2007	MW-104A-042606 4/26/2006	MW-104B-031104 3/11/2004	MW-104B-031207 3/12/2007	MW-104B-032305 3/23/2005	MW-104B-060304 6/3/2004	MW-104B-FD001-031104 3/11/2004	MW-104C-031407 3/14/2007	MW-104C-031604 3/16/2004
Inorganics (mg/L)										
Antimony	0.006		0.0032 U	0.005 U				0.005 U		0.005 U
Arsenic	0.01	0.004 U	0.008 U	0.01 U	0.004 U			0.01 U	0.003 J	0.01 U
Beryllium	0.004		0.0007 U	0.002 U				0.002 U		0.002 U
Boron			0.091	0.1 U		0.037	0.1 U	0.1 U		0.1 U
Cadmium	0.005		0.001 U	0.003 U				0.003 U		0.003 U
Chromium	0.1		0.005 U	0.088 J				0.076 J		0.013
Copper			0.0017 J	0.01 U				0.01 U		0.011 J
Lead	0.015		0.0075 U	0.005 U				0.005 U		0.005 U
Mercury	0.002		0.0002 U	0.0002 U				0.0002 U		0.0002 U
Nickel	0.1		0.005 U	0.053				0.046		0.01 U
Selenium	0.05		0.015 U	0.05 U				0.05 U		0.05 U
Silver	0.1		0.01 U	0.005 U				0.005 U		0.005 U
Thallium	0.002		0.0001 U	0.00125 U				0.00125 U		0.00125 U
Zinc	5		0.0052	0.05 U				0.05 U		0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-104C-032405 3/24/2005	MW-104C-060204 6/2/2004	MW-104D-031307 3/13/2007	MW-105A-031407 3/14/2007	MW-105A-041906 4/19/2006	MW-105A-071206 7/12/2006	MW-105B-030804 3/8/2004	MW-105B-031307 3/13/2007	MW-105B-032705 3/27/2005
Inorganics (mg/L)										
Antimony	0.006					0.006 U	0.0008 UJ			
Arsenic	0.01			0.004 U	0.004 U	0.004 U	0.004 UJ		0.004 U	
Beryllium	0.004					0.002 U	0.002 UJ			
Boron		0.0502	0.1 U			0.0362	0.0444 UJ	0.05 U		0.0716
Cadmium	0.005					0.0025 U	0.0004 U			
Chromium	0.1					0.005 U	0.002 J			
Copper						0.0084 U	0.0472			
Lead	0.015					0.0075 U	0.0025 J			
Mercury	0.002					0.00006 J	0.00009 J			
Nickel	0.1					0.005 U	0.0026 J			
Selenium	0.05					0.015 U	0.015 UJ			
Silver	0.1					0.007 U	0.005 UJ			
Thallium	0.002					0.00006 U	0.00007 U			
Zinc	5					0.0114 U	0.0548 J			

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-105B-042006 4/20/2006	MW-105B-060304 6/3/2004	MW-105B-090903 9/9/2003	MW-105B-FD002-032705 3/27/2005	MW-105C-030304 3/3/2004	MW-105C-030607 3/6/2007	MW-105C-032705 3/27/2005
Inorganics (mg/L)								
Antimony	0.006	0.006 U		0.005 U				
Arsenic	0.01	0.004 U		0.01 U			0.0022 J	
Beryllium	0.004	0.002 U		0.002 U				
Boron		0.041	0.1 U	0.18	0.0725	0.05 U		0.0336
Cadmium	0.005	0.0025 U		0.003 U				
Chromium	0.1	0.005 U		0.01 U				
Copper		0.0034 U		0.01 U				
Lead	0.015	0.0075 U		0.005 U				
Mercury	0.002	0.0002 U		0.0002 U				
Nickel	0.1	0.005 U		0.01 U				
Selenium	0.05	0.0062 U		0.05 UJ				
Silver	0.1	0.007 U		0.005 U				
Thallium	0.002	0.00004 U		0.00125 UJ				
Zinc	5	0.0102 U		0.05 U				

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-105C-041906 4/19/2006	MW-105C-060304 6/3/2004	MW-105C-090903 9/9/2003	FD001-121106 12/11/2006	FD005-031207 3/12/2007	FD006-091206 9/12/2006	MW-107A-031207 3/12/2007	MW-107A-042506 4/25/2006	MW-107A-070506 7/5/2006	MW-107A-091206 9/12/2006
Inorganics (mg/L)											
Antimony	0.006	0.006 U		0.005 U	0.015 U		0.0026 U		0.0051 U	0.0056 U	0.0021 U
Arsenic	0.01	0.004 U		0.01 U	0.0116	0.009	0.0105	0.0094	0.0126	0.0144	0.0112
Beryllium	0.004	0.002 U		0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U
Boron		0.0428	0.1 U	0.12 U	0.0598		0.0339 J		0.115	0.107 J	0.0444 J
Cadmium	0.005	0.0025 U		0.003 U	0.0025 U		0.0025 U		0.0025 U	0.0002 J	0.0025 U
Chromium	0.1	0.0024 J		0.01 U	0.005 U		0.005 U		0.0082	0.005 U	0.005 U
Copper		0.0029 U		0.01 U	0.0103		0.0296		0.0418	0.0191	0.0222
Lead	0.015	0.0075 U		0.005 U	0.0075 U		0.0075 U		0.0024 J	0.0075 U	0.0075 U
Mercury	0.002	0.0002 U		0.0002 U	0.0002 U		0.00006 J		0.0002 U	0.00011 J	0.00015 J
Nickel	0.1	0.005 U		0.01 U	0.0131		0.0126		0.0098	0.0102	0.0124
Selenium	0.05	0.0065 U		0.05 UJ	0.015 U		0.015 U		0.015 U	0.015 U	0.015 U
Silver	0.1	0.007 U		0.005 U	0.005 U	0.0012 J	0.005 U	0.001 J	0.0078	0.005 UJ	0.005 U
Thallium	0.002	0.00002 U		0.00125 UJ	0.00009 J		0.00003 U		0.00002 U	0.00003 U	0.00004 U
Zinc	5	0.0182 U		0.05 U	0.0156		0.0636		0.0104 U	0.0123	0.0452

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-107A-121106 12/11/2006	FD006-031307 3/13/2007	MW-107B-031304 3/13/2004	MW-107B-031307 3/13/2007	MW-107B-042606 4/26/2006	MW-107B-052104 5/21/2004	MW-107C-031304 3/13/2004	MW-107C-031307 3/13/2007	MW-107C-042606 4/26/2006
Inorganics (mg/L)										
Antimony	0.006	0.0008 J		0.005 U		0.012 U		0.005 U		0.012 U
Arsenic	0.01	0.0123	0.004 U	0.01 U	0.004 U	0.008 U		0.01 U	0.004 U	0.008 U
Beryllium	0.004	0.002 U		0.002 U		0.0004 U		0.002 U		0.0006 U
Boron		0.0648		0.26		0.0138 U	0.1 U	0.4		0.214
Cadmium	0.005	0.0025 U		0.003 U		0.0025 U		0.003 U		0.0025 U
Chromium	0.1	0.005 U		0.026 J		0.005 U		0.01 UJ		0.005 U
Copper		0.0116		0.016		0.005 U		0.01 U		0.0019 J
Lead	0.015	0.0075 U		0.016 J		0.0075 U		0.005 U		0.0075 U
Mercury	0.002	0.00004 J		0.0002 UJ		0.00018 U		0.0002 UJ		0.0002 U
Nickel	0.1	0.013		0.016		0.005 U		0.01 U		0.0018 J
Selenium	0.05	0.015 U		0.05 U		0.015 U		0.05 U		0.015 U
Silver	0.1	0.005 U		0.005 U		0.01 U		0.005 U		0.01 U
Thallium	0.002	0.00005 J		0.00125 U		0.00004 U		0.00125 U		0.0001 U
Zinc	5	0.0316		0.12		0.0056		0.05 U		0.0108

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-107C-052204 5/22/2004	MW-107D-031304 3/13/2004	MW-107D-031407 3/14/2007	MW-107D-042506 4/25/2006	MW-107D-052204 5/22/2004	MW-107E-031407 3/14/2007	MW-107E-071006 7/10/2006	MW-107F-030807 3/8/2007	MW-107F-091806 9/18/2006
Inorganics (mg/L)										
Antimony	0.006		0.005 U		0.006 U			0.0051 J		0.0011 U
Arsenic	0.01		0.01 U	0.004 U	0.004 U		0.004 U	0.004 U	0.004 U	0.004 U
Beryllium	0.004		0.002 U		0.0004 U			0.002 U		0.002 U
Boron		0.38	0.13		0.157	0.2		0.014 U		0.05 UJ
Cadmium	0.005		0.003 U		0.0025 U			0.0025 U		0.0025 U
Chromium	0.1		0.01 UJ		0.005 U			0.005 U		0.005 U
Copper			0.01 U		0.005 U			0.0018 U		0.005 U
Lead	0.015		0.005 U		0.0075 U			0.0025 J		0.0075 U
Mercury	0.002		0.0002 UJ		0.0002 U			0.0002 U		0.00016 U
Nickel	0.1		0.01 U		0.005 U			0.005 U		0.005 U
Selenium	0.05		0.05 U		0.015 U			0.015 U		0.015 U
Silver	0.1		0.005 U		0.007 U			0.005 UJ		R
Thallium	0.002		0.00125 U		0.000009 U			0.0001 U		0.00004 U
Zinc	5		0.05 U		0.0092 U			0.0078		0.051 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-109A-030507 3/5/2007	MW-109A-041906 4/19/2006	MW-109B-030507 3/5/2007	MW-109B-031605 3/16/2005	MW-109B-050306 5/3/2006	MW-109B-090704 9/7/2004	MW-109C-030807 3/8/2007	MW-109C-031605 3/16/2005	MW-109C-042406 4/24/2006
Inorganics (mg/L)										
Antimony	0.006		0.006 U			0.0027 UJ	0.005 U			0.006 U
Arsenic	0.01	0.004 U	0.004 U	0.004 U		0.004 U	0.01 U	0.006 U		0.004 U
Beryllium	0.004		0.002 U			0.0006 U	0.002 U			0.002 U
Boron			0.012 U		0.0157	0.05 UJ	0.1 U		0.0256	0.0012 U
Cadmium	0.005		0.0025 U			0.0025 U	0.003 U			0.0025 U
Chromium	0.1		0.005 U			0.005 U	0.01 U			0.005 U
Copper			0.006 U			0.0114	0.01 U			0.005 U
Lead	0.015		0.0075 U			0.0075 U	0.005 U			0.0075 U
Mercury	0.002		0.0002 U			0.0002 U	0.0002 U			0.0002 U
Nickel	0.1		0.005 U			0.005 U	0.01 UJ			0.0018 J
Selenium	0.05		0.0074 U			0.015 U	0.05 U			0.015 U
Silver	0.1		0.007 U			R	0.005 U			0.007 UJ
Thallium	0.002		0.0002 U			0.00003 U	0.00125 U			0.00002 U
Zinc	5		0.009 U			0.0169 U	0.05 U			0.0108 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-109C-090704 9/7/2004	MW-109D-030507 3/5/2007	MW-109D-031605 3/16/2005	MW-109D-042606 4/26/2006	MW-109D-090704 9/7/2004	MW-110A-031307 3/13/2007	MW-110A-042506 4/25/2006	MW-110B-032007 3/20/2007	MW-110B-050206 5/2/2006
Inorganics (mg/L)										
Antimony	0.006	0.005 U			0.012 U	0.005 U		0.006 U		0.006 U
Arsenic	0.01	0.01 U	0.0026 J		0.008 U	0.01 U	0.0034 J	0.0042	0.004 U	0.004 U
Beryllium	0.004	0.002 U			0.0005 U	0.002 U		0.0003 U		0.0002 U
Boron		0.1 U		0.0364	0.01 U	0.1 U		0.049		0.05 U
Cadmium	0.005	0.003 U			0.0025 U	0.003 U		0.0025 U		0.0025 U
Chromium	0.1	0.01 U			0.005 U	0.01 U		0.005 U		0.005 U
Copper		0.01 U			0.0048 J	0.01 U		0.005		0.005 U
Lead	0.015	0.005 U			0.0075 U	0.005 U		0.0075 U		0.0075 U
Mercury	0.002	0.0002 U			0.00005 U	0.0002 U		0.0002 U		0.0002 UJ
Nickel	0.1	0.01 UJ			0.005 U	0.01 UJ		0.0092		0.005 U
Selenium	0.05	0.05 U			0.015 U	0.05 U		0.015 U		0.015 U
Silver	0.1	0.005 U			0.01 U	0.005 U		0.007 U		R
Thallium	0.002	0.00125 U			0.00009 U	0.00125 U		0.000007 U		0.00004 U
Zinc	5	0.05 U			0.0108	0.05 U		0.0082 U		0.022 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-110C-030707 3/7/2007	MW-110C-042506 4/25/2006	FD002-050206 5/2/2006	MW-110D-031907 3/19/2007	MW-110D-050206 5/2/2006	MW-111A-031507 3/15/2007	MW-111A-042606 4/26/2006	MW-111B-031507 3/15/2007	MW-111B-042706 4/27/2006
Inorganics (mg/L)										
Antimony	0.006		0.006 U	0.004 U		0.006 U		0.012 U		0.006 U
Arsenic	0.01	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.003 J	0.0043 J	0.004 U	0.004 U
Beryllium	0.004		0.0006 U	0.0004 U		0.0001 U		0.002 U		0.0001 J
Boron			0.0066 U	0.05 U		0.05 U		0.0242 U		0.05 U
Cadmium	0.005		0.0025 U	0.0004 J		0.0025 U		0.0025 U		0.0025 U
Chromium	0.1		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U
Copper			0.005 U	0.005 U		0.005 U		0.0542		0.005 U
Lead	0.015		0.0075 U	0.0075 U		0.0075 U		0.0075 U		0.0075 U
Mercury	0.002		0.0002 U	0.0002 UJ		0.0002 UJ		0.0002 U		0.0002 UJ
Nickel	0.1		0.005 U	0.005 U		0.005 U		0.0184		0.0023 J
Selenium	0.05		0.015 U	0.015 U		0.015 U		0.015 U		0.015 U
Silver	0.1		0.007 U	R		R		0.01 U		R
Thallium	0.002		0.00002 U	0.00003 U		0.00001 U		0.00004 U		0.00001 U
Zinc	5		0.0118 U	0.013 U		0.0106 U		0.0065		0.0189

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-111C-031507 3/15/2007	MW-111C-042606 4/26/2006	FD002-101106 10/11/2006	MW-112A-030707 3/7/2007	MW112A-101106 10/11/2006	MW-2-030504 3/5/2004	MW-2-052204 5/22/2004	MW-2-072203 7/22/2003	FD-001-052204 5/22/2004	MW-5-030304 3/3/2004
Inorganics (mg/L)											
Antimony	0.006		0.006 U	0.0022 J		0.0014 J			0.005 U		
Arsenic	0.01	0.0101	0.004	0.004 U	0.004 U	0.004 U			0.01 U		
Beryllium	0.004		0.0002 J	0.002 U		0.002 U			0.002 U		
Boron			0.0488	0.0224 J		0.0234 J	0.12	0.26	0.2	0.15	0.11
Cadmium	0.005		0.0025 U	0.0004 J		0.0004 J			0.003 U		
Chromium	0.1		0.004 J	0.005 U		0.005 U			0.01 U		
Copper			0.016 U	0.005 U		0.005 U			0.01 U		
Lead	0.015		0.0032 J	0.0075 U		0.0075 U			0.005 U		
Mercury	0.002		0.0002 UJ	0.0002 U		0.0002 U			0.0002 U		
Nickel	0.1		0.028	0.005 U		0.005 U			0.01 U		
Selenium	0.05		0.015 U	0.015 U		0.015 U			0.05 U		
Silver	0.1		R	0.001 J		0.005 U			0.005 UJ		
Thallium	0.002		0.00006 U	0.01 U		0.01 U			0.00125 U		
Zinc	5		0.0196	0.0061 J		0.0065 J			0.05 U		

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - Inorganics
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-5-052204 5/22/2004	MW-5-072203 7/22/2003	MW-6-030404 3/4/2004	MW-6-072203 7/22/2003	MW-6R-031407 3/14/2007
Inorganics (mg/L)						
Antimony	0.006		0.005 U		0.005 U	
Arsenic	0.01		0.01 U		0.01 U	0.004 U
Beryllium	0.004		0.002 U		0.002 U	
Boron		0.13	0.14	0.05 U	0.1 U	
Cadmium	0.005		0.003 U		0.003 U	
Chromium	0.1		0.01 U		0.01 U	
Copper			0.01 U		0.01 U	
Lead	0.015		0.005 U		0.005 U	
Mercury	0.002		0.0002 U		0.0002 U	
Nickel	0.1		0.01 U		0.01 U	
Selenium	0.05		0.05 U		0.05 U	
Silver	0.1		0.005 UJ		0.005 UJ	
Thallium	0.002		0.00125 U		0.00125 U	
Zinc	5		0.05 U		0.05 U	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	B-1-071603	CB-1-072103	CB-1-F	CB-1-U	CB-10-072903	CB-11A-072403	FD002-072403	CB-12-072903	CB-2-071403	CB-2-F
Date Sampled	GW-1	7/16/2003	7/21/2003	10/22/2002	10/22/2002	7/29/2003	7/24/2003	7/24/2003	7/29/2003	7/14/2003	10/22/2002
PCBs (µg/L)											
Aroclor-1254	0.5	0.25 U	0.25 U	0.05 U	0.05 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.05 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-2-U	CB-3-071603	CB-7-072303	CB-8-072303	CB-9-072403	CB-9-F	CB-9-U	DUP-1-102102	DUP-2-102102	CW-11-072503	CW-2-072403	CW-2-F
Date Sampled	GW-1	10/22/2002	7/16/2003	7/23/2003	7/23/2003	7/24/2003	10/21/2002	10/21/2002	10/21/2002	10/21/2002	7/25/2003	7/24/2003	10/22/2002
PCBs (µg/L)													
Aroclor-1254	0.5	0.05 U	0.25 U	0.25 U	0.25 U	0.25 U	0.05 U	0.05 U	0.05 U	0.055 U	0.25 U	0.25 U	0.055 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CW-2-U	CW-3-072303	CW-4-072403	CW-5-072103	CW-6-071503	CW-6-F	CW-6-U	FD001-071503	CW-7-071503	CW-7-F	CW-7-U	CW-8-071503
Date Sampled	GW-1	10/22/2002	7/23/2003	7/24/2003	7/21/2003	7/15/2003	10/22/2002	10/22/2002	7/15/2003	7/15/2003	10/22/2002	10/22/2002	7/15/2003
PCBs (µg/L)													
Aroclor-1254	0.5	0.05 U	0.25 U	0.25 U	0.25 U	0.25 U	0.05 U	0.05 U	0.25 U	0.25 U	0.05 U	0.055 U	0.25 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	ERM-SS-04C	ERM-SS-04D	MW-1-072303	MW-100A-091103	MW-100B-091103	MW-101B-091203	MW-101C-091603	MW-102A-091003	MW-102B-091003	MW-102C-091003
Date Sampled	GW-1	9/10/1997	9/10/1997	7/23/2003	9/11/2003	9/11/2003	9/12/2003	9/16/2003	9/10/2003	9/10/2003	9/10/2003
PCBs (µg/L)											
Aroclor-1254	0.5	0.5 U	0.5 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-104B-031104	MW-104B-031104-F	MW-104B-FD001-031104	MW-104B-FD001-031104-F	MW-104C-031604	MW-105B-090903	MW-105C-090903	FD006-031307	FD007-091306
Date Sampled	GW-1	3/11/2004	3/11/2004	3/11/2004	3/11/2004	3/16/2004	9/9/2003	9/9/2003	3/13/2007	9/13/2006
PCBs (µg/L)										
Aroclor-1254	0.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.222 U	0.2 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-107B Soluble-082904	MW-107B-031304	MW-107B-031307	MW-107B-042606	MW-107B-052204	MW-107B-052204-F	MW-107B-082904	MW-107B-091306	MW-107B-111904
Date Sampled	GW-1	8/29/2004	3/13/2004	3/13/2007	4/26/2006	5/22/2004	5/22/2004	8/29/2004	9/13/2006	11/19/2004
PCBs (µg/L)										
Aroclor-1254	0.5	0.25 U	5.5 J	0.211 U	0.211 U	3.9 J	0.38	0.42	0.202 U	0.25 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-107BF-042606	MW-107C-031304	FD 005-052204	MW-107D Soluble-082804	MW-107D-031304	MW-107D-031407	MW-107D-042506	MW-107D-052204	MW-107D-082804
Date Sampled	GW-1	4/26/2006	3/13/2004	5/22/2004	8/28/2004	3/13/2004	3/14/2007	4/25/2006	5/22/2004	8/28/2004
PCBs (µg/L)										
Aroclor-1254	0.5	0.211 U	0.25 U	0.25 U	0.25 U	2	0.242 U	0.2 U	0.25 U	0.45

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-107D-091406	MW-107D-111904	MW-107DF-042506	MW-109B-090704	MW-109C-090704	MW-109D-090704	MW-110A-031307	MW-110A-042506	MW-110A-091906
Date Sampled	GW-1	9/14/2006	11/19/2004	4/25/2006	9/7/2004	9/7/2004	9/7/2004	3/13/2007	4/25/2006	9/19/2006
PCBs (µg/L)										
Aroclor-1254	0.5	0.222 U	0.25 U	0.2 U	0.25 U	0.25 U	0.25 U	0.235 U	0.205 U	0.0211 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-110AF-042506	MW-2-072203	FD-001-052204	FD-001-052204-F	FD002-082104	FD002-082104-F	FD002-111404	FD002-111404-F	MW-5 Filtered-120103	MW-5-030304
Date Sampled	GW-1	4/25/2006	7/22/2003	5/22/2004	5/22/2004	8/21/2004	8/21/2004	11/14/2004	11/14/2004	12/1/2003	3/3/2004
PCBs (µg/L)											
Aroclor-1254	0.5	0.205 U	0.25 U	2.6 J	1.4	3.4 J	0.25 U	2.8	R	1.5 J	0.25 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-5-031704	MW-5-031704-F	MW-5-052204	MW-5-052204-F	MW-5-072203	MW-5-082104	MW-5-082104-F	MW-5-111404	MW-5-111404-F	MW-5-120103	MW-5-F
Date Sampled	GW-1	3/17/2004	3/17/2004	5/22/2004	5/22/2004	7/22/2003	8/21/2004	8/21/2004	11/14/2004	11/14/2004	12/1/2003	10/21/2002
PCBs (µg/L)												
Aroclor-1254	0.5	3.1	1.5	3.7 J	1.8 J	4.6	3 J	0.25 U	2.4 J	R	2.2 J	0.05 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - PCBs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-5-U	MW-6-072203	MW-6-102101-F	MW-6-U
Date Sampled	GW-1	10/21/2002	7/22/2003	10/21/2002	10/21/2002
PCBs (µg/L)					
Aroclor-1254	0.5	4	0.25 U	0.05 U	0.05 U

4 > MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	B-1-071603	CB-1-072103	CB-10-072903	CB-11A-072403	FD002-072403	CB-12-072903	CB-2-071403	CB-3-071603	CB-7-072303
Date Sampled	GW-1	7/16/2003	7/21/2003	7/29/2003	7/24/2003	7/24/2003	7/29/2003	7/14/2003	7/16/2003	7/23/2003
SVOC (µg/L)										
Acenaphthene	20	0.2 UJ	0.2 UJ	0.16 J	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Acenaphthylene	300	0.2 UJ	0.2 UJ	0.17 J	0.2 UJ	0.2 UJ	0.38 J	0.2 UJ	0.2 UJ	0.2 UJ
Anthracene	2000	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
Benzo(a)anthracene	1	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Benzo(a)pyrene	0.2	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Benzo(b)fluoranthene	1	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Benzo(g,h,i)perylene	300	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Benzo(k)fluoranthene	1	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 U	10 UJ	10 U	10 U	2.6 J	3.8 J	10 U	10 U	10 U
Chrysene	2	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Dibenzo(a,h)anthracene	0.5	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Diethyl phthalate	2000	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	90	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Fluorene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Indeno(1,2,3-cd)pyrene	0.5	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 U
Naphthalene	140	0.2 UJ	0.2 UJ	0.2	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Pentachlorophenol	1	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U
Phenanthrene	300	0.2 UJ	0.2 U	0.16 J	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
Phenol	900	10 U	R	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	80	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-8-072303	CB-9-072403	CW-11-072503	CW-2-072403	CW-3-072303	CW-4-072403	CW-4-082504	FD001-082504	CW-5-072103	CW-6-071503
Date Sampled	GW-1	7/23/2003	7/24/2003	7/25/2003	7/24/2003	7/23/2003	7/24/2003	8/25/2004	8/25/2004	7/21/2003	7/15/2003
SVOC (µg/L)											
Acenaphthene	20	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Acenaphthylene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Anthracene	2000	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
Benzo(a)anthracene	1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Benzo(a)pyrene	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Benzo(b)fluoranthene	1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Benzo(g,h,i)perylene	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Benzo(k)fluoranthene	1	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 U	3 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Dibenzo(a,h)anthracene	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Diethyl phthalate	2000	10 U	10 U	10 U	10 U	10 U	10 U	3.5 J	4.2 J	10 U	10 U
Fluoranthene	90	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Fluorene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.1 J	0.11 J	0.2 UJ	0.2 UJ
Indeno(1,2,3-cd)pyrene	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Naphthalene	140	0.2 UJ	0.2 UJ	0.15 J	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Pentachlorophenol	1	1 U	1 UJ	1 UJ	1 UJ	1 U	R	1 U	1 U	1 UJ	1 UJ
Phenanthrene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.11 J	0.2 U	0.2 U	0.2 UJ
Phenol	900	R	10 U	R	10 U	10 U	R	5.7 J	10 U	10 U	10 U
Pyrene	80	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	FD001-071503	CW-7-071503	CW-8-071503	MW-1-072303	MW-100A-091103	MW-100B-091103	MW-101B-091203	MW-101C-091603	MW-102A-091003
Date Sampled	GW-1	7/15/2003	7/15/2003	7/15/2003	7/23/2003	9/11/2003	9/11/2003	9/12/2003	9/16/2003	9/10/2003
SVOC (µg/L)										
Acenaphthene	20	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Acenaphthylene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Anthracene	2000	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Benzo(a)anthracene	1	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Benzo(a)pyrene	0.2	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Benzo(b)fluoranthene	1	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Benzo(g,h,i)perylene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Benzo(k)fluoranthene	1	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	4.9 J
Chrysene	2	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Dibenzo(a,h)anthracene	0.5	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Diethyl phthalate	2000	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U
Fluoranthene	90	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Fluorene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Indeno(1,2,3-cd)pyrene	0.5	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Naphthalene	140	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Pentachlorophenol	1	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 U	1 U	1 UJ	1 UJ
Phenanthrene	300	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ
Phenol	900	10 U	10 U	10 U	10 U	10 UJ	R	10 U	10 U	10 U
Pyrene	80	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.13 J	0.2 UJ

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-102B-091003	MW-102C-091003	FD-004-060304	MW-104B-031104	MW-104B-060304	MW-104B-FD001-031104	MW-104C-031604	MW-104C-060204
Date Sampled	GW-1	9/10/2003	9/10/2003	6/3/2004	3/11/2004	6/3/2004	3/11/2004	3/16/2004	6/2/2004
SVOC (µg/L)									
Acenaphthene	20	0.2 UJ	0.06 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Acenaphthylene	300	0.2 UJ	0.2 UJ	0.2 UJ	10 U	0.2 UJ	10 U	10 U	0.2 U
Anthracene	2000	0.2 UJ	0.15 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Benzo(a)anthracene	1	0.2 UJ	0.15 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Benzo(a)pyrene	0.2	0.2 UJ	0.13 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Benzo(b)fluoranthene	1	0.2 UJ	0.16 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 UJ
Benzo(g,h,i)perylene	300	0.2 UJ	0.13 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 UJ
Benzo(k)fluoranthene	1	0.2 U	0.2 UJ	0.2 U	10 U	0.2 U	10 U	10 U	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 UJ	3.6 J		3.2 J		10 UJ	10 U	
Chrysene	2	0.2 UJ	0.15 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Dibenzo(a,h)anthracene	0.5	0.2 UJ	0.11 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 UJ
Diethyl phthalate	2000	10 U	10 U		10 U		10 U	10 U	
Fluoranthene	90	0.2 UJ	0.18 J	0.2 U	10 U	0.2 U	10 U	10 U	0.22 J
Fluorene	300	0.2 UJ	0.06 J	0.2 UJ	10 U	0.2 UJ	10 U	10 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.5	0.2 UJ	0.12 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 UJ
Naphthalene	140	0.11 J	0.06 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U
Pentachlorophenol	1	1 UJ	1 UJ	1 UJ	50 U	1 UJ	50 U	50 U	1 U
Phenanthrene	300	0.2 UJ	0.18 J	0.2 U	10 U	0.2 U	10 U	10 U	0.11 J
Phenol	900	10 U	10 U		10 U		10 U	10 U	
Pyrene	80	0.2 UJ	0.3 J	0.2 U	10 U	0.2 U	10 U	10 U	0.2 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-105B-031307 3/13/2007	MW-105B-042006 4/20/2006	MW-105B-090903 9/9/2003	MW-105B-092006 9/20/2006	MW-105C-090903 9/9/2003	MW-107B-031304 3/13/2004	MW-107B-052204 5/22/2004	MW-107C-031304 3/13/2004	MW-107C-031307 3/13/2007
SVOC (µg/L)										
Acenaphthene	20	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Acenaphthylene	300	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Anthracene	2000	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Benzo(a)anthracene	1	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Benzo(a)pyrene	0.2	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Benzo(b)fluoranthene	1	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Benzo(g,h,i)perylene	300	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Benzo(k)fluoranthene	1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	10 U		10 U	0.2 U
bis(2-Ethylhexyl)phthalate	6	5.26 U	5.26 U	7.9 J	5.56 U	10 UJ	10 U	10 U	10 U	5.56 U
Chrysene	2	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Dibenzo(a,h)anthracene	0.5	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Diethyl phthalate	2000	5.26 U	5.26 U	10 U	5.56 U	10 U	10 U	10 U	10 U	5.56 U
Fluoranthene	90	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Fluorene	300	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.5	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Naphthalene	140	5.26 U	5.26 U	0.09 J	5.56 U	0.2 UJ	10 U		10 U	5.56 U
Pentachlorophenol	1	1 U	1 UJ	1 UJ	1 U	1 UJ	50 U		2.3 J	1 U
Phenanthrene	300	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U
Phenol	900	5.26 U	5.26 UJ	10 U	5.56 U	10 U	2.2 J	10 U	10 UJ	5.56 U
Pyrene	80	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	10 U		10 U	0.2 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-107C-042606	MW-107C-052204	MW-107D-031304	MW-107D-052204	FD003-092006	MW-109B-030507	MW-109B-050306	MW-109B-090704	MW-109B-092006
Date Sampled	GW-1	4/26/2006	5/22/2004	3/13/2004	5/22/2004	9/20/2006	3/5/2007	5/3/2006	9/7/2004	9/20/2006
SVOC (µg/L)										
Acenaphthene	20	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acenaphthylene	300	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Anthracene	2000	0.2 U	0.2 UJ	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.1 J	0.2 U
Benzo(a)anthracene	1	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(a)pyrene	0.2	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(b)fluoranthene	1	0.126 J	0.2 UJ	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	300	0.126 J	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	1	0.147 J	0.2 UJ	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
bis(2-Ethylhexyl)phthalate	6	5.26 U		10 U		5.56 U	5.41 U	5.26 U	10 U	5.26 U
Chrysene	2	0.2 U	0.2 UJ	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibenzo(a,h)anthracene	0.5	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Diethyl phthalate	2000	5.26 U		10 U		5.56 U	5.41 U	5.26 U	10 U	5.26 U
Fluoranthene	90	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.12 J	0.2 U
Fluorene	300	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.5	0.2 U	0.2 U	10 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Naphthalene	140	5.26 UJ	0.27 UJ	10 U	0.2 UJ	5.56 U	5.41 U	5.26 U	0.2 U	5.26 U
Pentachlorophenol	1	1 U	1 U	50 UJ	1 U	1 U	1 U	1 U	14 J	1 U
Phenanthrene	300	0.2 U	0.18 J	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.1 J	0.042 J
Phenol	900	5.26 U		10 UJ		5.56 U	5.41 U	5.26 U	10 U	5.26 U
Pyrene	80	0.2 U	0.1 J	10 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.13 J	0.2 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-109C-030807 3/8/2007	MW-109C-042406 4/24/2006	MW-109C-090704 9/7/2004	MW-109C-091906 9/19/2006	MW-109D-030507 3/5/2007	MW-109D-042606 4/26/2006	MW-109D-090704 9/7/2004	MW-109D-092006 9/20/2006	MW-2-072203 7/22/2003
SVOC (µg/L)										
Acenaphthene	20	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Acenaphthylene	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Anthracene	2000	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.12 J	0.2 U	0.2 U
Benzo(a)anthracene	1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(a)pyrene	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(b)fluoranthene	1	0.2 U	0.2 U	0.2 U						
Benzo(g,h,i)perylene	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
bis(2-Ethylhexyl)phthalate	6	5.41 U	5.13 U	10 U	5.26 U	5.56 U	5.56 U	10 U	5.56 U	10 U
Chrysene	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibenzo(a,h)anthracene	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Diethyl phthalate	2000	5.41 U	5.13 U	10 U	5.26 U	5.56 U	5.56 U	10 U	5.56 U	10 U
Fluoranthene	90	0.2 U	0.2 UJ	0.11 J	0.2 U	0.2 U	0.2 U	0.11 J	0.2 U	0.2 U
Fluorene	300	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Indeno(1,2,3-cd)pyrene	0.5	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Naphthalene	140	5.41 U	5.13 U	0.2 U	5.26 U	5.56 U	5.56 UJ	0.2 U	5.56 U	0.2 UJ
Pentachlorophenol	1	1 U	1 UJ	6.2 J	1 U	1 U	1 U	2.1 J	1 U	1 U
Phenanthrene	300	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	0.2 U	0.2 UJ
Phenol	900	5.41 U	5.13 U	10 U	5.26 U	5.56 U	5.56 U	10 U	5.56 U	10 U
Pyrene	80	0.2 U	0.2 U	0.11 J	0.2 U	0.2 U	0.2 U	0.11 J	0.033 J	0.2 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - SVOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-5-072203 7/22/2003	MW-6-072203 7/22/2003
SVOC (µg/L)			
Acenaphthene	20	0.2 UJ	0.2 UJ
Acenaphthylene	300	0.2 UJ	0.2 UJ
Anthracene	2000	0.2 U	0.2 UJ
Benzo(a)anthracene	1	0.2 U	0.2 UJ
Benzo(a)pyrene	0.2	0.2 U	0.2 UJ
Benzo(b)fluoranthene	1	0.2 U	0.2 UJ
Benzo(g,h,i)perylene	300	0.2 U	0.2 UJ
Benzo(k)fluoranthene	1	0.2 U	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 U	10 U
Chrysene	2	0.2 U	0.2 UJ
Dibenzo(a,h)anthracene	0.5	0.2 U	0.2 UJ
Diethyl phthalate	2000	10 U	10 U
Fluoranthene	90	0.2 U	0.2 UJ
Fluorene	300	0.2 UJ	0.2 UJ
Indeno(1,2,3-cd)pyrene	0.5	0.2 U	0.2 UJ
Naphthalene	140	0.2 UJ	0.2 UJ
Pentachlorophenol	1	1 UJ	1 UJ
Phenanthrene	300	0.2 U	0.2 UJ
Phenol	900	10 U	10 U
Pyrene	80	0.2 UJ	0.2 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	B-1-071603	CB-1-072103	CB-10-072903	CB-11A-072403	FD002-072403	CB-12-072903	CB-2-071403	CB-3-030804	CB-3-071603	CB-3-120103
Date Sampled	GW-1	7/16/2003	7/21/2003	7/29/2003	7/24/2003	7/24/2003	7/29/2003	7/14/2003	3/8/2004	7/16/2003	12/1/2003
TPH (µg/L)											
TPH-DRO	200	33	25 U	58	43	43	25 U	55 J	72 J	230 J	45 J
TPH-GRO	200	10 U	10 U	10 U	10 U	10 U	10 U	10 U		10 U	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-3-FD004-030804	CB-7-072303	CB-8-072303	CB-9-072403	CW-11-072503	CW-2-072403	CW-3-072303	CW-4-072403	CW-5-072103	CW-6-071503	FD001-071503
Date Sampled	GW-1	3/8/2004	7/23/2003	7/23/2003	7/24/2003	7/25/2003	7/24/2003	7/23/2003	7/24/2003	7/21/2003	7/15/2003	7/15/2003
TPH (µg/L)												
TPH-DRO	200	46 J	35	69	280 J	44	98	57	25 U	61	25 U	25 U
TPH-GRO	200		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CW-7-071503	CW-8-071503	MW-1-072303	MW-100A-091103	MW-100B-091103	MW-101B-091203	MW-101C-091603	MW-102A-091003	MW-102B-091003	MW-102C-091003
Date Sampled	GW-1	7/15/2003	7/15/2003	7/23/2003	9/11/2003	9/11/2003	9/12/2003	9/16/2003	9/10/2003	9/10/2003	9/10/2003
TPH (µg/L)											
TPH-DRO	200	25 U	25 U	99	260 J	25 U	25 U	180	430 J	25 U	720 J
TPH-GRO	200	10 U	10 U	10 U	10 U	10 U	10 U	10 U	43	10 U	15

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - TPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-105B-090903	MW-105C-090903	MW-2-072203	MW-5-072203	MW-6-072203
Date Sampled	GW-1	9/9/2003	9/9/2003	7/22/2003	7/22/2003	7/22/2003
TPH (µg/L)						
TPH-DRO	200	25 U	25 U	25 U	32	110
TPH-GRO	200	10 U	10 U	16	10 U	10 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	B-1-071603 7/16/2003	CB-1-072103 7/21/2003	CB-10-072903 7/29/2003	CB-11A-072403 7/24/2003	FD002-072403 7/24/2003	CB-12-072903 7/29/2003	CB-2-071403 7/14/2003	CB-3-050306 5/3/2006	CB-3-071603 7/16/2003
VOC (µg/L)										
Acetone	3000	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	R	10 UJ
Benzene	5	1 U	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U
2-Butanone	4000	10 U	10 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U	10 U
n-Butylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
Carbon disulfide		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 UJ
Chloroform	5	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U
Chloromethane		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	2 U	5 U
Dichlorodifluoromethane		5 U	5 U	5 UJ	5 UJ	5 UJ	0.84 J	5 U	2 U	5 U
1,1-Dichloroethane	70	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
1,1-Dichloroethene	7	2 U	2 UJ	2 UJ	2 U	2 U	2 UJ	2 U	1 U	2 UJ
1,4-Dioxane									R	
Ethylbenzene	700	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
2-Hexanone		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	10 U	5 U
Iodomethane		5 U	5 U	5 UJ	R	R	5 UJ	5 U		5 UJ
Isopropylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
4-Isopropyltoluene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
4-Methyl-2-pentanone	350	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	10 U	5 U
Methylene chloride	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U	2 UJ
Methyl-t-butyl ether	70	0.68 J	5 U	3.1 J	5 U	5 U	5 UJ	5 U	1 U	0.77 J
Naphthalene	140	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
n-Propylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
Tetrahydrofuran		5 U	5 U	5 UJ	5 U	5 U	5 UJ	R	1.3 J	5 UJ
Toluene	1000	5 U	5 UJ	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
1,1,1-Trichloroethane	200	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 UJ
1,2,4-Trimethylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
1,3,5-Trimethylbenzene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
o-Xylene		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	1 U	5 U
m+p-Xylenes		5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	2 U	5 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	FD003-050306	CB-7-072303	CB-8-072303	CB-9-072403	CW-11-072503	CW-2-072403	CW-3-072303	CW-4-072403	CW-5-072103	CW-5R-101006
Date Sampled	GW-1	5/3/2006	7/23/2003	7/23/2003	7/24/2003	7/25/2003	7/24/2003	7/23/2003	7/24/2003	7/21/2003	10/10/2006
VOC (µg/L)											
Acetone	3000	R	10 UJ	10 U	3.4 J	10 UJ	10 U	10 U	10 U	10 UJ	10 U
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	R	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
n-Butylbenzene		1 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	1 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	2 U
Dichlorodifluoromethane		2 UJ	0.67 J	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 UJ	2 U
1,1-Dichloroethane	70	1 U	5 U	5 U	0.8 J	5 U	5 U	5 U	5 U	5 U	1 U
1,1-Dichloroethene	7	1 U	2 UJ	2 UJ	2 U	2 U	2 U	2 UJ	2 UJ	2 UJ	1 U
1,4-Dioxane		R									20 U
Ethylbenzene	700	1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
2-Hexanone		10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Iodomethane			5 U	R	R	5 U	R	R	R	5 U	
Isopropylbenzene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
4-Isopropyltoluene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
4-Methyl-2-pentanone	350	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U
Methylene chloride	5	10 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	10 U
Methyl-t-butyl ether	70	1 U	5 U	5 U	5 U	2.7 J	5 U	5 U	5 U	5 U	1 U
Naphthalene	140	1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
n-Propylbenzene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
Tetrahydrofuran		1 J	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	10 U
Toluene	1000	1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
1,1,1-Trichloroethane	200	1 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	1 U
1,2,4-Trimethylbenzene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
1,3,5-Trimethylbenzene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
o-Xylene		1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
m+p-Xylenes		2 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	FD001-101006 10/10/2006	CW-6-071503 7/15/2003	FD001-071503 7/15/2003	CW-7-032005 3/20/2005	CW-7-071503 7/15/2003	FD005-032005 3/20/2005	CW-8-071503 7/15/2003	MW-1-072303 7/23/2003	MW-100A-091103 9/11/2003	MW-100B-091103 9/11/2003
VOC (µg/L)											
Acetone	3000	10 U	10 U	10 U	R	10 U	R	10 U	10 UJ	10 UJ	10 UJ
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
2-Butanone	4000	10 U	10 U	10 U	10 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 UJ
n-Butylbenzene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
Carbon disulfide		5 U	5 U	5 U	5 U	6.9	5 U	5 U	5 U	5 UJ	5 UJ
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 J	1 UJ
Chloromethane		2 U	5 U	5 U	2 U	5 U	2 U	5 U	5 U	1.6 J	0.59 J
Dichlorodifluoromethane		2 U	5 U	5 U	2 U	5 U	2 U	5 U	5 UJ	5 UJ	5 UJ
1,1-Dichloroethane	70	1 U	5 U	5 U	1.7	5 U	1.8	5 U	5 U	5 UJ	5 UJ
1,1-Dichloroethene	7	1 U	2 U	2 U	1 U	2 U	1 U	2 U	2 UJ	2 UJ	2 UJ
1,4-Dioxane		20 U			R		R				
Ethylbenzene	700	1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
2-Hexanone		10 U	5 U	5 U	10 UJ	5 U	10 UJ	5 U	5 U	5 UJ	5 UJ
Iodomethane			5 U	5 U		5 U		5 U	5 U	5 UJ	5 UJ
Isopropylbenzene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
4-Isopropyltoluene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
4-Methyl-2-pentanone	350	10 U	5 U	5 U	10 UJ	5 U	10 UJ	5 U	5 U	5 UJ	5 UJ
Methylene chloride	5	10 U	2 U	2 U	10 U	2 U	10 U	2 U	2 U	2 UJ	2 UJ
Methyl-t-butyl ether	70	1 U	5 U	1.9 J	2	2 J	2	5 U	5 U	5 UJ	5 UJ
Naphthalene	140	1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
n-Propylbenzene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
Tetrahydrofuran		10 U	5 U	R	R	R	R	5 U	5 U	R	R
Toluene	1000	1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
1,1,1-Trichloroethane	200	1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
1,2,4-Trimethylbenzene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
1,3,5-Trimethylbenzene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
o-Xylene		1 U	5 U	5 U	1 U	5 U	1 U	5 U	5 U	5 UJ	5 UJ
m+p-Xylenes		2 U	5 U	5 U	2 U	5 U	2 U	5 U	5 U	5 UJ	5 UJ

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	208/MW101A-062806 6/28/2006	MW-101B-050106 5/1/2006	MW-101B-052204 5/22/2004	MW-101B-091203 9/12/2003	FD001-111404 11/14/2004	FD-002-052204 5/22/2004	FD003-031907 3/19/2007	FD003-031907-RE 3/19/2007	FD004-082204 8/22/2004
VOC (µg/L)										
Acetone	3000	232 J	R	98 J	10 UJ	3400	11000 J	3450 E	3640	5500 J
Benzene	5	1.3	1 U	0.5 U	1 UJ	50 U	1 U	1 U	50 U	1 U
2-Butanone	4000	41.6 J	10 U	5 U	10 UJ	500 U	10 U	15	500 U	10 U
n-Butylbenzene		1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
Carbon disulfide		5 U	5 U	5 U	5 UJ	500 U	25 J	0.8 J	250 U	11
Chloroform	5	1 U	1 U	0.75 U	1 UJ	75 U	0.83 J	1 U	50 U	0.49 J
Chloromethane		2 U	2 U	2.5 U	5 UJ	250 U	5 U	2 U	100 U	5 U
Dichlorodifluoromethane		2 U	2 U	5 U	5 UJ	500 U	5 U	2 U	100 U	5 U
1,1-Dichloroethane	70	1 U	1 U	0.75 U	5 UJ	75 U	5 U	1 U	50 U	5 U
1,1-Dichloroethene	7	1 U	1 U	0.5 U	2 UJ	50 U	2 U	1 U	50 U	2 U
1,4-Dioxane		36.6 J	R	250 U				20 U	1000 U	
Ethylbenzene	700	1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
2-Hexanone		10 UJ	10 U	5 U	5 UJ	500 U	5 U	10 U	500 U	5 UJ
Iodomethane				5 U	5 UJ	500 U	5 U			5 UJ
Isopropylbenzene		1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
4-Isopropyltoluene		1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
4-Methyl-2-pentanone	350	1.4 J	10 U	5 U	5 UJ	500 U	0.82 J	10 U	500 U	5 UJ
Methylene chloride	5	10 U	10 U	5 U	3.8 U	500 U	2 U	10 U	500 U	2 U
Methyl-t-butyl ether	70	1 U	1 U	1 U	5 UJ	100 U	5 U	1 U	50 U	5 UJ
Naphthalene	140	1 UJ	1 U	2.5 U	5 UJ			1 U	50 U	
n-Propylbenzene		1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
Tetrahydrofuran		1.2 J	15	10 U	R	1000 U	5 U	74	60.5 J	5 UJ
Toluene	1000	0.6 J	1 U	0.75 U	5 UJ	75 U	5 U	1 U	50 U	0.2 J
1,1,1-Trichloroethane	200	1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
1,2,4-Trimethylbenzene		1 U	1 U	2.5 U	5 UJ	250 U	5 U	1 U	50 U	5 U
1,3,5-Trimethylbenzene		1 U	1 U	2.5 U	5 UJ	250 U	5 U	1 U	50 U	5 U
o-Xylene		1 U	1 U	0.5 U	5 UJ	50 U	5 U	1 U	50 U	5 U
m+p-Xylenes		2 U	2 U	0.5 U	5 UJ	50 U	5 U	2 U	100 U	5 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	FD004-091406 9/14/2006	MW-101C-031907 3/19/2007	MW-101C-052204 5/22/2004	MW-101C-082204 8/22/2004	MW-101C-091406 9/14/2006	MW-101C-091603 9/16/2003	MW-101C-111404 11/14/2004	MW-101C-120706 12/7/2006	MW-101C-120706-RE 12/7/2006
VOC (µg/L)										
Acetone	3000	1390 J	2890	14000 J	3800 J	1670 J	690 J	2900		3570
Benzene	5	25 U	50 U	1 U	1 U	25 U	1 UJ	50 U	10 U	
2-Butanone	4000	R	500 U	10 U	10 U	R	10 UJ	500 U	35.1 J	
n-Butylbenzene		25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
Carbon disulfide		125 U	250 U	19 J	11 J	125 U	5 UJ	500 U	5.1 J	
Chloroform	5	25 U	50 U	0.75 J	0.54 J	25 U	1.7 J	75 U	10 U	
Chloromethane		50 UJ	100 U	5 U	5 U	50 UJ	5 UJ	250 U	20 U	
Dichlorodifluoromethane		50 U	100 U	5 U	5 U	50 U	5 UJ	500 U	20 U	
1,1-Dichloroethane	70	25 U	50 U	5 U	5 U	25 U	5 UJ	75 U	10 U	
1,1-Dichloroethene	7	25 U	50 U	2 U	2 U	25 U	2 UJ	50 U	10 U	
1,4-Dioxane		R	1000 U	10000 U	5000 U	R			200 U	
Ethylbenzene	700	25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
2-Hexanone		250 UJ	500 U	5 U	5 U	250 UJ	5 UJ	500 U	100 U	
Iodomethane				5 U	5 UJ		5 UJ	500 U		
Isopropylbenzene		25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
4-Isopropyltoluene		25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
4-Methyl-2-pentanone	350	250 UJ	500 U	5 U	5 U	250 UJ	5 UJ	500 U	100 U	
Methylene chloride	5	250 UJ	500 U	2 UJ	2 U	250 UJ	2 UJ	500 U	100 U	
Methyl-t-butyl ether	70	25 U	50 U	5 U	5 U	25 U	5 UJ	100 U	10 U	
Naphthalene	140	25 U	50 U	100 U	50 U	25 U	5 UJ		10 U	
n-Propylbenzene		25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
Tetrahydrofuran		72.2 J	62.5 J	5 U	5 U	198 J	R	1000 U	212	
Toluene	1000	25 U	50 U	5 U	5 U	25 U	5 UJ	75 U	10 U	
1,1,1-Trichloroethane	200	25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
1,2,4-Trimethylbenzene		25 U	50 U	5 U	5 U	25 U	5 UJ	250 U	10 U	
1,3,5-Trimethylbenzene		25 U	50 U	5 U	5 U	25 U	5 UJ	250 U	10 U	
o-Xylene		25 U	50 U	5 U	5 U	25 U	5 UJ	50 U	10 U	
m+p-Xylenes		50 U	100 U	5 U	5 U	50 U	5 UJ	50 U	20 U	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-102A-091003 9/10/2003	MW-102B-091003 9/10/2003	MW-102C-042406 4/24/2006	MW-102C-091003 9/10/2003	MW-102C-111404 11/14/2004	FD001-042506 4/25/2006	MW-102D-042506 4/25/2006	MW-104A-042606 4/26/2006	MW-104B-031104 3/11/2004
VOC (µg/L)										
Acetone	3000	74 J	220	R	170 J	5 U	R	R	3.2 J	1500
Benzene	5	1 UJ	1 U	1 U	1 UJ	0.5 U	0.6 J	0.6 J	1 U	1 U
2-Butanone	4000	10 UJ	10 UJ	10 U	10 UJ	5 U	3.3 J	3 J	10 U	10 U
n-Butylbenzene		5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
Carbon disulfide		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	0.87 J
Chloroform	5	1 UJ	1 U	1 U	1 UJ	0.75 U	1 U	1 U	1 U	1 UJ
Chloromethane		5 UJ	5 UJ	2 U	5 UJ	2.5 U	2 U	2 U	2 U	5 U
Dichlorodifluoromethane		5 UJ	5 UJ	2 U	5 UJ	5 U	9.7	9.9	2 U	5 UJ
1,1-Dichloroethane	70	4.7 J	5 U	0.6 J	0.87 J	0.75	1 U	1 U	1 U	5 U
1,1-Dichloroethene	7	2 UJ	2 U	1 U	2 UJ	0.5 U	1 U	1 U	1 U	2 U
1,4-Dioxane				R			22.2 J	25.8 J	R	
Ethylbenzene	700	5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
2-Hexanone		R	R	10 U	5 UJ	5 U	10 U	10 U	10 U	5 U
Iodomethane		5 UJ	5 U		5 UJ	5 U				5 U
Isopropylbenzene		5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
4-Isopropyltoluene		5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
4-Methyl-2-pentanone	350	5 UJ	5 UJ	10 U	5 UJ	5 U	10 U	10 U	10 U	5 U
Methylene chloride	5	2 UJ	2 U	10 U	2 UJ	5 U	10 U	10 U	10 U	2 U
Methyl-t-butyl ether	70	5 UJ	5 UJ	1 U	5 UJ	1 U	1 U	1 U	1 U	5 U
Naphthalene	140	5 UJ	5 U	1 U	5 UJ		1	1.1	1 U	5 U
n-Propylbenzene		5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
Tetrahydrofuran		R	R	R	R	10 U	14.4 J	14.8 J	R	5 U
Toluene	1000	5 UJ	5 U	1 U	5 UJ	0.75 U	1 U	1 U	1 U	5 U
1,1,1-Trichloroethane	200	5 UJ	5 UJ	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
1,2,4-Trimethylbenzene		5 UJ	5 U	1 U	5 UJ	2.5 U	1 U	1 U	1 U	5 U
1,3,5-Trimethylbenzene		5 UJ	5 U	1 U	5 UJ	2.5 U	1 U	1 U	1 U	5 U
o-Xylene		5 UJ	5 U	1 U	5 UJ	0.5 U	1 U	1 U	1 U	5 U
m+p-Xylenes		5 UJ	5 U	2 U	5 UJ	0.5 U	2 U	2 U	2 U	5 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
Groundwater Sample Results - VOCs
YAEC BUD/TSCA
YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-104B-FD001-031104 3/11/2004	MW-104C-031604 3/16/2004	MW-105A-041906 4/19/2006	MW-105A-071206 7/12/2006	MW-105B-042006 4/20/2006	MW-105B-090903 9/9/2003	FD 002-032705 3/27/2005	MW-105C-030304 3/3/2004
VOC (µg/L)									
Acetone	3000	1700	10 U	R	5.5 J	15.4 J	460	R	56
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	10 U	10 U	2.4 J	17.6	10 U	10 UJ	14.5 J	10 U
n-Butylbenzene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
Carbon disulfide		7.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	0.64 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		5 U	5 U	2 U	2 U	2 U	5 UJ	2 U	2.3 J
Dichlorodifluoromethane		5 UJ	5 UJ	2 UJ	2 U	2 UJ	5 UJ	2 U	5 UJ
1,1-Dichloroethane	70	5 U	5 U	1 U	1 U	2.7	4.8 J	5.8	3.8 J
1,1-Dichloroethene	7	2 U	2 U	1 U	1 U	1 U	2 U	1.5	1.3 J
1,4-Dioxane				R	R	9.3 J		R	
Ethylbenzene	700	5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
2-Hexanone		5 U	5 U	10 U	10 U	10 UJ	R	10 UJ	5 U
Iodomethane		5 U	5 U				5 U		1.2 J
Isopropylbenzene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
4-Isopropyltoluene		5 U	0.72 J	1 U	1 U	1 U	5 U	1 U	5 U
4-Methyl-2-pentanone	350	5 U	5 U	10 U	10 U	10 U	5 UJ	10 UJ	5 U
Methylene chloride	5	2 U	2 U	10 U	10 U	10 U	2 U	10 U	2 U
Methyl-t-butyl ether	70	5 U	5 U	1 U	1 U	0.9 J	1.9 J	0.9 J	1.5 J
Naphthalene	140	5 U	5 U	1 U	1 U		5 U	1 U	5 U
n-Propylbenzene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
Tetrahydrofuran		5 U	5 U	7.1 J	27.5	242 J	R	R	5 U
Toluene	1000	5 U	5 U	1 U	1 U	1 U	5 U	55.2 J	5 U
1,1,1-Trichloroethane	200	5 U	5 U	1 U	1 U	1 U	5 UJ	1 U	5 U
1,2,4-Trimethylbenzene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
1,3,5-Trimethylbenzene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
o-Xylene		5 U	5 U	1 U	1 U	1 U	5 U	1 U	5 U
m+p-Xylenes		5 U	5 U	2 U	2 U	2 U	5 U	2 U	5 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-105C-030607 3/6/2007	MW-105C-032705 3/27/2005	MW-105C-041906 4/19/2006	MW-105C-060304 6/3/2004	MW-105C-082704 8/27/2004	MW-105C-090903 9/9/2003	MW-105C-092006 9/20/2006	MW-105C-112104 11/21/2004
VOC (µg/L)									
Acetone	3000	10 U	R	37.7 J	5600 J	10 U	900	R	10 UJ
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	10 U	17.3 J	2.6 J	10 U	10 UJ	10 UJ	R	10 U
n-Butylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 UJ
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	0.86 J	1 U	1 U
Chloromethane		2 U	2 U	2 U	0.36 J	5 U	1.9 J	2 U	0.93 J
Dichlorodifluoromethane		2 U	2 U	2 UJ	5 U	5 U	5 UJ	2 U	5 U
1,1-Dichloroethane	70	4.3	6.2	2.1	2.6 J	4.9 J	3.4 J	2.2	7.4
1,1-Dichloroethene	7	1.2	1.5	0.7 J	0.86 J	1.7 J	1.3 J	0.8 J	2.6
1,4-Dioxane		11.5 J	R	10.7 J				20 U	
Ethylbenzene	700	1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
2-Hexanone		10 U	10 UJ	10 UJ	5 U	5 U	R	10 U	5 U
Iodomethane					5 UJ	5 U	5 U		5 U
Isopropylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
4-Isopropyltoluene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
4-Methyl-2-pentanone	350	10 U	10 UJ	10 U	5 U	5 U	5 J	10 U	5 U
Methylene chloride	5	10 U	10 U	10 U	2 UJ	2 U	2 U	10 U	2 UJ
Methyl-t-butyl ether	70	1.7	1	3.2	2 J	2.1 J	3.6 J	3	1.4 J
Naphthalene	140	1 U	1 U	1 U			5 U	1 U	
n-Propylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
Tetrahydrofuran		21.8	R	470 J	5 U	5 UJ	R	62.6	R
Toluene	1000	1 U	43.3 J	1 U	5 U	5 U	5 U	1 U	5 U
1,1,1-Trichloroethane	200	1 U	1 U	1 U	5 U	5 U	5 UJ	1 U	5 U
1,2,4-Trimethylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
1,3,5-Trimethylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
o-Xylene		1 U	1 U	1 U	5 U	5 U	5 U	1 U	5 U
m+p-Xylenes		2 U	2 U	2 U	5 U	5 U	5 U	2 U	5 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-105-C-112603 11/26/2003	MW-107A-042506 4/25/2006	MW-107B-031304 3/13/2004	MW-107B-042606 4/26/2006	MW-107C-031304 3/13/2004	MW-107C-042606 4/26/2006	MW-107C-111904 11/19/2004	MW-107D-031304 3/13/2004	MW-107D-031407 3/14/2007
VOC (µg/L)										
Acetone	3000	630	78.4 J	18 UJ	R	11 J	13.1 J	5 U	28 UJ	10 U
Benzene	5	1 U	1 U	1.5	1 U	1 U	1 U	0.5 U	1 U	1 U
2-Butanone	4000	10 U	24.8	10 U	10 U	10 U	36.5	5 U	10 U	10 U
n-Butylbenzene		5 U	1 U	5 U	1 U	0.71 J	1 U	0.5 U	5 U	1 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	0.75 U	1 U	1 U
Chloromethane		5 U	2 U	5 U	2 U	0.65 J	2 U	2.5 U	5 U	2 U
Dichlorodifluoromethane		5 U	0.6 J	5 UJ	2 UJ	5 UJ	2 U	5 U	5 UJ	2 U
1,1-Dichloroethane	70	3.7 J	1 U	5 U	1 U	5 U	1.9	1.7	0.81 J	1.3
1,1-Dichloroethene	7	1.5 J	1 U	2 U	1 U	2 U	1 U	0.5 U	2 U	1 U
1,4-Dioxane			9.5 J		R		9 J			20 U
Ethylbenzene	700	5 U	2.4	1.6 J	1 U	2.4 J	1 U	0.5 U	0.5 J	1 U
2-Hexanone		5 U	10 U	5 U	10 U	5 U	10 U	5 U	5 U	10 U
Iodomethane		5 U		5 UJ		5 U		5 U	5 UJ	
Isopropylbenzene		5 U	1 U	5 U	1 U	0.74 J	1 U	0.5 U	5 U	1 U
4-Isopropyltoluene		5 U	1 U	5 U	1 U	1.1 J	1 U	0.5 U	5 U	1 U
4-Methyl-2-pentanone	350	5 U	0.7 J	5 U	10 U	5 U	10 U	5 U	5 U	10 U
Methylene chloride	5	2 U	10 U	2 U	10 U	2 U	10 U	5 U	2 U	10 U
Methyl-t-butyl ether	70	2.8 J	1 U	1.5 J	1 U	5 U	0.6 J	1 U	5 U	1 U
Naphthalene	140	5 U	1 U	1.6 J	1 U	2.2 J			5 U	1 U
n-Propylbenzene		5 U	1 U	0.58 J	1 U	1.4 J	1 U	0.5 U	5 U	1 U
Tetrahydrofuran		5 U	17.3 J	5 U	16.6 J	5 U	101 J	10 U	5 U	10 U
Toluene	1000	5 U	4.8	8.7	1 U	5.3	1 U	0.75 U	1.3 J	1 U
1,1,1-Trichloroethane	200	5 U	1 U	5 U	1 U	5 U	1 U	0.5 U	5 U	1 U
1,2,4-Trimethylbenzene		5 U	0.8 J	4.1 J	1 U	8.8	1 U	2.5 U	1.8 J	1 U
1,3,5-Trimethylbenzene		5 U	1 U	1.5 J	1 U	2.9 J	1 U	2.5 U	0.71 J	1 U
o-Xylene		5 U	2.1	3.5 J	1 U	5	1 U	0.5 U	1.4 J	1 U
m+p-Xylenes		5 U	7.9	6.7	2 U	10	2 U	0.5 U	2.6 J	2 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-107D-042506 4/25/2006	MW-107D-111904 11/19/2004	MW-107E-071006 7/10/2006	MW-107F-091806 9/18/2006	MW-109A-041906 4/19/2006	MW-109B-050306 5/3/2006	MW-109B-090704 9/7/2004	MW-109C-042406 4/24/2006	MW-109C-090704 9/7/2004
VOC (µg/L)										
Acetone	3000	72 J	5 U	R	R	24.1 J	R	10 UJ	R	10 UJ
Benzene	5	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	191	5 U	10 U	10 U	121	10 U	10 U	10 U	10 U
n-Butylbenzene		1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	0.75 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2 U	2.5 U	2 U	2 U	2 U	2 U	5 U	2 U	5 U
Dichlorodifluoromethane		2 U	5 U	2 UJ	2 U	2 UJ	2 U	5 U	2 U	5 U
1,1-Dichloroethane	70	1.5	1.3	0.9 J	1	1 U	1 U	5 U	1 U	5 U
1,1-Dichloroethene	7	1 U	0.5 U	1 U	1 U	1 U	1 U	2 U	1 U	2 U
1,4-Dioxane		R		R	20 U	R	R		R	
Ethylbenzene	700	1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
2-Hexanone		10 U	5 U	10 U	10 U	10 UJ	10 U	5 UJ	10 U	5 UJ
Iodomethane			5 U					5 U		5 U
Isopropylbenzene		1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
4-Isopropyltoluene		1 U	0.5 U	1 U	1 U	1 U	1 U	0.33 J	1 U	5 U
4-Methyl-2-pentanone	350	10 U	5 U	10 U	10 U	10 U	10 U	5 U	10 U	5 U
Methylene chloride	5	10 U	5 U	10 U	10 U	10 U	10 U	2 U	10 U	2 UJ
Methyl-t-butyl ether	70	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
Naphthalene	140	1 U		1 U	1 U	1 U				
n-Propylbenzene		1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
Tetrahydrofuran		456 J	10 U	10 U	10 U	185 J	51.5 J	5 UJ	40.2 J	5 UJ
Toluene	1000	1 U	0.75 U	1 U	1 U	1 U	1 U	2.8 J	1 U	5 U
1,1,1-Trichloroethane	200	1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
1,2,4-Trimethylbenzene		1 U	2.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
1,3,5-Trimethylbenzene		1 U	2.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
o-Xylene		1 U	0.5 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U
m+p-Xylenes		2 U	0.5 U	2 U	2 U	2 U	2 U	5 U	2 U	5 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-109C-110204 11/2/2004	MW-109D-042606 4/26/2006	MW-109D-090704 9/7/2004	MW-109D-110304 11/3/2004	MW-110A-042506 4/25/2006	MW-110B-050206 5/2/2006	MW-110C-030707 3/7/2007	MW-110C-042506 4/25/2006	MW-110C-071106 7/11/2006
VOC (µg/L)										
Acetone	3000	5 U	17.7 J	10 UJ	5 U	R	R	10 U	507 J	R
Benzene	5	0.5 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	5 U	22	10 U	5 U	12.7	85.2	10 U	1160	3.8 J
n-Butylbenzene		0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	0.75 U	1 U	1 U	0.75 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2.5 U	2 U	5 U	2.5 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane		5 U	2 U	5 U	5 U	2 U	2 UJ	2 U	2 U	2 UJ
1,1-Dichloroethane	70	0.75 U	1 U	5 U	0.75 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	0.5 U	1 U	2 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane			R			R	R	20 U	R	R
Ethylbenzene	700	0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone		5 U	10 U	5 UJ	5 U	10 U	10 U	10 U	10 U	10 U
Iodomethane		5 U		5 U	5 U					
Isopropylbenzene		0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
4-Isopropyltoluene		0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	350	5 U	10 U	5 U	5 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	5	5 U	10 U	2 UJ	5 U	10 U	10 U	10 U	10 U	10 U
Methyl-t-butyl ether	70	1 U	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U
Naphthalene	140					1 U	1 U	1 U	1 U	1 U
n-Propylbenzene		0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
Tetrahydrofuran		10 U	66.8 J	5 UJ	10 U	23.9 J	175 J	10 U	1890 J	14.3
Toluene	1000	0.75 U	1 U	5 U	0.75 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene		2.5 U	1 U	5 U	2.5 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene		2.5 U	1 U	5 U	2.5 U	1 U	1 U	1 U	1 U	1 U
o-Xylene		0.5 U	1 U	5 U	0.5 U	1 U	1 U	1 U	1 U	1 U
m+p-Xylenes		0.5 U	2 U	5 U	0.5 U	2 U	2 U	2 U	2 U	2 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-110C-092106 9/21/2006	FD002-050206 5/2/2006	MW-110D-050206 5/2/2006	MW-111A-042606 4/26/2006	213/MW111B-062906 6/29/2006	MW-111B-031507 3/15/2007	MW-111B-042706 4/27/2006	MW-111B-091906 9/19/2006	MW-111C-042606 4/26/2006
VOC (µg/L)										
Acetone	3000	R	R	R	275 J	5.8 J	10 U	1000 J	R	R
Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	4000	10 UJ	33.3	35.1	383	14 J	10 U	2320	10 U	40.6 U
n-Butylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide		0.5 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2 UJ	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane		2 U	2 UJ	2 UJ	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane		R	R	R	8.4 J	R	20 U	R	20 U	R
Ethylbenzene	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Hexanone		10 UJ	0.5 J	10 U	10 U	10 UJ	10 U	10 U	10 U	1 J
Iodomethane										
Isopropylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Isopropyltoluene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-pentanone	350	10 UJ	0.6 J	10 U	10 U	10 U	10 U	10 U	10 U	1.5 J
Methylene chloride	5	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methyl-t-butyl ether	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Naphthalene	140	1 U	1 U	1 U	3.9	1 UJ	1 U	1 U	1 U	1 U
n-Propylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrahydrofuran		56.6 J	84.5 J	86 J	444 J	31.1	10 U	4470	5 J	51.9
Toluene	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m+p-Xylenes		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.2
 Groundwater Sample Results - VOCs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	FD002-101106 10/11/2006	MW112A-101106 10/11/2006	MW-112A-120606 12/6/2006	MW-2-072203 7/22/2003	MW-5-072203 7/22/2003	MW-6-072203 7/22/2003	MW-6R-101206 10/12/2006
VOC (µg/L)								
Acetone	3000	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U
Benzene	5	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
2-Butanone	4000	10 U	10 U	10 U	10 U	10 U	10 U	10 U
n-Butylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2 U	2 U	2 U	5 U	5 U	5 U	2 U
Dichlorodifluoromethane		2 U	2 U	2 U	5 U	5 UJ	5 U	9.9
1,1-Dichloroethane	70	1 U	1 U	1 U	5 U	5 U	5 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	2 UJ	2 UJ	2 U	1 U
1,4-Dioxane		20 U	20 U	20 U				20 U
Ethylbenzene	700	1 U	1 U	1 U	5 U	5 U	5 U	1 U
2-Hexanone		10 U	10 U	10 U	5 U	5 U	5 U	10 U
Iodomethane					5 U	5 U	5 U	
Isopropylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
4-Isopropyltoluene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
4-Methyl-2-pentanone	350	10 U	10 U	10 U	5 U	5 U	5 U	10 U
Methylene chloride	5	10 U	10 U	10 U	2 U	2 U	2	10 U
Methyl-t-butyl ether	70	1 U	1 U	1 U	5 U	14	5 U	1 U
Naphthalene	140	1 U	1 U	1 U	5 U	5 U	5 U	1 U
n-Propylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
Tetrahydrofuran		10 U	10 U	10 U	5 U	5 U	5 U	10 U
Toluene	1000	1 U	1 U	1 U	5 UJ	5 U	5 U	1 U
1,1,1-Trichloroethane	200	1 U	1 U	2.4	5 U	5 U	5 U	1 U
1,2,4-Trimethylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
1,3,5-Trimethylbenzene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
o-Xylene		1 U	1 U	1 U	5 U	5 U	5 U	1 U
m+p-Xylenes		2 U	2 U	2 U	5 U	5 U	5 U	2 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-3 FD-003-030804 3/8/2004	CB-3-030804 3/8/2004	CB-3-050306 5/3/2006	FD003-050306 5/3/2006	CB-9-031504 3/15/2004	CB-9-052104 5/21/2004	CW-2-052604 5/26/2004	CW-5R-101006 10/10/2006	FD001-101006 10/10/2006
VPH (µg/L)										
Adjusted C5-C8 Aliphatics				75 UJ	75 UJ					
Adjusted C9-C12 Aliphatics				25 UJ	25 UJ					
Unadjusted C5-C8 Aliphatics	400	40 U	40 U	75 UJ	75 UJ	40 U	40 U	40 U	75 U	75 U
Unadjusted C9-C12 Aliphatics	4000	40 U	40 U	25 UJ	25 UJ	40 U	40 U	76.3	25 U	8.49 J
Unadjusted C9-C10 Aromatics		40 U	40 U			40 U	40 U	45		
Methyl-t-butyl ether	70			5 U	5 U				5 U	5 U

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-100A-060704	MW-100B-060704	MW-101B-052204	FD001-111404	FD-002-052204	FD003-031907	FD004-082204	FD004-091406	MW-101C-030304
Date Sampled	GW-1	6/7/2004	6/7/2004	5/22/2004	11/14/2004	5/22/2004	3/19/2007	8/22/2004	9/14/2006	3/3/2004
VPH (µg/L)										
Adjusted C5-C8 Aliphatics							22.4 J		45.6 J	
Adjusted C9-C12 Aliphatics							9.02 J		12.2 J	
Unadjusted C5-C8 Aliphatics	400	40 U	40 U	40 U	R	3360	22.4 J	R	45.6 J	2390
Unadjusted C9-C12 Aliphatics	4000	40 U	40 U	40 U	250 U	800 U	13.4 J	250 U	12.2 J	400 U
Unadjusted C9-C10 Aromatics		40 U	40 U	40 U	250 U	800 U		250 U		400 U
Methyl-t-butyl ether	70						5 U		5 U	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-101C-031907 3/19/2007	MW-101C-052204 5/22/2004	MW-101C-082204 8/22/2004	MW-101C-091406 9/14/2006	MW-101C-111404 11/14/2004	MW-101C-120706 12/7/2006	MW-102A-030204 3/2/2004	MW-102C-030204 3/2/2004	MW-102C-111404 11/14/2004
VPH (µg/L)										
Adjusted C5-C8 Aliphatics		17.8 J			39.5 J		31 J			
Adjusted C9-C12 Aliphatics		5.49 J			10.2 J		8.66 J			
Unadjusted C5-C8 Aliphatics	400	17.8 J	3470	R	39.5 J	R	31 J	40 U	40 U	50 U
Unadjusted C9-C12 Aliphatics	4000	9.86 J	800 U	250 U	10.2 J	250 U	13.6 J	40 U	40 U	50 U
Unadjusted C9-C10 Aromatics			800 U	250 U		250 U		40 U	40 U	50 U
Methyl-t-butyl ether	70	5 U			5 U		5 U			

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-104B-031104 3/11/2004	MW-104B-060304 6/3/2004	MW-104B-FD001-031104 3/11/2004	MW-104C-031604 3/16/2004	MW-105B-042006 4/20/2006	MW-105C-041906 4/19/2006	MW-105C-092006 9/20/2006	MW-107B-031304 3/13/2004
VPH (µg/L)									
Adjusted C5-C8 Aliphatics						41.2 J	71.4 J	10.4 J	
Adjusted C9-C12 Aliphatics						25 UJ	25 UJ	25 U	
Unadjusted C5-C8 Aliphatics	400	97.3 J	40 U	368 J	40 U	41.2 J	71.4 J	10.4 J	40 U
Unadjusted C9-C12 Aliphatics	4000	40 U	40 U	40 U	40 U	25 UJ	25 UJ	25 U	45.8
Unadjusted C9-C10 Aromatics		40 U	40 U	40 U	40 U				40 U
Methyl-t-butyl ether	70					5 U	2.5 J	2.2 J	

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-107C-111904	MW-107D-031304	MW-107D-111904	MW-109B-090704	MW-109C-090704	MW-109C-110204	MW-109D-090704	MW-109D-110304	MW-2-052204
Date Sampled	GW-1	11/19/2004	3/13/2004	11/19/2004	9/7/2004	9/7/2004	11/2/2004	9/7/2004	11/3/2004	5/22/2004
VPH (µg/L)										
Adjusted C5-C8 Aliphatics										
Adjusted C9-C12 Aliphatics										
Unadjusted C5-C8 Aliphatics	400	50 U	40 U	50 U	50 U	50 U	50 U	50 U	50 U	59 U
Unadjusted C9-C12 Aliphatics	4000	50 U	40 U	50 U	50 U	50 U	50 U	50 U	50 U	40 U
Unadjusted C9-C10 Aromatics		50 U	40 U	50 U	50 U	50 U	50 U	50 U	50 U	40 U
Methyl-t-butyl ether	70									

> MCP GW-1

Appendix Table A.4.2
 Groundwater Sample Results - VPHs
 YAEC BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	FD-001-052204	MW-5-052204	MW-6-030404
Date Sampled	GW-1	5/22/2004	5/22/2004	3/4/2004
VPH (µg/L)				
Adjusted C5-C8 Aliphatics				
Adjusted C9-C12 Aliphatics				
Unadjusted C5-C8 Aliphatics	400	40 U	40 U	40 U
Unadjusted C9-C12 Aliphatics	4000	40 U	40 U	40 U
Unadjusted C9-C10 Aromatics		40 U	40 U	40 U
Methyl-t-butyl ether	70			

> MCP GW-1

Appendix Table A.4.3
 Summary Statistics of All Groundwater Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Alcohols (mg/L)</i>						
n-Butyl Alcohol	0	2	0%		0.50	
tert-Butyl Alcohol	0	2	0%		0.50	
Ethyl Alcohol	0	2	0%		0.50	
iso-Butyl Alcohol	0	2	0%		0.50	
iso-Propyl Alcohol	0	2	0%		0.50	
Methyl Alcohol	0	2	0%		0.50	
n-Propyl Alcohol	0	2	0%		0.50	
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	2	0%		0.50	
Acenaphthylene	0	2	0%		0.50	
Unadjusted C19-C36 Aliphatics	0	7	0%		64.29	
Unadjusted C9-C18 Aliphatics	0	7	0%		64.29	
Anthracene	0	2	0%		0.50	
Adjusted C11-C22 Aromatics	0	2	0%		100.00	
Unadjusted C11-C22 Aromatics	0	7	0%		64.29	
Benzo(a)anthracene	0	2	0%		0.50	
Benzo(a)pyrene	0	2	0%		0.10	
Benzo(b)fluoranthene	0	2	0%		0.50	
Benzo(g,h,i)perylene	0	2	0%		0.50	
Benzo(k)fluoranthene	0	2	0%		0.50	
Chrysene	0	2	0%		0.50	
Dibenzo(a,h)anthracene	0	2	0%		0.25	
Fluoranthene	0	2	0%		0.50	
Fluorene	0	2	0%		0.50	
Indeno(1,2,3-cd)pyrene	0	2	0%		0.25	
2-Methylnaphthalene	0	2	0%		0.50	
Naphthalene	0	2	0%		0.50	
Phenanthrene	0	2	0%		0.50	
Pyrene	0	2	0%		0.50	
Adjusted TPH	0	2	0%		100.00	
Unadjusted TPH	0	2	0%		100.00	
<i>Herbicide (µg/L)</i>						
2,4-DB	0	12	0%		2.50	
Dichloroprop	0	13	0%		2.50	
Dinoseb	0	2	0%		0.50	
2,4,5-T	0	13	0%		0.50	
2,4,5-TP (Silvex)	0	13	0%		0.50	
<i>Inorganics (mg/L)</i>						
Antimony	1	35	3%	0.0063	0.0030	0.0063
Arsenic	4	42	10%	0.0054	0.0058	0.068
Barium	26	27	96%	0.011	0.060	0.13
Beryllium	0	35	0%		0.00087	
Boron	13	56	23%	0.015	0.11	1.90
Cadmium	3	38	8%	0.00040	0.0011	0.00050
Calcium	3	3	100%	1.83	18.81	29.10
Chromium	9	38	24%	0.0022	0.0076	0.065
Copper	5	38	13%	0.0020	0.0056	0.036
Cyanide	0	18	0%		0.0050	
Iron	27	27	100%	0.084	64.00	300.00
Lead	9	41	22%	0.0029	0.0058	0.10
Lithium	0	14	0%		0.25	
Manganese	27	27	100%	0.047	5.27	11.00
Mercury	2	38	5%	0.000060	0.00010	0.00018
Nickel	10	35	29%	0.0038	0.0075	0.032
Selenium	2	38	5%	0.0070	0.018	0.0091
Silver	1	36	3%	0.0013	0.0026	0.0013
Sodium	3	3	100%	1.28	2.18	3.71
Thallium	0	34	0%		0.00078	
Zinc	4	38	11%	0.013	0.021	0.13
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	2	0%		0.11	
Aroclor-1268	0	2	0%		0.11	
Aroclor-1016	0	17	0%		0.26	
Aroclor-1221	0	17	0%		0.26	
Aroclor-1232	0	17	0%		0.26	
Aroclor-1242	0	17	0%		0.26	
Aroclor-1248	0	17	0%		0.26	
Aroclor-1254	0	17	0%		0.26	
Aroclor-1260	0	17	0%		0.26	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.3
 Summary Statistics of All Groundwater Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	21	0%		0.10	
Acenaphthylene	0	21	0%		0.10	
Aniline	0	21	0%		4.22	
Anthracene	0	21	0%		0.10	
Atrazine	0	7	0%		2.67	
Azobenzene	0	21	0%		17.56	
Benzidine	0	21	0%		7.56	
Benzo(a)anthracene	0	21	0%		0.10	
Benzo(a)pyrene	0	21	0%		0.10	
Benzo(b)fluoranthene	0	21	0%		0.10	
Benzo(g,h,i)perylene	0	21	0%		0.10	
Benzo(k)fluoranthene	0	21	0%		0.10	
Benzoic acid	0	13	0%		3.74	
Benzyl alcohol	0	21	0%		4.22	
Bis(2-chloroethoxy)methane	0	21	0%		4.22	
Bis(2-chloroethyl)ether	0	21	0%		4.22	
bis(2-Ethylhexyl)phthalate	4	21	19%	2.80	5.06	13.00
4-Bromophenyl phenyl ether	0	21	0%		4.22	
Butyl benzyl phthalate	0	21	0%		4.22	
Carbazole	0	21	0%		4.22	
4-Chloro-3-methylphenol	0	15	0%		6.58	
4-Chloroaniline	0	21	0%		4.22	
Bis(2-chloroisopropyl) ether	0	21	0%		4.22	
2-Chloronaphthalene	0	21	0%		4.22	
2-Chlorophenol	0	15	0%		3.91	
4-Chlorophenyl phenyl ether	0	21	0%		4.22	
Chrysene	0	21	0%		0.10	
Dibenzo(a,h)anthracene	0	21	0%		0.10	
Dibenzofuran	0	21	0%		4.22	
1,2-Dichlorobenzene	0	15	0%		4.85	
1,3-Dichlorobenzene	0	15	0%		4.85	
1,4-Dichlorobenzene	0	15	0%		4.85	
3,3'-Dichlorobenzidine	0	21	0%		7.56	
2,4-Dichlorophenol	0	15	0%		3.91	
Diethyl phthalate	0	21	0%		4.22	
Dimethyl phthalate	0	19	0%		4.14	
2,4-Dimethylphenol	0	15	0%		3.91	
Di-n-butyl phthalate	0	21	0%		4.22	
2,4-Dinitrophenol	0	15	0%		14.58	
2,4-Dinitrotoluene	0	21	0%		4.22	
2,6-Dinitrotoluene	0	21	0%		4.22	
Di-n-octyl phthalate	0	21	0%		4.22	
Fluoranthene	0	21	0%		0.10	
Fluorene	1	21	5%	1.00	0.15	1.00
Hexachlorobenzene	0	21	0%		3.50	
Hexachlorobutadiene	0	21	0%		3.37	
Hexachlorocyclopentadiene	0	21	0%		4.22	
Hexachloroethane	0	21	0%		4.22	
Indeno(1,2,3-cd)pyrene	0	21	0%		0.10	
Isophorone	0	21	0%		4.22	
4,6-Dinitro-2-methylphenol	0	15	0%		14.58	
1-Methylnaphthalene	0	7	0%		2.67	
2-Methylnaphthalene	0	21	0%		4.22	
3+4-Methylphenol	0	15	0%		4.81	
2-Methylphenol	0	15	0%		3.91	
Naphthalene	7	21	33%	0.080	0.99	0.34
2-Nitroaniline	0	21	0%		4.22	
3-Nitroaniline	0	21	0%		17.56	
4-Nitroaniline	0	21	0%		19.48	
Nitrobenzene	0	21	0%		4.22	
2-Nitrophenol	0	15	0%		3.91	
4-Nitrophenol	0	15	0%		17.27	
N-Nitroso-di-n-propylamine	0	21	0%		4.22	
N-Nitrosodiphenylamine	0	21	0%		4.22	
N-Nitrosodimethylamine	0	21	0%		4.22	
Pentachlorophenol	1	21	5%	0.095	0.48	0.095
Phenanthrene	0	21	0%		0.10	
Phenol	0	15	0%		3.91	
Pyrene	0	21	0%		0.10	
Pyridine	0	7	0%		2.67	
1,2,4-Trichlorobenzene	0	15	0%		4.85	
2,4,5-Trichlorophenol	0	15	0%		3.91	
2,4,6-Trichlorophenol	0	15	0%		3.91	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.3
 Summary Statistics of All Groundwater Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Total Petroleum Hydrocarbons (µg/L)</i>						
TPH-DRO	5	14	36%	53.00	58.14	230.00
TPH-GRO	0	14	0%		5.00	
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	7	31	23%	2.60	224.27	6200.00
Acrylonitrile	0	35	0%		3.07	
Allyl Chloride	0	23	0%		0.50	
t-Amyl methyl ether	0	22	0%		0.70	
Benzene	0	38	0%		0.50	
Bromobenzene	0	38	0%		1.71	
Bromochloromethane	0	38	0%		1.71	
Bromodichloromethane	0	38	0%		0.50	
Bromoform	0	38	0%		0.50	
Bromomethane	0	37	0%		1.00	
2-Butanone	1	36	3%	5.90	5.03	5.90
tert-Butyl Alcohol	0	4	0%		5.00	
n-Butylbenzene	0	38	0%		1.71	
sec-Butylbenzene	0	38	0%		1.71	
tert-Butylbenzene	0	38	0%		1.71	
Carbon disulfide	4	38	11%	0.60	2.43	5.00
Carbon Tetrachloride	0	38	0%		0.50	
Chlorobenzene	0	38	0%		1.71	
1-Chlorobutane	0	23	0%		2.50	
Chloroethane	0	38	0%		3.42	
2-Chloroethylvinyl Ether	0	18	0%		2.50	
Chloroform	0	38	0%		0.50	
Chloromethane	7	38	18%	0.52	1.65	0.90
2-Chlorotoluene	0	38	0%		1.71	
4-Chlorotoluene	0	38	0%		1.71	
1,2-Dibromo-3-chloropropane	0	27	0%		1.67	
Dibromochloromethane	0	38	0%		0.50	
1,2-Dibromoethane	0	38	0%		0.43	
Dibromomethane	0	38	0%		1.71	
1,2-dichlorobenzene	0	38	0%		1.71	
1,3-Dichlorobenzene	0	38	0%		1.71	
1,4-Dichlorobenzene	0	38	0%		0.50	
Dichlorodifluoromethane	1	38	3%	3.00	1.92	3.00
1,1-Dichloroethane	0	38	0%		1.71	
1,2-Dichloroethane	0	38	0%		0.50	
cis-1,2-Dichloroethene	0	38	0%		1.71	
trans-1,2-Dichloroethene	0	38	0%		1.71	
1,1-Dichloroethene	0	38	0%		0.80	
1,3-Dichloropropane	0	38	0%		1.71	
2,2-Dichloropropane	0	38	0%		1.71	
1,2-Dichloropropane	0	38	0%		0.50	
1,1-Dichloropropene	0	38	0%		1.61	
cis-1,3-Dichloropropene	0	38	0%		0.40	
trans-1,3-Dichloropropene	0	38	0%		0.40	
Diethyl Ether	0	38	0%		1.71	
Diisopropyl ether	0	24	0%		0.69	
1,4-Dioxane	0	7	0%		10.00	
Ethyl Methacrylate	0	23	0%		2.50	
Ethylbenzene	0	38	0%		1.71	
Ethyl-t-butyl ether	0	24	0%		0.69	
Hexachlorobutadiene	0	24	0%		0.44	
Hexachloroethane	0	14	0%		1.00	
2-Hexanone	0	37	0%		3.51	
Iodomethane	0	23	0%		2.50	
Isopropylbenzene	0	38	0%		1.71	
4-Isopropyltoluene	0	38	0%		1.71	
Methacrylonitrile	0	23	0%		2.50	
Methyl methacrylate	0	20	0%		2.50	
4-Methyl-2-Pentanone	3	38	8%	0.60	3.17	1.40
Methylene chloride	0	38	0%		2.58	
Methyl-t-butyl ether	0	38	0%		1.71	
Naphthalene	0	24	0%		1.67	
2-Nitropropane	0	17	0%		2.50	
Pentachloroethane	0	21	0%		2.50	
Propionitrile	0	9	0%		25.00	
n-Propylbenzene	0	38	0%		1.71	
Styrene	0	37	0%		1.69	
1,1,1,2-Tetrachloroethane	0	38	0%		0.50	
1,1,2,2-Tetrachloroethane	0	38	0%		0.50	
Tetrachloroethene	0	38	0%		0.50	
Tetrahydrofuran	0	24	0%		3.33	
Toluene	3	38	8%	0.32	1.55	0.47
trans-1,4-Dichloro-2-Butene	0	22	0%		2.50	
1,2,3-Trichlorobenzene	0	38	0%		1.71	
1,2,4-Trichlorobenzene	0	38	0%		1.71	
1,1,1-Trichloroethane	0	38	0%		1.71	
1,1,2-Trichloroethane	0	38	0%		0.50	
Trichloroethene	0	38	0%		0.80	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.3
 Summary Statistics of All Groundwater Sample Results --
 Outside RUA
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from YAEC Non-BUD/TSCA					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
Trichlorofluoromethane	0	38	0%		1.71	
1,2,3-Trichloropropane	0	38	0%		1.71	
1,1,2-Trichlorotrifluoroethane	0	7	0%		0.50	
1,2,4-Trimethylbenzene	0	38	0%		1.71	
1,3,5-Trimethylbenzene	0	38	0%		1.71	
Vinyl Acetate	0	23	0%		7.50	
Vinyl Chloride	0	38	0%		0.80	
o-Xylene	0	38	0%		1.71	
m+p-Xylenes	0	38	0%		1.91	
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	0	2	0%		37.50	
Adjusted C9-C12 Aliphatics	0	2	0%		12.50	
Unadjusted C5-C8 Aliphatics	1	7	14%	106.00	37.29	106.00
Unadjusted C9-C12 Aliphatics	0	7	0%		17.86	
Adjusted C9-C10 Aromatics	1	2	50%	14.30	13.40	14.30
Unadjusted C9-C10 Aromatics	0	5	0%		20.00	
Benzene	0	2	0%		2.50	
Ethylbenzene	0	2	0%		2.50	
Methyl-t-butyl ether	0	2	0%		2.50	
Naphthalene	0	2	0%		2.50	
Toluene	0	2	0%		2.50	
o-Xylene	0	2	0%		2.50	
m+p-Xylenes	0	2	0%		5.00	
<i>Wet Chemistry (mg/L)</i>						
Chemical Oxygen Demand	2	4	50%	95.00	50.75	98.00
Chloride	3	4	75%	2.20	2.78	4.20
Nitrate	0	4	0%		1.00	
Sulfate	2	4	50%	4.90	2.80	5.30
Total Alkalinity	4	4	100%	46.00	64.00	91.00
Total Dissolved Solids	4	4	100%	40.00	156.50	280.00

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-5-032204 3/22/2004	CB-5-060804 6/8/2004	CB-5-072903 7/29/2003	CB-5-081704 8/17/2004	CFW-1-031505 3/15/2005	CFW-1-031607 3/16/2007	CFW-1-031804 3/18/2004	CFW-1-060804 6/8/2004	CFW-1-080703 8/7/2003	CFW-1-081804 8/18/2004
Inorganics (mg/L)											
Antimony	0.006			0.005 U	0.005 U					0.005 U	0.005 UJ
Arsenic	0.01			0.01 U	0.01 U		0.004 U			0.01 U	0.01 U
Barium	2			0.011	0.01 U		0.0138			0.017	0.014
Boron		0.1 U	0.1 UJ	0.1 U		0.015 U		0.1 U	0.27 J	0.1 U	
Cadmium	0.005			0.003 U	0.003 U		0.0005 J			0.003 U	0.003 U
Calcium							1.83				
Chromium	0.1			0.01 U	0.01 U		0.005 U			0.01 U	0.01 U
Copper				0.01 U	0.01 U		0.0026 J			0.01 U	0.01 U
Iron				0.23	0.084 J		1.98			1.8	1.2 J
Lead	0.015			0.005 U	0.005 U		0.0041 J			0.005 U	0.005 UJ
Manganese				0.38	0.073		0.12			0.047	0.11
Mercury	0.002			0.00021 U	0.0002 U		0.0002 U			0.0002 U	0.0002 U
Nickel	0.1			0.01 U	0.01 U					0.01 U	0.01 U
Selenium	0.05			0.05 U	0.05 U		0.015 U			0.05 U	0.05 U
Silver	0.1			0.005 U	0.005 U		0.0013 J			0.005 UJ	0.005 U
Sodium							1.28				
Zinc	5			0.05 U	0.05 U		0.0126			0.05 U	0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-1-081905 8/19/2005	CFW-1-091906 9/19/2006	CFW-2-031804 3/18/2004	CFW-2-060704 6/7/2004	CFW-2-072803 7/28/2003	CFW-2-081804 8/18/2004	CFW-3-032304 3/23/2004	CFW-3-060804 6/8/2004	CFW-3-080603 8/6/2003	CFW-3-081704 8/17/2004
Inorganics (mg/L)											
Antimony	0.006	0.0027 U	0.0012 U			0.005 U	0.005 UJ			0.005 U	0.0063 J
Arsenic	0.01	0.004 UJ	0.004 U			0.01 U	0.01 U			0.01 U	0.019
Barium	2	0.012	0.0451			0.097	0.1			0.094	0.13
Boron				0.1 U	0.1 UJ	0.1 U		1.9	0.14 J	0.1 U	
Cadmium	0.005	0.0012 U	0.0005 U			0.003 U	0.003 U			0.003 U	0.003 U
Calcium											
Chromium	0.1	0.0025 U	0.0036 J			0.01 U	0.01 U			0.025	0.065
Copper		0.001 U	0.0091			0.01 U	0.01 U			0.015 U	0.01 U
Iron		0.706 J	10.7			74	70 J			180 J	300 J
Lead	0.015	0.0028 UJ	0.0056 J			R	0.005 UJ			0.005 U	0.006 J
Manganese		0.0533	0.305			10	9			8	11
Mercury	0.002	0.00004 UJ	0.0001 U			0.0002 U	0.0002 U			0.0002 U	0.0002 U
Nickel	0.1	0.0013 U	0.0073			0.013	0.01 U			0.027	0.032
Selenium	0.05	0.0075 U	0.015 U			0.05 U	0.05 U			0.05 U	0.05 U
Silver	0.1	0.005 U	0.0044 UJ			0.005 U	0.005 U			0.005 UJ	0.005 U
Sodium											
Zinc	5	0.0146 U	0.0318 U			0.05 U	0.05 U			0.05 U	0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-4-032304 3/23/2004	CFW-4-060804 6/8/2004	CFW-4-080603 8/6/2003	CFW-4-081704 8/17/2004	CFW-4-FD-002-032304 3/23/2004	FD001-081704 8/17/2004	CFW-5-030807 3/8/2007	CFW-5-031505 3/15/2005	CFW-5-032204 3/22/2004	CFW-5-060804 6/8/2004
Inorganics (mg/L)											
Antimony	0.006			0.005 U	0.005 U		0.005 U				
Arsenic	0.01			0.01 U	0.01 U		0.01 U	0.0063			
Barium	2			0.062	0.059		0.042	0.0537			
Boron		0.33	0.1 UJ	0.1 U		0.21			0.01 U	0.74	0.1 UJ
Cadmium	0.005			0.003 U	0.003 U		0.003 U	0.0025 U			
Calcium								29.1			
Chromium	0.1			0.01 U	0.02		0.01 U	0.005 U			
Copper				0.036	0.011		0.01 U	0.005 U			
Iron				10	19 J		14 J	70.6			
Lead	0.015			0.005 U	0.005 U		0.005 U	0.0075 U			
Manganese				5.7	6.7		5.1	4.28			
Mercury	0.002			0.0002 U	0.0002 U		0.0002 U	0.0002 U			
Nickel	0.1			0.01 U	0.016		0.01 U				
Selenium	0.05			0.05 U	0.05 U		0.05 U	0.015 U			
Silver	0.1			0.005 UJ	0.005 U		0.005 U	0.005 U			
Sodium								3.71			
Zinc	5			0.05 U	0.05 U		0.05 U	0.005 U			

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-5-080503 8/5/2003	CFW-5-081705 8/17/2005	CFW-5-081804 8/18/2004	CFW-5-091306 9/13/2006	CFW-6-030807 3/8/2007	CFW-6-032204 3/22/2004	CFW-6-032205 3/22/2005	CFW-6-042006 4/19/2006	CFW-6-060804 6/8/2004	CFW-6-081103 8/11/2003
Inorganics (mg/L)											
Antimony	0.006	0.005 U	0.006 U	0.005 UJ	0.015 U				0.006 U		0.005 U
Arsenic	0.01	0.01 U	0.004 U	0.01 U	0.004 U	0.0054 J			0.004 U		0.01 UJ
Barium	2	0.043	0.0612	0.061	0.0638	0.0612					0.069
Boron		0.1 U					0.6	0.01 U	0.013 U	0.1 UJ	0.1 U
Cadmium	0.005	0.003 U	0.0012 U	0.003 U	0.0012 U	0.0005 J			0.0006 U		0.003 U
Calcium						25.5					
Chromium	0.1	0.01 U	0.0025 U	0.01 U	0.005 U	0.0022 J			0.005 U		0.01 U
Copper		0.015 U	0.0012 U	0.01 U	0.025 U	0.005 U			0.0032 U		0.01 UJ
Iron		38	89.2	67	75.1	56.8					67
Lead	0.015	R	0.0048 UJ	0.005 UJ	0.0036 J	0.0029 J			0.0075 U		0.005 U
Manganese		3.5	4.16 J	4.4	4.62	6.74					8.8
Mercury	0.002	0.0002 U	0.00022 UJ	0.0002 U	0.0002 U	0.00006 J			0.0002 U		0.0002 U
Nickel	0.1	0.01 U	0.0037 U	0.01 U	0.0129				0.005 U		0.01 U
Selenium	0.05	0.05 U	0.0075 U	0.05 U	0.007 J	0.015 U			0.015 U		0.05 U
Silver	0.1	0.005 UJ	0.005 U	0.005 U	0.005 U	0.005 U			0.007 U		0.005 U
Sodium						1.56					
Zinc	5	0.057 U	0.0043 U	0.05 U	0.025 U	0.005 U			0.0132 U		0.05 UJ

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-6-081804 8/18/2004	CFW-6-082405 8/24/2005	CFW-6-091306 9/13/2006	FD001-082405 8/24/2005	FD001-091306 9/13/2006	FD007-030807 3/8/2007	CFW-7-031804 3/18/2004	CFW-7-060704 6/7/2004	CFW-7-072903 7/29/2003	CFW-7-081704 8/17/2004
Inorganics (mg/L)											
Antimony	0.006	0.005 UJ	0.006 U	0.015 U	0.006 U	0.015 U				0.005 U	0.005 U
Arsenic	0.01	0.01 U	0.004 U	0.004 U	0.004 U	0.004 U	0.0049 J			0.01 U	0.01 U
Barium	2	0.077	0.0629	0.0544	0.0641	0.0592	0.0592			0.095	0.074
Boron								0.1 U	0.1 UJ	0.1 U	
Cadmium	0.005	0.003 U	0.0004 U	0.001 U	0.0005 U	0.0012 U	0.0002 J			0.003 U	0.003 U
Calcium							25.4				
Chromium	0.1	0.01 U	0.0031 U	0.0024 J	0.0032 U	0.0027 J	0.0028 J			0.01 U	0.01 U
Copper		0.01 U	0.0025 U	0.025 U	0.001 U	0.025 U	0.005 U			0.01 U	0.01 U
Iron		51 J	71	64.6	71.5	68.1	58.8			100	120 J
Lead	0.015	0.005 UJ	0.0035 U	0.0031 J	0.0036 U	0.003 J	0.0075 U			0.005 U	0.005 U
Manganese		6.9	7.54	6.69	7.65	7.2	6.8			9.6	11
Mercury	0.002	0.0002 U	0.00014 UJ	0.00018 J	0.00015 UJ	0.0002 U	0.0002 U			0.0002 U	0.0002 U
Nickel	0.1	0.01 U	0.0015 U	0.0098	0.0012 U	0.01				0.01 U	0.01 U
Selenium	0.05	0.05 U	0.0075 U	0.0091 J	0.0075 U	0.0101 J	0.015 U			0.05 U	0.05 U
Silver	0.1	0.005 U	0.005 U			0.005 U	0.005 U				
Sodium							1.52				
Zinc	5	0.05 U	0.0042 U	0.0134	0.0067 U	0.005 U	0.0056			0.05 U	0.05 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	DW-001 Potable H2O-060104 6/1/2004	DW001-030607 3/6/2007	DW001-031704 3/17/2004	DW001-042606 4/26/2006	DW001-071703 7/17/2003	DW-1-031505 3/15/2005	DW-002 Furlou House-060104 6/1/2004	DW002-031704 3/17/2004	DW002-071703 7/17/2003
Inorganics (mg/L)										
Antimony	0.006				0.012 U	0.005 U				0.005 U
Arsenic	0.01		0.004 U		0.008 U	0.01 U				0.01 U
Barium	2									
Boron		0.1 U		0.1 U	0.01 U	0.1 U	0.0296	0.1 U	0.1 U	0.1 U
Cadmium	0.005				0.0025 U	0.001 U				0.003 U
Calcium										
Chromium	0.1				0.005 U	0.01 UJ				0.01 UJ
Copper					0.002 J	0.01 UJ				0.01 UJ
Iron										
Lead	0.015				0.0075 U	0.011 U				0.005 U
Manganese										
Mercury	0.002				0.0002 U	0.0002 U				0.0002 U
Nickel	0.1				0.005 U	0.01 U				0.01 U
Selenium	0.05				0.015 U	0.05 U				0.05 U
Silver	0.1				0.01 U	0.005 U				0.005 U
Sodium										
Zinc	5				0.005 U	0.01 U				0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	DW-2-032205 3/22/2005	MW-103A-030104 3/1/2004	MW-103A-030507 3/5/2007	MW-103A-031505 3/15/2005	MW-103A-052104 5/21/2004	MW-103A-090803 9/8/2003	FD003-060104 6/1/2004	FD003-060104-F 6/1/2004	FD003-090903 9/9/2003	FD004-032007 3/20/2007
Inorganics (mg/L)											
Antimony	0.006						0.005 U			0.005 U	
Arsenic	0.01			0.004 U			0.01 U			0.028	
Barium	2										
Boron		0.0336	0.05 U		0.0147	0.1 U	0.11	0.1 U		0.16 U	
Cadmium	0.005						0.003 U			0.003 U	
Calcium											
Chromium	0.1						0.01 UJ			0.013	
Copper							0.01 UJ			0.01 U	
Iron											
Lead	0.015						0.005 U	0.005 U	0.005 U	0.11	0.0054 J
Manganese											
Mercury	0.002						0.0002 U			0.0002 U	
Nickel	0.1						0.01 UJ			0.01 U	
Selenium	0.05						0.05 UJ			0.05 UJ	
Silver	0.1						0.005 UJ			0.005 U	
Sodium											
Zinc	5						0.05 U			0.05 U	

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-103B-030904 3/9/2004	MW-103B-030904-F 3/9/2004	MW-103B-032007 3/20/2007	MW-103B-032205 3/22/2005	MW-103B-050306 5/3/2006	MW-103B-060104 6/1/2004	MW-103B-060104-F 6/1/2004	MW-103B-090903 9/9/2003	MW-103B-112105 11/21/2005
Inorganics (mg/L)										
Antimony	0.006					0.006 UJ			0.005 U	0.006 U
Arsenic	0.01			0.004 U		0.004 U			0.01 U	0.0107 U
Barium	2									
Boron		0.05 U			0.0377	0.05 UJ	0.1 U		0.1 U	0.0056 U
Cadmium	0.005					0.0004 J			0.003 U	0.0012 U
Calcium										
Chromium	0.1					0.005 U			0.015	0.0025 U
Copper						0.003 U			0.01 U	0.0025 U
Iron										
Lead	0.015	0.005 U	0.005 U	0.0052 J		0.0075 U	0.005 U	0.005 U	0.1	0.0038 U
Manganese										
Mercury	0.002					0.00022 U			0.0002 U	0.0002 U
Nickel	0.1					0.005 U			0.01 U	0.001 U
Selenium	0.05					0.015 U			0.05 UJ	0.0075 UJ
Silver	0.1					R			0.005 U	0.005 U
Sodium										
Zinc	5					0.0145 U			0.05 U	0.0062 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	FD001L-111905 11/19/2005	MW-103C-031004 3/10/2004	MW-103C-032007 3/20/2007	MW-103C-032405 3/24/2005	MW-103C-050106 5/1/2006	MW-103C-060104 6/1/2004	MW-103C-091103 9/11/2003	MW-103C-111905 11/19/2005	OSR-1-031704 3/17/2004
Inorganics (mg/L)										
Antimony	0.006	0.0013 U				0.006 U		0.005 U	0.006 U	
Arsenic	0.01	0.0047 U		0.004 U		0.004 U		0.068	0.004 U	
Barium	2									
Boron		0.0046 U	0.05 U		0.0646	0.0646	0.1 U	0.15 U	0.0039 U	0.1 U
Cadmium	0.005	0.0004 U				0.0025 U		0.003 U	0.0012 U	
Calcium										
Chromium	0.1	0.0029 U				0.0038 J		0.04	0.003 U	
Copper		0.0025 U				0.005 U		0.01 U	0.0025 U	
Iron										
Lead	0.015	0.0038 U				0.0075 U		0.02	0.0038 U	
Manganese										
Mercury	0.002	0.00014 U				0.0002 UJ		0.0002 U	0.0002 U	
Nickel	0.1	0.0023 U				0.0038 J		0.031	0.0016 U	
Selenium	0.05	0.0075 UJ				0.015 U		0.05 UJ	0.0075 UJ	
Silver	0.1	0.005 U				R		0.005 UJ	0.005 U	
Sodium										
Zinc	5	0.0045 U				0.0594		0.13	0.0036 U	

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blank results indicate not analyzed

Appendix Table A.4.4
 Groundwater Sample Results - Inorganics
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	OSR-1-060704 6/7/2004	OSR-1-080703 8/7/2003	OSR-1-081904 8/19/2004
Inorganics (mg/L)				
Antimony	0.006		0.005 U	0.005 UJ
Arsenic	0.01		0.01 U	0.01 U
Barium	2		0.086	0.1
Boron		0.1 UJ	0.1 U	
Cadmium	0.005		0.003 U	0.003 U
Calcium				
Chromium	0.1		0.01 U	0.01 U
Copper			0.01 U	0.01 U
Iron			110	78 J
Lead	0.015		0.005 U	0.005 UJ
Manganese			7.4	5.3
Mercury	0.002		0.0002 U	0.0002 U
Nickel	0.1		0.011	0.01 U
Selenium	0.05		0.05 U	0.05 U
Silver	0.1		0.005 UJ	0.005 U
Sodium				
Zinc	5		0.05 U	0.05 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-5-072903	CFW-1-080703	CFW-2-072803	CFW-3-080603	CFW-4-080603	CFW-5-080503	CFW-6-081103	CFW-7-072903	DW001-042606	DW001-071703	DW002-071703
Date Sampled	GW-1	7/29/2003	8/7/2003	7/28/2003	8/6/2003	8/6/2003	8/5/2003	8/11/2003	7/29/2003	4/26/2006	7/17/2003	7/17/2003
SVOC (µg/L)												
Acenaphthene	20	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	10 U	10 U	5.4 UJ	10 UJ	10 U	10 U	10 U	12	5.13 U	10 U	2.8 J
Fluorene	300	0.2 UJ	1 J	0.2 UJ	0.2 UJ	0.68 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 U	0.2 UJ	0.2 UJ
Naphthalene	140	0.16 J	0.2 UJ	0.2 UJ	0.34	0.19 J	0.2 UJ	0.22 J	0.22 J	5.13 UJ	0.2 UJ	0.2 UJ
Pentachlorophenol	1	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 UJ	1 UJ

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-103A-090803	FD003-090903	FD004-032007	MW-103B-032007	MW-103B-050306	MW-103B-090903	MW-103B-112105	FD001L-111905	MW-103C-032007	MW-103C-050106
Date Sampled	GW-1	9/8/2003	9/9/2003	3/20/2007	3/20/2007	5/3/2006	9/9/2003	11/21/2005	11/19/2005	3/20/2007	5/1/2006
SVOC (µg/L)											
Acenaphthene	20	0.2 UJ	0.06 J	0.2 U	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U
bis(2-Ethylhexyl)phthalate	6	10 U	8.4 J	6.06 U	5.56 U	5.13 UJ	12 J	5.26 U	5.13 U	5.56 U	5.56 U
Fluorene	300	0.2 UJ	0.2 UJ	0.2 U	0.2 U	0.2 U	0.05 UJ	0.2 U	0.2 U	0.2 U	0.2 U
Naphthalene	140	0.2 UJ	0.17 J	6.06 U	5.56 U	5.13 U	0.08 J	5.26 U	5.13 U	5.56 U	5.56 U
Pentachlorophenol	1	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	0.095 J	1 U	1 U	1 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - SVOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-103C-091103 9/11/2003	MW-103C-111905 11/19/2005	OSR-1-080703 8/7/2003
SVOC (µg/L)				
Acenaphthene	20	0.2 UJ	0.2 U	0.2 UJ
bis(2-Ethylhexyl)phthalate	6	13 J	5.13 U	10 U
Fluorene	300	0.2 UJ	0.2 U	0.2 UJ
Naphthalene	140	0.2 UJ	5.13 U	0.18 J
Pentachlorophenol	1	1 UJ	1 U	1 UJ

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-5-072903	CFW-1-080703	CFW-2-072803	CFW-3-080603	CFW-4-080603	CFW-5-080503	CFW-6-081103	CFW-7-072903	DW001-071703	DW002-071703
Date Sampled	GW-1	7/29/2003	8/7/2003	7/28/2003	8/6/2003	8/6/2003	8/5/2003	8/11/2003	7/29/2003	7/17/2003	7/17/2003
TPH (µg/L)											
TPH-DRO	200	25 U	25 U	53	92 UJ	25 U	25 U	25 U	65	25 U	25 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - TPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	MW-103A-090803	FD003-090903	MW-103B-090903	MW-103C-091103	OSR-1-080703
Date Sampled	GW-1	9/8/2003	9/9/2003	9/9/2003	9/11/2003	8/7/2003
TPH (µg/L)						
TPH-DRO	200	25 U	310 J	200 J	230	120 J

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CB-5-072903 7/29/2003	CB-5-081704 8/17/2004	CFW-1-031507 3/15/2007	CFW-1-080703 8/7/2003	CFW-1-081804 8/18/2004	CFW-1-081905 8/19/2005	CFW-1-091806 9/18/2006	CFW-2-072803 7/28/2003	CFW-2-081804 8/18/2004
VOC (µg/L)										
Acetone	3000	10 UJ	10 U	10 U	R	10 UJ	10 U	R	10 UJ	10 UJ
2-Butanone	4000	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		5 UJ	5 UJ	2 U	5 U	0.69 J	0.7 J	2 U	5 UJ	5 U
Dichlorodifluoromethane		5 U	5 U	2 U	5 U	5 U	2 U	2 U	5 U	5 U
4-Methyl-2-pentanone	350	5 U	5 UJ	10 U	5 U	5 UJ	1.4 J	10 U	5 U	5 UJ
Toluene	1000	5 U	5 U	1 U	5 U	0.43 J	1 U	1 U	5 U	0.47 J

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CFW-3-080603	CFW-3-081704	CFW-4-080603	CFW-4-081704	FD001-081704	CFW-5-030807	CFW-5-080503	CFW-5-081705	CFW-5-081804	CFW-5-091306
Date Sampled	GW-1	8/6/2003	8/17/2004	8/6/2003	8/17/2004	8/17/2004	3/8/2007	8/5/2003	8/17/2005	8/18/2004	9/13/2006
VOC (µg/L)											
Acetone	3000	9.1 J	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ	10 U	10 UJ	R
2-Butanone	4000	10 U	10 UJ	10 U	10 U	R					
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
Chloromethane		5 UJ	5 UJ	5 UJ	0.52 J	5 U	2 U	5 UJ	0.9 J	0.69 J	2 U
Dichlorodifluoromethane		5 UJ	5 U	5 UJ	5 U	5 U	2 U	5 UJ	2 UJ	5 U	2 U
4-Methyl-2-pentanone	350	5 U	5 UJ	5 U	5 UJ	5 UJ	10 U	5 UJ	0.6 J	5 UJ	10 U
Toluene	1000	5 U	0.32 J	5 U	5 U	5 U	1 U	5 UJ	1 U	5 U	1 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-6-030807 3/8/2007	CFW-6-042006 4/19/2006	CFW-6-081103 8/11/2003	CFW-6-081804 8/18/2004	CFW-6-082405 8/24/2005	CFW-6-091306 9/13/2006	FD001-082405 8/24/2005	FD001-091306 9/13/2006	FD007-030807 3/8/2007	CFW-7-072903 7/29/2003
VOC (µg/L)											
Acetone	3000	10 U	2.6 J	10 U	10 UJ	8 J	R	10 U	R	10 U	10 UJ
2-Butanone	4000	10 U	10 U	10 U	10 U	10 UJ	R	10 UJ	R	10 U	10 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		2 U	2 U	5 U	5 U	2 U	2 U	2 U	2 U	2 U	5 UJ
Dichlorodifluoromethane		2 U	2 UJ	5 U	5 U	2 U	2 U	2 U	2 U	2 U	5 U
4-Methyl-2-pentanone	350	10 U	10 U	5 U	5 UJ	0.8 J	10 U	0.9 J	10 U	10 U	5 U
Toluene	1000	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 U	1 U	5 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CFW-7-081704	DW001-042606	DW001-071703	DW002-071703	MW-103A-090803	FD003-090903	MW-103B-050306	MW-103B-090903	FD001L-111905
Date Sampled	GW-1	8/17/2004	4/26/2006	7/17/2003	7/17/2003	9/8/2003	9/9/2003	5/3/2006	9/9/2003	11/19/2005
VOC (µg/L)										
Acetone	3000	10 UJ	R	10 U	10 U	10 UJ	310 J	R	160 J	407 J
2-Butanone	4000	10 U	10 U	10 U	10 U	10 UJ	10 UJ	10 U	10 UJ	6.6 J
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 J	0.7 J
Chloroform	5	1 U	1 U	1 U	1 U	1 UJ	1.3	1 U	1 UJ	1 U
Chloromethane		5 U	2 U	5 U	5 U	0.53 J	5 UJ	2 U	5 UJ	1 J
Dichlorodifluoromethane		5 U	2 U	5 U	5 U	3 J	5 UJ	2 U	5 UJ	2 UJ
4-Methyl-2-pentanone	350	5 UJ	10 U	5 U	5 U	5 UJ	5 UJ	10 U	5 UJ	10 U
Toluene	1000	5 U	1 U	5 U	5 U	5 UJ	5 UJ	1 U	5 UJ	1 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VOCs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	MW-103C-032007 3/20/2007	MW-103C-050106 5/1/2006	MW-103C-091103 9/11/2003	MW-103C-111905 11/19/2005	OSR-1-080703 8/7/2003	OSR-1-081904 8/19/2004
VOC (µg/L)							
Acetone	3000	74.8	R	6200 J	378 J	10 UJ	10 UJ
2-Butanone	4000	10 U	10 U	10 UJ	5.9 J	10 UJ	10 U
Carbon disulfide		0.6 J	0.9 J	5 U	0.8 J	5 UJ	5 U
Chloroform	5	1 U	1 U	1 UJ	1 U	1 UJ	1 U
Chloromethane		2 U	2 U	0.53 J	2 U	5 UJ	5 U
Dichlorodifluoromethane		2 U	2 U	5 UJ	2 UJ	5 UJ	5 U
4-Methyl-2-pentanone	350	10 U	10 U	5 UJ	10 U	5 UJ	5 UJ
Toluene	1000	1 U	1 U	5 UJ	1 U	5 UJ	5 U

> MCP GW-1

Appendix Table A.4.4
 Groundwater Sample Results - VPHs
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CFW-6-042006	DW-001 Potable H2O-060104	DW001-042606	MW-103B-030904	MW-103B-060104	MW-103C-031004	OSR-1-031704
Date Sampled	GW-1	4/19/2006	6/1/2004	4/26/2006	3/9/2004	6/1/2004	3/10/2004	3/17/2004
VPH (µg/L)								
Unadjusted C5-C8 Aliphatics	400	75 UJ	40 U	75 U	106	40 U	40 U	40 U
Adjusted C9-C10 Aromatics	200	25 UJ		14.3 J				

Appendix Table A.4.4
 Groundwater Sample Results - Wet Chemistry
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CB-5-072903	CB-5-081704	CFW-1-031507	CFW-1-031607	CFW-1-080703	CFW-1-081804	CFW-1-081905	CFW-1-082505	CFW-1-091806	CFW-1-091906
Date Sampled	GW-1	7/29/2003	8/17/2004	3/15/2007	3/16/2007	8/7/2003	8/18/2004	8/19/2005	8/25/2005	9/18/2006	9/19/2006
WET CHEMISTRY (mg/L)											
Chemical Oxygen Demand		10 U	10 U		17.8	10 U	10 U	5 U		14.4	
Chloride		2 U	2.2	0.67 J		2 U	2 U	0.69 U		0.75 U	
Cyanide	0.2				0.01 U			0.01 U			0.01 U
Cyanide (PAC)											
Nitrate		2 UJ	2 U		0.1 U	2 UJ	2 U		0.1 U		0.08 J
Sulfate		4.9	5.3	3.32		4.4 J	4.9	3.81 J		3.7	
Total Alkalinity		46	47	7.14		6	5.1	7		5	
Total Dissolved Solids		46	40		12	1 U	4	22	13		29

Appendix Table A.4.4
 Groundwater Sample Results - Wet Chemistry
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-2-072803 7/28/2003	CFW-2-081804 8/18/2004	CFW-3-080603 8/6/2003	CFW-3-081704 8/17/2004	CFW-4-080603 8/6/2003	CFW-4-081704 8/17/2004	FD001-081704 8/17/2004	CFW-5-030807 3/8/2007	CFW-5-080503 8/5/2003	CFW-5-081705 8/17/2005	CFW-5-081804 8/18/2004
WET CHEMISTRY (mg/L)												
Chemical Oxygen Demand		54	48	85	130	18	18	18	51.9	26	27.3	32
Chloride		2.4	2.9	2.4	3.7	2 U	2.6	2.5	9.12	2 U	1.91	2.7
Cyanide	0.2								0.0176		0.01 U	
Cyanide (PAC)									0.00271 J			
Nitrate		2 U	2 U	2 UJ	2 U	2 U	2 U	2 U	0.04 J	2 U	0.1 U	2 U
Sulfate		1 U	1 U	1 U	1 U	3.8	3.9	4.1	0.44 J	1.2	0.58 J	1.2
Total Alkalinity		110	95	120	210	110	120	120	127	87	101	93
Total Dissolved Solids		190	180	150	300	110	120	120	170	120	111	200

Appendix Table A.4.4
 Groundwater Sample Results - Wet Chemistry
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CFW-5-091306	CFW-6-030807	CFW-6-081103	CFW-6-081804	CFW-6-082405	CFW-6-091306	FD001-082405	FD001-091306	FD007-030807
Date Sampled	GW-1	9/13/2006	3/8/2007	8/11/2003	8/18/2004	8/24/2005	9/13/2006	8/24/2005	9/13/2006	3/8/2007
WET CHEMISTRY (mg/L)										
Chemical Oxygen Demand		36.9	26.3	38	33	31.8	35.1	30.1	36.4	51.9
Chloride		15.5 J	12.5	2 U	2.3	7.79	14.7 J	9.12	16.1 J	11.8
Cyanide	0.2	0.01 U	0.01 U			0.0127	0.01 U	0.01 U	0.01 U	0.01 U
Cyanide (PAC)										
Nitrate		0.1 U	0.04 J	2 UJ	2 U	0.1 UJ	0.04 J	0.1 U	0.1 U	0.04 J
Sulfate		0.44 U	0.7 J	1 U	1 U	0.4 U	0.26 U	0.24 U	0.21 U	0.68 J
Total Alkalinity		130	100	100	110	116	108	136	131	128
Total Dissolved Solids		170	189	180	200	214	147	204	172	181

Appendix Table A.4.4
 Groundwater Sample Results - Wet Chemistry
 YAEC Non-BUD/TSCA
 YNPS Rowe, MA

Sample ID	MCP	CFW-7-072903	CFW-7-081704	OSR-1-080703	OSR-1-081904
Date Sampled	GW-1	7/29/2003	8/17/2004	8/7/2003	8/19/2004
WET CHEMISTRY (mg/L)					
Chemical Oxygen Demand		76	74	98	95
Chloride		2.2	3.2	3.7 J	4.2
Cyanide	0.2				
Cyanide (PAC)					
Nitrate		2 J	2 U	2 UJ	2 U
Sulfate		1.2	1 U	1 U	1 U
Total Alkalinity		73	130	72	91
Total Dissolved Solids		240	230	260	280

Appendix Table A.4.5
 Summary Statistics of All Groundwater Sample Results --
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Inside BUD Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Unadjusted C19-C36 Aliphatics	0	4	0%		50.00	
Unadjusted C9-C18 Aliphatics	0	4	0%		50.00	
Unadjusted C11-C22 Aromatics	0	4	0%		50.00	
<i>Herbicide (µg/L)</i>						
2,4-D	0	4	0%		0.50	
2,4-DB	0	4	0%		2.50	
Dicamba	0	3	0%		0.50	
Dichloroprop	0	4	0%		2.50	
Dinoseb	0	3	0%		0.50	
2,4,5-T	0	4	0%		0.50	
2,4,5-TP (Silvex)	0	4	0%		0.50	
<i>Inorganics (mg/L)</i>						
Antimony	0	6	0%		0.0027	
Arsenic	0	10	0%		0.0032	
Beryllium	1	6	17%	0.00020	0.0008	0.00020
Boron	6	11	55%	0.02	0.12	0.40
Cadmium	0	6	0%		0.0014	
Chromium	0	6	0%		0.012	
Copper	1	6	17%	0.0036	0.012	0.0036
Lead	0	6	0%		0.0029	
Lithium	0	4	0%		0.25	
Mercury	0	6	0%		0.00010	
Nickel	1	6	17%	0.0022	0.012	0.0022
Selenium	0	6	0%		0.019	
Silver	0	5	0%		0.0027	
Thallium	0	6	0%		0.0004	
Zinc	1	6	17%	0.021	0.022	0.021
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1016	0	4	0%		0.13	
Aroclor-1221	0	4	0%		0.13	
Aroclor-1232	0	4	0%		0.13	
Aroclor-1242	0	4	0%		0.13	
Aroclor-1248	0	4	0%		0.13	
Aroclor-1254	0	4	0%		0.13	
Aroclor-1260	0	4	0%		0.13	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.5
Summary Statistics of All Groundwater Sample Results --
TransCanada Inside BUD Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Inside BUD Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	1	11	9%	0.11	0.10	0.11
Acenaphthylene	1	11	9%	0.10	0.10	0.10
Aniline	0	11	0%		3.82	
Anthracene	1	11	9%	0.13	0.10	0.13
Atrazine	0	7	0%		3.15	
Azobenzene	0	11	0%		11.10	
Benzidine	3	10	30%	2.10	3.88	3.70
Benzo(a)anthracene	0	11	0%		0.10	
Benzo(a)pyrene	0	11	0%		0.10	
Benzo(b)fluoranthene	0	11	0%		0.10	
Benzo(g,h,i)perylene	0	11	0%		0.10	
Benzo(k)fluoranthene	0	11	0%		0.10	
Benzoic acid	0	8	0%		3.38	
Benzyl alcohol	0	11	0%		3.82	
Bis(2-chloroethoxy)methane	0	11	0%		3.82	
Bis(2-chloroethyl)ether	0	11	0%		3.82	
bis(2-Ethylhexyl)phthalate	2	11	18%	12.00	7.28	36.00
4-Bromophenyl phenyl ether	0	11	0%		3.82	
Butyl benzyl phthalate	0	11	0%		3.82	
Carbazole	0	11	0%		3.82	
4-Chloro-3-methylphenol	0	10	0%		5.21	
4-Chloroaniline	0	11	0%		3.82	
Bis(2-chloroisopropyl) ether	0	11	0%		3.82	
2-Chloronaphthalene	0	11	0%		3.82	
2-Chlorophenol	0	10	0%		3.71	
4-Chlorophenyl phenyl ether	0	11	0%		3.82	
Chrysene	0	11	0%		0.10	
Dibenzo(a,h)anthracene	0	11	0%		0.10	
Dibenzofuran	0	11	0%		3.82	
1,2-Dichlorobenzene	0	7	0%		3.84	
1,3-Dichlorobenzene	0	7	0%		3.84	
1,4-Dichlorobenzene	0	7	0%		3.84	
3,3'-Dichlorobenzidine	0	11	0%		5.64	
2,4-Dichlorophenol	0	10	0%		3.71	
Diethyl phthalate	0	11	0%		3.82	
Dimethyl phthalate	0	11	0%		3.82	
2,4-Dimethylphenol	0	10	0%		3.71	
Di-n-butyl phthalate	0	11	0%		4.05	
2,4-Dinitrophenol	0	10	0%		9.71	
2,4-Dinitrotoluene	0	11	0%		3.82	
2,6-Dinitrotoluene	0	11	0%		3.82	
Di-n-octyl phthalate	0	11	0%		3.82	
Fluoranthene	3	11	27%	0.10	0.11	0.14
Fluorene	0	11	0%		0.10	
Hexachlorobenzene	1	11	9%	0.02	2.09	0.02
Hexachlorobutadiene	0	11	0%		1.88	
Hexachlorocyclopentadiene	0	11	0%		3.82	
Hexachloroethane	0	11	0%		3.82	
Indeno(1,2,3-cd)pyrene	0	11	0%		0.10	
Isophorone	0	11	0%		3.82	
4,6-Dinitro-2-methylphenol	0	10	0%		9.71	
1-Methylnaphthalene	0	7	0%		2.81	
2-Methylnaphthalene	0	11	0%		3.61	
3+4-Methylphenol	0	10	0%		5.64	
2-Methylphenol	0	10	0%		3.71	
Naphthalene	1	11	9%	0.20	1.83	0.20
2-Nitroaniline	0	11	0%		3.82	
3-Nitroaniline	0	11	0%		11.10	
4-Nitroaniline	0	11	0%		15.70	
Nitrobenzene	0	11	0%		3.82	
2-Nitrophenol	0	10	0%		3.71	
4-Nitrophenol	0	10	0%		14.77	
N-Nitroso-di-n-propylamine	0	11	0%		3.82	
N-Nitrosodiphenylamine	0	11	0%		3.82	
N-Nitrosodimethylamine	0	11	0%		3.82	
Pentachlorophenol	2	9	22%	1.46	1.02	4.20
Phenanthrene	2	11	18%	0.10	0.10	0.12
Phenol	0	10	0%		3.71	
Pyrene	2	11	18%	0.13	0.11	0.13
Pyridine	0	7	0%		3.15	
1,2,4-Trichlorobenzene	0	7	0%		3.84	
2,4,5-Trichlorophenol	0	10	0%		3.71	
2,4,6-Trichlorophenol	0	10	0%		3.71	
<i>Total Petroleum Hydrocarbons (µg/L)</i>						
TPH-DRO	1	1	100%	150.00	150.00	150.00
TPH-GRO	0	1	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.5
Summary Statistics of All Groundwater Sample Results --
TransCanada Inside BUD Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Inside BUD Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	1	6	17%	5.60	5.10	5.60
Acrylonitrile	0	8	0%		3.88	
Allyl Chloride	0	6	0%		0.50	
t-Amyl methyl ether	0	7	0%		0.86	
Benzene	0	8	0%		0.50	
Bromobenzene	0	8	0%		2.00	
Bromochloromethane	0	8	0%		2.00	
Bromodichloromethane	0	8	0%		0.50	
Bromoform	0	8	0%		0.50	
Bromomethane	0	8	0%		1.00	
2-Butanone	0	7	0%		5.00	
n-Butylbenzene	0	8	0%		2.00	
sec-Butylbenzene	0	8	0%		2.00	
tert-Butylbenzene	0	8	0%		2.00	
Carbon disulfide	1	8	13%	0.51	2.25	0.51
Carbon Tetrachloride	0	8	0%		0.50	
Chlorobenzene	0	8	0%		2.00	
1-Chlorobutane	0	6	0%		2.50	
Chloroethane	0	8	0%		4.00	
2-Chloroethylvinyl Ether	0	3	0%		2.50	
Chloroform	0	8	0%		0.50	
Chloromethane	0	8	0%		2.13	
2-Chlorotoluene	0	8	0%		2.00	
4-Chlorotoluene	0	8	0%		2.00	
1,2-Dibromo-3-chloropropane	0	5	0%		1.90	
Dibromochloromethane	0	8	0%		0.50	
1,2-Dibromoethane	0	8	0%		0.44	
Dibromomethane	0	8	0%		2.00	
1,2-dichlorobenzene	0	8	0%		2.00	
1,3-Dichlorobenzene	0	8	0%		2.00	
1,4-Dichlorobenzene	0	8	0%		0.50	
Dichlorodifluoromethane	2	8	25%	0.62	1.97	1.60
1,1-Dichloroethane	3	8	38%	0.45	2.18	8.00
1,2-Dichloroethane	0	8	0%		0.50	
cis-1,2-Dichloroethene	0	8	0%		2.00	
trans-1,2-Dichloroethene	0	8	0%		2.00	
1,1-Dichloroethene	0	8	0%		1.25	
1,3-Dichloropropane	0	8	0%		2.00	
2,2-Dichloropropane	0	8	0%		2.00	
1,2-Dichloropropane	0	8	0%		0.50	
1,1-Dichloropropene	0	8	0%		1.94	
cis-1,3-Dichloropropene	0	8	0%		0.44	
trans-1,3-Dichloropropene	0	8	0%		0.44	
Diethyl Ether	0	8	0%		2.00	
Diisopropyl ether	0	7	0%		0.86	
Ethyl Methacrylate	0	6	0%		2.50	
Ethylbenzene	0	8	0%		2.00	
Ethyl-t-butyl ether	0	7	0%		0.86	
Hexachlorobutadiene	0	1	0%		0.50	
Hexachloroethane	0	1	0%		1.00	
2-Hexanone	0	8	0%		3.13	
Iodomethane	0	6	0%		2.50	
Isopropylbenzene	0	8	0%		2.00	
4-Isopropyltoluene	0	8	0%		2.00	
Methacrylonitrile	0	4	0%		2.50	
Methyl methacrylate	0	6	0%		2.50	
4-Methyl-2-Pentanone	0	8	0%		3.13	
Methylene chloride	0	8	0%		2.00	
Methyl-t-butyl ether	0	8	0%		2.00	
Naphthalene	0	1	0%		2.50	
2-Nitropropane	0	5	0%		2.50	
Pentachloroethane	0	6	0%		2.50	
Propionitrile	0	3	0%		25.00	
n-Propylbenzene	0	8	0%		2.00	
Styrene	0	8	0%		2.00	
1,1,1,2-Tetrachloroethane	0	8	0%		0.50	
1,1,2,2-Tetrachloroethane	0	8	0%		0.50	
Tetrachloroethene	0	8	0%		0.50	
Tetrahydrofuran	1	5	20%	2.20	2.94	2.20
Toluene	3	8	38%	0.31	1.60	3.70
trans-1,4-Dichloro-2-Butene	0	6	0%		2.50	
1,2,3-Trichlorobenzene	0	8	0%		2.00	
1,2,4-Trichlorobenzene	0	8	0%		2.00	
1,1,1-Trichloroethane	0	8	0%		2.00	
1,1,2-Trichloroethane	0	8	0%		0.50	
Trichloroethene	0	8	0%		0.88	
Trichlorofluoromethane	0	8	0%		2.00	
1,2,3-Trichloropropane	0	8	0%		2.00	
1,1,2-Trichlorotrifluoroethane	0	2	0%		0.50	
1,2,4-Trimethylbenzene	0	8	0%		2.00	
1,3,5-Trimethylbenzene	0	8	0%		2.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.5
 Summary Statistics of All Groundwater Sample Results --
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Inside BUD Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
Vinyl Acetate	0	6	0%		7.50	
Vinyl Chloride	0	8	0%		0.88	
o-Xylene	0	8	0%		2.00	
m+p-Xylenes	2	8	25%	0.25	1.56	0.25
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Unadjusted C5-C8 Aliphatics	0	4	0%		23.75	
Unadjusted C9-C12 Aliphatics	0	4	0%		23.75	
Unadjusted C9-C10 Aromatics	0	4	0%		23.75	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.6
 Groundwater Sample Results - Inorganics
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID	MCP	CW-10-030404	CW-10-042506	CW-10-052704	CW-10-071503	MW-108A-031705	MW-108A-090804	MW-108B-031705	MW-108B-050106	MW-108B-090804	MW-108C-031605	MW-108C-090804
Date Sampled	GW-1	3/4/2004	4/25/2006	5/27/2004	7/15/2003	3/17/2005	9/8/2004	3/17/2005	5/1/2006	9/8/2004	3/16/2005	9/8/2004
Inorganics (mg/L)												
Beryllium	0.004		0.0006 U		0.002 U		0.002 U		0.0002 J	0.002 U		0.002 U
Boron		0.4	0.213	0.34	0.1 U	0.0326	0.1 U	0.0232	0.05 U	0.1 U	0.0362	0.1 U
Copper			0.0036 J		0.01 UJ		0.1 U		0.005 U	0.01 U		0.01 U
Nickel	0.1		0.0022 J		0.01 UJ		0.1 UJ		0.005 U	0.01 UJ		0.01 UJ
Zinc	5		0.0221 U		0.05 U		0.05 U		0.021	0.05 U		0.05 U

Appendix Table A.4.6
 Groundwater Sample Results - SVOCs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CW-10-030707 3/7/2007	CW-10-042506 4/25/2006	CW-10-071503 7/15/2003	CW-10-092106 9/21/2006	MW-108A-090804 9/8/2004	FD004-031705 3/17/2005	MW-108 B-111105 11/11/2005	MW-108B-031207 3/12/2007	MW-108B-031705 3/17/2005	MW-108B-050106 5/1/2006	MW-108B-090804 9/8/2004	MW-108C-090804 9/8/2004
SVOC (µg/L)													
Acenaphthene	20	0.2 U	0.2 U	0.2 UJ	0.2 U	0.11 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acenaphthylene	300	0.2 U	0.2 U	0.2 UJ	0.2 U	0.1 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Anthracene	2000	0.2 U	0.2 UJ	0.2 U	0.2 U	0.13 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzidine		12.5 U	5.26 UJ	20 UJ	5.56 UJ	3.4 J	R	5.41 U	5.26 U	R	5.13 U	3.7 J	2.1 J
bis(2-Ethylhexyl)phthalate	6	12.5 U	5.26 UJ	12	5.56 U	10 U	5 U	5.41 U	5.26 U	5 U	5.13 U	36 B	10 U
Fluoranthene	90	0.2 U	0.2 UJ	0.2 U	0.2 U	0.13 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	0.14 J
Hexachlorobenzene	1	1 U	1 UJ	10 U	1 U	10 U	1 U	0.022 J	1 U	1 U	1 U	10 U	10 U
Naphthalene	140	12.5 U	5.26 UJ	0.2 UJ	5.56 U	0.2	0.2 U	5.41 U	5.26 U	0.2 U	5.13 U	0.2 U	0.2 U
Pentachlorophenol	1	1 U	1 UJ	1 UJ	1 U	R	1 UJ	1 U	1 U	1.46 J	1 U	4.2 J	R
Phenanthrene	300	0.2 U	0.2 UJ	0.2 U	0.2 U	0.12 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J
Pyrene	80	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.13 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.13 J

> MCP GW-1

Appendix Table A.4.6
 Groundwater Sample Results - TPHs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID	MCP	CW-10-071503
Date Sampled	GW-1	7/15/2003
TPH (µg/L)		
TPH-DRO	200	150

Appendix Table A.4.6
 Groundwater Sample Results -VOCs
 TransCanada Inside BUD Study Area
 YNPS Rowe, MA

Sample ID	MCP	CW-10-042506	CW-10-071503	MW-108A-090804	MW-108A-112104	MW-108B-050106	MW-108B-090804	MW-108C-090804	MW-108C-112104
Date Sampled	GW-1	4/25/2006	7/15/2003	9/8/2004	11/21/2004	5/1/2006	9/8/2004	9/8/2004	11/21/2004
VOC (µg/L)									
Acetone	3000	R	10 U	10 UJ	10 UJ	R	10 UJ	5.6 J	10 UJ
Carbon disulfide		5 U	5 U	0.51 J	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane		1.6 J	0.62 J	5 U	5 U	2 U	5 U	5 U	5 U
1,1-Dichloroethane	70	1 U	5 U	0.49 J	0.45 J	1 U	5 U	5 U	8
Tetrahydrofuran		2.2 J	5 U	5 UJ	R	10 U	5 UJ	R	R
Toluene	1000	1 U	5 U	0.31 J	5 U	1 U	3.7 J	0.32 J	5 U
m+p-Xylenes		2 U	5 U	5 U	0.25 J	2 U	5 U	5 U	0.25 J

Appendix Table A.4.7
 Summary Statistics of All Groundwater Sample Results --
 TransCanada Property Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Property Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	3	0%		0.50	
Acenaphthylene	0	3	0%		0.50	
Unadjusted C19-C36 Aliphatics	0	7	0%		70.74	
Unadjusted C9-C18 Aliphatics	0	7	0%		70.74	
Anthracene	0	3	0%		0.50	
Adjusted C11-C22 Aromatics	0	3	0%		100.00	
Unadjusted C11-C22 Aromatics	0	7	0%		70.74	
Benzo(a)anthracene	0	3	0%		0.50	
Benzo(a)pyrene	0	3	0%		0.10	
Benzo(b)fluoranthene	0	3	0%		0.50	
Benzo(g,h,i)perylene	0	3	0%		0.50	
Benzo(k)fluoranthene	0	3	0%		0.50	
Chrysene	0	3	0%		0.50	
Dibenzo(a,h)anthracene	0	3	0%		0.25	
Fluoranthene	0	3	0%		0.50	
Fluorene	0	3	0%		0.50	
Indeno(1,2,3-cd)pyrene	0	3	0%		0.25	
2-Methylnaphthalene	0	3	0%		0.50	
Naphthalene	0	3	0%		0.50	
Phenanthrene	0	3	0%		0.50	
Pyrene	0	3	0%		0.50	
Adjusted TPH	0	3	0%		100.00	
Unadjusted TPH	0	3	0%		100.00	
<i>Herbicide (µg/L)</i>						
2,4-D	0	5	0%		0.50	
2,4-DB	0	6	0%		2.50	
Dicamba	0	3	0%		0.50	
Dichloroprop	0	6	0%		2.50	
Dinoseb	0	3	0%		0.50	
2,4,5-T	0	6	0%		0.50	
2,4,5-TP (Silvex)	0	6	0%		0.50	
<i>Inorganics (mg/L)</i>						
Antimony	0	11	0%		0.0024	
Arsenic	0	20	0%		0.0030	
Beryllium	0	11	0%		0.0008	
Boron	9	23	39%	0.0078	0.049	0.15
Cadmium	0	11	0%		0.0012	
Chromium	1	11	9%	0.015	0.0049	0.015
Copper	2	11	18%	0.003	0.0040	0.004
Lead	0	11	0%		0.0029	
Lithium	0	7	0%		0.25	
Mercury	1	11	9%	0.00021	0.00010	0.00021
Nickel	0	11	0%		0.0040	
Selenium	0	11	0%		0.018	
Silver	2	15	13%	0.0018	0.0030	0.0090
Thallium	0	11	0%		0.00063	
Zinc	2	11	18%	0.060	0.025	0.070
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1262	0	2	0%		0.14	
Aroclor-1268	0	2	0%		0.14	
Aroclor-1016	0	11	0%		0.13	
Aroclor-1221	0	11	0%		0.13	
Aroclor-1232	0	11	0%		0.13	
Aroclor-1242	0	11	0%		0.13	
Aroclor-1248	0	11	0%		0.13	
Aroclor-1254	0	11	0%		0.13	
Aroclor-1260	0	11	0%		0.13	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.7
Summary Statistics of All Groundwater Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Property Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	9	0%		0.10	
Acenaphthylene	0	9	0%		0.10	
Aniline	0	9	0%		4.50	
Anthracene	0	9	0%		0.10	
Atrazine	0	2	0%		2.74	
Azobenzene	0	9	0%		20.05	
Benzidine	0	8	0%		9.10	
Benzo(a)anthracene	0	9	0%		0.10	
Benzo(a)pyrene	0	9	0%		0.10	
Benzo(b)fluoranthene	0	9	0%		0.10	
Benzo(g,h,i)perylene	0	9	0%		0.11	
Benzo(k)fluoranthene	0	9	0%		0.10	
Benzoic acid	0	5	0%		4.10	
Benzyl alcohol	0	9	0%		4.50	
Bis(2-chloroethoxy)methane	0	9	0%		4.50	
Bis(2-chloroethyl)ether	0	9	0%		4.50	
bis(2-Ethylhexyl)phthalate	0	9	0%		8.94	
4-Bromophenyl phenyl ether	0	9	0%		4.50	
Butyl benzyl phthalate	0	9	0%		4.50	
Carbazole	0	9	0%		4.50	
4-Chloro-3-methylphenol	0	9	0%		8.39	
4-Chloroaniline	0	9	0%		4.50	
Bis(2-chloroisopropyl) ether	0	9	0%		4.50	
2-Chloronaphthalene	0	9	0%		4.50	
2-Chlorophenol	0	9	0%		4.50	
4-Chlorophenyl phenyl ether	0	9	0%		4.50	
Chrysene	0	9	0%		0.10	
Dibenzo(a,h)anthracene	0	9	0%		0.11	
Dibenzofuran	0	9	0%		4.50	
1,2-Dichlorobenzene	0	3	0%		5.00	
1,3-Dichlorobenzene	0	3	0%		5.00	
1,4-Dichlorobenzene	0	3	0%		5.00	
3,3'-Dichlorobenzidine	0	9	0%		8.39	
2,4-Dichlorophenol	0	9	0%		4.50	
Diethyl phthalate	0	9	0%		4.50	
Dimethyl phthalate	0	9	0%		4.50	
2,4-Dimethylphenol	0	9	0%		4.50	
Di-n-butyl phthalate	0	9	0%		5.22	
2,4-Dinitrophenol	0	9	0%		20.05	
2,4-Dinitrotoluene	0	9	0%		4.50	
2,6-Dinitrotoluene	0	9	0%		4.50	
Di-n-octyl phthalate	0	9	0%		4.50	
Fluoranthene	0	9	0%		0.10	
Fluorene	0	9	0%		0.10	
Hexachlorobenzene	0	9	0%		4.00	
Hexachlorobutadiene	0	9	0%		3.91	
Hexachlorocyclopentadiene	0	9	0%		4.50	
Hexachloroethane	0	9	0%		4.50	
Indeno(1,2,3-cd)pyrene	0	9	0%		0.11	
Isophorone	0	9	0%		4.50	
4,6-Dinitro-2-methylphenol	0	9	0%		20.05	
1-Methylnaphthalene	0	2	0%		2.74	
2-Methylnaphthalene	0	9	0%		4.50	
3+4-Methylphenol	0	9	0%		5.11	
2-Methylphenol	0	9	0%		4.50	
Naphthalene	0	9	0%		0.69	
2-Nitroaniline	0	9	0%		4.50	
3-Nitroaniline	0	9	0%		20.05	
4-Nitroaniline	0	9	0%		21.88	
Nitrobenzene	0	9	0%		4.50	
2-Nitrophenol	0	9	0%		4.50	
4-Nitrophenol	0	9	0%		21.88	
N-Nitroso-di-n-propylamine	0	9	0%		4.50	
N-Nitrosodiphenylamine	0	9	0%		4.50	
N-Nitrosodimethylamine	0	9	0%		4.50	
Pentachlorophenol	0	5	0%		0.50	
Phenanthrene	0	9	0%		0.10	
Phenol	0	9	0%		4.50	
Pyrene	0	9	0%		0.10	
Pyridine	0	2	0%		2.74	
1,2,4-Trichlorobenzene	0	3	0%		5.00	
2,4,5-Trichlorophenol	0	9	0%		4.50	
2,4,6-Trichlorophenol	0	9	0%		4.50	
<i>Total Petroleum Hydrocarbons (µg/L)</i>						
TPH-DRO	1	3	33%	46.00	23.67	46.00
TPH-GRO	0	3	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.7
Summary Statistics of All Groundwater Sample Results --
TransCanada Property Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Property Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	1	7	14%	2.40	4.63	2.40
Acrylonitrile	0	10	0%		3.65	
Allyl Chloride	0	7	0%		0.50	
t-Amyl methyl ether	0	7	0%		0.79	
Benzene	0	10	0%		0.50	
Bromobenzene	0	10	0%		1.90	
Bromochloromethane	0	10	0%		1.90	
Bromodichloromethane	0	10	0%		0.50	
Bromoform	0	10	0%		0.50	
Bromomethane	0	10	0%		1.00	
2-Butanone	0	10	0%		5.00	
n-Butylbenzene	0	10	0%		1.90	
sec-Butylbenzene	0	10	0%		1.90	
tert-Butylbenzene	0	10	0%		1.90	
Carbon disulfide	2	10	20%	0.30	2.07	0.40
Carbon Tetrachloride	0	10	0%		0.50	
Chlorobenzene	0	10	0%		1.90	
1-Chlorobutane	0	7	0%		2.50	
Chloroethane	0	10	0%		3.80	
Chloroform	0	10	0%		0.50	
Chloromethane	2	10	20%	2.40	2.28	4.90
2-Chlorotoluene	0	10	0%		1.90	
4-Chlorotoluene	0	10	0%		1.90	
1,2-Dibromo-3-chloropropane	0	4	0%		1.38	
Dibromochloromethane	0	10	0%		0.50	
1,2-Dibromoethane	0	10	0%		0.43	
Dibromomethane	0	10	0%		1.90	
1,2-dichlorobenzene	0	10	0%		1.90	
1,3-Dichlorobenzene	0	10	0%		1.90	
1,4-Dichlorobenzene	0	10	0%		0.50	
Dichlorodifluoromethane	0	10	0%		2.05	
1,1-Dichloroethane	1	10	10%	0.60	1.91	0.60
1,2-Dichloroethane	0	10	0%		0.50	
cis-1,2-Dichloroethene	0	10	0%		1.90	
trans-1,2-Dichloroethene	0	10	0%		1.90	
1,1-Dichloroethene	0	10	0%		0.85	
1,3-Dichloropropane	0	10	0%		1.90	
2,2-Dichloropropane	0	10	0%		1.90	
1,2-Dichloropropane	0	10	0%		0.50	
1,1-Dichloropropene	0	10	0%		1.83	
cis-1,3-Dichloropropene	0	10	0%		0.43	
trans-1,3-Dichloropropene	0	10	0%		0.43	
Diethyl Ether	0	10	0%		1.90	
Diisopropyl ether	0	7	0%		0.79	
Ethyl Methacrylate	0	7	0%		2.50	
Ethylbenzene	0	10	0%		1.90	
Ethyl-t-butyl ether	0	7	0%		0.79	
Hexachlorobutadiene	0	4	0%		0.45	
Hexachloroethane	0	3	0%		1.00	
2-Hexanone	0	10	0%		3.25	
Iodomethane	0	7	0%		2.50	
Isopropylbenzene	0	10	0%		1.90	
4-Isopropyltoluene	0	10	0%		1.90	
Methacrylonitrile	0	7	0%		2.50	
Methyl methacrylate	0	7	0%		2.50	
4-Methyl-2-Pentanone	0	10	0%		3.25	
Methylene chloride	0	10	0%		3.42	
Methyl-t-butyl ether	0	10	0%		1.90	
Naphthalene	0	4	0%		2.00	
2-Nitropropane	0	7	0%		2.50	
Pentachloroethane	0	7	0%		2.50	
n-Propylbenzene	0	10	0%		1.90	
Styrene	0	10	0%		1.90	
1,1,1,2-Tetrachloroethane	0	10	0%		0.50	
1,1,2,2-Tetrachloroethane	0	10	0%		0.50	
Tetrachloroethene	0	10	0%		0.50	
Tetrahydrofuran	0	5	0%		3.50	
Toluene	4	10	40%	0.21	1.58	2.80
trans-1,4-Dichloro-2-Butene	0	7	0%		2.50	
1,2,3-Trichlorobenzene	0	10	0%		1.90	
1,2,4-Trichlorobenzene	0	10	0%		1.90	
1,1,1-Trichloroethane	0	10	0%		1.90	
1,1,2-Trichloroethane	0	10	0%		0.50	
Trichloroethene	0	10	0%		0.85	
Trichlorofluoromethane	0	10	0%		1.90	
1,2,3-Trichloropropane	0	10	0%		1.90	
1,1,2-Trichlorotrifluoroethane	0	3	0%		0.50	
1,2,4-Trimethylbenzene	0	10	0%		1.90	
1,3,5-Trimethylbenzene	0	10	0%		1.90	
Vinyl Acetate	0	7	0%		7.50	
Vinyl Chloride	0	10	0%		0.85	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.7
 Summary Statistics of All Groundwater Sample Results --
 TransCanada Property Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from TransCanada Property Area					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
o-Xylene	0	10	0%		1.90	
m+p-Xylenes	1	10	10%	0.90	2.04	0.90
<i>Volatile Petroleum Hydrocarbons (µg/L)</i>						
Adjusted C5-C8 Aliphatics	1	3	33%	6.10	26.37	6.10
Adjusted C9-C12 Aliphatics	1	3	33%	22.20	15.63	22.20
Unadjusted C5-C8 Aliphatics	1	7	14%	6.10	25.59	6.10
Unadjusted C9-C12 Aliphatics	1	7	14%	22.20	20.99	22.20
Adjusted C9-C10 Aromatics	1	3	33%	15.90	10.46	15.90
Unadjusted C9-C10 Aromatics	0	4	0%		25.00	
Benzene	0	3	0%		2.50	
Ethylbenzene	0	3	0%		2.50	
Methyl-t-butyl ether	0	3	0%		2.50	
Naphthalene	0	3	0%		2.50	
Toluene	0	3	0%		2.50	
o-Xylene	0	3	0%		2.50	
m+p-Xylenes	0	3	0%		5.00	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.8
 Groundwater Sample Results - EPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID	MCP	CB-4-042506	218 (MW-113A)-062706	FD002-062806	MW-113C-062806
Date Sampled	GW-1	4/25/2006	6/27/2006	6/28/2006	6/28/2006
EPH (µg/L)					
Benzo(a)anthracene	1	1 U	1 U	0.383 J	1 U
Benzo(k)fluoranthene	1	1 U	1 U	0.468 J	1 UJ
Chrysene	2	1 U	1 U	0.489 J	1 U
Fluoranthene	90	1 UJ	1 U	0.298 J	1 U

Appendix Table A.4.8
 Groundwater Sample Results - Inorganics
 TransCanada Property Study Areas
 YNPS Rowe, MA

Sample ID	MCP	CB-4-030104	CB-4-030607	CB-4-042506	CB-4-052604	CB-4-071403	CB-4-110503	CB-4-110503F	CB-4-110905	CB-6-031004	CB-6-031405	CB-6-052704	CB-6-071403	MW-106A-031405	MW-106A-110304
Date Sampled	GW-1	3/1/2004	3/6/2007	4/25/2006	5/26/2004	7/14/2003	11/5/2003	11/5/2003	11/9/2005	3/10/2004	3/14/2005	5/27/2004	7/14/2003	3/14/2005	11/3/2004
Inorganics (mg/L)															
Boron		0.05 U		0.0166 U	0.1 U	0.1 U			0.079	0.05 U	0.148	0.12	0.1 U	0.0945	0.1 U
Chromium	0.1			0.005 U		0.01 UJ			0.0025 U				0.01 UJ		0.01 U
Copper				0.005 U		0.01 UJ			0.0014 U				0.01 U		0.01 U
Mercury	0.002			0.0002 U		0.0002 U			0.00008 U				0.0002 U		0.00021 J
Silver	0.1	0.005 U	0.005 U	0.007 U		0.009	0.005 U	0.01 U	0.005 U				0.005 U		0.005 U
Zinc	5			0.0062 U		0.05 U			0.0063 U				0.05 U		0.07 J

Appendix Table A.4.8
 Groundwater Sample Results - Inorganics
 TransCanada Property Study Areas
 YNPS Rowe, MA

Sample ID	MCP	FD003-111604	MW-106B-031505	MW-106B-111604	MW-106C-031405	MW-106C-111704	FD-001-031505	MW-106D-031505	MW-106D-110304	218 (MW-113A)-062706	FD002-062806	MW-113C-062806
Date Sampled	GW-1	11/16/2004	3/15/2005	11/16/2004	3/14/2005	11/17/2004	3/15/2005	3/15/2005	11/3/2004	6/27/2006	6/28/2006	6/28/2006
Inorganics (mg/L)												
Boron		0.1 U	0.0106	0.1 U	0.0184	0.1 U	0.0136	0.0144	0.1 U	0.0078 J	0.01 U	0.01 U
Chromium	0.1	0.01 U		0.01 U		0.015			0.01 U	0.005 U	0.005 U	0.005 U
Copper		0.01 U		0.01 U		0.01 U			0.01 U	0.0027 J	0.0028 J	0.0036 J
Mercury	0.002	0.0002 U		0.0002 U		0.0002 U			0.0002 UJ	0.0002 U	0.00004 U	0.00008 U
Silver	0.1	0.005 U		0.005 U		0.005 U			0.005 U	0.0018 U	R	0.0018 J
Zinc	5	0.05		0.05 U		0.05 U			0.06 J	0.0234 U	0.0077 U	0.0092 U

Appendix Table A.4.8
 Groundwater Sample Results - Inorganics
 TransCanada Property Study Areas
 YNPS Rowe, MA

Sample ID	MCP	Sherman Spring-060104	SP001	SP001-031704	SP-1-032205
Date Sampled	GW-1	6/1/2004	7/17/2003	3/17/2004	3/22/2005
Inorganics (mg/L)					
Boron		0.1 U	0.1 U	0.1 U	0.0761
Chromium	0.1		0.01 UJ		
Copper			0.01 UJ		
Mercury	0.002		0.0002 U		
Silver	0.1		0.005 U		
Zinc	5		0.05 U		

Appendix Table A.4.8
 Groundwater Sample Results - TPHs
 TransCanada Property Study Areas
 YNPS Rowe, MA

Sample ID	MCP	CB-4-071403	CB-6-071403	SP001
Date Sampled	GW-1	7/14/2003	7/14/2003	7/17/2003
TPH (µg/L)				
TPH-DRO	200	25 U	46	25 U

Appendix Table A.4.8
 Groundwater Sample Results - VOCs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID	MCP	CB-4-042506	CB-4-071403	CB-6-071403	MW-106A-110304	FD003-111604	MW-106B-111604	MW-106C-111704	MW-106D-110304	218 (MW-113A)-062706	FD002-062806	MW-113C-062806	SP001
Date Sampled	GW-1	4/25/2006	7/14/2003	7/14/2003	11/3/2004	11/16/2004	11/16/2004	11/17/2004	11/3/2004	6/27/2006	6/28/2006	6/28/2006	7/17/2003
VOC (µg/L)													
Acetone	3000	R	10 UJ	10 U	10 UJ	10 UJ	10 UJ	2.4 J	10 UJ	R	R	R	10 U
Carbon disulfide		5 U	5 U	5 U	5 U	5 U	0.4 J	0.3 J	5 U	5 U	0.5 J	5 U	5 U
Chloromethane		2 U	5 U	5 U	5 U	5 U	2.4 J	4.9 J	5 U	2 U	2 U	2 U	5 U
1,1-Dichloroethane	70	1 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	1 U	0.6 J	0.6 J	5 U
Toluene	1000	1 U	5 U	5 U	0.21 J	5 U	2.8 J	5 UJ	0.35 J	1 U	1.7	1.4	5 U
m+p-Xylenes		2 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	2 U	1.1 J	0.9 J	5 U

Appendix Table A.4.8
 Groundwater Sample Results - VPHs
 TransCanada Property Study Area
 YNPS Rowe, MA

Sample ID	MCP	CB-4-042506	MW-106A-110304	FD003-111604	MW-106B-111604	MW-106C-111704	MW-106D-110304	218 (MW-113A)-062706	FD002-062806	MW-113C-062806
Date Sampled	GW-1	4/25/2006	11/3/2004	11/16/2004	11/16/2004	11/17/2004	11/3/2004	6/27/2006	6/28/2006	6/28/2006
VPH (µg/L)										
Adjusted C5-C8 Aliphatics		6.1 J						75 U	62.1 U	71 U
Adjusted C9-C12 Aliphatics		22.2 J						25 U	18.2 U	24.4 U
Unadjusted C5-C8 Aliphatics	400	6.1 J	50 U	50 U	50 U	50 U	50 U	75 U	62.1 U	71 U
Unadjusted C9-C12 Aliphatics	4000	22.2 J	50 U	50 U	50 UJ	50 U	50 U	25 U	18.2 U	24.4 U
Adjusted C9-C10 Aromatics	200	15.9 J						25 U	11.9 U	5.96 U

Appendix Table A.4.9
Summary Statistics of All Groundwater Sample Results --
Wheeler Brook Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Extractable Petroleum Hydrocarbons (µg/L)</i>						
Acenaphthene	0	1	0%		0.500	
Acenaphthylene	0	1	0%		0.500	
Unadjusted C19-C36 Aliphatics	0	1	0%		100.000	
Unadjusted C9-C18 Aliphatics	0	1	0%		100.000	
Anthracene	0	1	0%		0.500	
Adjusted C11-C22 Aromatics	0	1	0%		100.000	
Unadjusted C11-C22 Aromatics	0	1	0%		100.000	
Benzo(a)anthracene	0	1	0%		0.500	
Benzo(a)pyrene	0	1	0%		0.100	
Benzo(b)fluoranthene	0	1	0%		0.500	
Benzo(g,h,i)perylene	0	1	0%		0.500	
Benzo(k)fluoranthene	0	1	0%		0.500	
Chrysene	0	1	0%		0.500	
Dibenzo(a,h)anthracene	0	1	0%		0.250	
Fluoranthene	0	1	0%		0.500	
Fluorene	0	1	0%		0.500	
Indeno(1,2,3-cd)pyrene	0	1	0%		0.250	
2-Methylnaphthalene	0	1	0%		0.500	
Naphthalene	0	1	0%		0.500	
Phenanthrene	0	1	0%		0.500	
Pyrene	0	1	0%		0.500	
Adjusted TPH	0	1	0%		100.000	
Unadjusted TPH	0	1	0%		100.000	
<i>Herbicide (µg/L)</i>						
2,4-DB	0	6	0%		2.500	
Dichloroprop	0	6	0%		2.500	
2,4,5-T	0	6	0%		0.500	
2,4,5-TP (Silvex)	0	6	0%		0.500	
<i>Inorganics (mg/L)</i>						
Antimony	1	21	5%	0.006	0.003	0.006
Arsenic	1	21	5%	0.019	0.005	0.019
Barium	20	20	100%	0.012	0.065	0.130
Beryllium	0	21	0%		0.001	
Boron	6	25	24%	0.140	0.190	1.900
Cadmium	0	21	0%		0.001	
Chromium	5	21	24%	0.002	0.009	0.065
Copper	3	21	14%	0.009	0.007	0.036
Cyanide	0	14	0%		0.005	
Iron	20	20	100%	0.706	70.515	300.000
Lead	4	19	21%	0.003	0.003	0.006
Lithium	0	7	0%		0.250	
Manganese	20	20	100%	0.047	5.906	11.000
Mercury	1	21	5%	0.000	0.000	0.000
Nickel	7	21	33%	0.007	0.008	0.032
Selenium	2	21	10%	0.007	0.019	0.009
Silver	0	21	0%		0.003	
Thallium	0	20	0%		0.001	
Zinc	1	21	5%	0.013	0.020	0.013
<i>Polychlorinated Biphenyls (µg/L)</i>						
Aroclor-1016	0	7	0%		0.464	
Aroclor-1221	0	7	0%		0.464	
Aroclor-1232	0	7	0%		0.464	
Aroclor-1242	0	7	0%		0.464	
Aroclor-1248	0	7	0%		0.464	
Aroclor-1254	0	7	0%		0.464	
Aroclor-1260	0	7	0%		0.464	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.9
Summary Statistics of All Groundwater Sample Results --
Wheeler Brook Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Semivolatile Organic Compounds (µg/L)</i>						
Acenaphthene	0	7	0%		0.100	
Acenaphthylene	0	7	0%		0.100	
Aniline	0	7	0%		5.000	
Anthracene	0	7	0%		0.100	
Azobenzene	0	7	0%		25.000	
Benzidine	0	7	0%		10.000	
Benzo(a)anthracene	0	7	0%		0.100	
Benzo(a)pyrene	0	7	0%		0.100	
Benzo(b)fluoranthene	0	7	0%		0.100	
Benzo(g,h,i)perylene	0	7	0%		0.100	
Benzo(k)fluoranthene	0	7	0%		0.100	
Benzoic acid	0	2	0%		5.000	
Benzyl alcohol	0	7	0%		5.000	
Bis(2-chloroethoxy)methane	0	7	0%		5.000	
Bis(2-chloroethyl)ether	0	7	0%		5.000	
bis(2-Ethylhexyl)phthalate	1	7	14%	12.000	5.671	12.000
4-Bromophenyl phenyl ether	0	7	0%		5.000	
Butyl benzyl phthalate	0	7	0%		5.000	
Carbazole	0	7	0%		5.000	
4-Chloro-3-methylphenol	0	2	0%		10.000	
4-Chloroaniline	0	7	0%		5.000	
Bis(2-chloroisopropyl) ether	0	7	0%		5.000	
2-Chloronaphthalene	0	7	0%		5.000	
2-Chlorophenol	0	2	0%		5.000	
4-Chlorophenyl phenyl ether	0	7	0%		5.000	
Chrysene	0	7	0%		0.100	
3+4-Methylphenol	0	2	0%		5.000	
Dibenzo(a,h)anthracene	0	7	0%		0.100	
Dibenzofuran	0	7	0%		5.000	
1,2-Dichlorobenzene	0	7	0%		5.000	
1,3-Dichlorobenzene	0	7	0%		5.000	
1,4-Dichlorobenzene	0	7	0%		5.000	
3,3'-Dichlorobenzidine	0	7	0%		10.000	
2,4-Dichlorophenol	0	2	0%		5.000	
Diethyl phthalate	0	7	0%		5.000	
Dimethyl phthalate	0	7	0%		5.000	
2,4-Dimethylphenol	0	2	0%		5.000	
Di-n-butyl phthalate	0	7	0%		5.000	
2,4-Dinitrophenol	0	2	0%		25.000	
2,4-Dinitrotoluene	0	7	0%		5.000	
2,6-Dinitrotoluene	0	7	0%		5.000	
Di-n-octyl phthalate	0	7	0%		5.000	
Fluoranthene	0	7	0%		0.100	
Fluorene	1	7	14%	1.000	0.263	1.000
Hexachlorobenzene	0	7	0%		5.000	
Hexachlorobutadiene	0	7	0%		5.000	
Hexachlorocyclopentadiene	0	7	0%		5.000	
Hexachloroethane	0	7	0%		5.000	
Indeno(1,2,3-cd)pyrene	0	7	0%		0.100	
Isophorone	0	7	0%		5.000	
4,6-Dinitro-2-methylphenol	0	2	0%		25.000	
2-Methylnaphthalene	0	7	0%		5.000	
2-Methylphenol	0	2	0%		5.000	
Naphthalene	4	7	57%	0.190	0.181	0.340
2-Nitroaniline	0	7	0%		5.000	
3-Nitroaniline	0	7	0%		25.000	
4-Nitroaniline	0	7	0%		25.000	
Nitrobenzene	0	7	0%		5.000	
2-Nitrophenol	0	2	0%		5.000	
4-Nitrophenol	0	2	0%		25.000	
N-Nitroso-di-n-propylamine	0	7	0%		5.000	
N-Nitrosodiphenylamine	0	7	0%		5.000	
N-Nitrosodimethylamine	0	7	0%		5.000	
Pentachlorophenol	0	7	0%		0.500	
Phenanthrene	0	7	0%		0.100	
Phenol	0	2	0%		5.000	
Pyrene	0	7	0%		0.100	
1,2,4-Trichlorobenzene	0	7	0%		5.000	
2,4,5-Trichlorophenol	0	2	0%		5.000	
2,4,6-Trichlorophenol	0	2	0%		5.000	
<i>Total Petroleum Hydrocarbons (µg/L)</i>						
TPH-DRO	2	7	29%	53.000	30.571	65.000
TPH-GRO	0	7	0%		5.000	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.9
 Summary Statistics of All Groundwater Sample Results --
 Wheeler Brook Study Area
 YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (µg/L)</i>						
Acetone	3	17	18%	2.600	5.276	9.100
Acrylonitrile	0	19	0%		3.342	
Allyl Chloride	0	14	0%		0.500	
t-Amyl methyl ether	0	12	0%		0.792	
Benzene	0	21	0%		0.500	
Bromobenzene	0	21	0%		1.833	
Bromochloromethane	0	21	0%		1.833	
Bromodichloromethane	0	21	0%		0.500	
Bromoform	0	21	0%		0.500	
Bromomethane	0	21	0%		1.000	
2-Butanone	0	19	0%		5.000	
n-Butylbenzene	0	21	0%		1.833	
sec-Butylbenzene	0	21	0%		1.833	
tert-Butylbenzene	0	21	0%		1.833	
Carbon disulfide	0	21	0%		2.500	
Carbon Tetrachloride	0	21	0%		0.500	
Chlorobenzene	0	21	0%		1.833	
1-Chlorobutane	0	14	0%		2.500	
Chloroethane	0	21	0%		3.667	
2-Chloroethylvinyl Ether	0	14	0%		2.500	
Chloroform	0	21	0%		0.500	
Chloromethane	5	21	24%	0.520	1.714	0.900
2-Chlorotoluene	0	21	0%		1.833	
4-Chlorotoluene	0	21	0%		1.833	
1,2-Dibromo-3-chloropropane	0	17	0%		1.882	
Dibromochloromethane	0	21	0%		0.500	
1,2-Dibromoethane	0	21	0%		0.452	
Dibromomethane	0	21	0%		1.833	
1,2-dichlorobenzene	0	21	0%		1.833	
1,3-Dichlorobenzene	0	21	0%		1.833	
1,4-Dichlorobenzene	0	21	0%		0.500	
Dichlorodifluoromethane	0	21	0%		2.000	
1,1-Dichloroethane	0	21	0%		1.833	
1,2-Dichloroethane	0	21	0%		0.500	
cis-1,2-Dichloroethene	0	21	0%		1.833	
trans-1,2-Dichloroethene	0	21	0%		1.833	
1,1-Dichloroethene	0	21	0%		0.833	
1,3-Dichloropropane	0	21	0%		1.833	
2,2-Dichloropropane	0	21	0%		1.833	
1,2-Dichloropropane	0	21	0%		0.500	
1,1-Dichloropropene	0	21	0%		1.750	
cis-1,3-Dichloropropene	0	21	0%		0.417	
trans-1,3-Dichloropropene	0	21	0%		0.417	
Diethyl Ether	0	21	0%		1.833	
Diisopropyl ether	0	14	0%		0.750	
1,4-Dioxane	0	3	0%		10.000	
Ethyl Methacrylate	0	14	0%		2.500	
Ethylbenzene	0	21	0%		1.833	
Ethyl-t-butyl ether	0	14	0%		0.750	
Hexachlorobutadiene	0	14	0%		0.443	
Hexachloroethane	0	7	0%		1.000	
2-Hexanone	0	21	0%		3.333	
Iodomethane	0	14	0%		2.500	
Isopropylbenzene	0	21	0%		1.833	
4-Isopropyltoluene	0	21	0%		1.833	
Methacrylonitrile	0	14	0%		2.500	
Methyl methacrylate	0	13	0%		2.500	
4-Methyl-2-Pentanone	3	21	14%	0.600	2.752	1.400
Methylene chloride	0	21	0%		2.333	
Methyl-t-butyl ether	0	21	0%		1.833	
Naphthalene	0	14	0%		1.500	
2-Nitropropane	0	12	0%		2.500	
Pentachloroethane	0	13	0%		2.500	
Propionitrile	0	7	0%		25.000	
n-Propylbenzene	0	21	0%		1.833	
Styrene	0	20	0%		1.800	
1,1,1,2-Tetrachloroethane	0	21	0%		0.500	
1,1,2,2-Tetrachloroethane	0	21	0%		0.500	
Tetrachloroethene	0	21	0%		0.500	
Tetrahydrofuran	0	14	0%		3.036	
Toluene	3	21	14%	0.320	1.534	0.470
trans-1,4-Dichloro-2-Butene	0	13	0%		2.500	
1,2,3-Trichlorobenzene	0	21	0%		1.833	
1,2,4-Trichlorobenzene	0	21	0%		1.833	
1,1,1-Trichloroethane	0	21	0%		1.833	
1,1,2-Trichloroethane	0	21	0%		0.500	
Trichloroethene	0	21	0%		0.833	
Trichlorofluoromethane	0	21	0%		1.833	
1,2,3-Trichloropropane	0	21	0%		1.833	
1,1,2-Trichlorotrifluoroethane	0	4	0%		0.500	
1,2,4-Trimethylbenzene	0	21	0%		1.833	
1,3,5-Trimethylbenzene	0	21	0%		1.833	
Vinyl Acetate	0	14	0%		7.500	

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
 Blank indicates not detected.

Appendix Table A.4.9
Summary Statistics of All Groundwater Sample Results --
Wheeler Brook Study Area
YNPS Rowe, MA

Oil or Hazardous Material	All Groundwater Samples from Wheeler Brook					
	Number Detected	Number Sampled	Percent Detected	Minimum Detected	Mean	Maximum Detected
<i>Volatile Organic Carbons (μg/L) cont.</i>						
Vinyl Chloride	0	21	0%		0.833	
o-Xylene	0	21	0%		1.833	
m+p-Xylenes	0	21	0%		2.000	
<i>Volatile Petroleum Hydrocarbons (μg/L)</i>						
Adjusted C5-C8 Aliphatics	0	1	0%		37.500	
Adjusted C9-C12 Aliphatics	0	1	0%		12.500	
Unadjusted C5-C8 Aliphatics	0	1	0%		37.500	
Unadjusted C9-C12 Aliphatics	0	1	0%		12.500	
Adjusted C9-C10 Aromatics	0	1	0%		12.500	
Benzene	0	1	0%		2.500	
Ethylbenzene	0	1	0%		2.500	
Methyl-t-butyl ether	0	1	0%		2.500	
Naphthalene	0	1	0%		2.500	
Toluene	0	1	0%		2.500	
o-Xylene	0	1	0%		2.500	
m+p-Xylenes	0	1	0%		5.000	
<i>Wet Chemistry (mg/L)</i>						
Chemical Oxygen Demand	17	20	85%	14.400	39.500	130.000
Chloride	13	20	65%	1.910	3.501	15.500
Cyanide	1	6	17%	0.013	0.006	0.013
Nitrate	3	20	15%	0.040	0.766	2.000
Sulfate	10	20	50%	0.580	1.637	4.900
Total Alkalinity	20	20	100%	5.000	91.805	210.000
Total Dissolved Solids	20	21	95%	4.000	139.548	300.000

Mean concentrations calculated by averaging detected concentrations and 1/2 the detection limit of non-detects.
Blank indicates not detected.

Appendix Table A.4.10
 Groundwater Sample Results - Inorganic
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-1-031505 3/15/2005	CFW-1-031804 3/18/2004	CFW-1-060804 6/8/2004	CFW-1-080703 8/7/2003	CFW-1-081804 8/18/2004	CFW-1-081905 8/19/2005	CFW-1-091906 9/19/2006	CFW-2-031804 3/18/2004	CFW-2-060704 6/7/2004	CFW-2-072803 7/28/2003
Inorganics (mg/L)											
Antimony	0.006				0.005 U	0.005 UJ	0.0027 U	0.0012 U			0.005 U
Arsenic	0.01				0.01 U	0.01 U	0.004 UJ	0.004 U			0.01 U
Barium	2				0.017	0.014	0.012	0.0451			0.097
Boron		0.015 U	0.1 U	0.27 J	0.1 U				0.1 U	0.1 UJ	0.1 U
Chromium	0.1				0.01 U	0.01 U	0.0025 U	0.0036 J			0.01 U
Copper					0.01 U	0.01 U	0.001 U	0.0091			0.01 U
Iron					1.8	1.2 J	0.706 J	10.7			74
Lead	0.015				0.005 U	0.005 UJ	0.0028 UJ	0.0056 J			R
Manganese					0.047	0.11	0.0533	0.305			10
Mercury	0.002				0.0002 U	0.0002 U	0.00004 UJ	0.0001 U			0.0002 U
Nickel	0.1				0.01 U	0.01 U	0.0013 U	0.0073			0.013
Selenium	0.05				0.05 U	0.05 U	0.0075 U	0.015 U			0.05 U
Zinc	5				0.05 U	0.05 U	0.0146 U	0.0318 U			0.05 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blanks indicate not analyzed

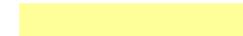
Appendix Table A.4.10
 Groundwater Sample Results - Inorganic
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-2-081804 8/18/2004	CFW-3-032304 3/23/2004	CFW-3-060804 6/8/2004	CFW-3-080603 8/6/2003	CFW-3-081704 8/17/2004	CFW-4-032304 3/23/2004	CFW-4-060804 6/8/2004	CFW-4-080603 8/6/2003	CFW-4-081704 8/17/2004
Inorganics (mg/L)										
Antimony	0.006	0.005 UJ			0.005 U	0.0063 J			0.005 U	0.005 U
Arsenic	0.01	0.01 U			0.01 U	0.019			0.01 U	0.01 U
Barium	2	0.1			0.094	0.13			0.062	0.059
Boron			1.9	0.14 J	0.1 U		0.33	0.1 UJ	0.1 U	
Chromium	0.1	0.01 U			0.025	0.065			0.01 U	0.02
Copper		0.01 U			0.015 U	0.01 U			0.036	0.011
Iron		70 J			180 J	300 J			10	19 J
Lead	0.015	0.005 UJ			0.005 U	0.006 J			0.005 U	0.005 U
Manganese		9			8	11			5.7	6.7
Mercury	0.002	0.0002 U			0.0002 U	0.0002 U			0.0002 U	0.0002 U
Nickel	0.1	0.01 U			0.027	0.032			0.01 U	0.016
Selenium	0.05	0.05 U			0.05 U	0.05 U			0.05 U	0.05 U
Zinc	5	0.05 U			0.05 U	0.05 U			0.05 U	0.05 U

> MCP GW-1

Appendix Table A.4.10
 Groundwater Sample Results - Inorganic
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-4-FD-002-032304 3/23/2004	FD001-081704 8/17/2004	CFW-5-031505 3/15/2005	CFW-5-032204 3/22/2004	CFW-5-060804 6/8/2004	CFW-5-080503 8/5/2003	CFW-5-081705 8/17/2005	CFW-5-081804 8/18/2004	CFW-5-091306 9/13/2006
Inorganics (mg/L)										
Antimony	0.006		0.005 U				0.005 U	0.006 U	0.005 UJ	0.015 U
Arsenic	0.01		0.01 U				0.01 U	0.004 U	0.01 U	0.004 U
Barium	2		0.042				0.043	0.0612	0.061	0.0638
Boron		0.21		0.01 U	0.74	0.1 UJ	0.1 U			
Chromium	0.1		0.01 U				0.01 U	0.0025 U	0.01 U	0.005 U
Copper			0.01 U				0.015 U	0.0012 U	0.01 U	0.025 U
Iron			14 J				38	89.2	67	75.1
Lead	0.015		0.005 U				R	0.0048 UJ	0.005 UJ	0.0036 J
Manganese			5.1				3.5	4.16 J	4.4	4.62
Mercury	0.002		0.0002 U				0.0002 U	0.00022 UJ	0.0002 U	0.0002 U
Nickel	0.1		0.01 U				0.01 U	0.0037 U	0.01 U	0.0129
Selenium	0.05		0.05 U				0.05 U	0.0075 U	0.05 U	0.007 J
Zinc	5		0.05 U				0.057 U	0.0043 U	0.05 U	0.025 U

 > MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blanks indicate not analyzed

Appendix Table A.4.10
 Groundwater Sample Results - Inorganic
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-6-032204 3/22/2004	CFW-6-032205 3/22/2005	CFW-6-042006 4/19/2006	CFW-6-060804 6/8/2004	CFW-6-081103 8/11/2003	CFW-6-081804 8/18/2004	CFW-6-082405 8/24/2005	CFW-6-091306 9/13/2006	FD001-082405 8/24/2005	FD001-091306 9/13/2006
Inorganics (mg/L)											
Antimony	0.006			0.006 U		0.005 U	0.005 UJ	0.006 U	0.015 U	0.006 U	0.015 U
Arsenic	0.01			0.004 U		0.01 UJ	0.01 U	0.004 U	0.004 U	0.004 U	0.004 U
Barium	2					0.069	0.077	0.0629	0.0544	0.0641	0.0592
Boron		0.6	0.01 U	0.013 U	0.1 UJ	0.1 U					
Chromium	0.1			0.005 U		0.01 U	0.01 U	0.0031 U	0.0024 J	0.0032 U	0.0027 J
Copper				0.0032 U		0.01 UJ	0.01 U	0.0025 U	0.025 U	0.001 U	0.025 U
Iron						67	51 J	71	64.6	71.5	68.1
Lead	0.015			0.0075 U		0.005 U	0.005 UJ	0.0035 U	0.0031 J	0.0036 U	0.003 J
Manganese						8.8	6.9	7.54	6.69	7.65	7.2
Mercury	0.002			0.0002 U		0.0002 U	0.0002 U	0.00014 UJ	0.00018 J	0.00015 UJ	0.0002 U
Nickel	0.1			0.005 U		0.01 U	0.01 U	0.0015 U	0.0098	0.0012 U	0.01
Selenium	0.05			0.015 U		0.05 U	0.05 U	0.0075 U	0.0091 J	0.0075 U	0.0101 J
Zinc	5			0.0132 U		0.05 UJ	0.05 U	0.0042 U	0.0134	0.0067 U	0.005 U

> MCP GW-1

J-estimated value; U-not detected (value is the detection limit); UJ-nondetect (estimated detection limit); R-rejected
 Blanks indicate not analyzed

Appendix Table A.4.10
 Groundwater Sample Results - Inorganic
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID Date Sampled	MCP GW-1	CFW-7-031804 3/18/2004	CFW-7-060704 6/7/2004	CFW-7-072903 7/29/2003	CFW-7-081704 8/17/2004
Inorganics (mg/L)					
Antimony	0.006			0.005 U	0.005 U
Arsenic	0.01			0.01 U	0.01 U
Barium	2			0.095	0.074
Boron		0.1 U	0.1 UJ	0.1 U	
Chromium	0.1			0.01 U	0.01 U
Copper				0.01 U	0.01 U
Iron				100	120 J
Lead	0.015			0.005 U	0.005 U
Manganese				9.6	11
Mercury	0.002			0.0002 U	0.0002 U
Nickel	0.1			0.01 U	0.01 U
Selenium	0.05			0.05 U	0.05 U
Zinc	5			0.05 U	0.05 U

> MCP GW-1

Appendix Table A.4.10
 Groundwater Sample Results - SVOC
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		CFW-1-080703	CFW-2-072803	CFW-3-080603	CFW-4-080603	CFW-5-080503	CFW-6-081103	CFW-7-072903
Date Sampled	MCP GW-1	8/7/2003	7/28/2003	8/6/2003	8/6/2003	8/5/2003	8/11/2003	7/29/2003
SVOC (µg/L)								
bis(2-Ethylhexyl)phthalate	6	10 U	5.4 UJ	10 UJ	10 U	10 U	10 U	12
Fluorene	300	1 J	0.2 UJ	0.2 UJ	0.68 UJ	0.2 UJ	0.2 UJ	0.2 UJ
Naphthalene	140	0.2 UJ	0.2 UJ	0.34	0.19 J	0.2 UJ	0.22 J	0.22 J

> MCP GW-1

Appendix Table A.4.10
 Groundwater Sample Results - TPH
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		CFW-1-080703	CFW-2-072803	CFW-3-080603	CFW-4-080603	CFW-5-080503	CFW-6-081103	CFW-7-072903
Date Sampled	MCP GW-1	8/7/2003	7/28/2003	8/6/2003	8/6/2003	8/5/2003	8/11/2003	7/29/2003
TPH (µg/L)								
TPH-DRO	200	25 U	53	92 UJ	25 U	25 U	25 U	65

Appendix Table A.4.10
 Groundwater Sample Results - WetChem
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		CFW-1-080703	CFW-1-081804	CFW-1-081905	CFW-1-082505	CFW-1-091806	CFW-1-091906	CFW-2-072803	CFW-2-081804	CFW-3-080603
Date Sampled	MCP GW-1	8/7/2003	8/18/2004	8/19/2005	8/25/2005	9/18/2006	9/19/2006	7/28/2003	8/18/2004	8/6/2003
WET CHEMISTRY (mg/L)										
Chemical Oxygen Demand		10 U	10 U	5 U		14.4		54	48	85
Chloride		2 U	2 U	0.69 U		0.75 U		2.4	2.9	2.4
Cyanide	0.2			0.01 U			0.01 U			
Nitrate		2 UJ	2 U		0.1 U		0.08 J	2 U	2 U	2 UJ
Sulfate		4.4 J	4.9	3.81 J		3.7		1 U	1 U	1 U
Total Alkalinity		6	5.1	7		5		110	95	120
Total Dissolved Solids		1 U	4	22	13		29	190	180	150

Appendix Table A.4.10
 Groundwater Sample Results - WetChem
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		CFW-3-081704	CFW-4-080603	CFW-4-081704	FD001-081704	CFW-5-080503	CFW-5-081705	CFW-5-081804	CFW-5-091306	CFW-6-081103
Date Sampled	MCP GW-1	8/17/2004	8/6/2003	8/17/2004	8/17/2004	8/5/2003	8/17/2005	8/18/2004	9/13/2006	8/11/2003
WET CHEMISTRY (mg/L)										
Chemical Oxygen Demand		130	18	18	18	26	27.3	32	36.9	38
Chloride		3.7	2 U	2.6	2.5	2 U	1.91	2.7	15.5 J	2 U
Cyanide	0.2						0.01 U		0.01 U	
Nitrate		2 U	2 U	2 U	2 U	2 U	0.1 U	2 U	0.1 U	2 UJ
Sulfate		1 U	3.8	3.9	4.1	1.2	0.58 J	1.2	0.44 U	1 U
Total Alkalinity		210	110	120	120	87	101	93	130	100
Total Dissolved Solids		300	110	120	120	120	111	200	170	180

Appendix Table A.4.10
 Groundwater Sample Results - WetChem
 Wheeler Brook Study Area
 YNPS Rowe, MA

Sample ID		CFW-6-081804	CFW-6-082405	CFW-6-091306	FD001-082405	FD001-091306	CFW-7-072903	CFW-7-081704
Date Sampled	MCP GW-1	8/18/2004	8/24/2005	9/13/2006	8/24/2005	9/13/2006	7/29/2003	8/17/2004
WET CHEMISTRY (mg/L)								
Chemical Oxygen Demand		33	31.8	35.1	30.1	36.4	76	74
Chloride		2.3	7.79	14.7 J	9.12	16.1 J	2.2	3.2
Cyanide	0.2		0.0127	0.01 U	0.01 U	0.01 U		
Nitrate		2 U	0.1 UJ	0.04 J	0.1 U	0.1 U	2 J	2 U
Sulfate		1 U	0.4 U	0.26 U	0.24 U	0.21 U	1.2	1 U
Total Alkalinity		110	116	108	136	131	73	130
Total Dissolved Solids		200	214	147	204	172	240	230

Appendix B
Sampling Results – Radionuclides

List of Tables

Table B.1.1.1	Soil Sample Results – FSS Data – Background REF-01 Area
Table B.1.1.2	Soil Sample Results – Background NIA Area
Table B.1.1.3	Soil Sample Results – Background Pelham Lake Area
Table B.1.2	Soil Sample Results – FSS Data – YAEC BUD/TSCA
Table B.1.3	Soil Sample Results – FSS Data – YAEC SCFA/TSCA
Table B.1.4	Soil Sample Results – FSS Data – YAEC Non-BUD/TSCA
Table B.1.5	Soil Sample Results – TransCanada Inside BUD Area
Table B.1.6	Soil Sample Results – FSS Data – TransCanada Property
Table B.1.7	Soil Sample Results – TransCanada Shoreline
Table B.2.1	Sediment Sample Results – Background
Table B.2.2	Sediment Sample Results – FSS Data – Sherman Reservoir
Table B.2.3	Sediment Sample Results – Deerfield River
Table B.3.1	Surface Water Sample Results
Table B.4.1	Groundwater Sample Results

Appendix Table B.1.1.1
 Soil Sample Results - FSS Data
 Background REF-01 Area
 YNPS Rowe, MA

Station	REF-01-01-001-F	REF-01-01-002-F	REF-01-01-003-F	REF-01-01-004-F	REF-01-01-005-F	REF-01-01-006-F	REF-01-01-007-F	REF-01-01-008-F	REF-01-01-009-F	REF-01-01-010-F
gamma-spec (pCi/g)										
Ag-108m	0.01847 U	0.01716 U	0.0003594 U	-0.006661 U	-0.02678 U	-0.009638 U	-0.008626 U	0.126 U	0.01605 U	-0.0001317 U
Am-241	0.0406 U	0.0378 U	-0.09506 U	0.1297 U	-0.1027 U	-0.08277 U	0.01159 U	-0.02758 U	-0.04584 U	0.04984 U
Co-60	-0.01119 U	-0.01374 U	-0.002459 U	0.0008582 U	-0.03929 U	0.01014 U	-0.009895 U	-0.00504 U	-0.02606 U	-0.01485 U
Cs-134	0.0001587 U	0.02558 U	-0.02854 U	-0.02072 U	0.0001065 U	-0.02202 U	-0.01093 U	-0.05944 U	-0.0008119 U	-0.00009439 U
Cs-137	0.2028	0.4682	1.53	0.5047	0.8341	0.3988	1.788	0.5548	0.9324	0.7654
Eu-152	0.02232 U	0.04077 U	-0.06242 U	0.03238 U	0.02315 U	0.01654 U	-0.01163 U	0.03484 U	0.1779 U	0.0003984 U
Eu-154	0.01998 U	0.03779 U	0.03306 U	0.0252 U	-0.03775 U	-0.00187 U	0.03942 U	0.02891 U	0.01456 U	-0.009193 U
Eu-155	0.1067 U	0.1277 U	-0.0001783 U	0.02025 U	0.1196 U	0.201 U	0.07691 U	-0.004601 U	0.01901 U	0.1358 U
Mn-54	0.01246 U	-0.01309 U	0.00366 U	0.008717 U	-0.007804 U	0.01628 U	-0.00513 U	-0.002131 U	-0.006986 U	-0.008975 U
Nb-94	-0.00001249 U	-0.0099 U	0.005022 U	-0.008695 U	-0.00148 U	0.07795 U	-0.0004558 U	-0.0033 U	-0.00542 U	0.007462 U
Sb-125	-0.008553 U	-0.02361 U	0.1677 U	-0.04959 U	-0.005884 U	0.1112 U	0.000401 U	-0.002844 U	0.07007 U	0.04079 U
Hard to detect (pCi/g)										
Sr-90	0.00993 U	0.0179 U	0.0782	0.0225 U	0.0688	0.0396	0.00815 U	0.0641	0.0309 U	0.0181 U

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.1.1
 Soil Sample Results - FSS Data
 Background REF-01 Area
 YNPS Rowe, MA

Station	REF-01-01-011-F	REF-01-01-012-F	REF-01-01-013-F	REF-01-01-014-F	REF-01-01-015-F	REF-01-01-016-F	REF-01-01-017-F	REF-01-01-018-F	REF-01-01-019-F	REF-01-01-020-F
gamma-spec (pCi/g)										
Ag-108m	0.002546 U	-0.01902 U	0.01452 U	-0.01904 U	-0.01026 U	-0.01265 U	-0.01739 U	-0.001421 U	0.002641 U	-0.01419 U
Am-241	0.07812 U	-0.05954 U	0.08322 U	-0.05826 U	0.02831 U	-0.007196 U	-0.007566 U	0.004178 U	0.02961 U	-0.06782 U
Co-60	-0.03897 U	0.0005426 U	-0.03732 U	-0.004813 U	-0.02473 U	0.00567 U	0.004758 U	0.01094 U	0.005124 U	-0.007036 U
Cs-134	0.007643 U	0.03617 U	-0.0148 U	-0.01911 U	-0.002634 U	-0.009905 U	-0.004164 U	0.002724 U	-0.02168 U	-0.004 U
Cs-137	0.6246	0.3781	0.5573	0.6824	0.8016	1.185	1.079	0.4708	0.4412	0.6667
Eu-152	-0.0311 U	-0.002155 U	0.0002659 U	0.00786 U	0.01594 U	-0.024 U	0.04733 U	0.03715 U	0.1544 U	-0.0319 U
Eu-154	-0.02404 U	0.03945 U	0.02162 U	0.0006731 U	-0.0007058 U	-0.02207 U	0.001402 U	0.01457 U	0.0009836 U	0.005879 U
Eu-155	-0.002787 U	0.02559 U	-0.01859 U	0.08675 U	-0.008159 U	0.006545 U	-0.001 U	0.04439 U	0.06606 U	0.009378 U
Mn-54	0.01831 U	0.001203 U	-0.02022 U	0.00683 U	0.02114 U	0.009603 U	-0.004489 U	0.09233 U	-0.01201 U	-0.005001 U
Nb-94	0.08483 U	0.01833 U	0.02945 U	0.01451 U	-0.01546 U	0.01155 U	0.0002717 U	-0.008388 U	-0.01714 U	-0.007377 U
Sb-125	0.0548 U	0.09492 U	0.05336 U	-0.03914 U	0.1961 U	0.0676 U	0.172 U	-0.006703 U	0.001351 U	0.05162 U
Hard to detect (pCi/g)										
Sr-90	0.0224 U	0.0221 U	0.0235 U	0.0244 U	0.0554	0.0722	0.0978	0.048	0.0177 U	0.0548

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.1.1
 Soil Sample Results - FSS Data
 Background REF-01 Area
 YNPS Rowe, MA

Station	REF-01-01-021-F	REF-01-01-022-F	REF-01-01-023-F	REF-01-01-024-F	REF-01-01-025-F	REF-01-01-026-F	REF-01-01-027-F	REF-01-01-028-F	REF-01-01-029-F	REF-01-01-030-F
gamma-spec (pCi/g)										
Ag-108m	0.008285 U	0.1102 U	0.02025 U	0.1206 U	0.1354 U	0.1454 U	0.00009249 U	-0.006265 U	-0.02594 U	
Am-241	-0.03095 U	0.02591 U	0.08537 U	0.1019 U	-0.1172 U	-0.007214 U	0.07019 U	0.02337 U	0.2952 U	
Co-60	-0.001265 U	0.02083 U	-0.02504 U	-0.001972 U	-0.01568 U	0.004636 U	-0.004761 U	-0.0156 U	0.02819 U	
Cs-134	0.02252 U	-0.007803 U	0.0006674 U	0.05068 U	-0.01351 U	-0.02689 U	0.02434 U	0.002303 U	-0.01989 U	
Cs-137	1.712	1.015	0.5018	1.908	0.5313	0.367	0.5913	0.6304	1.757	
Eu-152	-0.02918 U	-0.0474 U	-0.02764 U	-0.01194 U	-0.01944 U	0.03146 U	-0.04601 U	0.0348 U	0.04667 U	
Eu-154	-0.0007105 U	0.1306 U	0.1207 U	0.02484 U	0.02952 U	-0.02243 U	0.006233 U	-0.01326 U	0.03183 U	
Eu-155	-0.006806 U	0.06456 U	0.1194 U	0.1323 U	0.1264 U	0.1305 U	0.0687 U	0.08079 U	-0.005922 U	
Mn-54	-0.002735 U	-0.004352 U	-0.00009711 U	0.08179 U	-0.001097 U	0.003236 U	0.007918 U	0.005219 U	0.04057 U	
Nb-94	-0.01571 U	0.001654 U	-0.01304 U	-0.01365 U	0.09145 U	-0.01028 U	-0.004391 U	0.01639 U	-0.01258 U	
Sb-125	-0.01982 U	-0.03418 U	-0.04162 U	0.004018 U	-0.05425 U	0.08636 U	0.07968 U	-0.02717 U	-0.0001838 U	
Hard to detect (pCi/g)										
Sr-90	0.157	0.0366	0.0359	0.152	0.0234 U	0.0184 U	0.0301	0.0776	0.175	0.04

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.1.2
 Soil Sample Results -- Historical Site Assessment Data
 Background NIA Area
 YNPS Rowe, MA

Station	PR001-003	PR001-001	PR001-004	PR001-005	PR001-006	PR001-007	PR001-008	PR001-009	PR001-010	PR001-011	PR001-012	PR001-013	PR001-014
Date Sampled	8/24/1998	8/24/1998	8/25/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/24/1998	8/25/1998
Gamma-spec (pCi/g)													
Ag-108m	-0.02681 U	-0.03076 U	-0.0043 U	0.01296 U	-0.02624 U	0.0002096 U	-0.002759 U	0.003541 U	-0.01396 U	0.02559 U	0.01365 U	-0.002616 U	0.01008 U
Am-241	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Co-60	0.007521 U	-0.009002 U	-0.05305 U	-0.02841 U	-0.0674 U	0.02823 U	0.00378 U	-0.02651 U	-0.003418 U	-0.05621 U	-0.02498 U	-0.02752 U	0.0168 U
Cs-134	-0.04433 U	-0.04639 U	-0.03978 U	0.016 U	-0.01687 U	0.01988 U	-0.1071 U	0.0224 U	-0.1493 U	-0.01972 U	0.007604 U	-0.01033 U	0.006173 U
Cs-137	0.3018	0.8549	0.1782	0.289	0.7539	0.4259	0.2492	0.9047	0.7287	0.6201	0.5237	0.5758	0.7261
Mn-54	0.02042 U	-0.005933 U	-0.007164 U	0.01803 U	-0.01531 U	0.02911 U	0.02294 U	0.03599 U	0.02322 U	0.003681 U	-0.001758 U	-0.02323 U	0.002434 U
Nb-94					0.05059 U								
Sb-125		0.01547 U				-0.1618 U							
Hard to detect (pCi/g)													
Ag-110m	0.02602 U	0.04414 U	0.01956 U	0.009628 U	-0.01776 U	-0.0002988 U	-0.01575 U	-0.01628 U	-0.02202 U	0.03384 U	0.02237 U	-0.05268 U	0.01316 U
Ce-144	-0.135 U	-0.04514 U	0.08899 U	0.07789 U	0.105 U	-0.08908 U	-0.1132 U	-0.03716 U	0.0471 U	0.2885 U	-0.2007 U	-0.02332 U	-0.1618 U
Co-58	-0.007514 U	0.002696 U	0.02782 U	0.03958 U	0.02287 U	-0.04205 U	0.01468 U	0.031 U	0 U	0.002213 U	-0.004918 U	-0.03607 U	0.02161 U
Fe-59	-0.001637 U	-0.01421 U	-0.0592 U	0.1134 U	0.01201 U	-0.0494 U	-0.04735 U	0.1064 U	-0.1506 U	0.01906 U	-0.007883 U	-0.01444 U	0 U
Nb-95	0.007381 U	0.01233 U	-0.02259 U	0.0332 U	-0.04397 U	0.0007378 U	0.03288 U	-0.05519 U	0.01818 U	-0.0008109 U	-0.00171 U	-0.001252 U	0.04442 U
Np-239												0.1537 U	
Sb-124	-0.01019 U	0.03086 U	0 U	0.018 U	0.03795 U	-0.04129 U	0.01309 U	0.004201 U	0.05857 U	-0.01282 U	0.007818 U	0.06879 U	0 U
Zn-65	-0.01514 U	-0.07885 U	-0.06477 U	-0.03422 U	0.04617 U	0.1097 U	-0.1138 U	-0.09199 U	-0.1002 U	0.05538 U	-0.1609 U	-0.006346 U	-0.04015 U
Zr-95	0.07164 U	0.02584 U	0.05728 U	0.03486 U	0.009103 U	0.005996 U	0.02072 U	-0.03385 U	0.0551 U	0.0265 U	0.04804 U	-0.001101 U	0.02374 U

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Soil Sample Results -- Historical Site Assessment Data

Background NIA Area

YNPS Rowe, MA

Station Date Sampled	PR001-015 8/25/1998	PR001-016 8/25/1998	PR001-017 8/24/1998	PR001-018 8/24/1998	PR001-019 8/24/1998	PR001-020 8/24/1998	PR001-021 8/24/1998	PR001-022 8/24/1998	PR001-023 8/24/1998	PR001-024 8/24/1998	PR001-025 8/24/1998	PR001-026 8/24/1998	PR001-027 8/24/1998
Gamma-spec (pCi/g)													
Ag-108m	0.006894 U	0.01177 U	0.004206 U	-0.007407 U	0.02988 U	0.004631 U	-0.01937 U	-0.006974 U	0.00688 U	0.01022 U	-0.01008 U	-0.002721 U	-0.01494 U
Am-241	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
Co-60	-0.01776 U	-0.03129 U	-0.02575 U	0 U	-0.007929 U	-0.0401 U	-0.03636 U	0.005842 U	-0.008143 U	0.005853 U	-0.02495 U	-0.007636 U	0.009316 U
Cs-134	0.009674 U	0.1792 U	-0.2912 U	-0.1069 U	-0.01667 U	-0.02344 U	-0.09664 U	-0.06158 U	0.009315 U	-0.04735 U	-0.08943 U	-0.02149 U	-0.02622 U
Cs-137	0.4536	0.5935	0.5106	1.204	0.7093	1.605	0.505	0.8418	0.2321	1.09	0.006883 U	1.169	1.041
Mn-54	-0.02334 U	-0.04682 U	0.02039 U	0.02767 U	0.01357 U	-0.03168 U	-0.02308 U	0.03296 U	-0.01915 U	0.01704 U	-0.02036 U	0.02579 U	0.02054 U
Nb-94													
Sb-125	0.04495 U								-0.00008087 U				
Hard to detect (pCi/g)													
Ag-110m	0.03643 U	0.005292 U	-0.01795 U	0.0193 U	0.0395 U	0.0406 U	0.02421 U	0.009898 U	0.02471 U	-0.01831 U	-0.05412 U	0.01574 U	-0.04133 U
Ce-144	0.2165 U	-0.09754 U	0.2456 U	-0.1887 U	-0.1207 U	0.2424 U	0.07019 U	0.1146 U	-0.1277 U	-0.05024 U	0.0241 U	-0.3766 U	-0.2015 U
Co-58	0.008687 U	-0.03509 U	-0.02283 U	-0.0594 U	-0.02945 U	-0.03302 U	-0.0159 U	0 U	-0.003107 U	0.01075 U	-0.01614 U	-0.02755 U	-0.009833 U
Fe-59	0.05239 U	-0.0124 U	0.01017 U	0.01525 U	-0.00132 U	-0.01204 U	0.04862 U	0.04689 U	-0.00872 U	-0.04021 U	-0.03148 U	0.0843 U	0.03581 U
Nb-95	-0.01933 U	-0.03915 U	-0.01589 U	-0.01596 U	0.03366 U	-0.02048 U	-0.0361 U	0.007016 U	-0.00454 U	0.01701 U	0.01193 U	0.03821 U	0.01661 U
Np-239									1.466 U				
Sb-124	0 U	0 U	0.002016 U	0.01204 U	-0.01173 U	0 U	-0.03134 U	-0.05463 U	0.006916 U	0.01197 U	0.02904 U	0.01911 U	0 U
Zn-65	0.01991 U	-0.08128 U	-0.1448 U	0.05308 U	-0.07704 U	0.02515 U	0.02918 U	0.01459 U	-0.1021 U	-0.06383 U	-0.01635 U	-0.1266 U	-0.03224 U
Zr-95	0 U	0.009434 U	-0.008517 U	0.0955 U	0.06301	0.02461 U	0.003164 U	0.004264 U	0 U	0.04596 U	0.08445	0.01285 U	0.03362 U

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Soil Sample Results -- Historical Site Assessment Data

Background NIA Area

YNPS Rowe, MA

Station	PR001-028	PR001-029	PR001-030	PR001-032
Date Sampled	8/24/1998	8/25/1998	8/25/1998	8/24/1998
Gamma-spec (pCi/g)				
Ag-108m	-0.062 U	-0.006781 U	-0.01584 U	-0.01114 U
Am-241	0 U	0 U	0 U	0 U
Co-60	-0.0168 U	0.004757 U	0.0257 U	0.02084 U
Cs-134	-0.1576 U	-0.02923 U	-0.2166 U	-0.07742 U
Cs-137	1.222	0.1476	1.643	0.7272
Mn-54	0.05093 U	0.01943 U	-0.001821 U	0.01848 U
Nb-94				
Sb-125		-0.002423 U		
Hard to detect (pCi/g)				
Ag-110m	0.009048 U	-0.002056 U	-0.06035 U	-0.01767 U
Ce-144	-0.06533 U	-0.004842 U	-0.3158 U	-0.1335 U
Co-58	0.003544 U	-0.0104 U	-0.01314 U	0.01056 U
Fe-59	0.03314 U	-0.02263 U	-0.004549 U	0.03575 U
Nb-95	0.002301 U	0.01508 U	0.0004285 U	0.02996 U
Np-239				
Sb-124	0.03024 U	0 U	0.03253 U	0.06322 U
Zn-65	0.03322 U	-0.0001651 U	0.1246 U	0.03826 U
Zr-95	0.02525 U	0.04074 U	0.06431 U	-0.002005 U

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Soil Sample Results - Historical Site Assessment Data

Background Pelham Lake Area

YNPS Rowe, MA

Station	TS-01A	TS-01B	TS-01C	TS-01D	TS-02A	TS-02B	TS-02C	TS-02D	TS-03A	TS-03B	TS-03C	TS-03D	TS-04B	TS-04C
Sample ID	TS-01A	TS-01B	TS-01C	TS-01D	TS-02A	TS-02B	TS-02C	TS-02D	TS-03A	TS-03B	TS-03C	TS-03D	TS-04B	TS-04C
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996
Cs-137	1.038	0.941	1.517	1.07	0.928	0.74	0.451	1.216	2.08	0.999	0.853	-0.023 U	1.034	1.299
Sr-90	0.235	-0.18 U		0.952				1.142				1.112		

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Appendix Table B.1.1.3
Soil Sample Results - Historical Site Assessment Data
Background Pelham Lake Area
YNPS Rowe, MA

Station	TS-04D	TS-05A	TS-05B	TS-05C	TS-05D	TS-06A	TS-06B	TS-06C	TS-06D	TS-07A	TS-07B	TS-07C	TS-07D
Sample ID	TS-04D	TS-05A	TS-05B	TS-05C	TS-05D	TS-06A	TS-06B	TS-06C	TS-06D	TS-07A	TS-07B	TS-07C	TS-07D
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996
Cs-137	1.201	1.094	1.167	1.049	1.352	0.217	0.1	0.154	0.35	0.124	0.073	0.099	0.306
Sr-90	0.935												

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Appendix Table B.1.1.3
 Soil Sample Results - Historical Site Assessment Data
 Background Pelham Lake Area
 YNPS Rowe, MA

Station	TS-08A	TS-08B	TS-08C	TS-08D	TS-09A	TS-09B	TS-09C	TS-09D	TS-10A	TS-10B	TS-10C	TS-10D	TS-11A
Sample ID	TS-08A	TS-08B	TS-08C	TS-08D	TS-09A	TS-09B	TS-09C	TS-09D	TS-10A	TS-10B	TS-10C	TS-10D	TS-11A
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996
Cs-137	0.585	0.088	0.092	0.147	0.074	0.132	0.14	0.225	0.083	0.126	0.132	-0.035 U	0.554
Sr-90													-0.09 U

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Soil Sample Results - Historical Site Assessment Data

Background Pelham Lake Area

YNPS Rowe, MA

Station	TS-11B	TS-11C	TS-11D	TS-12A	TS-12B	TS-12C	TS-12D	TS-13A	TS-13B	TS-13C	TS-13D	TS-14A	TS-14B	TS-14C
Sample ID	TS-11B	TS-11C	TS-11D	TS-12A	TS-12B	TS-12C	TS-12D	TS-13A	TS-13B	TS-13C	TS-13D	TS-14A	TS-14B	TS-14C
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996
Cs-137	0.591	2.03	0.374	0.852	0.769	0.897	2.16	0.732	0.717	1.194	1.385	0.757	1.472	0.959
Sr-90	0.069 U	0.624	0.75	0.12 U	-0.02 U	0.371		0.12 U	-0.02 U	0.413	0.649	0.31 U		0.496

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Soil Sample Results - Historical Site Assessment Data

Background Pelham Lake Area

YNPS Rowe, MA

Station	TS-14D	TS-15A	TS-15B	TS-15C	TS-15D	TS-16A	TS-16B	TS-16C	TS-16D	TS-17A	TS-17B	TS-17C	TS-17D	TS-18A
Sample ID	TS-14D	TS-15A	TS-15B	TS-15C	TS-15D	TS-16A	TS-16B	TS-16C	TS-16D	TS-17A	TS-17B	TS-17C	TS-17D	TS-18A
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996
Cs-137	-0.002 U	0.37	1.107	0.789	-0.006 U	1.051	0.774	0.599	1.217	0.539	1.42	0.292	0.605	0.84
Sr-90	0.173	-0.049 U	-0.146 U		0.148	0.244	0.188 U	0.072 U	0.506		0.684	-0.003 U		

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Appendix Table B.1.1.3

Soil Sample Results - Historical Site Assessment Data

Background Pelham Lake Area

YNPS Rowe, MA

Station	TS-18B	TS-18C	TS-18D	TS-19A	TS-19B	TS-19C	TS-19D	TS-20A	TS-20B	TS-20C	TS-20D	TS-21D
Sample ID	TS-18B	TS-18C	TS-18D	TS-19A	TS-19B	TS-19C	TS-19D	TS-20A	TS-20B	TS-20C	TS-20D	TS-21D
Date Sampled	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	10/15/1996	6/17/1997
Cs-137	1.212	0.659	0.346	0.518	0.763	0.909	1.125	1.104	1.038	0.936	1.496	
Sr-90	0.23 U	0.857						0.326	-0.002 U	0.464		1.058

U-Result<MDA;UI-Uncertain Identification, Negative results are an artifact of adjusting for instrument background interferences;
Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	BRT-01-07-030-F	BRT-01-07-031-F	BRT-01-07-032-F	NOL-01-01-001-F	NOL-01-01-002-F	NOL-01-01-003-F	NOL-01-01-004-F	NOL-01-01-005-F	NOL-01-01-006-F	NOL-01-01-007-F
gamma-spec (pCi/g)										
Ag-108m	0.001771 U	-0.051085 U	-0.0008383 U	-0.008486 U	0.0002178 U	0.09601 U	-0.01554 U	0.07307 U	-0.002056 U	-0.01132 U
Am-241	-0.3016 U	0.17969 U	-0.2681 U	0.4869 U	0.0005314 U	0.01746 U	-0.1655 U	-0.02249 U	-0.0601 U	-0.003569 U
Co-60	0.3692	1.7062	0.3344	0.0116 U	0.01079 U	0.02838 U	-0.003414 U	0.0677	0.04007 U	0.04076 U
Cs-134	0.01559 U	-0.01794 U	0.01873 U	-0.02224 U	-6.169E-08 U	0.0005442 U	-0.003106 U	0.09281 U	0.0246 U	0.02085 U
Cs-137	0.3572	0.6446	0.6595	0.009559 U	0.04992 U	0.1369	0.09555	0.1414	0.3347	0.09316
Eu-152	0.02368 U	0.034325 U	-0.000549 U	0.03152 U	-0.01517 U	0.001438 U	-0.005124 U	0.01438 U	0.02348 U	-0.01559 U
Eu-154	0.03057 U	0.1312 U	-0.00001136 U	-0.02437 U	-0.01337 U	-0.02137 U	0.01404 U	-0.00552 U	-0.02233 U	-0.0003902 U
Eu-155	0.0707 U	0.021335 U	0.1392 U	0.06019 U	0.06202 U	0.08177 U	-0.01125 U	-0.01144 U	-0.001388 U	0.01326 U
Mn-54	0.01447 U	0.024746 U	0.01777 U	0.02401 U	0.0004157 U	0.0118 U	0.008624 U	0.006429 U	0.01917 U	0.03242 U
Nb-94	-0.003728 U	0.01691 U	-0.009212 U	-0.0007288 U	0.009682 U	-0.00403 U	0.002286 U	0.007475 U	-0.0002349 U	-0.000204 U
Sb-125	0.01871 U	-0.032172 U	0.07692 U	0.129	0.139	0.0714 U	0.09436 U	0.05907 U	0.0117 U	0.07948 U
Hard to detect (pCi/g)										
C-14				0.27				4.86	0.263	
Cm-243				-0.00541 U				-0.0421 U	-0.0186 U	
Fe-55				-7.69 U				-0.706 U	-4.51 U	
H-3								1.28 U	-1.78 U	
Ni-63				-1.11 U				0.903 U	0.446 U	
Pu-238				0.0133 U				-0.0119 U	-0.00339 U	
Pu-239				-0.00902 U				0.0392 U	0.0141 U	
Pu-241				-0.142 U				-1.37 U	-0.665 U	
Sr-90				0.00603 U				0.000661 U	0.0132 U	
Tc-99				0.226 U				0.0945 U	0.0654 U	

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-01-008-F	NOL-01-01-009-F	NOL-01-01-010-F	NOL-01-01-011-F	NOL-01-01-012-F	NOL-01-01-013-F	NOL-01-01-014-F	NOL-01-01-015-F	NOL-01-01-016-F	NOL-01-01-017-F
gamma-spec (pCi/g)										
Ag-108m	-0.009626 U	-0.001829 U	-0.001571 U	-0.0007053 U	-0.01233 U	0.002552 U	-0.0004532 U	0.02053 U	-0.02831 U	-0.02432 U
Am-241	-0.1097 U	-0.1095 U	-0.004388 U	-0.1526 U	-0.008313 U	0.007675 U	-0.09387 U	-0.1331 U	0.08291 U	-0.3147 U
Co-60	0.0387 U	0.01669 U	0.1845	0.01047 U	0.0008993 U	-0.002604 U	-0.002605 U	-0.002712 U	0.01086 U	-0.002551 U
Cs-134	-0.025 U	0.00121 U	0.02257 U	-0.002317 U	-0.01631 U	0.02148 U	0.002217 U	0.0007892 U	-0.004649 U	-0.003697 U
Cs-137	0.09665	0.06359	-0.01137 U	-0.0003061 U	0.01499 U	-0.001481 U	-0.001141 U	-0.0002786 U	-0.00646 U	0.01129 U
Eu-152	0.09034 U	-0.03578 U	0.006186 U	0.03098 U	-0.004318 U	0.01864 U	0.03342 U	0.05886 U	0.0569 U	0.01515 U
Eu-154	-0.01725 U	-0.03698 U	-0.03172 U	-0.001435 U	0.01259 U	-0.009012 U	0.01969 U	0.02669 U	0.001594 U	0.1221
Eu-155	0.1515 U	-0.01298 U	0.02883 U	-0.007457 U	0.01555 U	0.1181 U	-0.001774 U	0.1665 U	0.05966 U	0.09867 U
Mn-54	0.02351 U	0.005831 U	0.007649 U	0.0132 U	0.01113 U	0.01813 U	0.02994 U	0.02116 U	0.01644 U	0.01406 U
Nb-94	-0.001927 U	-0.0101 U	-0.0035 U	0.01439 U	0.005889 U	0.004844 U	0.0112 U	0.03546 U	0.0008579 U	0.000796 U
Sb-125	0.09082 U	0.08276 U	0.103 U	0.058 U	0.1114	0.1071	0.0643 U	0.09164 U	0.09639	0.0785 U
Hard to detect (pCi/g)										
C-14	0.118 U		-0.0269 U	0.147 U	-0.0393 U		0.036 U			0.0612 U
Cm-243	0.0143 U		0.00972 U	0.00634 U	-0.0151 U		0.0233 U			-0.043 U
Fe-55	-1.21 U		-2.67 U	-1.87 U	-0.3 U		-1.27 U			-3.05 U
H-3	-2.39 U				-1.93 U					6.89
Ni-63	0.145 U		0.191 U	-1.04 U	-0.259 U		0.266 U			0.43 U
Pu-238	0.0171 U		0.000454 U	-0.0123 U	0.00666 U		0.00184 U			-0.041 U
Pu-239	-0.0125 U		0.0059 U	0.000864 U	-0.0114 U		-0.017 U			0.00634 U
Pu-241	-2.98 U		-4.2 U	-3.63 U	-1.35 U		1.21 U			-2.72 U
Sr-90	-0.00734 U		0.0073 U	-0.00284 U	0.0164 U		-0.00433 U			0.00586 U
Tc-99	0.0062 U		0.0534 U	0.0878 U	0.237 U		0.12 U			0.0291 U

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-01-018-F	NOL-01-01-019-F	NOL-01-01-047-F	NOL-01-01-048-F	NOL-01-01-049-F	NOL-01-02-001-F	NOL-01-02-002-F	NOL-01-02-003-F	NOL-01-02-004-F	NOL-01-02-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.01162 U	0.00003951 U	0.00009096 U	-0.001672 U	-0.005709 U	0.003512 U	-0.01707 U	0.005459 U	-0.01156 U	-0.01064 U
Am-241	-0.007523 U	-0.0802 U	0.1386 U	-0.08998 U	-0.156 U	-0.1884 U	0.01121 U	0.1157 U	-0.2398 U	0.3349 U
Co-60	0.03274	0.01186 U	0.2943	1.243	0.03582 U	0.04032 U	0.04296 U	0.2769	-0.0001769 U	-0.001144 U
Cs-134	0.0007049 U	-0.01031 U	0.02489 U	0.005367 U	0.01681 U	0.02393 U	-0.0208 U	-0.03013 U	0.001237 U	0.002502 U
Cs-137	0.1302	0.009347 U	0.5734	1.065	0.1221	0.3692	0.3065	0.3677	0.03327 U	0.1355
Eu-152	0.02019 U	0.0202 U	0.01756 U	0.03313 U	-0.04487 U	0.1643 U	0.04047 U	0.05251 U	0.05132 U	-0.0499 U
Eu-154	-0.0006202 U	-0.01057 U	0.01627 U	-0.01573 U	-0.01152 U	-0.004288 U	-0.02142 U	0.02843 U	0.03297 U	-0.002506 U
Eu-155	-0.08078 U	0.09089 U	0.09939 U	0.08236 U	0.106 U	-0.01885 U	-0.004917 U	0.2256 U	0.1292 U	0.2222 U
Mn-54	0.02156 U	0.005485 U	-0.0002914 U	0.01826 U	0.02104 U	-0.0005368 U	0.002416 U	0.01551 U	0.00526 U	-0.01777 U
Nb-94	0.005346 U	0.03105 U	-0.00004489 U	-0.002902 U	0.006936 U	0.00746 U	-0.008833 U	0.006152 U	0.01325 U	0.01297 U
Sb-125	0.03827 U	0.06141 U	-0.02471 U	0.01451 U	0.08323 U	0.01847 U	-0.01237 U	0.1784 U	0.002468 U	0.04022 U
Hard to detect (pCi/g)										
C-14	0.644	0.0224 U				0.066 U	-0.03 U	0.105 U	-0.00716 U	-0.0758 U
Cm-243	0.0124 U	-0.0328 U				0.016 U	-0.0017 U	0.0169 U	-0.00347 U	-0.0325 U
Fe-55	-0.572 U	-0.158 U				-2.7 U	-1.59 U	-3.43 U	-1.52 U	-3.61 U
H-3	-1.58 U	3.06 U						3.15 U		0.316 U
Ni-63	0.587 U	-0.431 U				0.691 U	-0.849 U	-0.0732 U	0.0765 U	-1.2 U
Pu-238	0.000528 U	0.00044 U				-0.0011 U	0.00428 U	0.00718 U	-0.0135 U	0.0378 U
Pu-239	-0.0158 U	-0.0493 U				0.0192 U	0.00599 U	0.0143 U	0.0239 U	-0.013 U
Pu-241	-1.85 U	-3.38 U				-5.74 U	-2.73 U	-1.6 U	-2.99 U	-0.997 U
Sr-90	0.0115 U	0.00674 U				0.000161 U	-0.0158 U	-0.0106 U	-0.0129 U	-0.000125 U
Tc-99	0.177 U	0.171 U				0.139 U	0.0487 U	0.1 U	0.0672 U	0.117 U

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-02-006-F	NOL-01-02-007-F	NOL-01-02-008-F	NOL-01-02-009-F	NOL-01-02-010-F	NOL-01-02-011-F	NOL-01-02-012-F	NOL-01-02-013-F	NOL-01-02-014-F	NOL-01-02-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.007461 U	-0.03135 U	0.01095 U	-0.01801 U	-0.01357 U	-0.000357 U	0.0009799 U	0.02957 U	0.201	0.0001851 U
Am-241	-0.002767 U	0.1651 U	0.03501 U	0.00003312 U	0.04162 U	-0.02596 U	-0.004932 U	-0.1375 U	-0.1934 U	0.005263 U
Co-60	0.008345 U	0.1636	0.2515	0.09806	-0.0001943 U	0.007058 U	0.1219	0.3619	0.1418	0.008543 U
Cs-134	0.01398 U	0.02998 U	0.02894 U	0.03178 U	0.02652 U	-0.02436 U	0.003208 U	-0.01881 U	-0.03031 U	0.001194 U
Cs-137	0.1261	0.4014	0.5643	1.934	0.01484 U	0.03488 U	0.3421	0.556	0.127	0.2253
Eu-152	0.002228 U	0.1604 U	0.02584 U	0.04675 U	0.01167 U	-0.02518 U	-0.00233 U	-0.002646 U	0.00891 U	-0.006062 U
Eu-154	-0.008774 U	0.02333 U	0.05495 U	0.0323 U	-0.04793 U	-0.03206 U	-0.03766 U	0.01129 U	0.08911 U	-0.003901 U
Eu-155	0.007709 U	0.1636 U	0.0659 U	-0.03347 U	-0.001124 U	0.009383 U	0.1956 U	0.07011 U	0.2196 U	0.06089 U
Mn-54	-0.006124 U	-0.007996 U	0.02702 U	0.01625 U	0.003199 U	0.02921 U	0.00667 U	-0.005669 U	0.01542 U	0.01473 U
Nb-94	0.01199 U	0.08195 U	-0.004015 U	0.01068 U	-0.01631 U	-0.0004095 U	-0.01644 U	-0.005927 U	0.06937 U	-0.00234 U
Sb-125	0.08476 U	0.1435 U	-0.002856 U	0.06607 U	0.02364 U	-0.0289 U	0.00968 U	0.171 U	0.1295 U	-0.01002 U
Hard to detect (pCi/g)										
C-14	0.032 U	0.101 U	0.0267 U	-0.0523 U	-0.0412 U	0.0438 U	0.0778 U	0.0257 U		0.0775 U
Cm-243	-0.00342 U	0.00704 U	0.0189 U	0.0138 U	0.0339 U	0.00784 U	0.0161 U	0.00651 U		-0.00761 U
Fe-55	-10.6 U	0.192 U	-1.76 U	-2.07 U	-3.85 U	-1.01 U	-3.01 U	-3.76 U		0.284 U
H-3					-3.01 U					
Ni-63	-0.865 U	-0.415 U	-0.472 U	-0.265 U	-1.15 U	0.365 U	1.68 U	1.48 U		-0.512 U
Pu-238	-0.0106 U	-0.00729 U	0.000246 U	0.0161 U	-0.0252 U	-0.019 U	0.0218 U	0.0425 U		0.0154 U
Pu-239	-0.0155 U	0.0133 U	0.0405 U	-0.00413 U	-0.0112 U	0.0016 U	0.0426 U	-0.0025 U		-0.00424 U
Pu-241	-1.88 U	-2.92 U	-1.05 U	-1.33 U	2.12 U	-1.16 U	-0.192 U	-1.85 U		0.0901 U
Sr-90	0.00516 U	-0.00887 U	0.0138 U	-0.00386 U	0.0176 U	0.00299 U	0.00662 U	0.113		0.00026 U
Tc-99	0.0666 U	0.0505 U	0.143 U	-0.0791 U	0.128 U	-0.0103 U	0.0375 U	-0.0434 U		0.0365 U

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-02-016-F	NOL-01-02-017-F	NOL-01-02-018-F	NOL-01-02-051-R	NOL-01-02-052-R	NOL-01-02-053-R	NOL-01-02-054-R	NOL-01-03-001-F	NOL-01-03-002-F	NOL-01-03-003-F
gamma-spec (pCi/g)										
Ag-108m	-0.007458 U	-0.0204 U	0.0213 U	0.0003235 U	-0.0009253 U	-0.02371 U	-0.01796 U	-0.0257 U	-0.01696 U	0.05922
Am-241	-0.008052 U	0.0468 U	-0.0762 U	0.1565 U	-0.06392 U	0.008023 U	-0.03823 U	0.1565 U	-0.0831 U	-0.1222 U
Co-60	0.3738	0.0292 U	0.201	0.1675	0.2886	0.1356	0.2863	0.07048	0.08584	0.06645
Cs-134	0.0003024 U	0.058 U	0.0598 U	0.01969 U	-0.004935 U	0.03108 U	0.02492 U	-0.03042 U	0.02755 U	-0.00665 U
Cs-137	0.5551	0.0644	0.395	0.5036	0.3288	0.2738	0.1996	0.3859	0.5021	0.2765
Eu-152	0.2276	0.0296 U	-0.0259 U	-0.03062 U	0.0327 U	0.1471 U	0.0174 U	-0.03257 U	-0.04064 U	-0.02743 U
Eu-154	0.03861 U	0.0483 U	0.0131 U	-0.02211 U	-0.001493 U	0.006275 U	-0.02526 U	0.03004 U	0.02188 U	0.003216 U
Eu-155	0.1694 U	0.0517 U	0.0521 U	-0.006331 U	-0.03835 U	0.1741 U	0.09847 U	0.1538 U	0.08355 U	-0.01102 U
Mn-54	0.001841 U	0.031 U	0.0245 U	0.008465 U	0.01375 U	0.005163 U	0.02354 U	0.02347 U	-0.0003968 U	0.01995 U
Nb-94	0.01771 U	-0.00541 U	0.0234 U	0.005802 U	0.001208 U	0.04332 U	0.004521 U	0.02664 U	0.01751 U	-0.0103 U
Sb-125	0.05456 U	-0.0194 U	-0.0064 U	0.091 U	0.08993 U	0.1103 U	0.1073 U	0.02468 U	0.009667 U	0.003619 U
Hard to detect (pCi/g)										
C-14		0.132 U	-0.0372 U							
Cm-243		0.0473 U	-0.0167 U							
Fe-55		-0.169 U	-2.34 U							
H-3		-3.84 U	-3.75 U							
Ni-63		-1.47 U	-0.487 U							
Pu-238		-0.0118 U	0.0581 U							
Pu-239		0.00687 U	0.0874 U							
Pu-241		-0.585 U	5.75 U							
Sr-90		0.00546 U	0.016 U							
Tc-99		0.243 U	0.187 U							

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-03-004-F	NOL-01-03-005-F	NOL-01-03-006-F	NOL-01-03-007-F	NOL-01-03-008-F	NOL-01-03-009-F	NOL-01-03-010-F	NOL-01-03-011-F	NOL-01-03-012-F	NOL-01-03-013-F
gamma-spec (pCi/g)										
Ag-108m	0.02073 U	-0.01778 U	0.04582 U	0.004422 U	0.2325	0.08379 U	0.01173 U	0.09008 U	-0.01687 U	-0.008461 U
Am-241	-0.1935 U	-0.006564 U	0.125 U	0.01907 U	-0.03732 U	0.1787 U	-0.05242 U	-0.006755 U	0.107 U	-0.001166 U
Co-60	-0.007124 U	0.03859 U	0.4876	-0.0001829 U	0.02999 U	-0.002574 U	0.02564 U	0.008427 U	0.01709 U	0.08031
Cs-134	0.02296 U	0.0003337 U	0.119 U	0.02028 U	0.02103 U	-0.01275 U	0.01933 U	0.02304 U	0.00779 U	-0.002951 U
Cs-137	0.2175	0.08884	1.477	0.001612 U	1.18	0.1252	0.02439 U	0.01339 U	-0.01046 U	0.02215 U
Eu-152	-0.0009606 U	0.0008001 U	-0.001297 U	-0.00263 U	0.01521 U	-0.01895 U	0.009494 U	-0.01854 U	-0.0021 U	-0.02172 U
Eu-154	-0.01335 U	0.06149 U	-0.0006861 U	-0.0002003 U	0.166	-0.01401 U	0.009383 U	-0.01775 U	0.008239 U	-0.01416 U
Eu-155	0.008855 U	0.1192 U	0.1848 U	0.1657 U	-0.004273 U	0.0007375 U	0.02556 U	0.09768 U	0.01077 U	0.01958 U
Mn-54	0.03535 U	0.006712 U	-0.009194 U	-0.01591 U	0.01603 U	-0.0137 U	0.02023 U	0.002209 U	0.00874 U	-0.002123 U
Nb-94	-0.004358 U	0.007996 U	0.01085 U	0.01186 U	0.01371 U	0.01109 U	-0.008769 U	-0.007945 U	-0.00548 U	-0.0003687 U
Sb-125	0.1491	-0.04438 U	-0.04848 U	0.09755 U	-0.007082 U	0.01846 U	0.09148 U	0.08416 U	0.09706 U	0.09002 U
Hard to detect (pCi/g)										
C-14								0.293		
Cm-243								0.0816 U		
Fe-55								-1.97 U		
H-3								0.681 U		
Ni-63								-2.45 U		
Pu-238								0.00199 U		
Pu-239								0.187		
Pu-241								21.9		
Sr-90								0.231 U		
Tc-99								-0.352 U		

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-03-014-F	NOL-01-03-015-F	NOL-01-03-016-F	NOL-01-03-017-F	NOL-01-03-028-F	NOL-01-03-029-F	NOL-01-03-030-F	NOL-01-03-031-F	NOL-01-03-032-F	NOL-01-03-033-F
gamma-spec (pCi/g)										
Ag-108m	-0.01192 U	0.02204 U	-0.03162 U	0.3426	0.007145 U	0.01491 U	-0.01014 U	0.02128 U	0.05028 U	0.01753 U
Am-241	-0.03135 U	-0.01405 U	-0.1315 U	0.0794 U	0.05764 U	0.05915 U	-0.1009 U	0.07676 U	0.02825 U	-0.1184 U
Co-60	0.03346 U	0.02798 U	0.05521 U	0.2619	0.0603 U	0.009909 U	-0.01466 U	2.126	0.2938	0.229
Cs-134	-0.02229 U	-0.01297 U	0.02716 U	0.01742 U	-0.01746 U	0.0005391 U	-0.015 U	-0.02206 U	0.02605 U	0.03402 U
Cs-137	-0.006133 U	0.006476 U	0.1878	0.4762	0.06116 U	0.02217 U	0.0411 U	1.76	1.237	0.6589
Eu-152	0.0007161 U	0.02974 U	-0.05721 U	-0.01231 U	-0.03344 U	0.007371 U	-0.005317 U	0.03202 U	-0.01514 U	-0.05885 U
Eu-154	-0.00003394 U	-0.03469 U	0.04362 U	0.2989	-0.01263 U	-0.01371 U	-0.02626 U	-0.01026 U	-0.001881 U	-0.03972 U
Eu-155	0.08732 U	0.1469 U	-0.07471 U	-0.04723 U	-0.0004022 U	0.09506 U	0.01266 U	-0.002217 U	0.1526 U	-0.008333 U
Mn-54	0.02327 U	-0.004078 U	0.02588 U	0.00009642 U	-0.01848 U	-0.01053 U	0.02142 U	-0.004677 U	-0.0007106 U	-0.004411 U
Nb-94	-0.0002129 U	-0.005001 U	0.00004595 U	0.008033 U	0.01542 U	0.01238 U	0.01693 U	-0.005772 U	-0.01577 U	-0.01239 U
Sb-125	0.1318	0.007604 U	0.141 U	0.1448 U	0.09803 U	0.09251 U	0.1131 U	-0.00126 U	0.2246	0.1089 U
Hard to detect (pCi/g)										
C-14	0.466									
Cm-243	0.067 U									
Fe-55	-13.4 U									
H-3	-0.721 U									
Ni-63	-0.855 U									
Pu-238	0.00624 U									
Pu-239	0.00178 U									
Pu-241	10.3 U									
Sr-90	0.642 U									
Tc-99	-0.0576 U									

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-03-034-F	NOL-01-03-035-F	NOL-01-03-037-F	NOL-01-03-038-F	NOL-01-03-039-F	NOL-01-03-040-F	NOL-01-03-043-R	NOL-01-03-044-R	NOL-01-03-049-F	NOL-01-03-054-F
gamma-spec (pCi/g)										
Ag-108m	-0.008541 U	0.01224 U	0.03005 U	-0.04653 U	0.05281 U	0.02098 U	0.0007362 U	-0.0008538 U	0.001051 U	0.0151 U
Am-241	0.00809 U	0.08005 U	-0.06731 U	0.1531 U	-0.01407 U	0.01347 U	0.2575 U	0.01718 U	-0.1642 U	0.1163 U
Co-60	0.8852	-0.0002242 U	0.5198	15.15	1.862	0.0485 U	0.01728 U	0.02451 U	0.2179	0.009504 U
Cs-134	-0.02124 U	-0.003437 U	0.001549 U	-0.07896 U	-0.03138 U	0.00009175 U	0.01781 U	-0.0152 U	0.00381 U	0.02929 U
Cs-137	1.86	0.2712	1.819	0.9573	4.115	0.2727	0.5009	0.1074	0.6413	0.09528
Eu-152	-0.08109 U	0.005803 U	0.001349 U	0.0001012 U	-0.06287 U	-0.02687 U	0.0749 U	-0.01756 U	-0.005744 U	0.03242 U
Eu-154	-0.03045 U	0.07893 U	-0.005147 U	0.003139 U	-0.03844 U	-0.004883 U	-0.0005458 U	0.0009625 U	0.00671 U	-0.007333 U
Eu-155	0.115 U	0.1228 U	0.1562 U	0.1798 U	0.1313 U	0.1403 U	0.1361 U	0.183 U	0.1952 U	-0.003209 U
Mn-54	0.004802 U	-0.008301 U	0.01644 U	0.003764 U	-0.001288 U	-0.0004578 U	0.02686 U	0.0005741 U	-0.002252 U	0.001663 U
Nb-94	-0.02122 U	0.08548 U	-0.01257 U	-0.003043 U	0.003498 U	-0.006336 U	-0.002601 U	0.0008902 U	0.0171 U	-0.009821 U
Sb-125	0.1935 U	0.2065	0.1376 U	0.01178 U	0.03237 U	-0.005103 U	0.09467 U	0.06932 U	0.1187 U	0.08489 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-03-055-F	NOL-01-03-056-F	NOL-01-03-057-F	NOL-01-03-058-F	NOL-01-04-001-F	NOL-01-04-001-R	NOL-01-04-002-F	NOL-01-04-002-R	NOL-01-04-003-F	NOL-01-04-003-R
gamma-spec (pCi/g)										
Ag-108m	-0.004448 U	-0.001941 U	-0.01563 U	0.01462 U	-0.02483 U	0.1093 U	-0.01041 U	-0.02858 U	-0.04622 U	-0.02756 U
Am-241	-0.07305 U	-0.06765 U	-0.1038 U	0.001332 U	-0.1792 U	-0.1767 U	-0.2013 U	-0.04689 U	0.0436 U	-0.009371 U
Co-60	0.005619 U	0.4247	-0.0001252 U	0.1391	0.0309 U	0.03813 U	0.01463 U	0.05237 U	0.08488	0.1986
Cs-134	-0.004284 U	-0.01501 U	-0.01804 U	0.01485 U	0.003714 U	0.03194 U	0.02535 U	0.01937 U	-0.02898 U	-0.01833 U
Cs-137	-0.009964 U	0.7521	-0.004607 U	0.426	-0.001563 U	0.04494 U	0.02473 U	0.1154	0.02907 U	0.2308
Eu-152	0.0356 U	0.02532 U	-0.00002801 U	-0.01015 U	-0.01778 U	0.05829 U	-0.04444 U	-0.04823 U	0.02312 U	0.08559 U
Eu-154	0.02819 U	-0.01243 U	0.02201 U	-0.0003882 U	-0.01574 U	0.03689 U	-0.0005288 U	-0.01678 U	-0.01477 U	0.02565 U
Eu-155	0.05878 U	0.1956 U	-0.007403 U	0.1026 U	0.06895 U	0.1682 U	0.1552 U	0.1147 U	-0.008453 U	0.1226 U
Mn-54	0.02642 U	0.003382 U	-0.0214 U	0.01134 U	-0.0121 U	0.007125 U	0.003559 U	0.001551 U	0.01657 U	0.01306 U
Nb-94	0.006349 U	-0.003084 U	0.01915 U	-0.00408 U	-0.008293 U	0.007792 U	0.00002598 U	0.002588 U	0.01 U	-0.00304 U
Sb-125	0.181	0.02337 U	0.1472 U	0.08348 U	0.07859 U	0.1047 U	0.1028	0.09458 U	0.1816	0.0919 U
Hard to detect (pCi/g)										
C-14					0.0306 U			-0.00136 U		
Cm-243					-0.00851 U			0.0112 U		
Fe-55					-2.79 U			-2.08 U		
H-3					-1.45 U			0.321 U		
Ni-63					-0.206 U			-0.968 U		
Pu-238					0.000594 U			-0.0119 U		
Pu-239					0.00415 U			-0.0045 U		
Pu-241					0.589 U			3.59 U		
Sr-90					0.00818 U			0.00789 U		
Tc-99					0.0494 U			0.199 U		

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Station	NOL-01-04-004-F	NOL-01-04-004-R	NOL-01-04-005-F	NOL-01-04-005-R	NOL-01-04-006-F	NOL-01-04-006-R	NOL-01-04-007-F	NOL-01-04-007-R	NOL-01-04-008-F	NOL-01-04-008-R
gamma-spec (pCi/g)										
Ag-108m	-0.01843 U	0.001357 U	-0.02757 U	-0.009694 U	0.00061 U	-0.001609 U	0.05938 U	0.03735	-0.001099 U	-0.02565 U
Am-241	0.1872 U	0.05961 U	-0.136 U	-0.02463 U	-0.08013 U	-0.07877 U	0.0225 U	-0.09797 U	-0.1401 U	-0.1608 U
Co-60	0.01108 U	0.1404	-0.02455 U	0.1227	0.07258	0.01154 U	0.9914	0.2087	0.02961 U	0.003588 U
Cs-134	0.02244 U	0.01885 U	0.02646 U	-0.01235 U	-0.01312 U	-0.001223 U	0.03261 U	0.02383 U	-0.01709 U	0.02966 U
Cs-137	0.02327 U	0.0821	0.012 U	0.07043	-0.01937 U	0.01225 U	0.1297	0.1208	0.05712 U	-0.000487 U
Eu-152	0.1652	0.09414 U	-0.001305 U	0.07753 U	-0.03291 U	-0.06162 U	-0.02858 U	-0.02989 U	0.04143 U	0.1106 U
Eu-154	-0.007199 U	-0.0004837 U	0.02028 U	0.00677 U	-0.02097 U	-0.0005053 U	0.2522	0.03044 U	0.03276 U	-0.01446 U
Eu-155	0.1349 U	0.1185 U	0.1746 U	0.1736 U	0.07017 U	0.01119 U	0.001744 U	-0.004395 U	0.0841 U	0.1203 U
Mn-54	0.003077 U	0.009075 U	0.02508 U	0.009493 U	0.0316 U	0.0008527 U	-0.0003024 U	-0.0003167 U	0.0202 U	0.02581 U
Nb-94	0.0409 U	0.002324 U	-0.0004029 U	0.01001 U	0.005765 U	0.004864 U	-0.0001165 U	-0.004969 U	0.05021 U	-0.007575 U
Sb-125	0.09033 U	0.07486 U	0.05071 U	0.07113 U	0.08088 U	0.1028 U	0.107 U	0.0001713 U	0.05553 U	0.1017 U
Hard to detect (pCi/g)										
C-14			-0.0167 U							
Cm-243			-0.00646 U							
Fe-55			-2.05 U							
H-3			1.94 U							
Ni-63			-1.64 U							
Pu-238			-0.00467 U							
Pu-239			0.0144 U							
Pu-241			0.964 U							
Sr-90			0.00087 U							
Tc-99			0.128 U							

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-04-009-F	NOL-01-04-010-F	NOL-01-04-011-F	NOL-01-04-012-F	NOL-01-04-013-F	NOL-01-04-014-F	NOL-01-04-015-F	NOL-01-04-135-F	NOL-01-04-136-F	NOL-01-04-137-F
gamma-spec (pCi/g)										
Ag-108m	0.0002218 U	0.01375 U	0.000003184 U	-0.004052 U	-0.01828 U	-0.02238 U	-0.006508 U	-0.00908 U	-0.008223 U	0.003665 U
Am-241	-0.2918 U	-0.2543 U	0.1679 U	0.01168 U	0.0001122 U	-0.04114 U	0.3505 U	-0.1024 U	-0.01064 U	-0.0507 U
Co-60	0.09114	0.03605 U	0.2199	0.03316 U	0.01192 U	0.002323 U	0.00771 U	-0.002441 U	0.016 U	0.06215 U
Cs-134	0.02002 U	-0.0237 U	-0.02711 U	0.02994 U	-0.002677 U	-0.008751 U	0.02441 U	-0.01906 U	-0.02839 U	0.002869 U
Cs-137	0.08554	0.02692 U	0.05918	0.02593 U	0.04998 U	0.01221 U	0.09631	0.1667	0.01711 U	0.1726
Eu-152	-0.02501 U	0.1723	0.1384 U	-0.03135 U	0.1204 U	-0.01309 U	0.1091 U	0.02933 U	0.01881 U	-0.03004 U
Eu-154	0.003262 U	0.02264 U	-0.009235 U	0.02826 U	0.00004226 U	-0.01621 U	0.01228 U	0.02402 U	-0.0001663 U	-0.001351 U
Eu-155	0.001557 U	0.1673 U	0.2167 U	-0.02361 U	0.1224 U	-0.07612 U	-0.01118 U	0.01804 U	0.05592 U	0.1139 U
Mn-54	0.007241 U	0.02076 U	0.01653 U	0.02438 U	-0.00138 U	0.02485 U	0.01897 U	0.006193 U	-0.009657 U	0.0003998 U
Nb-94	0.003991 U	0.004438 U	0.0001288 U	0.06798 U	-0.004415 U	-0.01189 U	0.00003507 U	0.01603 U	0.009156 U	0.06209 U
Sb-125	0.1353	0.1094	0.09593 U	0.1221 U	0.1208 U	-0.01417 U	0.0962 U	0.02223 U	0.1211 U	-0.004316 U
Hard to detect (pCi/g)										
C-14						0.0259 U				
Cm-243						-0.0222 U				
Fe-55						-1.25 U				
H-3						1.32 U				
Ni-63						-0.875 U				
Pu-238						-0.0312 U				
Pu-239						0.000439 U				
Pu-241						0.577 U				
Sr-90						-0.00782 U				
Tc-99						0.157 U				

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-01-04-182-F	NOL-02-01-001-F	NOL-02-01-001-R	NOL-02-01-002-F	NOL-02-01-002-R	NOL-02-01-003-F	NOL-02-01-003-R	NOL-02-01-004-F	NOL-02-01-004-R	NOL-02-01-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.02897 U	0.0006893 U	-0.0179 U	0.01296 U	-0.02518 U	-0.006885 U	-0.0002584 U	0.01051 U	-0.006212 U	-0.004691 U
Am-241	0.1743 U	-0.06114 U	-0.3203 U	0.05172 U	0.08029 U	0.0813 U	0.1549 U	0.02758 U	-0.36 U	0.007807 U
Co-60	0.04348 U	0.05494 U	0.02124 U	0.02018 U	-0.007056 U	0.04394 U	0.02534 U	-0.007843 U	0.06269	0.000975 U
Cs-134	0.024 U	0.01961 U	-0.0007072 U	0.02413	0.001405 U	-0.01503 U	0.01547 U	0.02345 U	0.02448 U	0.02667 U
Cs-137	0.05654	0.2351	0.1118	-0.002307 U	-0.003547 U	0.1895	0.1126	-0.004171 U	0.1077	0.0351 U
Eu-152	-0.003947 U	0.009606 U	0.0209 U	0.1229 U	0.07936 U	0.03116 U	-0.00775 U	-0.02218 U	0.02286 U	0.1405 U
Eu-154	0.03615 U	0.01187 U	0.01348 U	0.01902 U	-0.03683 U	0.02148 U	-0.006562 U	-0.000837 U	0.01916 U	0.009573 U
Eu-155	0.1667 U	-0.002411 U	0.15 U	0.1281 U	-0.02104 U	0.1141 U	-0.003636 U	0.1175 U	0.01528 U	0.02815 U
Mn-54	0.003261 U	-0.0006412 U	-0.0002982 U	0.01285 U	-0.002374 U	-0.0006854 U	0.008683 U	0.0122 U	-0.001255 U	-0.01396 U
Nb-94	0.004614 U	0.008538 U	-0.006815 U	-0.004082 U	-0.002631 U	0.002905 U	-0.006162 U	0.01721 U	0.01242 U	0.0003756 U
Sb-125	0.1297	-0.01435 U	0.117	0.06631 U	0.1062 U	0.1431	0.1006 U	0.1186 U	0.09628 U	0.1362
Hard to detect (pCi/g)										
C-14										-0.021 U
Cm-243										0.0018 U
Fe-55										-3.88 U
H-3										-0.714 U
Ni-63										-1.01 U
Pu-238										-0.00234 U
Pu-239										0.0361 U
Pu-241										-1.61 U
Sr-90										0.0164 U
Tc-99										0.137 U

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-02-01-006-F	NOL-02-01-007-F	NOL-02-01-008-F	NOL-02-01-009-F	NOL-02-01-010-F	NOL-02-01-011-F	NOL-02-01-012-F
gamma-spec (pCi/g)							
Ag-108m	0.02954 U	-0.02676 U	0.01085 U	-0.01588 U	-0.01978 U	-0.02593 U	0.1231 U
Am-241	0.007116 U	-0.003799 U	0.08942 U	0.02873 U	0.02789 U	0.0308 U	-0.01024 U
Co-60	0.04313 U	0.01375 U	0.08807 U	0.02683 U	0.02356 U	-0.005997 U	0.02047 U
Cs-134	0.03896 U	-0.02771 U	-0.01847 U	0.0005436 U	0.0006136 U	0.02014 U	0.00355 U
Cs-137	0.2101 U	0.0384 U	0.05345 U	0.01435 U	0.01095 U	-0.001293 U	0.01896 U
Eu-152	0.02322 U	-0.01168 U	-0.002489 U	-0.01806 U	-0.03068 U	-0.00341 U	-0.01902 U
Eu-154	0.02016 U	0.02478 U	-0.002605 U	-0.002388 U	-0.0219 U	-0.0003732 U	-0.01897 U
Eu-155	-0.04559 U	0.163 U	0.1899 U	0.01695 U	0.1799 U	0.00976 U	0.1708 U
Mn-54	0.001008 U	0.004894 U	-0.006435 U	0.02364 U	-0.0008466 U	0.005105 U	-0.002733 U
Nb-94	-0.009086 U	-0.0002174 U	-0.0006723 U	0.01628 U	-0.0005242 U	0.01534 U	0.02025 U
Sb-125	0.1539 U	0.1094 U	0.135 U	0.09182 U	0.03417 U	0.09923 U	0.1245 U
Hard to detect (pCi/g)							
C-14			-0.0816 U				
Cm-243			0.00842 U				
Fe-55			-1.14 U				
H-3			-0.869 U				
Ni-63			0.106 U				
Pu-238			0.0644 U				
Pu-239			-0.0094 U				
Pu-241			-2.9 U				
Sr-90			0.012 U				
Tc-99			0.17 U				

U-Result<MDA, Negative results are an artifact of adjusting for instrument background interferences;
 Blanks indicate not analyzed

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-02-01-013-F	NOL-02-01-014-F	NOL-02-01-015-F	NOL-02-01-020-R	NOL-02-01-021-R	NOL-02-02-001-F	NOL-02-02-001-R	NOL-02-02-002-F	NOL-02-02-002-R	NOL-02-02-003-F
gamma-spec (pCi/g)										
Ag-108m	-0.02123 U	-0.001167 U	-0.01577 U	0.0000546 U	0.02606 U	-0.0014322 U	-0.020724 U	-0.017216 U	0.0015842 U	0.0074072 U
Am-241	-0.08627 U	-0.01918 U	0.1547 U	0.147 U	0.00851 U	-0.057304 U	-0.0017182 U	-0.0036593 U	0.040127 U	-0.066343 U
Co-60	0.1967	0.05163	0.05034	0.002735 U	0.01387 U	-0.012038 U	0.0077007 U	0.07915 U	-0.00015427 U	0.0040126 U
Cs-134	0.02534 U	0.02324 U	0.02595 U	0.002965 U	-0.02176 U	-0.0048186 U	0.018543 U	0.010495 U	0.001596 U	0.015782 U
Cs-137	0.2218	0.0007978 U	0.0433 U	0.1076	0.001989 U	0.020544 U	0.0019558 U	-0.0003022 U	-0.0025806 U	0.1826
Eu-152	-0.004154 U	0.01127 U	-0.01865 U	0.04316 U	0.0454 U	0.03424 U	0.0038014 U	0.044083 U	-0.0048816 U	0.028914 U
Eu-154	-0.0015 U	0.009661 U	-0.02002 U	-0.02669 U	0.002314 U	-0.0013964 U	0.03063 U	0.035928 U	-0.0074802 U	-0.00096586 U
Eu-155	0.01327 U	0.1651 U	-0.01271 U	-0.02639 U	0.07579 U	-0.07897 U	0.10709 U	0.0069226 U	0.13527 U	0.0050923 U
Mn-54	0.03112 U	-0.01596 U	-0.001298 U	-0.01857 U	0.01586 U	-0.0027842 U	0.015016 U	-0.0081216 U	0.016659 U	0.0012985 U
Nb-94	-0.006907 U	-0.009931 U	0.005638 U	-0.003177 U	-0.01162 U	0.0061593 U	0.0051647 U	0.013857 U	-0.0023574 U	0.000040569 U
Sb-125	0.1249 U	0.1336 U	0.1393	-0.004645 U	0.123 U	0.093909 U	0.08307 U	0.075891 U	0.13067	0.11496 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	NOL-02-02-003-R	NOL-02-02-004-F	NOL-02-02-004-R	NOL-02-02-005-F	NOL-02-02-005-R	NOL-02-02-006-F	NOL-02-02-006-R	NOL-02-02-007-F	NOL-02-02-007-R	NOL-02-02-008-F
gamma-spec (pCi/g)										
Ag-108m	-0.0045461 U	-0.00059587 U	0.0050512 U	0.009526 U	0.0091408 U	-0.0092766 U	0.05794 U	-0.013762 U	-0.021227 U	0.00665 U
Am-241	0.16602 U	-0.17261 U	-0.075499 U	0.20244 U	0.01468 U	-0.12719 U	-0.0065543 U	-0.18708 U	-0.11535 U	0.10237 U
Co-60	0.00092851 U	0.073629	0.011678 U	0.013396 U	0.0026387 U	-0.0059748 U	0.015483 U	0.001764 U	0.0085145 U	0.016001 U
Cs-134	0.023959 U	0.014266 U	-0.006163 U	0.017085 U	-0.0092606 U	0.012959 U	0.01459 U	-0.013118 U	0.024103 U	0.00016833 U
Cs-137	0.034773 U	0.11426	0.0095976 U	0.056379	0.055319 U	0.060324	0.0313 U	-0.0078574 U	0.026978 U	0.017335 U
Eu-152	0.0014414 U	0.060992 U	0.067714 U	0.055932 U	0.074015 U	0.00046255 U	-0.0080515 U	-0.030271 U	0.025382 U	0.036926 U
Eu-154	-0.0034086 U	-0.0016772 U	-0.030589 U	0.025252 U	-0.0015181 U	0.0033489 U	-0.011124 U	0.0046168 U	0.0017906 U	0.011989 U
Eu-155	-0.0032397 U	0.2304 U	0.087867 U	-0.0064606 U	0.15615 U	0.16917 U	0.11413 U	0.032332 U	0.13477 U	0.15968 U
Mn-54	-0.010979 U	0.00078619 U	0.012495 U	-0.00030814 U	0.00095859 U	0.0080627 U	-0.0033768 U	-0.0001991 U	0.031818 U	0.0068532 U
Nb-94	-0.00089166 U	0.010761 U	0.0041438 U	0.0027841 U	0.0079519 U	0.012697 U	0.0080352 U	0.00087651 U	-0.0025879 U	0.0038609 U
Sb-125	0.098396 U	0.00042435 U	0.10144 U	0.068807 U	0.087799 U	0.089344 U	0.05836 U	0.09559 U	0.1013 U	0.10743
Hard to detect (pCi/g)										
C-14				-0.00558 U						0.0198 U
Cm-243				0.0516 U						0.0173 U
Fe-55				-1.71 U						0.000914 U
H-3				3.28 U						12
Ni-63				-1.29 U						-0.515 U
Pu-238				0.0356 U						0.0214 U
Pu-239				0.0757						0.0126 U
Pu-241				0.918 U						4.19 U
Sr-90				-0.0433 U						0.0179
Tc-99				-0.0103 U						0.141 U

Station	NOL-02-02-008-R	NOL-02-02-009-F	NOL-02-02-010-F	NOL-02-02-011-F	NOL-02-02-012-F	NOL-02-02-013-F	NOL-02-02-014-F	NOL-02-02-015-F	NOL-02-02-016-F	NOL-02-02-017-F
gamma-spec (pCi/g)										
Ag-108m	0.00091775 U	-0.0092136 U	-0.01634 U	-0.0056906 U	-0.0092693 U	-0.0061686 U	-0.012086 U	-0.0050277 U	0.00071647 U	-0.00020569 U
Am-241	0.39781 U	-0.0019582 U	-0.042799 U	0.11544 U	-0.17361 U	-0.25532 U	0.013595 U	0.27347 U	-0.16931 U	-0.066921 U
Co-60	-0.0025678 U	-0.0033581 U	0.0012531 U	0.014467 U	0.0054772 U	-0.00031623 U	-0.0019182 U	0.05371	0.045945	0.076151
Cs-134	0.0014124 U	-0.019622 U	0.026513 U	0.014523 U	0.0024335 U	0.014212 U	0.0062353 U	0.018321 U	0.01675 U	0.020878 U
Cs-137	0.020318 U	0.22143	0.034959 U	0.010492 U	-0.00041448 U	0.070932	0.022983 U	0.12279	0.10489	0.14058
Eu-152	-0.0020147 U	-0.01334 U	-0.029599 U	0.014865 U	0.0018158 U	0.078148 U	-0.039927 U	-0.0041619 U	0.0011316 U	-0.02859 U
Eu-154	-0.013523 U	-0.017601 U	-0.021111 U	0.0095191 U	-0.00022087 U	-0.0095973 U	-0.0034674 U	-0.012076 U	-0.021804 U	-0.019286 U
Eu-155	0.012602 U	0.14411 U	-0.012428 U	0.086954 U	-0.0053649 U	0.078267 U	-0.0010528 U	0.14079 U	0.0094407 U	0.096895 U
Mn-54	0.0045355 U	0.013896 U	0.015435 U	0.018704 U	-0.00036193 U	0.00028433 U	0.0071778 U	0.022441 U	-0.00026826 U	-0.0078651 U
Nb-94	0.0091896 U	0.000088449 U	0.05877 U	-0.0037403 U	-0.010736 U	0.0043714 U	-0.0062594 U	0.01389 U	-0.0023577 U	0.0029599 U
Sb-125	0.018901 U	0.085227 U	0.12535 U	-0.010419 U	0.09612 U	0.077907 U	0.094368 U	0.10993	0.105	0.066 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-02-02-018-F	NOL-02-02-019-F	NOL-02-02-020-F	NOL-02-03-001-F	NOL-02-03-002-F	NOL-02-03-003-F	NOL-02-03-004-F	NOL-02-03-005-F	NOL-02-03-006-F	NOL-02-03-007-F
gamma-spec (pCi/g)										
Ag-108m	-0.010514 U	0.015368 U	-0.0046915 U	0.07569 U	0.0026518 U	-0.011141 U	-0.0086761 U	-0.016582 U	0.0704 U	-0.0010919 U
Am-241	0.0064798 U	-0.10438 U	-0.16331 U	0.012198 U	0.0018364 U	0.093737 U	0.0070136 U	-0.19479 U	0.20373 U	-0.11685 U
Co-60	0.023753 U	0.044779 U	0.0015039 U	0.025895 U	-0.0018186 U	0.10839	0.048832	-0.0094841 U	0.062516	0.023177 U
Cs-134	0.00052638 U	0.015799 U	0.01357 U	0.013536 U	0.022961 U	0.0042603 U	0.013022 U	0.0099496 U	-0.0089365 U	-0.04079 U
Cs-137	0.0037106 U	0.066825	0.014856 U	0.048419 U	0.025359 U	0.21206	0.050461	0.014292 U	0.133	0.031425 U
Eu-152	0.039145 U	-0.039235 U	-0.019777 U	0.026829 U	-0.0040293 U	-0.03292 U	-0.055823 U	0.090832 U	0.0082972 U	-0.000078575 U
Eu-154	0.0232 U	-0.012687 U	0.0050961 U	-0.022936 U	-0.027318 U	-0.024333 U	-0.031107 U	0.041276 U	-0.010375 U	-0.0048646 U
Eu-155	0.0013664 U	0.10364 U	-0.0080758 U	0.1012 U	-0.0089555 U	-0.0035745 U	0.14883 U	0.16084 U	0.088148 U	0.14747 U
Mn-54	-0.00038917 U	-0.00034506 U	0.021557 U	0.014639 U	0.0096331 U	0.0038463 U	-0.0018393 U	-0.0020234 U	-0.011537 U	0.0009526 U
Nb-94	0.0082544 U	-0.00063103 U	0.0072435 U	0.011498 U	-0.00057812 U	-0.0051711 U	-0.004908 U	0.0066132 U	0.000056072 U	0.011937 U
Sb-125	-0.027438 U	0.018181 U	0.10333 U	0.0074591 U	R	0.10315 U	0.092431 U	0.081722 U	0.049063 U	0.16966
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	NOL-02-03-008-F	NOL-02-03-009-F	NOL-02-03-010-F	NOL-02-03-011-F	NOL-02-03-012-F	NOL-02-03-013-F	NOL-02-03-014-F	NOL-02-03-015-F	NOL-02-03-016-F	NOL-02-03-017-F
gamma-spec (pCi/g)										
Ag-108m	0.0021402 U	-0.013212 U	0.001936 U	0.00015759 U	-0.0044241 U	-0.0012594 U	-0.015481 U	-0.0085805 U	0.040217 U	0.05753 U
Am-241	0.014704 U	0.0059114 U	-0.07825 U	0.025374 U	-0.12385 U	0.0020231 U	-0.058916 U	0.13367 U	0.036531 U	-0.035228 U
Co-60	0.012494 U	-0.0031364 U	0.084789	0.0059877 U	0.016791 U	0.046372	-0.0021897 U	0.013564 U	0.016379 U	0.012569 U
Cs-134	0.016395 U	-0.0091725 U	0.013053 U	0.016863 U	0.015991 U	-0.022389 U	0.0059451 U	-0.0024207 U	0.012719 U	-0.019397 U
Cs-137	0.018186 U	0.10881	0.11712	0.023394 U	0.091047	0.10349	0.01667 U	0.013729 U	-0.018859 U	0.0064397 U
Eu-152	-0.028906 U	0.0026433 U	0.095171 U	0.0060464 U	0.059921 U	-0.032376 U	0.058001 U	0.012668 U	-0.02109 U	-0.010116 U
Eu-154	-0.018681 U	0.0051433 U	-0.0074598 U	-0.011894 U	0.041534 U	-0.023175 U	-0.019429 U	-0.020181 U	-0.0025435 U	0.0011415 U
Eu-155			0.019805 U	0.12617 U	0.14938 U		-0.08192 U	-0.022127 U	0.089962 U	0.13081 U
Mn-54	0.012615 U	0.00052795 U	-0.00024131 U	-0.008547 U	0.00012344 U	0.0090845 U	0.0094249 U	0.0058012 U	-0.010224 U	0.00052508 U
Nb-94	0.0057105 U	-0.00076667 U	0.0052025 U	-0.0041071 U	0.010451 U	-0.0042393 U	0.05955 U	0.0063409 U	-0.0063863 U	-0.000083739 U
Sb-125			0.065913 U	0.040696 U	0.10293 U	0.083096 U	0.12055 U	0.056905 U	-0.0086121 U	-0.029342 U
Hard to detect (pCi/g)										
C-14		0.0167 U			-0.0835 U					
Cm-243		0.00425 U			-0.0151 U					
Fe-55		-12.1 U			-7.16 U					
H-3		-2.07 U			-2.91 U					
Ni-63		-3.9 U			-4.11 U					
Pu-238		0.0641 U			-0.0827 U					
Pu-239		0.000674 U			-0.0135 U					
Pu-241		4.08 U			3.32 U					
Sr-90		-0.0183 U			0.0139 U					
Tc-99		0.0537 U			0.101 U					

Station	NOL-02-04-001-F	NOL-02-04-001-P	NOL-02-04-001-R	NOL-02-04-002-F	NOL-02-04-002-P	NOL-02-04-002-R	NOL-02-04-003-F	NOL-02-04-004-F	NOL-02-04-005-F	NOL-02-04-006-F
gamma-spec (pCi/g)										
Ag-108m	-0.0084719 U	-0.00211 U	-0.017853 U	-0.0012308 U	0.00383 U	0.06684 U	0.02509 U	0.0097745 U	0.00054771 U	-0.0049731 U
Am-241	0.029817 U	0.0702 U	0.011395 U	0.031558 U	-0.0251 U	-0.34284 U	0.38684 U	-0.0063157 U	0.039619 U	-0.040179 U
Co-60	0.014114 U		-0.0038504 U	0.0026815 U	-0.00725 U	0.0061546 U	-0.00024394 U	0.011014 U	0.0061952 U	0.01079 U
Cs-134	0.015469 U	0.0509 U	-0.0086317 U	0.015347 U	0.0389 U	0.020447 U	0.0068793 U	0.02039 U	0.018255 U	0.0063744 U
Cs-137	0.018258 U	0.0627	0.0020069 U	-0.006706 U	0.0915	0.067029	0.033157 U	0.01003 U	0.00056568 U	0.013192 U
Eu-152	0.026288 U	-0.00771 U	0.00031043 U	0.080549 U	-0.0271 U	0.10788 U	-0.074381 U	0.00066616 U	0.012171 U	0.012436 U
Eu-154	-0.0032455 U	-0.0252 U	0.018076 U	-0.00069243 U	0.0159 U	0.0025696 U	0.038739 U	-0.024129 U	0.010324 U	0.0074643 U
Eu-155	0.10161 U	-0.0259 U	0.12498 U	0.073337 U	0.0333 U	0.026601 U	0.074771 U	0.12092 U	0.10235 U	0.099887 U
Mn-54	-0.0042133 U	0.00935 U	0.023905 U	0.0046164 U	0.00561 U	-0.001346 U	0.0090133 U	-0.012676 U	0.011888 U	-0.00018904 U
Nb-94	-0.00087275 U	0.00602 U	-0.0080128 U	-0.0011343 U	0.00335 U	0.0093405 U	-0.0030624 U	0.011625 U	-0.0030799 U	0.0061104 U
Sb-125	R	0.0132 U	0.047191 U		R	0.00562 U		R	0.067607 U	R
Hard to detect (pCi/g)										
C-14		-0.0801 U			-0.00143 U					
Cm-243					-0.0974 U					
Fe-55		57.2 U			16 U					
H-3		-0.466 U			1.96 U					
Ni-63		-16.6 U			-21.1 U					
Pu-238		-0.0195 U			-0.02 U					
Pu-239		0.0114 U			-0.0299 U					
Pu-241		1.83 U			1.29 U					
Sr-90		0.00995 U			0.0245 U					
Tc-99		0.268 U			0.537					

Station	NOL-02-04-007-F	NOL-02-04-008-F	NOL-02-04-009-F	NOL-02-04-010-F	NOL-02-04-011-F	NOL-02-04-012-F	NOL-02-04-013-F	NOL-02-04-014-F	NOL-02-04-015-F	NOL-02-04-016-F
gamma-spec (pCi/g)										
Ag-108m	0.011534 U	0.0058766 U	-0.005629 U	0.00079424 U	-0.0020439 U	0.018202 U	0.00038022 U	-0.012995 U	-0.0010006 U	-0.014794 U
Am-241	-0.12186 U	-0.013789 U	-0.0079828 U	-0.034011 U	-0.14426 U	-0.047057 U	-0.000032649 U	-0.06651 U	-0.0065197 U	-0.0084144 U
Co-60	-0.0081753 U	-0.011185 U	0.020045 U	0.14007	0.0098568 U	-0.014623 U	-0.011325 U	0.28588	0.0075783 U	0.013653 U
Cs-134	0.0011124 U	0.028464 U	0.02818 U	0.015501 U	-0.0016716 U	0.033888 U	0.003679 U	-0.018604 U	0.014756 U	-0.013777 U
Cs-137	0.015004 U	-0.016378 U	-0.0028 U	0.11196	0.000074858 U	0.0132 U	0.093621	0.031485 U	0.033541 U	0.3207
Eu-152	-0.032186 U	-0.027862 U	0.022785 U	0.011198 U	0.022306 U	0.019857 U	-0.048871 U	0.11184 U	-0.0060929 U	-0.036574 U
Eu-154	-0.022743 U	0.042748 U	-0.01565 U	-0.0014504 U	0.017895 U	-0.0020611 U	-0.00021943 U	0.1176 U	0.0004723 U	0.034282 U
Eu-155	-0.051842 U	0.15382 U	-0.0049207 U	0.13237 U	-0.011968 U	0.078115 U	-0.095858 U	0.0099771 U	0.032905 U	0.095764 U
Mn-54	0.025893 U	-0.010934 U	-0.013869 U	-0.000077015 U	-0.0034223 U	0.020656 U	-0.012475 U	0.013513 U	0.015671 U	-0.0010648 U
Nb-94	0.0014454 U	0.0079137 U	-0.0065657 U	0.00011161 U	0.015827 U	-0.0050186 U	0.02256 U	-0.0025689 U	0.0070056 U	-0.0061874 U
Sb-125	0.17069	R	0.089383 U	0.081229 U	0.12394 U	R	0.037753 U	0.098802 U	R	0.13583 U
Hard to detect (pCi/g)										
C-14			0.0331 U		0.00383 U					
Cm-243			0.32 U		0.072 U					
Fe-55			71.5 U		-8.34 U					
H-3			2.31 U		-1.01 U					
Ni-63			3.19 U		3.58 U					
Pu-238			0.0338 U		0.0248 U					
Pu-239			-0.00534 U		-0.0229 U					
Pu-241			-1.92 U		-22.6 U					
Sr-90			0.00838 U		0.0228 U					
Tc-99			-0.0032 U		0.0257 U					

Station	NOL-02-04-017-F	NOL-02-04-018-F	NOL-02-04-019-F	NOL-02-04-020-F	NOL-03-01-001-F	NOL-03-01-002-F	NOL-03-01-003-F	NOL-03-01-004-F	NOL-03-01-005-F	NOL-03-01-006-F
gamma-spec (pCi/g)										
Ag-108m	-0.008709 U	-0.0058402 U	-0.018192 U	-0.016833 U	0.00001113 U	-0.01672 U	-0.01892 U	0.01853 U	-0.021 U	-0.03972 U
Am-241	-0.010224 U	0.089825 U	0.014149 U	-0.056375 U	-0.004266 U	-0.06961 U	0.01153 U	0.0114 U	0.04523 U	-0.001184 U
Co-60	-0.0078893 U	0.0077113 U	-0.00018325 U	0.015287 U	2.625	1.15	0.3251	2.269	0.4028	0.02004 U
Cs-134	0.0066041 U	0.05525 U	-0.0057686 U	0.020572 U	-0.01507 U	0.00293 U	-0.0198 U	0.007039 U	0.04052	0.0257 U
Cs-137	0.0039998 U	0.039516 U	0.021311 U	0.0093607 U	0.3792	0.2738	0.02879 U	0.247	0.01143 U	-0.01132 U
Eu-152	-0.02352 U	0.0041724 U	0.029584 U	-0.050329 U	-0.0009903 U	0.04354 U	-0.01559 U	0.03969 U	0.05345 U	-0.02281 U
Eu-154	-0.010947 U	-0.0023114 U	-0.006069 U	0.017383 U	0.01149 U	0.03338 U	-0.01692 U	0.02825 U	-0.03229 U	0.007218 U
Eu-155	0.13553 U	-0.0084143 U	0.062779 U	0.016889 U	0.2047	-0.004873 U	0.008048 U	-0.007192 U	0.1502 U	0.1072 U
Mn-54	-0.0064228 U	0.0065203 U	0.00043231 U	0.0013587 U	-0.02769 U	0.03066 U	-0.0003627 U	0.01052 U	-0.003052 U	0.02796 U
Nb-94	-0.0050267 U	-0.0056104 U	-0.00089531 U	-0.0026799 U	0.007908 U	-0.0005922 U	0.01268 U	0.008801 U	-0.002133 U	0.01123 U
Sb-125	0.13646 U	0.094356 U	0.0877 U	0.094442 U	0.1642 U	0.1417 U	0.1555 U	-0.03157 U	0.1037 U	0.08247 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	NOL-03-01-007-F	NOL-03-01-008-F	NOL-03-01-009-F	NOL-03-01-010-F	NOL-03-01-011-F	NOL-03-01-012-F	NOL-03-01-013-F	NOL-03-01-014-F	NOL-03-01-015-F	NOL-03-01-016-F
gamma-spec (pCi/g)										
Ag-108m	0.000228 U	-0.0145 U	0.002956 U	-0.03287 U	-0.02112 U	-0.005856 U	-0.0003308 U	-0.01496 U	-0.0176 U	0.0152 U
Am-241	-0.0000893 U	-0.007814 U	0.03655 U	-0.07305 U	0.06362 U	-0.03618 U	0.01433 U	-0.04332 U	-0.0391 U	-0.009717 U
Co-60	1.82	1.61	0.5285	0.328	0.1856	0.02069 U	0.2691	0.7007	0.1626	0.1369
Cs-134	0.01872 U	-0.01812 U	0.02726 U	0.01207 U	0.01537 U	-0.02529 U	-0.0125 U	0.02801 U	0.01549 U	0.04025 U
Cs-137	0.1594	0.2778	0.008535 U	0.05257 U	0.01363 U	-0.003124 U	0.0497 U	0.3253	0.03227 U	0.09457
Eu-152	-0.04134 U	-0.01245 U	0.0498 U	-0.01641 U	-0.003488 U	-0.08146 U	-0.004224 U	-0.003405 U	-0.04586 U	-0.001952 U
Eu-154	0.03913 U	-0.001539 U	-0.007027 U	-0.01473 U	0.0243 U	0.01922 U	0.02782 U	-0.00353 U	0.01237 U	-0.01341 U
Eu-155	0.002186 U	-0.005577 U	-0.001478 U	-0.005563 U	0.05656 U	0.175 U	0.08155 U	-0.02257 U	0.04343 U	0.123 U
Mn-54	0.04698 U	0.008085 U	0.008938 U	-0.01546 U	-0.003189 U	-0.002542 U	-0.01446 U	0.03228 U	0.03613 U	-0.001334 U
Nb-94	-0.01592 U	0.02865 U	-0.01183 U	-0.0009338 U	0.02154 U	0.008877 U	0.01538 U	-0.007866 U	-0.001691 U	0.006433 U
Sb-125	0.07348 U	0.1589 U	0.1308 U	-0.0009983 U	0.1362 U	0.1629	0.06543 U	0.01726 U	0.1001 U	0.1113 U
Hard to detect (pCi/g)										
C-14	0.117 U	0.0403 U								
Cm-243	0.0305 U	-0.00534 U								
Fe-55	-0.356 U	1.09 U								
H-3	-0.987 U	-1.83 U								
Ni-63	7.84	5.29								
Pu-238	-0.031 U	0.0513 U								
Pu-239	0.0569 U	0.00891 U								
Pu-241	0.594 U	-3.49 U								
Sr-90	0.0169 U	0.0138 U								
Tc-99	0.368	0.105 U								

Station	NOL-03-01-017-F	NOL-03-01-018-F	NOL-03-01-019-F	NOL-03-01-020-F	NOL-03-01-021-F	NOL-03-01-022-F	NOL-03-01-023-F	NOL-03-01-024-F	NOL-03-01-025-F	NOL-03-01-026-F
gamma-spec (pCi/g)										
Ag-108m	-0.009187 U	-0.03989 U	0.0003333 U	-0.02714 U	-0.0004592 U	0.0002395 U	0.004268 U	-0.01014 U	0.01337 U	-0.00456 U
Am-241	-0.07635 U	-0.001075 U	-0.009305 U	0.02416 U	0.07816 U	-0.06448 U	0.03093 U	-0.01035 U	-0.04872 U	0.006907 U
Co-60	1.517	0.4513	0.2705	0.1867	0.6504	0.3011	0.02148 U	0.1047	0.9054	0.0497 U
Cs-134	0.006007 U	0.03803	0.02148 U	0.01744 U	-0.001888 U	0.008643 U	0.02542 U	0.01524 U	-0.006626 U	0.02684 U
Cs-137	0.2072	0.03139 U	0.1475	0.161	0.4621	0.08855	0.00621 U	0.04046 U	0.1358	0.04429 U
Eu-152	0.03179 U	0.01441 U	0.01151 U	-0.02049 U	-0.002337 U	-0.02301 U	0.00372 U	0.1396 U	-0.0004605 U	0.2056
Eu-154	0.02363 U	0.009496 U	0.000149 U	-0.0004947 U	-0.04002 U	-0.01653 U	0.03786 U	-0.001925 U	-0.02193 U	0.03286 U
Eu-155	0.1528 U	0.005064 U	0.1543 U	0.06361 U	0.08969 U	-0.008676 U	0.002257 U	0.1593 U	0.2	-0.01042 U
Mn-54	-0.003066 U	0.01494 U	-0.002199 U	-0.008395 U	-0.0006871 U	0.0009957 U	0.001793 U	0.01352 U	-0.009004 U	-0.0006715 U
Nb-94	0.02825 U	-0.0001889 U	-0.000201 U	0.007409 U	0.01394 U	0.008094 U	-0.0009558 U	-0.005396 U	0.02109 U	-0.01103 U
Sb-125	0.00148 U	0.1229	0.1231 U	0.1097 U	-0.00896 U	0.01178 U	0.1774	0.08717 U	0.03541 U	0.1137 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-03-01-027-F	NOL-03-01-038-F	NOL-03-02-001-F	NOL-03-02-002-F	NOL-03-02-003-F	NOL-03-02-004-F	NOL-03-02-005-F	NOL-03-02-006-F	NOL-03-02-007-F	NOL-03-02-008-F
gamma-spec (pCi/g)										
Ag-108m	-0.00603 U	-0.0045 U	0.011643 U	0.024693 U	-0.012775 U	-0.013612 U	-0.010317 U	0.023377	0.00017756 U	0.029986 U
Am-241	-0.02301 U	-0.005661 U	0.0021395 U	0.11686 U	-0.037481 U	-0.018345 U	0.075361 U	-0.052642 U	-0.0046432 U	0.0055095 U
Co-60	0.9274	1.808	-0.015138 U	-0.0080552 U	0.013291 U	0.015996 U	0.0074403 U	-0.0060687 U	-0.0035067 U	0.00030142 U
Cs-134	-0.02232 U	-0.005549 U	0.015103 U	-0.0020614 U	0.015353 U	-0.02288 U	-0.0021094 U	-0.018075 U	0.016845 U	0.011305 U
Cs-137	0.04265 U	-0.001253 U	-0.0067417 U	0.016755 U	0.036605	0.052461	-0.0025947 U	0.016327 U	0.019887 U	0.053168
Eu-152	0.02403 U	-0.01982 U	-0.015359 U	-0.028615 U	-0.00089371 U	-0.0086413 U	-0.0030232 U	-0.0022408 U	0.038105 U	-0.040365 U
Eu-154	-0.01183 U	0.009872 U	0.0069813 U	-0.00057986 U	-0.00070176 U	-0.0072864 U	-0.030004 U	-0.014179 U	0.028238 U	-0.019413 U
Eu-155	0.09253 U	0.1133 U	-0.087788 U	0.054376 U	0.10224 U	0.10933 U	-0.14939 U	0.094649 U	0.07485 U	-0.015028 U
Mn-54	0.007905 U	-0.001183 U	-0.002154 U	-0.0078641 U	0.018364 U	0.0048312 U	-0.00058342 U	-0.0094742 U	0.010516 U	0.0062807 U
Nb-94	-0.0002148 U	-0.01377 U	-0.010473 U	0.0053461 U	-0.000080694 U	-0.00008002 U	0.016851 U	-0.0031855 U	0.004183 U	0.012775 U
Sb-125	0.002072 U	0.1562 U	0.017697 U	0.0026225 U	0.10591	0.068747 U	-0.002004 U	0.079195	0.050375 U	0.086966 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	NOL-03-02-009-F	NOL-03-02-010-F	NOL-03-02-011-F	NOL-03-02-012-F	NOL-03-02-013-F	NOL-03-02-014-F	NOL-03-02-015-F	NOL-03-02-016-F	NOL-03-02-017-F	NOL-03-02-018-F
gamma-spec (pCi/g)										
Ag-108m	0.00045915 U	-0.0072867 U	0.013032 U	-0.01816 U	0.00074343 U	-0.010979 U	0.014375 U	0.0035343 U	-0.01671 U	0.012777 U
Am-241	-0.19282 U	-0.075864 U	0.061313 U	-0.044928 U	-0.0053257 U	0.16428 U	-0.033569 U	-0.045489 U	-0.0086944 U	0.031167 U
Co-60	-0.00017432 U	-0.00014889 U	-0.010346 U	-0.0012278 U	-0.0089051 U	0.020784 U	-0.0065247 U	0.027305 U	0.013602 U	-0.014773 U
Cs-134	0.0062235 U	-0.00059084 U	0.027186 U	0.017185 U	-0.0015039 U	0.036361 U	0.0051193 U	-0.023298 U	0.029111	-0.011921 U
Cs-137	0.038273 U	0.0097096 U	0.015778 U	0.0042775 U	0.016059 U	0.037045 U	0.06728 U	0.046742 U	0.0027302 U	0.010727 U
Eu-152	0.022482 U	-0.020832 U	0.007688 U	0.001611 U	-0.019579 U	0.054185 U	-0.014426 U	-0.024956 U	-0.0017301 U	-0.02663 U
Eu-154	0.009923 U	0.0071868 U	-0.0011862 U	0.013683 U	-0.020531 U	-0.014229 U	-0.0061427 U	0.011309 U	-0.023747 U	0.020593 U
Eu-155	0.11199 U	-0.1057 U	0.018691 U	0.094516 U	-0.01519 U	0.075977 U	0.11755 U	0.050485 U	0.11892 U	-0.11081 U
Mn-54	0.010327 U	0.021376 U	0.023812 U	0.0096484 U	-0.0040329 U	0.00098182 U	-0.0057492 U	0.011452 U	0.013638 U	0.000099709 U
Nb-94	0.0058472 U	0.0030288 U	0.015801 U	-0.010846 U	0.020717 U	0.015233 U	-0.0054799 U	-0.0050029 U	0.0015086 U	-0.0047553 U
Sb-125	0.072939 U	0.024632 U	0.08078 U	0.095304	0.027066 U	0.10512 U	0.11464 U	0.088616 U	0.10724	0.046891 U
Hard to detect (pCi/g)										
C-14					-0.212 U					-0.0596 U
Cm-243					0.137 U					0.0256 U
Fe-55					-4.75 U					-4.5 U
H-3					-2.99 U					-2.51 U
Ni-63					-7.07 U					-12 U
Pu-238					0.00472 U					-0.0228 U
Pu-239					-0.0115 U					-0.0252 U
Pu-241					11.8 U					3.67 U
Sr-90					-0.00393 U					-0.00945 U
Tc-99					-0.0141 U					-0.0325 U

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-03-02-019-F	NOL-03-02-020-F	NOL-04-01-001-F	NOL-04-01-001-R	NOL-04-01-002-F	NOL-04-01-002-R	NOL-04-01-003-F
gamma-spec (pCi/g)							
Ag-108m	0.01159 U	0.021263 U	-0.0235 U	-0.001274 U	-0.0064774 U	-0.023632 U	0.05848 U
Am-241	-0.0019737 U	-0.10846 U	-0.07108 U	0.032859 U	0.377 U	-0.040136 U	0.014793 U
Co-60	-0.00018741 U	0.00040687 U	-0.00020942 U	0.0038834 U	-0.0034091 U	0.0011403 U	-0.0081139 U
Cs-134	-0.00067685 U	0.027245 U	0.011249 U	0.014433 U	0.011187 U	-0.0046956 U	0.013856 U
Cs-137	-0.0012133 U	0.0093948 U	0.014301 U	0.070918	0.01681 U	0.015686 U	0.010546 U
Eu-152	-0.00087443 U	-0.063429 U	0.033501 U	0.028809 U	0.0050371 U	-0.01077 U	0.071719 U
Eu-154	-0.00073562 U	0.059195 U	0.023391 U	0.01664 U	0.0040357 U	-0.002406 U	-0.029367 U
Eu-155	0.009184 U	0.012548 U	0.16302 U	0.045972 U	0.11696 U	0.11161 U	0.17877 U
Mn-54	-0.0006009 U	-0.0094128 U	0.025602 U	0.0079497 U	0.0038925 U	-0.000509 U	-0.00058122 U
Nb-94	-0.00019869 U	0.011551 U	-0.0047573 U	0.01121 U	0.03455 U	0.002809 U	0.0019077 U
Sb-125	-0.00084214 U	-0.025641 U	0.10202 U	0.082597 U	0.077873 U	0.039 U	0.080482 U
Hard to detect (pCi/g)							
C-14							
Cm-243							
Fe-55							
H-3							
Ni-63							
Pu-238							
Pu-239							
Pu-241							
Sr-90							
Tc-99							

Station	NOL-04-01-003-R	NOL-04-01-004-F	NOL-04-01-004-R	NOL-04-01-005-F	NOL-04-01-005-R	NOL-04-01-006-F	NOL-04-01-006-R	NOL-04-01-007-F	NOL-04-01-008-F	NOL-04-01-009-F
gamma-spec (pCi/g)										
Ag-108m	-0.0066903 U	-0.019025 U	0.0090512 U	-0.01403 U	-0.0010655 U	-0.0079103 U	-0.012619 U	-0.002052 U	-0.027019 U	-0.01286 U
Am-241	-0.039416 U	0.0037824 U	0.030635 U	-0.12202 U	-0.048268 U	-0.011878 U	-0.0067532 U	-0.0729 U	-0.050156 U	0.01082 U
Co-60	0.0041923 U	0.0038112 U	0.0027778 U	0.0095922 U	0.018411 U	-0.0074853 U	-0.0039183 U	0.009169 U	0.0070853 U	0.02136 U
Cs-134	0.018559 U	0.023809 U	-0.014365 U	0.015883 U	-0.0016775 U	0.014707 U	0.015277 U	-0.002125 U	0.010298 U	-0.009371 U
Cs-137	0.0062581 U	0.017827 U	-0.0074262 U	0.011334 U	0.00022297 U	0.024856 U	0.0048286 U	0.05562 U	-0.0010611 U	0.1528
Eu-152	-0.0028984 U	0.0062801 U	0.013724 U	0.098279 U	0.019137 U	-0.010476 U	-0.00087982 U	0.03519 U	0.063682 U	0.01847 U
Eu-154	-0.0094374 U	0.0088871 U	0.011184 U	0.0029604 U	-0.0029804 U	0.010514 U	-0.014399 U	-0.03308 U	-0.026421 U	0.000167 U
Eu-155	R	0.18009 U	0.094571 U	0.14774 U	0.016358 U	0.015249 U	0.11612 U	0.0153 U	0.11624 U	-0.02627 U
Mn-54	-0.0080786 U	-0.013695 U	-0.0059274 U	-0.0033342 U	0.0088637 U	0.035256 U	0.015088 U	-0.00639 U	0.012302 U	0.01421 U
Nb-94	-0.0064128 U	0.017988 U	0.0062136 U	-0.0055338 U	-0.00039904 U	0.00024455 U	-0.0018252 U	-0.003955 U	-0.0046747 U	-0.002317 U
Sb-125	0.069598 U	0.094136 U	R	0.098487	0.078091 U	0.083041 U	R	0.1389 U	0.020515 U	-0.02043 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-04-01-010-F	NOL-04-01-011-F	NOL-04-01-012-F	NOL-04-01-013-F	NOL-04-01-014-F	NOL-04-01-015-F	NOL-04-01-016-F	NOL-04-01-017-F	NOL-04-01-018-F	NOL-04-01-019-F
gamma-spec (pCi/g)										
Ag-108m	-0.013554 U	-0.028824 U	-0.03236 U	0.005278 U	0.0009277 U	0.009281 U	-0.01296 U	0.003772 U	0.0009544 U	0.00052823 U
Am-241	0.21877 U	-0.0044372 U		0.1603 U	0.02511 U	0.7051 U	0.0447 U	-0.2492 U	-0.09734 U	-0.039597 U
Co-60	0.029674 U	0.018011 U	-0.003463 U	0.1181	-0.002107 U	0.1698	-0.001093 U	0.02522 U	-0.0005383 U	0.12026
Cs-134	0.0088031 U	0.00085335 U	0.04186 U	0.01911 U	0.02505	-0.007098 U	0.02023 U	0.01295 U	0.01048 U	0.0031718 U
Cs-137	0.068807	0.028699 U	0.0015 U	0.4649	0.01362 U	0.1305	0.02082 U	0.08144	0.0006501 U	0.16423
Eu-152	0.084161 U	0.004077 U	-0.04688 U	0.02537 U	-0.01973 U	-0.007037 U	0.08296 U		-0.005433 U	-0.0037089 U
Eu-154	-0.016752 U	-0.031095 U	0.02734 U	0.01784 U	-0.01827 U	-0.01858 U	0.0009535 U	0.01274 U	0.008686 U	0.012505 U
Eu-155	0.11646 U	0.10478 U	-0.01796 U	0.1061 U	0.004685 U	-0.01486 U	0.2383 U	-0.01782 U	0.01313 U	0.1428 U
Mn-54	-0.00078313 U	0.02013 U	-0.0007974 U	-0.007617 U	-0.009075 U	0.0001534 U	0.01313 U	0.01006 U	0.0006472 U	0.01007 U
Nb-94	-0.00025701 U	-0.0075288 U	-0.0105 U	-0.00818 U	0.01084 U	-0.004066 U	0.006787 U	0.005624 U	-0.002274 U	-0.0077767 U
Sb-125	0.076803 U	0.08068 U	0.1499 U	0.0784 U	0.07929 U	0.07835 U	0.07415 U	0.1086	0.06945 U	0.16648
Hard to detect (pCi/g)										
C-14			-0.0902 U							
Cm-243			0.0497 U							
Fe-55			3.53 U							
H-3			-0.449 U							
Ni-63			-0.309 U							
Pu-238			-0.00557 U							
Pu-239			-0.0357 U							
Pu-241			3.69 U							
Sr-90			-0.00643 U							
Tc-99			0.046 U							

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-04-01-020-F	NOL-04-01-021-F	NOL-04-01-022-F	NOL-04-01-023-F	NOL-04-01-024-F	NOL-05-01-001-F	NOL-05-01-002-F	NOL-05-01-003-f	NOL-05-01-004-F	NOL-05-01-005-F
gamma-spec (pCi/g)										
Ag-108m	0.0038793 U	-0.022568 U	0.0097246 U	-0.01609 U	-0.007816 U	-0.0001437 U	0.0039193 U	-0.022327 U	-0.0091646 U	-0.0056695 U
Am-241	-0.13748 U	0.077373 U	0.26498 U	-0.002652 U	-0.071835 U	0.20429 U	-0.0056409 U	-0.0094166 U	-0.064139 U	-0.0017332 U
Co-60	0.37641	0.0073289 U	-0.0085994 U	0.1433	-0.0058584 U	-0.0066722 U	0.023519 U	-0.001066 U	0.018121 U	-0.0060418 U
Cs-134	0.014744 U	0.030795 U	0.012127 U	0.01748 U	-0.00067276 U	0.017811 U	-0.0042506 U	0.0024817 U	-0.019967 U	-0.0059065 U
Cs-137	0.11265	0.010978 U	0.013622 U	0.1092	0.13761	0.023405 U	0.034649 U	0.0095195 U	-0.010156 U	0.0049682 U
Eu-152	-0.07746 U	0.070895 U	0.0066224 U	-0.0006061 U	0.062352 U	0.14995	-0.019859 U	-0.0082724 U	-0.0089953 U	0.10782 U
Eu-154	-0.056469 U	-0.017596 U	-0.0043506 U	-0.02067 U	0.020088 U	0.041059 U	-0.0091052 U	-0.0018537 U	0.023012 U	-0.0099203 U
Eu-155	0.012937 U	-0.0072678 U	-0.0058553 U	0.06341 U	0.12233 U	0.037188 U	0.1259 U	0.11457 U	0.0022813 U	0.1288 U
Mn-54	0.015904 U	-0.011453 U	0.001338 U	-0.001827 U	0.0086755 U	-0.0080345 U	0.019736 U	-0.013906 U	0.031859 U	-0.0045525 U
Nb-94	-0.0068877 U	0.0014668 U	0.0031452 U	0.01002 U	0.0037366 U	-0.0059518 U	-0.0052045 U	0.00056901 U	-0.0017879 U	0.04191 U
Sb-125	0.10416 U	-0.000054394 U	0.060551 U	0.0005697 U	0.087595 U	0.099935 U	0.077748 U	0.080244 U	0.12051 U	0.097662
Hard to detect (pCi/g)										
C-14	0.0262 U									
Cm-243	-0.0177 U									
Fe-55	7.01 U									
H-3	3.76 U									
Ni-63	-0.146 U									
Pu-238	0.0129 U									
Pu-239	0.00979 U									
Pu-241	-0.208 U									
Sr-90	-0.00167 U									
Tc-99	0.0393 U									

Station	NOL-05-01-006-F	NOL-05-01-007-F	NOL-05-01-008-F	NOL-05-01-009-F	NOL-05-01-010-F	NOL-05-01-011-F	NOL-05-01-012-F	NOL-05-01-013-F	NOL-05-01-014-F	NOL-05-01-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.0078294 U	-0.0046661 U	-0.028122 U	0.0059841 U	-0.0007275 U	0.0014724 U	-0.025635 U	-0.013434 U	-0.01387 U	-0.0065284 U
Am-241	-0.1669 U	-0.0095246 U	-0.015788 U	-0.0089314 U	0.12074 U	-0.091254 U	-0.058347 U	-0.049723 U	-0.10182 U	-0.019945 U
Co-60	-0.0051004 U	0.0048593 U	0.0065799 U	0.0080871 U	0.0081438 U	0.055673	0.01197 U	-0.0047867 U	-0.0029205 U	0.15064
Cs-134	-0.012103 U	0.010434 U	-0.00064028 U	0.022472 U	0.01634 U	-0.052204 U	-0.02773 U	0.027478 U	0.015807 U	0.016589 U
Cs-137	0.069974	0.020028 U	0.0084966 U	0.016003 U	0.033354 U	0.060672	0.23744	0.045204 U	0.02463 U	0.18284
Eu-152	-0.033733 U	0.028312 U	-0.016265 U	-0.021845 U	0.022009 U	0.028956 U	0.016136 U	0.10878 U	0.012412 U	-0.029951 U
Eu-154	-0.000097623 U	0.017531 U	0.005704 U	0.013721 U	-0.0098812 U	0.027443 U	0.026058 U	-0.0026205 U	0.020044 U	-0.022317 U
Eu-155	0.18111 U	0.2208 U	0.12079 U	0.0062343 U	0.082576 U	0.20444	0.0072477 U	0.15518 U	0.016149 U	0.21078 U
Mn-54	-0.0041613 U	-0.011193 U	0.017702 U	0.00053977 U	0.0030092 U	0.0090402 U	-0.00025688 U	0.0045872 U	0.0060479 U	-0.0048008 U
Nb-94	0.0070516 U	0.0074221 U	-0.0072004 U	-0.0091954 U	0.0081905 U	0.0063734 U	-0.00021119 U	0.000070301 U	0.0045284 U	-0.0063375 U
Sb-125	0.081234 U	0.012362 U	0.091548 U	0.068835 U	0.10329	-0.030366 U	0.12435 U	0.094258 U	0.043237 U	0.15086
Hard to detect (pCi/g)										
C-14					0.00665 U			0.0606 U		
Cm-243					0.031 U			0.0175 U		
Fe-55					9.74 U			8.75 U		
H-3					0.357 U			2.5 U		
Ni-63					-1.35 U			5.54 U		
Pu-238					-0.00306 U			-0.00281 U		
Pu-239					-0.00612 U			-0.00514 U		
Pu-241					0.475 U			3.82 U		
Sr-90					0.0105 U			0.00881 U		
Tc-99					0.0321 U			0.00517 U		

Station	NOL-05-01-016-F	NOL-05-01-017-F	NOL-05-01-018-F	NOL-05-01-019-F	NOL-05-01-020-F	NOL-05-02-001-F	NOL-05-02-001-R	NOL-05-02-002-F	NOL-05-02-002-R	NOL-05-02-003-F
gamma-spec (pCi/g)										
Ag-108m	-0.015386 U	0.00038837 U	-0.000018994 U	-0.012839 U	-0.0015866 U	-0.020808 U	0.01298 U	-0.019689 U	-0.02396 U	-0.023176 U
Am-241	-0.066289 U	-0.04913 U	-0.54095 U	0.0024085 U	-0.058173 U	0.0083215 U	0.1274 U	0.13901 U	-0.08841 U	0.029191 U
Co-60	0.026238 U	0.024275 U	-0.0050348 U	0.0024813 U	-0.0022583 U	0.26345	0.08634	0.012536 U	-0.01335 U	0.02768 U
Cs-134	0.02774 U	0.0038533 U	0.02543 U	0.0016169 U	0.013496 U	0.022285 U	-0.02063 U	0.017809 U	0.02613 U	-0.0016298 U
Cs-137	0.023759 U	0.034471 U	0.06314	0.022832 U	0.042129 U	0.14751	0.1039	0.0829	0.02112 U	0.064832
Eu-152	-0.010954 U	-0.020914 U	0.047721 U	-0.027555 U	0.033808 U	-0.0012045 U	-0.0621 U	0.045848 U	0.1002 U	0.034658 U
Eu-154	-0.0010959 U	-0.022756 U	0.0042969 U	0.0060071 U	0.027206 U	-0.012149 U	-0.04281 U	0.010558 U	0.0141 U	0.000039151 U
Eu-155	0.1687 U	0.0033358 U	0.0019577 U	0.096975 U	0.14179 U	-0.012535 U	0.005113 U	0.043127 U	0.01084 U	0.0079494 U
Mn-54	0.018477 U	0.040201	0.0109 U	0.012261 U	0.014185 U	0.011919 U	0.01367 U	0.01979 U	0.006951 U	0.022659 U
Nb-94	0.0078347 U	0.0054395 U	-0.000076856 U	-0.00015238 U	0.004769 U	0.015005 U	0.001416 U	0.0076622 U	-0.00862 U	-0.0064949 U
Sb-125	0.10409 U	0.10389 U	0.10715	0.10885 U	0.11455 U	0.14035 U	0.08304 U	0.098914 U	0.09421 U	0.1341
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-05-02-003-R	NOL-05-02-004-F	NOL-05-02-004-R	NOL-05-02-005-F	NOL-05-02-005-R	NOL-05-02-006-F	NOL-05-02-006-R	NOL-05-02-007-F	NOL-05-02-007-R	NOL-05-02-008-F
gamma-spec (pCi/g)										
Ag-108m	0.001619 U	-0.0036244 U	-0.01406 U	-0.007019 U	-0.0218 U	-0.015851 U	-0.02764 U	-0.018873 U	-0.02228 U	-0.037371 U
Am-241	0.1328 U	0.15969 U	0.0199 U	-0.21371 U	-0.2008 U	-0.14208 U	-0.181 U	0.15495 U	-0.0542 U	-0.2049 U
Co-60	-0.0002304 U	0.066026	0.002452 U	0.024691 U	-0.005327 U	0.051091 U	-0.0002289 U	0.017693 U	0.01427 U	0.04179 U
Cs-134	0.02894 U	0.00047254 U	0.001979 U	-0.0037805 U	-0.01992 U	0.034712	-0.0206 U	-0.0025473 U	0.02217 U	0.027173 U
Cs-137	0.02078 U	0.054224 U	0.0004269 U	0.046165 U	0.01487 U	0.13215	0.01187 U	0.026622 U	0.02871 U	0.05932
Eu-152	0.02906 U	-0.026761 U	-0.02499 U	0.0029256 U	0.05344 U	0.040699 U	0.047 U	-0.013848 U	0.02119 U	-0.011134 U
Eu-154	-0.02749 U	-0.018833 U	-0.02008 U	-0.0012696 U	-0.005981 U	0.0078254 U	0.03107 U	0.037642 U	-0.02559 U	0.032767 U
Eu-155	0.1297 U	0.0040693 U	-0.007024 U	0.04051 U	0.1127 U	-0.0010616 U	-0.0262 U	0.18998 U	0.01727 U	0.063823 U
Mn-54	-0.00005773 U	-0.0099518 U	0.03063 U	-0.00034764 U	-0.0003131 U	0.013856 U	-0.001101 U	0.021642 U	0.01811 U	0.013939 U
Nb-94	0.07687 U	-0.01119 U		0.0091026 U	0.04205 U	-0.00022828 U	-0.01329 U	0.024875 U	-0.005551 U	0.023749 U
Sb-125	0.167	0.10655 U	0.09852 U	0.062479 U	0.1192	0.072987 U	0.1198 U	-0.021229 U	0.0568 U	0.10987
Hard to detect (pCi/g)										
C-14						0.0303 U				
Cm-243						0.0174 U				
Fe-55						-0.629 U				
H-3						-1.52 U				
Ni-63						1.97 U				
Pu-238						0.0052 U				
Pu-239						-0.0055 U				
Pu-241						3.76 U				
Sr-90						-0.00101 U				
Tc-99						0.0314 U				

Station	NOL-05-02-008-R	NOL-05-02-009-F	NOL-05-02-009-R	NOL-05-02-010-F	NOL-05-02-010-R	NOL-05-02-011-F	NOL-05-02-011-R	NOL-05-02-012-F	NOL-05-02-012-R	NOL-05-02-013-F
gamma-spec (pCi/g)										
Ag-108m	-0.01976 U	0.0016605 U	-0.01721 U	-0.00088572 U	-0.0001794 U	0.05549 U	0.0301 U	-0.0027989 U	0.001679 U	-0.020708 U
Am-241		0.12119 U	-0.1303 U	-0.0018348 U	-0.09975 U	-0.014256 U	0.00662 U	-0.067509 U	-0.3449 U	-0.048146 U
Co-60	-0.0002147 U	0.019868 U	-0.0002142 U	0.039509	0.003777 U	0.023093 U	0.005013 U	-0.0070636 U	0.08369	0.051165
Cs-134	0.03317 U	0.021191 U	-0.001255 U	0.0028698 U	-0.00101 U	0.023148 U	0.02178 U	-0.00009058 U	0.0207 U	-0.021931 U
Cs-137	0.0358 U	0.038961 U	0.01258 U	0.040393	0.02356 U	0.011066 U	0.01282 U	0.017285 U	0.1246	0.043966
Eu-152	-0.03334 U	-0.00010198 U	0.04087 U	0.074012 U		-0.0291 U	0.03922 U	-0.029663 U	-0.02921 U	-0.01907 U
Eu-154	0.005263 U	-0.013197 U	-0.03635 U	0.023819 U	0.003882 U	-0.020644 U	0.03356 U	-0.019063 U	-0.01953 U	0.013894 U
Eu-155	-0.008048 U	-0.0046199 U	0.03455 U	0.02912 U	0.09064 U	0.13579		0.090347 U	0.1125 U	0.10009 U
Mn-54	0.01488 U	0.014754 U	-0.000688 U	0.012615 U	0.01934 U	0.00045524 U	0.005301 U	0.010694 U	-0.006248 U	-0.000079702 U
Nb-94	0.07436 U	-0.0081247 U	0.006486 U	-0.0050772 U	-0.007142 U	0.000034783 U	0.008344 U	0.018548 U	-0.00001709 U	0.003164 U
Sb-125	0.08665 U	0.13056	0.1687	0.093292 U	0.0567 U	-0.0016236 U	0.0752 U	0.14303	0.1159	0.057712 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-05-02-013-R	NOL-05-02-014-F	NOL-05-02-014-R	NOL-05-02-015-F	NOL-05-02-016-F	NOL-05-02-017-F	NOL-05-02-018-F	NOL-05-02-019-F	NOL-05-02-020-F	NOL-05-02-021-F
gamma-spec (pCi/g)										
Ag-108m	-0.01727 U	-0.014777 U	-0.002211 U	0.05768 U	-0.0063621 U	0.0085848 U	-0.0091474 U	-0.038601 U	0.00036836 U	0.00030409 U
Am-241	-0.1004 U	0.067407 U	0.01851 U	-0.0043094 U	0.23566 U	-0.068102 U	-0.21009 U	-0.03565 U	-0.0074167 U	-0.018989 U
Co-60	-0.0002064 U	0.14911	-0.002491 U	0.22171	0.020719 U	0.15093	0.022173 U	0.13819	0.14051	0.096574
Cs-134	-0.00936 U	-0.023672 U	0.00308 U	0.016479 U	-0.0026748 U	-0.0008962 U	0.016696 U	-0.00445 U	-0.0018379 U	-0.002048 U
Cs-137	0.03059 U	0.17485		0.065488	0.0069006 U	0.02552 U	0.02454 U	0.070167	0.076914	0.02155 U
Eu-152	-0.04659 U	-0.0027722 U	0.1073 U	0.036352 U	-0.019401 U	0.038819 U	0.11775 U	0.030234 U	0.022032 U	-0.0064333 U
Eu-154	-0.00002206 U	0.012538 U	0.03834 U	-0.0052011 U	0.036546 U	-0.017423 U	-0.014138 U	-0.0043503 U	0.011439 U	-0.005183 U
Eu-155	0.01956 U	0.14268 U	0.1003 U	0.085541 U	0.0016221 U	0.0438 U	0.18561 U	0.078734 U	-0.07753 U	0.10294 U
Mn-54		-0.012296 U	0.02184 U	0.0032555 U	0.00055973 U	0.0051549 U	0.006676 U	-0.00064441 U	0.024072 U	0.0050393 U
Nb-94	0.01571 U	0.0067172 U	-0.01591 U	0.0067252 U	0.012149 U	0.022525 U	-0.0045428 U	-0.011669 U	0.00039573 U	-0.0083833 U
Sb-125	0.07583 U	-0.043758 U	0.09594 U	0.0951	0.099822 U	0.13937 U	0.07539 U	0.10366 U	-0.044528 U	0.13141
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-05-02-022-F	NOL-05-02-023-F	NOL-05-02-024-F	NOL-05-02-025-F	NOL-05-02-026-F	NOL-05-02-027-F	NOL-05-02-028-F	NOL-05-02-029-F	NOL-05-02-030-F	NOL-06-01-001-F
gamma-spec (pCi/g)										
Ag-108m	0.027612 U	0.016834 U	-0.01703 U	-0.015694 U	-0.018349 U	0.0018728 U	-0.018694 U	-0.0080771 U	-0.00071985 U	0.002098 U
Am-241	0.0038783 U	-0.086164 U	0.026467 U	0.043486 U	0.033972 U	-0.0044324 U	0.31087 U	-0.00080291 U	0.063916 U	-0.0387 U
Co-60	0.61621	-0.00016458 U	0.039208 U	0.25444	0.41963	0.36196	0.14709	0.1056	0.024467 U	0.0151 U
Cs-134	-0.034692 U	0.0094067 U	-0.0065275 U	-0.0013632 U	0.027395 U	0.018022 U	0.012892 U	-0.022993 U	0.023348 U	0.03642
Cs-137	0.21886	0.11914	0.040263 U	0.13414	0.12988	0.077584	0.065229	0.042623 U	0.0057807 U	0.03554 U
Eu-152	0.013882 U	0.0059095 U	0.0039878 U	0.017832 U	-0.0019889 U	-0.013689 U	0.088938 U	-0.0020006 U	-0.0021434 U	-0.01264 U
Eu-154	-0.035666 U	-0.0082532 U	-0.0075326 U	0.016951 U	-0.0019187 U	-0.0060493 U	-0.021394 U	0.023625 U	-0.0051818 U	-0.01636 U
Eu-155	0.2238 U	0.16167 U	0.0077215 U	0.157 U	0.10206 U	0.09016 U	0.020875 U	0.14103 U	0.10577 U	0.0131 U
Mn-54	0.0073979 U	0.0080892 U	0.0018192 U	-0.00082633 U	-0.00023165 U	0.010113 U	0.018187 U	0.013528 U	0.00049679 U	0.01979 U
Nb-94	-0.015112 U	0.0049432 U	0.01409 U	-0.00054369 U	-0.0078881 U	-0.00007616 U	0.0089525 U	0.00027247 U	-0.0014646 U	-0.004117 U
Sb-125	0.097831 U	0.10664 U	0.10943 U	0.087716 U	0.093417	0.073269 U	0.073501 U	0.065673 U	0.058477 U	0.09352 U
Hard to detect (pCi/g)										
C-14	-0.00957 U									
Cm-243	-0.0107 U									
Fe-55	-2.75 U									
H-3	-1.08 U									
Ni-63	2.58									
Pu-238	0.02 U									
Pu-239	-0.00809 U									
Pu-241	6.27 U									
Sr-90	0.0000975 U									
Tc-99	-0.0276 U									

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-01-001-R	NOL-06-01-002-F	NOL-06-01-002-R	NOL-06-01-003-F	NOL-06-01-003-R	NOL-06-01-004-F	NOL-06-01-004-R	NOL-06-01-005-F	NOL-06-01-005-R	NOL-06-01-006-F
gamma-spec (pCi/g)										
Ag-108m	0.02657 U	0.0105 U	-0.03742 U	0.09153 U	0.01348 U	0.002363 U	-0.01394 U	0.03817	-0.001848 U	-0.0006643 U
Am-241	-0.01888 U	-0.02127 U	-0.09806 U	-0.00427 U	-0.002183 U	0.02815 U	-0.03791 U	-0.01234 U	0.07017 U	-0.2196 U
Co-60	0.1134	0.1727	0.02903 U	0.0005261 U	0.06853	-0.002908 U	-0.004318 U	0.321	0.28	0.05467 U
Cs-134	0.02745 U	-0.006619 U	0.02722 U	0.00007135 U	-0.01134 U	-0.01986 U	0.04179 U	0.007352 U	0.1322 U	-0.02459 U
Cs-137	0.131	0.1265	0.04392 U	0.01997 U	0.8187	0.007978 U	0.02064 U	0.6668	0.2371	0.1585
Eu-152	0.03134 U	-0.05434 U	0.04205 U	-0.001463 U	-0.0005935 U	0.1102 U	0.04024 U	0.02385 U	0.1587 U	-0.01111 U
Eu-154	-0.00005083 U	-0.008565 U	-0.007923 U	0.02723 U	0.0047 U	0.006572 U	0.01756 U	0.02339 U	-0.0008372 U	-0.000845 U
Eu-155	0.1446 U	0.1764 U	0.07101 U	-0.01465 U	0.1541 U	0.1162 U	0.2281 U	0.1133 U	-0.002292 U	0.06326 U
Mn-54	0.01472 U	0.00127 U	-0.01849 U	0.0121 U	0.004791 U	0.0006206 U	0.02664 U	0.006606 U	0.01013 U	-0.01434 U
Nb-94	-0.009079 U	0.01656 U	0.02304 U	0.06466 U	0.0004189 U	-0.005134 U	0.07011 U	-0.004216 U	0.01783 U	-0.0001244 U
Sb-125	0.1042 U	0.03761 U	0.1369 U	0.08612 U	-0.00719 U	0.0938 U	0.1213 U	0.09982 U	0.1009 U	0.1115 U
Hard to detect (pCi/g)										
C-14								0.261		
Cm-243								-0.0495 U		
Fe-55								-1.4 U		
H-3								-1.26 U		
Ni-63								0.477 U		
Pu-238								-0.0018 U		
Pu-239								-0.00496 U		
Pu-241								-3.54 U		
Sr-90								-0.00135 U		
Tc-99								0.0261 U		

Station	NOL-06-01-006-R	NOL-06-01-007-F	NOL-06-01-008-F	NOL-06-01-009-F	NOL-06-01-010-F	NOL-06-01-011-F	NOL-06-01-012-F	NOL-06-01-013-F	NOL-06-01-014-F	NOL-06-01-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.006984 U	-0.01022 U	0.01396 U	-0.00841 U	-0.01597 U	-0.01701 U	-0.002986 U	0.006175 U	0.02654 U	-0.01642 U
Am-241	0.03059 U	-0.0147 U	0.006712 U	-0.252 U	0.03159 U	0.1623 U	-0.1131 U	-0.1325 U	-0.03694 U	-0.0284 U
Co-60	0.1672	0.1011	0.006435 U	0.001868 U	-0.0002069 U	0.01188 U	-0.0008105 U	0.00005724 U	0.01759 U	-0.002977 U
Cs-134	0.02363 U	-0.004419 U	-0.00007998 U		-0.01986 U	0.01779 U	-0.02061 U	0.00007899 U	-0.004366 U	0.01159 U
Cs-137	0.04447 U	0.1992	0.09595	0.09566	0.03141 U	0.06094	0.0165 U	0.04462 U	0.04494 U	0.1485
Eu-152	-0.04413 U	0.02363 U	-0.03553 U	0.01944 U	0.001845 U	0.06922 U	-0.01734 U	-0.001371 U	0.0002635 U	-0.0106 U
Eu-154	-0.02553 U	-0.0009175 U	-0.03022 U	-0.01137 U	0.01621 U	0.006769 U	-0.01688 U	0.01009 U	-0.007011 U	0.02753 U
Eu-155	0.04993 U	0.1884 U	0.0959 U	0.002962 U	0.07796 U	0.1487 U	0.1307 U	0.03538 U	-0.01351 U	0.0923 U
Mn-54	0.0223 U	-0.0003306 U	-0.0004027 U	0.01668 U	-0.0009434 U	0.01593 U	-0.001112 U	-0.0008951 U	0.02468 U	0.00231 U
Nb-94	-0.007828 U	0.008048 U	-0.003759 U	0.005976 U	0.0002977 U	0.009005 U	-0.003616 U	-0.005508 U	0.007065 U	-0.002753 U
Sb-125	0.09506 U	0.06982 U	0.04246 U	0.082 U	0.04413 U	0.09008 U	0.1175	-0.002371 U	0.02252 U	0.07396
Hard to detect (pCi/g)										
C-14		2.18	0.607				-0.0276 U			
Cm-243		0.0279 U	0.0182 U				0.0146 U			
Fe-55		-1.28 U	-3.1 U				-0.815 U			
H-3		4.39	-1.3 U				11.4			
Ni-63		-0.565 U	0.499 U				-0.0303 U			
Pu-238		-0.0185 U	-0.0138 U				0.00724 U			
Pu-239		0.00211 U	0.00346 U				-0.0119 U			
Pu-241		-0.912 U	-1.91 U				-0.532 U			
Sr-90		0.0131 U	-0.0198 U				0.00897 U			
Tc-99		0.0161 U	0.0881 U				0.09 U			

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-01-016-F	NOL-06-01-017-F	NOL-06-01-018-F	NOL-06-01-019-F	NOL-06-01-020-F	NOL-06-02-001-F	NOL-06-02-002-F	NOL-06-02-003-F	NOL-06-02-004-F	NOL-06-02-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.000112 U	0.001611 U	-0.01278 U	0.109 U	0.01582 U	-0.020267 U	0.0086426 U	-0.0041211 U	0.0010664 U	-0.00043677 U
Am-241	-0.09822 U	-0.1001 U	-0.001778 U	0.1029 U	-0.4571 U	-0.0058202 U	-0.023336 U	0.19244 U	-0.06947 U	-0.063412 U
Co-60	-0.0005084 U	0.0918	-0.007163 U	-0.01332 U	-0.006955 U	-0.004925 U	0.0055794 U	-0.0074123 U	-0.0021949 U	0.024896 U
Cs-134	-0.01757 U	-0.00008906 U	-0.004653 U	0.003023 U	-0.001367 U	0.01603 U	0.018445 U	0.016296 U	-0.025482 U	0.017214 U
Cs-137	0.01142 U	0.121	0.4502	0.3833	0.3244	-0.00079494 U	-0.0051659 U	-0.010532 U	0.026491 U	-0.0026502 U
Eu-152	-0.006367 U	0.05634 U	0.0744 U	0.02347 U	0.0164 U	-0.0023095 U	0.0085062 U	-0.041246 U	-0.004856 U	0.13767
Eu-154	0.007252 U	-0.02995 U	0.0465 U		-0.0202 U	0.0018598 U	0.0085272 U	-0.025114 U	-0.0022839 U	0.009744 U
Eu-155	0.08659 U	0.1056 U	0.05944 U	-0.023 U	0.1584 U	0.075623 U	0.2482 U	0.001717 U	0.15979 U	0.0096866 U
Mn-54	-0.001865 U	0.02778 U	0.01453 U	-0.01352 U	-0.007415 U	0.013021 U	0.0076048 U	-0.010024 U	0.020651 U	-0.0017406 U
Nb-94	0.01786 U	0.004879 U	-0.0006087 U	-0.005839 U	0.01577 U	0.0065314 U	0.0058701 U	-0.00049415 U	0.0022198 U	-0.0001819 U
Sb-125	0.102 U	0.07957 U	0.04791 U	0.06046 U	0.04901 U	0.074397 U	0.11565	0.13144	0.15312	0.10957
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-02-006-F	NOL-06-02-007-F	NOL-06-02-008-F	NOL-06-02-009-F	NOL-06-02-010-F	NOL-06-02-011-F	NOL-06-02-012-F
gamma-spec (pCi/g)							
Ag-108m	-0.0018405 U	0.010352 U	0.0044481 U	-0.011182 U	0.0010402 U	0.001824 U	0.016487 U
Am-241	0.091717 U	0.0014155 U	0.032379 U	-0.090495 U	0.079157 U	0.018832 U	-0.013556 U
Co-60	-0.007976 U	-0.0090875 U	0.022029 U	0.0030781 U	-0.00020316 U	0.02022 U	0.053315 U
Cs-134	0.02469 U	0.02048 U	0.029358 U	0.016704 U	-0.0041772 U	-0.014232 U	0.0062423 U
Cs-137	0.0024111 U	0.032968 U	0.015844 U	0.0045301 U	0.016282 U	0.015328 U	0.12132
Eu-152	0.10305 U	-0.0037255 U	-0.00038471 U	-0.013125 U	-0.052687 U	0.03357 U	-0.031921 U
Eu-154	0.027082 U	-0.025889 U	0.011896 U	0.026292 U	-0.021048 U	-0.008064 U	-0.028357 U
Eu-155	-0.0027767 U	0.094725 U	0.0035981 U	-0.11502 U	0.099788 U	0.094939 U	0.12726 U
Mn-54	0.011336 U	0.019892 U	-0.0021782 U	0.000017432 U	0.000069514 U	-0.00071167 U	-0.012322 U
Nb-94	0.014618 U	0.003434 U	0.011322 U	-0.0030156 U	-0.0023442 U	-0.0083776 U	-0.011534 U
Sb-125	0.04744 U	0.094071 U	0.062258 U	0.091578 U	-0.018564 U	-0.0023892 U	0.11867 U
Hard to detect (pCi/g)							
C-14							
Cm-243							
Fe-55							
H-3							
Ni-63							
Pu-238							
Pu-239							
Pu-241							
Sr-90							
Tc-99							

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-02-013-F	NOL-06-02-014-F	NOL-06-02-015-F	NOL-06-02-016-F	NOL-06-02-017-F	NOL-06-02-018-F	NOL-06-02-019-F	NOL-06-02-020-F	NOL-06-02-021-F	NOL-06-02-022-F
gamma-spec (pCi/g)										
Ag-108m	0.007826 U	-0.0045596 U	-0.022734 U	-0.0027827 U	0.00094926 U	-0.017185 U	-0.010945 U	0.00078512 U	-0.016646 U	-0.027381 U
Am-241	-0.023838 U	0.0032003 U	-0.051205 U	0.0025164 U	-0.012142 U	-0.045183 U	0.025135 U	0.039337 U	-0.017629 U	0.45546 U
Co-60	0.0027253 U	0.0061413 U	0.014741 U	0.020748 U	-0.0012226 U	0.016681 U	0.011936 U	0.020502 U	0.0082453 U	-0.015827 U
Cs-134	0.037733	-0.018035 U	-0.026356 U	0.020491 U	0.0016016 U	0.018324 U	0.01221 U	0.018241 U	-0.0017867 U	-0.0009108 U
Cs-137	0.062812	0.01326 U	0.02324 U	0.05218	0.0091656 U	0.011232 U	0.024091 U	0.065242	0.37723	0.34074
Eu-152	-0.0011508 U	-0.0040273 U	-0.036985 U	0.038218 U	-0.0069407 U	0.025438 U	-0.025464 U	-0.0071446 U	0.030056 U	0.03951 U
Eu-154	0.1202 U	0.023885 U	-0.016162 U	0.0028784 U	0.0070908 U	0.0063354 U	0.0073975 U	-0.0053415 U	-0.023269 U	0.029258 U
Eu-155	0.091082 U	0.073385 U	0.042506 U	0.0050709 U	0.014796 U	0.12297 U	0.15226 U	0.10092 U	0.13653 U	-0.016013 U
Mn-54	-0.0016263 U	-0.0082364 U	-0.00059279 U	-0.0095088 U	-0.0040612 U	0.023981 U	-0.0069778 U	0.0056251 U	-0.0012336 U	-0.00083145 U
Nb-94	-0.0036266 U	0.0064398 U	0.015566 U	0.0078762 U	0.010237 U	-0.00020632 U	-0.0041332 U	-0.004484 U	-0.0029339 U	0.0052362 U
Sb-125	0.065016 U	0.068241 U	0.10149 U	0.094626 U	0.079419 U	0.09718	0.13652	0.04935 U	0.052739 U	-0.018116 U
Hard to detect (pCi/g)										
C-14	0.22 U		-0.239 U							
Cm-243	0.0624 U		0.0699 U							
Fe-55	2.96 U		0.619 U							
H-3	-0.827 U		8.23 U							
Ni-63	-3.68 U		-1.03 U							
Pu-238	-0.0765 U		-0.0864 U							
Pu-239	0.000721 U		-0.0175 U							
Pu-241	2.39 U		4.1 U							
Sr-90	0.0163 U		-0.00234 U							
Tc-99	-0.0439 U		0.109 U							

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-02-023-F	NOL-06-02-024-F	NOL-06-02-025-F	NOL-06-02-026-F	NOL-06-02-027-F	NOL-06-02-028-F	NOL-06-02-029-F	NOL-06-02-030-F	NOL-06-02-031-F	NOL-06-02-032-F
gamma-spec (pCi/g)										
Ag-108m	-0.01173 U	0.0014811 U	-0.010281 U	-0.017499 U	0.010213 U	-0.0077544 U	-0.0011511 U	-0.0005873 U	0.010003 U	0.0047731 U
Am-241	-0.00098986 U	0.045579 U	-0.07692 U	-0.026614 U	-0.32177 U	-0.090846 U	-0.0014761 U	-0.07378 U	-0.21611 U	-0.047561 U
Co-60	0.16129	0.0043992 U	0.040196 U	0.0054527 U	-0.0058732 U	0.12009	0.013903 U	0.015407 U	0.00014002 U	0.0087851 U
Cs-134	0.0125 U	0.012892 U	0.029029 U	0.015475 U	0.032 U	0.016687 U	0.016011 U	-0.002279 U	0.016257 U	0.017509 U
Cs-137	0.33706	0.017999 U	0.094012	0.041899	0.038201 U	0.023298 U	0.011479 U	-0.0073637 U	0.016217 U	0.011925 U
Eu-152	-0.00022652 U	0.012485 U	-0.042581 U	0.0013487 U	-0.035369 U	-0.0041145 U	-0.011651 U	-0.037914 U	0.077375 U	-0.0047092 U
Eu-154	0.00059696 U	0.0082209 U	-0.020691 U	-0.00025836 U	-0.023095 U	0.016594 U	-0.01166 U	0.004178 U	0.0051722 U	-0.0089855 U
Eu-155	0.13384	0.09732 U	0.2182 U	0.13197 U	-0.082363 U	0.1046 U	0.10389 U	-0.1044 U	0.074215 U	0.12068 U
Mn-54	0.015209 U	0.03168	-0.00074948 U	0.017101 U	-0.001338 U	0.01666 U	0.011341 U	-0.010093 U	0.010232 U	-0.0056242 U
Nb-94	-0.0015799 U	-0.0030305 U	0.0023015 U	0.0058896 U	0.0087465 U	0.006781 U	0.0070686 U	0.010263 U	-0.00018927 U	-0.0084021 U
Sb-125	0.07733 U	0.06948	0.20041	0.084126	0.11514 U	0.1298	0.091196	-0.012662 U	0.079873 U	0.06813 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	NOL-06-03-001-F	NOL-06-03-002-F	NOL-06-03-003-F	NOL-06-03-004-F	NOL-06-03-005-F	NOL-06-03-006-F	NOL-06-03-007-F	NOL-06-03-008-F	NOL-06-03-009-F	NOL-06-03-010-F
gamma-spec (pCi/g)										
Ag-108m	-0.006011 U	0.0009845 U	-0.007852 U	-0.004994 U	0.0008398 U	-0.01226 U	-0.002536 U	0.01105 U	-0.01039 U	-0.02568 U
Am-241	0.1628 U	0.1382 U	0.01426 U	0.09471 U	0.06615 U	-0.05459 U	-0.1664 U	0.07398 U	0.2452 U	0.1007 U
Co-60	0.01848 U	0.8431	0.1446	0.003307 U	0.3024	0.01977 U	0.05045 U	0.07743	1.363	0.02485 U
Cs-134	0.0123 U	0.0007951 U	0.008346 U	0.02133 U	0.01133 U	0.01448 U	0.03904 U	0.01951 U	0.02187 U	0.02767 U
Cs-137	0.004349 U	0.6008	0.1275	0.00959 U	0.3921	0.01291 U	0.1953	0.2032	0.3333	0.1109
Eu-152	0.005548 U	0.02438 U	0.02638 U	-0.03388 U	0.001224 U	-0.05577 U	-0.003495 U	0.1211 U	-0.03594 U	0.003402 U
Eu-154	-0.008331 U	0.001867 U	-0.008998 U	-0.00294 U	0.007042 U	-0.001221 U	-0.004353 U	-0.01248 U	0.02482 U	0.0168 U
Eu-155	0.01037 U	0.1137 U	0.06161 U	0.01167 U	0.2414 U	0.1038 U	0.1755 U	-0.01684 U	0.09691 U	0.01256 U
Mn-54	0.01676 U	-0.001333 U	-0.01741 U	-0.002035 U	0.00128 U	-0.007724 U	0.03418 U	0.0005564 U	0.0001818 U	0.02992 U
Nb-94	0.00106 U	0.001026 U	-0.00005515 U	0.005435 U	-0.004986 U	-0.003711 U	0.01923 U	0.0004749 U	-0.01298 U	-0.001885 U
Sb-125	0.1379	0.08659 U	0.1323 U	0.07985 U	0.1178	0.0725 U	0.0985 U	-0.01023 U	0.09717 U	0.0664 U
Hard to detect (pCi/g)										
C-14					0.127 U	0.0147 U				
Cm-243					0.00472 U	0.0192 U				
Fe-55					2.23 U	-0.512 U				
H-3					1.89 U	-0.665 U				
Ni-63					-0.712 U	-1.8 U				
Pu-238					0.0333 U	-0.0949 U				
Pu-239					-0.0194 U	-0.0229 U				
Pu-241					0.782 U	-0.218 U				
Sr-90					0.0189 U	0.00512 U				
Tc-99					0.0531 U	0.0545 U				

Station	NOL-06-03-011-F	NOL-06-03-012-F	NOL-06-03-013-F	NOL-06-03-014-F	NOL-06-03-015-F	OOL-02-01-001-F	OOL-02-01-002-F	OOL-02-01-003-F	OOL-02-01-004-F	OOL-02-01-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.0007595 U	0.002512 U	0.0212 U	-0.0004083 U	0.01162 U	-0.01489 U	-0.02435 U	0.01267 U	-0.007661 U	-0.02915 U
Am-241	-0.1078 U	0.1271 U	0.13 U	0.2891 U	0.002515 U	0.12 U	0.3027 U	-0.0657 U	-0.002196 U	0.05654 U
Co-60	0.02883	0.06794	0.04798 U	0.01478 U	0.0109 U	0.4278	0.04018	0.03109 U	0.005162 U	0.0177 U
Cs-134	0.02898	0.02941 U	0.02877 U	0.0194 U	0.02384 U	0.001462 U	0.01613 U	-0.002467 U	-0.02633 U	-0.01867 U
Cs-137	0.06184	0.1854	0.07469	0.02735 U	0.002618 U	0.3998	0.07081	0.1158	-0.0002774 U	0.0201 U
Eu-152	0.1296 U	-0.007791 U	-0.08205 U	0.0802 U	0.01795 U	0.008891 U	-0.02826 U	-0.01372 U	-0.00269 U	0.03282 U
Eu-154	0.02427 U	-0.001234 U	-0.05107 U	-0.01951 U	-0.0001956 U	0.008718 U	-0.02215 U	-0.0002112 U	-0.002916 U	0.03344 U
Eu-155	0.1454 U	0.164 U	-0.0197 U	-0.0758 U	0.1566 U	0.1652 U	0.1755 U	0.1881 U	0.01095 U	-0.004746 U
Mn-54	0.009173 U	0.04402 U	0.03249 U	0.01691 U	-0.01261 U	0.009702 U	0.01556 U	-0.002275 U	0.008312 U	0.0163 U
Nb-94	0.006907 U	-0.003273 U	0.003625 U	-0.009842 U	0.002125 U	-0.01098 U	-0.004631 U	0.006311 U	-0.00316 U	-0.005823 U
Sb-125	0.09905	0.09253 U	0.1075 U	0.1249	0.1042 U	0.02242 U	0.09664 U	0.1011 U	0.08158 U	0.1079
Hard to detect (pCi/g)										
C-14	0.0433 U		0.0872 U							
Cm-243	0.0209 U		-0.04 U							
Fe-55	-1.4 U		-3.33 U							
H-3	7.06 U		4 U							
Ni-63	-0.816 U		-0.426 U							
Pu-238	0.000509 U		0.0118 U							
Pu-239	-0.0183 U		0.0294 U							
Pu-241	0.126 U		1.09 U							
Sr-90	-0.00679 U		-0.0165 U							
Tc-99	0.083 U		0.17 U							

Station	OOL-02-01-006-F	OOL-02-01-007-F	OOL-02-01-008-F	OOL-02-01-009-F	OOL-02-01-010-F	OOL-02-01-011-F	OOL-02-01-012-F	OOL-02-01-013-F	OOL-02-01-014-F	OOL-02-01-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.0001992 U	-0.03266 U	0.1013 U	-0.01827 U	-0.03676 U	0.1035 U	-0.01706 U	-0.01391 U	0.00516 U	-0.01047 U
Am-241	-0.2068 U	-0.01926 U	-0.1376 U	-0.1685 U	-0.1401 U	-0.06364 U	0.01275 U	-0.0326 U	0.01377 U	-0.02576 U
Co-60	0.0136 U	0.2906	0.01744 U	0.005796 U	0.02728 U	0.006041 U	-0.009907 U	0.08728	-0.009746 U	0.005728 U
Cs-134	0.002016 U	0.01592 U	0.02931 U	-0.002845 U	-0.02458 U	-0.01877 U	0.0007371 U	-0.001381 U	0.003077 U	0.000675 U
Cs-137	0.02331 U	0.6496	0.06421	0.07676	0.11	0.8813	0.001823 U	0.1034	0.01222 U	0.02537 U
Eu-152	-0.02356 U	0.144 U	-0.01916 U	0.09266 U	-0.01763 U	-0.01602 U	-0.02297 U	0.07786 U	0.1013 U	-0.01003 U
Eu-154	-0.01497 U	0.01165 U	-0.01025 U	-0.0002035 U	0.02155 U	0.01854 U	-0.01074 U	0.005271 U	-0.01239 U	-0.01308 U
Eu-155	0.133 U	0.1012 U	0.06654 U	0.1552 U	0.1048 U	-0.01063 U	0.02148 U	0.1694 U	-0.02303 U	0.1287 U
Mn-54	0.0339 U	0.01741 U	0.004515 U	0.01816 U	0.01608 U	0.01038 U	-0.006507 U	0.01856 U	-0.000405 U	0.01033 U
Nb-94	0.007586 U	0.01508 U	0.003807 U	0.0001343 U	0.0008883 U	-0.006812 U	0.0005364 U	-0.00647 U	0.005378 U	-0.003921 U
Sb-125	0.08068 U	-0.009494 U	-0.002723 U	0.1003	0.06241 U	0.1354 U	0.08101 U	-0.001785 U	-0.02359 U	0.09726
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-02-01-016-F	OOL-02-01-017-F	OOL-02-01-018-F	OOL-02-01-019-F	OOL-02-01-020-F	OOL-02-01-021-F	OOL-02-01-022-F	OOL-02-01-023-F	OOL-02-01-024-F	OOL-02-01-025-F
gamma-spec (pCi/g)										
Ag-108m	-0.01447 U	-0.008839 U	-0.002355 U	-0.008031 U	0.01166 U	-0.01158 U	-0.02168 U	-0.001781 U	-0.01616 U	-0.006224 U
Am-241	-0.023 U	-0.1245 U	0.1665 U	-0.07929 U	0.1419 U	0.02793 U	0.2011 U	-0.1567 U	0.1541 U	-0.1463 U
Co-60	0.0002087 U	-0.008061 U	0.003841 U	-0.01287 U	0.004399 U	0.005162 U	0.01774 U	1.129E-07 U	0.003135 U	0.01068 U
Cs-134	0.02771 U	0.02204 U	-0.0002715 U	0.002717 U	-0.004338 U	0.01491 U	0.01396 U	-0.02163 U	0.0169 U	0.001312 U
Cs-137	0.008622 U	0.03004 U	0.0217 U	0.02108 U	0.01441 U	0.01659 U	0.008698 U	0.001708 U	0.01736 U	0.02838 U
Eu-152	-0.005947 U	-0.006563 U	-0.03793 U	0.01771 U	-0.0193 U	-0.0002601 U	0.02289 U	0.04974 U	0.01984 U	0.0355 U
Eu-154	-0.0002276 U	0.006758 U	-0.02062 U	0.0008909 U	0.0221 U	-0.001527 U	-0.0007555 U	-0.01923 U	0.01446 U	-0.01666 U
Eu-155	0.07279 U	0.1145 U	0.1128 U	-0.01265 U	0.1 U	0.07785 U	0.125 U	-9.031E-07 U	0.1295 U	0.05711 U
Mn-54	0.001778 U	-0.003038 U	-0.001135 U	-0.00104 U	-0.0003807 U	0.007797 U	0.01175 U	0.01713 U	0.006085 U	0.01128 U
Nb-94	0.007365 U	0.0676 U	0.006047 U	-0.007688 U	0.004373 U	-0.004408 U	-0.002781 U	0.004286 U	0.03959 U	0.007105 U
Sb-125	0.1039 U	0.1115 U	-0.01483 U	-0.003004 U	0.02428 U	0.1364	0.08102 U	0.08131 U	0.09411	0.08758 U
Hard to detect (pCi/g)										
C-14									0.299	-0.0547 U
Cm-243									-0.0102 U	0.0546 U
Fe-55									-3.32 U	-0.215 U
H-3									0.967 U	-0.708 U
Ni-63									-0.0211 U	-0.589 U
Pu-238									-0.025 U	0.0269 U
Pu-239									-0.00365 U	0.0152 U
Pu-241									0.656 U	0.175 U
Sr-90									0.0186 U	0.0161 U
Tc-99									0.0927 U	0.0248 U

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-02-01-026-F	OOL-02-01-027-F	OOL-02-02-001-F	OOL-02-02-001-R	OOL-02-02-002-F	OOL-02-02-002-R	OOL-02-02-003-F	OOL-02-02-003-R	OOL-02-02-004-F	OOL-02-02-004-R
gamma-spec (pCi/g)										
Ag-108m	-0.01033 U	-0.001132 U	-0.009615 U	0.029658 U	0.02296 U	0.0017384 U	0.007406 U	-0.018136 U	-0.002009 U	0.010879 U
Am-241	-0.2686 U	0.1612 U	0.04288 U	0.15606 U	0.009892 U	0.064427 U	0.07671 U	-0.14795 U	0.01849 U	0.033246 U
Co-60	0.0006689 U	-0.005936 U	0.006806 U	0.00087751 U	0.009559 U	0.037486 U	-0.008986 U	0.0049903 U	0.008668 U	0.0099416 U
Cs-134	0.0195 U	-0.002251 U	-0.01889 U	-0.0083826 U	-0.005355 U	0.0287 U	-0.0102 U	0.01884 U	0.01122 U	0.0011722 U
Cs-137	0.01613 U	0.009588 U	0.01349 U	0.00092402 U	0.01448 U	0.031476 U	0.01117 U	0.036116 U	0.0104 U	0.043845 U
Eu-152	0.09636 U	0.004108 U	0.0509 U	0.025236 U	-0.0001437 U	-0.038409 U	0.03652 U	0.092432 U	0.1094 U	0.0088121 U
Eu-154	0.02463 U	-0.004021 U	0.03039 U	0.017384 U	0.001343 U	0.028797 U	0.02966 U	-0.0021449 U	0.008745 U	-0.020291 U
Eu-155	0.1465 U	0.17 U	0.1436 U	-0.006277 U	0.09524 U	0.18196 U	0.1466 U	0.10129 U	0.1116 U	-0.0027977 U
Mn-54	0.0208 U	0.01534 U	-0.000301 U	0.025218 U	-0.009901 U	0.036067 U	-0.004216 U	0.0017446 U	-0.0008744 U	-0.0096372 U
Nb-94	0.004713 U	0.0001327 U	0.003013 U	-0.0039458 U	-0.005078 U	0.00065552 U	-0.005996 U	-0.0018099 U	-0.009041 U	-0.0088435 U
Sb-125	0.07212 U	0.06739 U	0.05873 U	0.092624 U	0.1843	0.16055 U	0.1088 U	0.10293 U	0.1079	0.064373 U
Hard to detect (pCi/g)										
C-14	0.019 U	0.849			-0.0646 U					
Cm-243	-0.0158 U	-0.0359 U			-0.0863 U					
Fe-55	-1.99 U	-2.9 U			-1 U					
H-3	0.96 U	1.3 U			-5.52 U					
Ni-63	-0.511 U	-0.0639 U			0.128 U					
Pu-238	0.0262 U	-0.00332 U			0.00393 U					
Pu-239	0.000524 U	-0.0133 U			-0.0206 U					
Pu-241	-1.2 U	2.03 U			-9.66 U					
Sr-90	-0.0192 U	-0.0131 U			0.0116 U					
Tc-99	-0.188 U	0.072 U			0.132 U					

Station	OOL-02-02-005-F	OOL-02-02-005-R	OOL-02-02-006-F	OOL-02-02-006-R	OOL-02-02-007-F	OOL-02-02-007-R	OOL-02-02-008-F	OOL-02-02-008-R	OOL-02-02-009-F	OOL-02-02-009-R
gamma-spec (pCi/g)										
Ag-108m	-0.004126 U	0.011942 U	-0.02083 U	-0.013536 U	-0.001666 U	-0.011364 U	-0.002529 U	0.0014403 U	-0.00007013 U	0.0019003 U
Am-241	-0.0418 U	-0.028586 U	-0.1447 U	0.10961 U	-0.2821 U	0.075944 U	0.05436 U	0.049658 U	0.2388 U	0.027739 U
Co-60	-0.00885 U	0.0065052 U	-0.00323 U	-0.00020285 U	-0.00537 U	0.014865 U	0.03319 U	-0.0037228 U	-0.00003279 U	0.0090324 U
Cs-134	0.002311 U	0.01498 U	0.01693 U	0.030314 U	0.06978 U	0.041135 U	-0.01894 U	0.025521 U	-0.004235 U	0.015329 U
Cs-137	0.001363 U	0.053214	0.005695 U	0.0656 U	0.006826 U	0.029524 U	0.1405	0.030248	0.008625 U	0.026866 U
Eu-152	-0.02419 U	-0.002289 U	0.1047 U	0.099967 U	0.0633 U	0.18049 U	0.1059 U	0.016761 U	-0.02798 U	0.0014586 U
Eu-154	-0.01245 U	0.0029844 U	0.001585 U	0.028908 U	-0.01234 U	0.000068982 U	0.01128 U	-0.024749 U	-0.00117 U	-0.0080236 U
Eu-155	-0.02594 U	0.11552 U	-0.004922 U	-0.021215 U	-0.01146 U	0.15133 U	-0.008282 U	0.14418 U	-0.06883 U	-0.028925 U
Mn-54	-0.004862 U	-0.013585 U	-0.01269 U	-0.00037357 U	-0.006987 U	-0.0047948 U	-0.001084 U	0.021446 U	-0.006859 U	0.020227 U
Nb-94	-0.005147 U	0.0055326 U	-0.005676 U	0.0096147 U	0.009382 U	0.08374 U	0.03069 U	0.0096351 U	0.01046 U	0.010422 U
Sb-125	0.1072	0.061867 U	0.09136 U	0.082787 U	0.1076	0.17823 U	0.05801 U	0.09549 U	0.1443	0.09592 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-02-02-010-F	OOL-02-02-010-R	OOL-02-02-011-F	OOL-02-02-012-F	OOL-02-02-013-F	OOL-02-02-014-F	OOL-02-02-015-F	OOL-02-02-016-F	OOL-02-02-017-F	OOL-02-02-018-F
gamma-spec (pCi/g)										
Ag-108m	0.008261 U	0.0018143 U	0.01424 U	-0.003232 U	-0.001742 U	-0.01596 U	-0.01783 U	-0.01572 U	0.006909 U	-0.01151 U
Am-241	-0.2721 U	-0.36351 U	-0.1797 U	-0.2768 U	0.008537 U	-0.004063 U	-0.3507 U	0.06001 U	0.1492 U	0.2009 U
Co-60	0.005 U	0.013022 U	-0.002924 U	0.002571 U	-0.001175 U	-0.005105 U	0.01092 U	0.007329 U	0.001163 U	-0.005564 U
Cs-134	0.01372 U	0.017515 U	0.00877 U	0.02127 U	-0.002007 U	0.02604 U	0.01955 U	0.01928 U	0.02215 U	0.03079 U
Cs-137	0.00521 U	0.026071 U	0.01078 U	0.008982 U	0.01598 U	0.01528 U	-0.0007311 U	0.0305 U	0.0619 U	-0.002934 U
Eu-152	-0.03098 U	0.013339 U	0.00947 U	0.01554 U	-0.03326 U	-0.0006389 U	-0.0128 U	0.02115 U	-0.01829 U	-0.05964 U
Eu-154	-0.02164 U	0.0029821 U	0.01583 U	-0.0004217 U	-0.02108 U	-0.0223 U	-0.008047 U	-0.02477 U	0.01604 U	-0.03738 U
Eu-155	0.1234 U	0.16136 U	-0.07808 U	-0.01005 U	-0.03552 U	0.03993 U	0.1468 U	0.002014 U	0.07379 U	-0.01054 U
Mn-54	0.003977 U	0.012205 U	0.007219 U	0.01502 U	-0.002323 U	-0.001287 U	0.01426 U	-0.0003388 U	0.004468 U	-0.006581 U
Nb-94	-0.004213 U	0.0050532 U	0.03154 U	0.009182 U	-0.001144 U	-0.003529 U	0.0009728 U	0.009736 U	0.05186 U	-0.0003869 U
Sb-125	0.08525 U	0.10034	0.03238 U		0.07614 U	0.06126 U	0.07738 U	0.0816 U	0.1051 U	0.1245 U
Hard to detect (pCi/g)										
C-14	-0.0467 U									
Cm-243	0.00552 U									
Fe-55	-0.421 U									
H-3	5.51 U									
Ni-63	-0.524 U									
Pu-238	-0.0265 U									
Pu-239	0.000564 U									
Pu-241	-4.75 U									
Sr-90	0.0234 U									
Tc-99	0.202 U									

Station	OOL-02-02-019-F	OOL-02-02-020-F	OOL-02-03-007-F	OOL-02-03-009-F	OOL-02-03-011-F	OOL-02-03-012-F	OOL-02-03-013-F	OOL-02-03-014-F	OOL-02-03-015-F	OOL-02-03-016-F
gamma-spec (pCi/g)										
Ag-108m	-0.004067 U	-0.007681 U	-0.021644 U	0.0088301 U	-0.01536 U	0.011703 U	-0.0069971 U	0.001073 U	-0.011035 U	-0.0089804 U
Am-241	-0.3589 U	0.004242 U	0.10357 U	-0.14723 U	0.05762 U	-0.10223 U	0.0016606 U	-0.26294 U	0.051299 U	-0.25116 U
Co-60	-0.003028 U	-0.0006512 U	-0.0045233 U	-0.0037058 U	0.015112 U	-0.00021437 U	0.00812 U	0.012795 U	0.0036931 U	-0.0028268 U
Cs-134	0.0281	0.00002701 U	-0.014858 U	0.02365 U	-0.009139 U	-0.0043925 U	-0.011014 U	-0.0044038 U	-0.012103 U	0.0097076 U
Cs-137	0.008038 U	0.0004738 U	0.20634	0.07228	-0.0017792 U	0.20465	0.31153	0.2029	0.1107	0.14118
Eu-152	0.06494 U	0.001776 U	0.11872 U	-0.0092001 U	0.0012095 U	-0.070012 U	0.012861 U	0.083521 U	-0.026807 U	0.090671 U
Eu-154	-0.00008142 U	0.01014 U	-0.020145 U	-0.00099143 U	-0.0077882 U	-0.0091196 U	0.011044 U	0.032236 U	-0.019863 U	0.021385 U
Eu-155	0.0067 U	0.1303 U	0.10793 U	-0.026591 U	-0.14229 U	-0.0036587 U	0.063851 U	0.015474 U	0.041094 U	0.13613 U
Mn-54	0.01532 U	-0.009528 U	0.0044392 U	-0.010822 U	0.011923 U	-0.0057492 U	0.016577 U	-0.001258 U	0.0021146 U	-0.0029352 U
Nb-94	-0.004848 U	-0.01396 U	-0.0037535 U	0.0077788 U	-0.006032 U	-0.0013447 U	-0.0082807 U	-0.00048989 U	-0.0037874 U	-0.0050956 U
Sb-125	0.0837 U	0.1078 U	0.096577 U	0.088219 U	0.11881	-0.0033102 U	-0.0011964 U	0.084758 U	-0.018557 U	0.10679
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-02-03-017-F	OOL-02-03-018-F	OOL-02-03-019-F	OOL-02-03-020-F	OOL-02-03-021-F	OOL-02-03-022-F	OOL-02-03-023-F	OOL-02-03-024-F	OOL-02-03-025-F	OOL-02-04-001-F
gamma-spec (pCi/g)										
Ag-108m	-0.0065577 U	0.0096985 U	-0.0046111 U	-0.016638 U	-0.0036395 U	0.0094365 U	-0.018035 U	-0.0029448 U	-0.013694 U	-0.0067908 U
Am-241	-0.3246 U	-0.09588 U	0.11946 U	0.0051523 U	0.081141 U	0.070167 U	0.00074175 U	-0.13555 U	0.0011171 U	-0.14689 U
Co-60	-0.0010935 U	0.0059531 U	0.00016478 U	0.0087903 U	-0.0015808 U	0.01108 U	-0.0070033 U	0.0064962 U	0.028395 U	-0.0015626 U
Cs-134	0.011785 U	0.0089172 U	0.017255 U	0.016809	0.020273 U	-0.010343 U	0.013695 U	0.00072768 U	-0.020924 U	-0.02018 U
Cs-137	0.2	0.014888 U	0.0028503 U	0.18408	0.18766	0.42672	0.23364	0.19926	0.34349	0.042813
Eu-152	0.060636 U	-0.015242 U	-0.043785 U	0.014428 U	0.018376 U	-0.04389 U	-0.0015184 U	-0.005936 U	0.046259 U	0.002324 U
Eu-154	0.0013123 U	0.015948 U	-0.016313 U	-0.00034381 U	-0.0020281 U	-0.03364 U	0.012339 U	0.0072008 U	-0.0011151 U	-0.030784 U
Eu-155	0.11363 U	0.087766 U	0.074696 U	0.058552 U	0.014722 U	-0.019712 U	0.091456 U	0.1752 U	0.12401 U	-0.016401 U
Mn-54	-0.000093042 U	0.01407 U	-0.0099865 U	0.00042588 U	0.0014237 U	-0.00038936 U	0.0053889 U	0.014185 U	-0.010116 U	0.0014079 U
Nb-94	0.0056589 U	0.0016757 U	0.0018939 U	0.0053798 U	-0.00035296 U	-0.0038997 U	0.0038182 U	0.0946 U	-0.0069706 U	0.03275 U
Sb-125	0.057941 U	0.065323 U	-0.0042684 U	0.037299 U	0.049945 U	-0.049518 U	-0.0070605 U	0.16219 U	-0.0012766 U	R
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-02-04-002-F	OOL-02-04-003-F	OOL-02-04-004-F	OOL-02-04-005-F	OOL-02-04-006-F	OOL-02-04-007-F	OOL-02-04-008-F	OOL-02-04-009-F	OOL-02-04-010-F	OOL-02-04-011-F
gamma-spec (pCi/g)										
Ag-108m	-0.0071154 U	-0.020452 U	-0.010382 U	-0.025989 U	-0.0080651 U	-0.015813 U	-0.00091951 U	-0.00077375 U	-0.018786 U	-0.0092665 U
Am-241	0.037497 U	-0.018329 U	0.041967 U	0.022696 U	0.011546 U	-0.047824 U	0.23801 U	0.037491 U	-0.037281 U	0.019253 U
Co-60	-0.0062114 U	-0.010712 U	0.010426 U	0.0074065 U	0.016659 U	0.0059796 U	-0.011847 U	0.0013614 U	0.012443 U	0.0055776 U
Cs-134	-0.036053 U	0.014113 U	0.040308 U	-0.027559 U	-0.021138 U	0.012728 U	-0.0092104 U	0.020262 U	0.024213 U	0.011497 U
Cs-137	0.012538 U	0.012807 U	0.0082792 U	0.04595	0.023669 U	0.0059897 U	0.012778 U	0.017162 U	0.0044102 U	0.004752 U
Eu-152	-0.023924 U	-0.0076003 U	0.024384 U	-0.000093358 U	-0.0055788 U	0.046052 U	0.0094447 U	0.00058739 U	-0.0028001 U	0.045535 U
Eu-154	-0.016022 U	-0.0054204 U	0.011054 U	-0.0097609 U	0.0037332 U	0.001686 U	0.020785 U	-0.030823 U	-0.010404 U	0.021667 U
Eu-155	0.0084039 U	0.091747 U	-0.0065696 U	0.074191 U	0.14663 U	0.079228 U	0.10651 U	0.063223 U	0.097876 U	0.024949 U
Mn-54	-0.0057108 U	0.011817 U	0.0053548 U	-0.0078233 U	-0.0033658 U	-0.00024173 U	0.0015486 U	0.028289 U	0.014615 U	-0.0084234 U
Nb-94	0.00095352 U	-0.00084667 U	0.0019418 U	-0.0041136 U	-0.0002204 U	-0.000078947 U	0.001318 U	0.011491 U	0.0056706 U	-0.0084806 U
Sb-125	R	R	0.061709 U	R	0.097691 U	R	0.093851 U	0.10367 U	0.056467 U	0.087486 U
Hard to detect (pCi/g)										
C-14		0.0696 U								
Cm-243		0.024 U								
Fe-55		8.19 U								
H-3		0.253 U								
Ni-63		-0.257 U								
Pu-238		-0.103 U								
Pu-239		-0.0892 U								
Pu-241		15.6 U								
Sr-90		-0.00377 U								
Tc-99		-0.0427 U								

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-02-04-012-F	OOL-02-04-013-F	OOL-02-04-014-F	OOL-02-04-015-F	OOL-02-04-016-F	OOL-02-04-017-F	OOL-02-04-018-F
gamma-spec (pCi/g)							
Ag-108m	-0.01466 U	-0.0065839 U	0.020424 U	-0.0016898 U	-0.0065168 U	-0.022962 U	0.0080808 U
Am-241	-0.060897 U	0.20797 U	-0.18858 U	0.00044734 U	0.22613 U	0.0053941 U	-0.034124 U
Co-60	-0.007966 U	-0.0018444 U	0.0016629 U	-0.00059484 U	-0.0073038 U	-0.00019727 U	-0.0031062 U
Cs-134	0.026488 U	0.013296 U	0.01528 U	0.021107 U	0.015677 U	-0.0014357 U	0.015869 U
Cs-137	-0.0028141 U	-0.00025782 U	0.017246 U	0.018565 U	0.030954 U	0.019702 U	-0.00075992 U
Eu-152	-0.0012993 U	-0.037025 U	-0.0031788 U	-0.014123 U	0.054255 U	-0.02986 U	0.016534 U
Eu-154	-0.010707 U	-0.03446 U	0.017917 U	0.004143 U	-0.0025124 U	0.016701 U	-0.0025881 U
Eu-155	0.0055534 U	0.010884 U	0.047904 U	0.13441 U	0.069029 U	0.14723 U	0.11305 U
Mn-54	0.026491 U	-0.0095833 U	-0.0051221 U	0.013196 U	R	-0.00088432 U	0.0079182 U
Nb-94	0.0042674 U	0.00037233 U	0.01892 U	-0.00030769 U	0.0026885 U	0.0025386 U	-0.0047526 U
Sb-125	0.13163 U	0.14701 U	R	-0.00096022 U	0.083424 U	0.074594 U	0.060826 U
Hard to detect (pCi/g)							
C-14				0.181			
Cm-243				0.355 U			
Fe-55				-13.3 U			
H-3				1.72 U			
Ni-63				-4.38 U			
Pu-238				0.108 U			
Pu-239				0.0904 U			
Pu-241				12.2 U			
Sr-90				-0.00841 U			
Tc-99				0.0289 U			

Station	OOL-02-04-019-F	OOL-02-04-020-F	OOL-02-05-001-F	OOL-02-05-002-F	OOL-02-05-003-F	OOL-02-05-004-F	OOL-02-05-006-F	OOL-02-05-007-F	OOL-02-05-008-F	OOL-02-05-014-F
gamma-spec (pCi/g)										
Ag-108m	-0.0017987 U	-0.0090496 U	0.0017944 U	0.1083 U	-0.010758 U	0.015001 U	-0.029556 U	-0.0066679 U	0.055956	0.00063209 U
Am-241	-0.070148 U	-0.19264 U	-0.029864 U	0.028384 U	0.0040729 U	-0.033184 U	0.08524 U	0.020744 U	-0.0016876 U	0.08765 U
Co-60	0.018475 U	0.0016097 U	-0.0018326 U	-0.0008396 U	0.011923 U	0.043679 U	0.0091368 U	-0.000295 U	-0.012091 U	0.00026724 U
Cs-134	0.0035216 U	R	0.02446 U	-0.028894 U	0.07198 U	0.024201 U	-0.0021971 U	-0.023314 U	0.018939 U	-0.0086254 U
Cs-137	0.015783 U	0.030596	0.01307 U	0.016302 U	-0.00026782 U	0.026226 U	0.051016 U	-0.0025138 U	0.010591 U	0.045581 U
Eu-152	-0.0018941 U	0.09663 U	-0.005792 U	-0.0024257 U	0.11142 U	0.0050288 U	-0.0069428 U	-0.016905 U	-0.034252 U	0.032892 U
Eu-154	-0.033629 U	0.021185 U	0.020238 U	0.028589 U	0.012147 U	0.0036784 U	-0.019471 U	0.00018625 U	-0.017197 U	0.019564 U
Eu-155	0.11775 U	0.16047 U	0.11452 U	-0.00553 U	0.157 U	0.015284 U	0.13456 U	0.14254	0.11177 U	0.14831 U
Mn-54	-0.0053535 U	0.019 U	0.0084585 U	-0.002824 U	-0.0038898 U	0.025496 U	0.011702 U	-0.011687 U	-0.00095784 U	0.023919 U
Nb-94	-0.0069725 U	0.0017819 U	0.010741 U	0.012837 U	-0.0043277 U	0.0059455 U	-0.0025655 U	0.0054584 U	0.00033796 U	-0.0045674 U
Sb-125	0.027356 U	R	0.079049 U	-0.010238 U	0.082421 U	0.097374 U	0.090899 U	0.069608 U	0.093937	0.094903 U
Hard to Detect (pCi/g)										
C-14							-0.0527 U		-0.141 U	
Cm-243							0.002 U		0.0753 U	
Fe-55							28.8 U		24.3 U	
H-3							1.06 U		2.57 U	
Ni-63							-0.65 U		-2.63 U	
Pu-238							0.0336 U		-0.0231 U	
Pu-239							-0.0115 U		0.0423 U	
Pu-241							-5.87 U		-5.08 U	
Sr-90							0.0103 U		0.0113 U	
Tc-99							0.202 U		0.236 U	

Station	OOL-02-05-015-F	OOL-02-05-016-F	OOL-06-02-022-F	OOL-08-02-005-F	OOL-08-02-011-F	OOL-08-02-012-F	OOL-08-02-013-F	OOL-08-02-017-F	OOL-08-02-018-F	OOL-08-02-021-F
gamma-spec (pCi/g)										
Ag-108m	-0.0022318 U	-0.0070843 U	-0.016019 U	0.00017908 U	0.0039035 U	-0.001101 U	-0.010614 U	-0.011679 U	0.0011968 U	-0.016934 U
Am-241	-0.00065309 U	-0.0017725 U	-0.032503 U	-0.0093741 U	0.11009 U	-0.29104 U	0.0059881 U	0.17487 U	-0.058812 U	0.2283 U
Co-60	-0.004467 U	0.0042559 U	0.0035443 U	-0.023665 U	-0.0017084 U	-0.00037076 U	0.0035826 U	0.52696	-0.0059765 U	0.045151 U
Cs-134	0.013034 U	0.01277 U	0.027849 U	-0.017261 U	-0.013374 U	0.011207 U	0.00042285 U	-0.029425 U	0.013697 U	0.017489 U
Cs-137	0.014481 U	-0.014371 U	0.016842 U	0.80882	0.82145	1.1596	0.46181	3.6506	0.12853	0.42477
Eu-152	-0.0059811 U	-0.0021488 U	0.069261 U	-0.0075882 U	-0.09324 U	0.029969 U	0.0013068 U	-0.026884 U	-0.02253 U	-0.07094 U
Eu-154	-0.0025437 U	0.014371 U	0.012584 U	-0.083053 U	-0.063303 U	0.0055103 U	0.014613 U	0.0054851 U	-0.014947 U	-0.052376 U
Eu-155	0.11878 U	0.13536 U	0.17691 U	0.10998 U	0.12355 U	-0.011822 U	0.069476 U	0.0043003 U	0.13504 U	0.0059197 U
Mn-54	-0.0098067 U	-0.0007086 U	-0.00016579 U	0.0058015 U	-0.010224 U	-0.013081 U	0.0045721 U	0.002815 U	-0.00082569 U	0.014525 U
Nb-94	0.0062158 U	-0.00682 U	0.0092664 U	0.032261 U	0.0057957 U	0.0092318 U	-0.0092532 U	-0.0072475 U	0.0069303 U	-0.00055976 U
Sb-125	0.083366 U	0.057238 U	0.11047 U	-0.044741 U	0.026906 U	0.0039099 U	0.052243 U	-0.0084793 U	0.073489 U	-0.018759 U
Hard to Detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-08-02-022-F	OOL-08-02-023-F	OOL-08-02-024-F	OOL-08-02-025-F	OOL-08-02-026-F	OOL-08-02-027-F	OOL-08-02-028-F	OOL-08-02-029-F	OOL-08-04-001-F	OOL-08-04-003-F
gamma-spec (pCi/g)										
Ag-108m	0.011806 U	-0.013492 U	-0.0148 U	-0.0067241 U	-0.0084987 U	0.020419 U	0.0071997 U	0.00019613 U	0.0084583 U	-0.0071309 U
Am-241	0.00015943 U	0.16751 U	0.20325 U	0.27515 U	0.17083 U	-0.16523 U	0.10172 U	-0.11285 U	0.02319 U	-0.16476 U
Co-60	-0.0073968 U	0.0055833 U	0.23665	-0.017916 U	-0.0055824 U	-0.000045072 U	-0.0093845 U	-0.011001 U	0.030768 U	0.12355
Cs-134	-0.015645 U	-0.00034732 U	0.025775 U	-0.00080688 U	0.09014 U	0.07922 U	-0.0024963 U	-0.0073204 U	-0.016541 U	-0.01083 U
Cs-137	0.16554	1.2425	3.9771	0.75575	1.4959	3.8109	0.46355	0.056971 U	0.11237	0.35949
Eu-152	0.043779 U	0.0076138 U	0.0030004 U	0.0035425 U	0.037009 U	-0.079958 U	0.051316 U	-0.024188 U	-0.038797 U	0.17662 U
Eu-154	-0.0029266 U	-0.010304 U	0.0088326 U	-0.013679 U	-0.026148 U	0.0059019 U	0.035176 U	0.013331 U	0.00092421 U	0.039006 U
Eu-155	0.14103 U	-0.01636 U	-0.0087639 U	0.0015449 U	-0.056019 U	-0.0083526 U	0.069575 U	-0.018228 U	-0.022506 U	0.1415 U
Mn-54	-0.0011108 U	-0.00066806 U	0.017488 U	-0.0095603 U	-0.016173 U	-0.00060156 U	-0.0065376 U	0.014145 U	0.0077569 U	-0.00044493 U
Nb-94	-0.0017279 U	-0.0053047 U	-0.0018942 U	0.1084 U	-0.0072314 U	-0.0035523 U	0.012945 U	0.0027647 U	-0.0017916 U	0.0039368 U
Sb-125	0.11153 U	0.0095561 U	0.09339 U	-0.025651 U	-0.086791 U	-0.074096 U	-0.00010928 U	0.11681 U	0.062495 U	0.043317 U
Hard to Detect (pCi/g)										
C-14								-0.0574 U		
Cm-243								0.216		
Fe-55								31.1 U		
H-3								-0.568 U		
Ni-63								8.28 U		
Pu-238								-0.0347 U		
Pu-239								-0.0359 U		
Pu-241								10.6 U		
Sr-90								0.00182 U		
Tc-99								0.349 U		

Station	OOL-08-04-005-F	OOL-08-04-006-F	OOL-08-04-007-F	OOL-08-04-009-F	OOL-08-04-012-F	OOL-08-05-001-F	OOL-08-05-002-F	OOL-08-05-003-F	OOL-08-05-004-F	OOL-08-05-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.018107 U	-0.0061044 U	0.014294 U	0.07524 U	0.00057784 U	-0.006475 U	-0.01352 U	0.0004965 U	0.001481 U	-0.01002 U
Am-241	-0.07632 U	-0.061364 U	0.090627 U	-0.20281 U	-0.0086328 U	0.01222 U	-0.007394 U	0.03122 U	-0.1184 U	0.0142 U
Co-60	0.038289 U	0.030237 U	-0.00017373 U	-0.005423 U	0.006931 U	0.005217 U	0.01887 U	-0.002185 U	0.01276 U	0.01773 U
Cs-134	0.029298 U	-0.055688 U	-0.0010213 U	-0.0060588 U	0.000093405 U	0.001521 U	-0.02108 U	0.02788 U	-0.007547 U	0.01475 U
Cs-137	0.18698	0.089667	0.13355	0.18078	0.13779	0.06217	0.03011 U	0.04085 U	0.01035 U	0.06588
Eu-152	-0.0063317 U	0.019905 U	-0.0032694 U	0.18883	0.013323 U	-0.03841 U	0.02057 U	0.02456 U	-0.03786 U	0.0248 U
Eu-154	0.029215 U	0.00054791 U	-0.011363 U	-0.011527 U	0.013627 U	-0.02564 U	-0.0233 U	-0.01072 U	0.01595 U	0.01516 U
Eu-155	-0.060065 U	0.12523 U	0.12331 U	-0.11338 U	0.16388 U	0.1821 U	0.003181 U	0.09925 U	0.009836 U	0.008385 U
Mn-54	-0.019412 U	0.019039 U	-0.0086771 U	-0.00048126 U	-0.0018588 U	0.024 U	-0.0004193 U	-0.01249 U	-0.006491 U	-0.009737 U
Nb-94	-0.00029638 U	0.00060771 U	0.020981 U	0.0076009 U	-0.0085685 U	-0.001982 U	-0.004073 U	-0.001548 U	0.01472 U	-0.007854 U
Sb-125	0.11467 U	0.053907 U	0.039083 U	0.092902 U	0.015578 U	0.0994 U	0.1091 U		0.07907 U	0.09856
Hard to Detect (pCi/g)										
C-14		0.0271 U				-0.037 U				
Cm-243		0.292 U				0.00898 U				
Fe-55		-3.14 U				9.84 U				
H-3		-1.34 U				-1.78 U				
Ni-63		-2.14 U				1.44 U				
Pu-238		-0.0163 U				0.0184 U				
Pu-239		0.00136 U				0.0253 U				
Pu-241		11.8 U				-2.18 U				
Sr-90		0.0229 U				0.00431 U				
Tc-99		0.129 U				0.0621 U				

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-08-05-006-F	OOL-08-05-007-F	OOL-08-05-008-F	OOL-08-05-009-F	OOL-08-05-010-F	OOL-08-05-011-F	OOL-08-05-012-F	OOL-08-05-013-F	OOL-08-05-014-F	OOL-08-05-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.01208 U	0.00932 U	0.006592 U	0.0009252 U	0.0003382 U	0.008651 U	-0.0007002 U	-0.01243 U	-0.00003048 U	-0.003422 U
Am-241	0.1488 U	0.05168 U	-0.08189 U	-0.0105 U	0.008735 U	0.008154 U	0.1239 U	0.2478 U	0.1764 U	-0.3896 U
Co-60	0.08452	0.01182 U	0.003515 U	0.212	0.005577 U	0.1642	0.01516 U	0.08553	0.1103	0.006911 U
Cs-134	0.1039 U	0.08885 U	0.0143 U	0.01869 U	0.01584 U	0.0003567 U	-0.01055 U	0.01581 U	0.01849 U	0.0179 U
Cs-137	0.4326	0.2559	0.03623 U	0.1393	0.03563	0.3373	0.1035	0.2392	0.4846	0.08207
Eu-152	0.007048 U	-0.0311 U	0.0453 U	-0.04833 U	-0.01658 U	0.002178 U	0.08699 U	-0.01905 U	0.09786 U	-0.0009361 U
Eu-154	0.0268 U	0.01738 U	-0.01156 U	0.016 U	-0.01083 U	0.006132 U	-0.0002746 U	-0.01659 U	0.02154 U	-0.003456 U
Eu-155	0.05862 U	0.05447 U	0.009241 U	-0.08619 U	-0.008029 U	0.03821 U	0.1108 U	-0.05807 U	0.1158 U	0.1564 U
Mn-54	-0.0005617 U	0.01015 U	0.02096 U	0.0002306 U	0.01325 U	0.01007 U	0.01242 U	-0.0001634 U	-0.003248 U	0.01445 U
Nb-94	0.01005 U	0.0001573 U	-0.01033 U	0.002771 U	0.009868 U	-0.003399 U	0.0003509 U	-0.00419 U	0.00004061 U	0.0001155 U
Sb-125	-0.02377 U	0.03842 U	0.09089 U	0.1228	0.0637 U	0.1513 U	0.08057 U	0.08235 U	0.06971 U	0.1059 U
Hard to Detect (pCi/g)										
C-14								0.104 U		
Cm-243								0.0153 U		
Fe-55								-0.4 U		
H-3								-1.84 U		
Ni-63								4.22 U		
Pu-238								-0.00265 U		
Pu-239								0.0299 U		
Pu-241								-0.581 U		
Sr-90								0.00101 U		
Tc-99								0.00254 U		

Station	OOL-08-05-016-F	OOL-08-05-017-F	OOL-08-05-018-F	OOL-08-05-019-F	OOL-08-05-020-F	OOL-08-05-021-F	OOL-08-05-024-F	OOL-08-05-026-P	OOL-08-05-027-P	OOL-08-05-028-P
gamma-spec (pCi/g)										
Ag-108m	0.0001067 U	0.01301 U	0.007401 U	0.1058 U	0.0273 U	-0.01107 U	0.0064023 U	-3.2183E-07 U	0.020723 U	-0.019961 U
Am-241	-0.1763 U	0.020908 U	0.1796 U	-0.107 U	-0.2252 U	0.007635 U	0.089442 U	-0.41832 U	0.0010726 U	-0.013767 U
Co-60	0.06446 U	0.015383 U	0.009904 U	-0.009637 U	-0.01823 U	0.1292	0.13987	-0.0032657 U	0.093837	-0.0067629 U
Cs-134	0.001892 U	0.020165 U	0.02451 U	-0.00187 U	0.119 U	0.09867 U	-0.0061832 U	0.019307 U	-0.00084301 U	-0.018154 U
Cs-137	0.1996	0.036659 U	-0.01365 U	0.5146	0.4443	0.1766	0.25506	0.15371	0.19929	0.018222 U
Eu-152	-0.05764 U	0.040216 U	0.04273 U		-0.002925 U	0.04694 U	0.04445 U	0.027605 U	-0.022087 U	-0.025312 U
Eu-154	0.002147 U	0.030017 U	0.02602 U	0.005155 U	0.05216 U	-0.0002983 U	-0.029993 U	0.041129 U	-0.0016695 U	-0.010711 U
Eu-155	-0.0157 U	-0.014275 U	0.0227 U	0.009441 U	-0.01151 U	0.1387 U	0.002013 U	0.18776 U	0.00086846 U	0.22038
Mn-54	0.007324 U	0.013858 U	0.002647 U	-0.006141 U	-0.01173 U	-0.008298 U	-0.00046015 U	0.012862 U	0.021124 U	0.0111 U
Nb-94	-0.01555 U	-0.0037225 U	-0.00542 U	-0.007232 U	0.006275 U	0.01356 U	0.04253 U	-0.0015494 U	-0.011179 U	0.012194 U
Sb-125	-0.04288 U	0.10712 U	0.1216	0.01402 U	-0.03196 U	0.01157 U	0.086001 U	0.1547	0.027079 U	0.072174 U
Hard to Detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-08-06-004-F	OOL-08-06-005-F	OOL-08-06-006-F	OOL-08-06-008-F	OOL-08-06-009-F	OOL-08-06-010-F	OOL-08-06-011-F	OOL-08-06-012-F	OOL-08-06-013-F	OOL-08-06-014-F
gamma-spec (pCi/g)										
Ag-108m	-0.0076374 U	-0.015622 U	0.000039236 U	0.0081506 U	0.011606 U	-0.0015897 U	-0.014114 U	-0.012617 U	0.0025543 U	-0.010113 U
Am-241	-0.28597 U	-0.086254 U	0.24648 U	-0.042522 U	0.015666 U	0.01168 U	0.067094 U	0.0033931 U	-0.0050019 U	-0.010304 U
Co-60	0.018269 U	0.30943	-0.0019385 U	0.0068782 U	-0.0043289 U	0.0072817 U	0.034581 U	0.02563 U	0.103	0.010749 U
Cs-134	-0.008096 U	-0.017619 U	0.019495 U	-0.0086486 U	0.08963 U	0.014549 U	-0.020316 U	-0.023478 U	-0.0014541 U	0.0074205 U
Cs-137	0.55955	1.5425	1.1888	0.18407	0.70917	0.54765	0.7748	0.48132	0.4835	0.34612
Eu-152	0.0010268 U	0.036711 U	0.038465 U	0.019723 U	0.089818 U	0.010994 U	0.027505 U	-0.00019042 U	-0.0069535 U	-0.013745 U
Eu-154	-0.0075822 U	0.028187 U	0.027306 U	-0.018385 U	-0.093051 U	0.036532 U	0.016947 U	0.015198 U	-0.0061532 U	-0.01688 U
Eu-155	-0.023762 U	0.06134 U	-0.11315 U	0.065031 U	0.14494 U	0.0031243 U	0.11418 U	0.11014 U	0.09416 U	0.051911 U
Mn-54	0.005529 U	-0.0023737 U	-0.0048604 U	0.012382 U	0.016688 U	0.0096993 U	0.0064981 U	0.0058648 U	-0.0094567 U	0.016246 U
Nb-94	-0.00086522 U	0.0060109 U	0.021459 U	0.0012029 U	-0.0010508 U	-0.0081049 U	0.000075718 U	0.000065828 U	0.0077565 U	-0.0024478 U
Sb-125	-0.0066404 U	-0.0082766 U	0.03952 U	-0.013154 U	0.059125 U	0.08203 U	0.0049312 U	-0.020807 U	0.090685 U	0.10549 U
Hard to Detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-08-06-015-F	OOL-08-06-016-F	OOL-08-06-017-F	OOL-08-06-018-F	OOL-08-06-019-F	OOL-08-06-020-F	OOL-08-06-021-F	OOL-08-06-022-F	OOL-08-06-023-F	OOL-08-06-024-F
gamma-spec (pCi/g)										
Ag-108m	0.03017 U	-0.00027106 U	-0.020629 U	-0.0030211 U	-0.0085404 U	-0.0080092 U	0.011294 U	-0.005274 U	-0.006773 U	-0.020997 U
Am-241	-0.1082 U	0.016478 U	0.11288 U	-0.025504 U	-0.043754 U	-0.022831 U	0.023886 U	-0.13692 U	-0.11787 U	-0.0071309 U
Co-60	-0.010698 U	0.015464 U	-0.011688 U	-0.0087426 U	-0.00021884 U	0.010806 U	0.0077955 U	-0.0029887 U	-0.0002096 U	0.065463
Cs-134	0.00039778 U	-0.0018936 U	0.027346 U	0.017365 U	0.021538 U	-0.0024896 U	-0.014801 U	0.019264 U	0.038033 U	0.02032 U
Cs-137	0.2869	1.7753	0.41379	0.27268	0.031145 U	0.065634	0.18947	0.0061111 U	0.080056	0.70005
Eu-152	-0.0090635 U	0.032149 U	0.022716 U	0.0016364 U	0.0052988 U	-0.017936 U	0.010065 U	0.098738 U	-0.038208 U	0.019788 U
Eu-154	-0.033483 U	-0.0088573 U	0.0027066 U	-0.03695 U	0.0079233 U	0.026617 U	0.023157 U	0.025501 U	-0.029127 U	-0.022701 U
Eu-155	0.18956 U	0.13053 U	0.079096 U	0.14088 U	0.17928 U	0.083908 U	0.1118 U	0.14693 U	-0.053347 U	0.10507 U
Mn-54	-0.01945 U	-0.00045472 U	0.00086594 U	0.012673 U	-0.0016243 U	0.0002079 U	-0.011689 U	0.0065949 U	-0.0068248 U	-0.0039411 U
Nb-94	-0.002112 U	-0.0036251 U	0.023088 U	-0.00093563 U	-0.0079279 U	0.00025109 U	-0.003769 U	0.010396 U	-0.00090566 U	0.0031007 U
Sb-125	R	-0.002964 U	0.10724 U	0.12994	R	0.023297 U	0.073559 U	R	0.047564 U	0.080564 U
Hard to Detect (pCi/g)										
C-14										0.0395 U
Cm-243										-0.00786 U
Fe-55										3.3 U
H-3										2.78 U
Ni-63										-3.61 U
Pu-238										0.0902 U
Pu-239										0.0505 U
Pu-241										7.71 U
Sr-90										0.00438 U
Tc-99										0.229 U

Station	OOL-08-06-025-F	OOL-08-06-026-F	OOL-08-07-001-F	OOL-08-07-002-F	OOL-08-07-003-F	OOL-08-07-004-F	OOL-08-07-005-F	OOL-08-07-006-F	OOL-08-07-007-F	OOL-08-07-008-F
gamma-spec (pCi/g)										
Ag-108m	0.0089672 U	-0.0019163 U	0.014318 U	0.00047171 U	0.0076063 U	-0.016759 U	0.010826 U	-0.01274 U	-0.0010509 U	0.016743 U
Am-241	0.044322 U	0.00083734 U	0.004938 U	-0.0042418 U	0.039686 U	-0.0067825 U	0.27093 U	0.12035 U	0.2926 U	0.11483 U
Co-60	-0.011377 U	0.033358	-0.001026 U	0.022013 U	-0.0095853 U	0.0017527 U	-0.014934 U	-0.015583 U	0.012607 U	0.028281 U
Cs-134	0.0081575 U	-0.014616 U	0.00057339 U	0.024376 U	-0.007249 U	-0.0020008 U	0.0066232 U	-0.0060973 U	-0.00098461 U	0.018256 U
Cs-137	0.48115	0.50076	0.27486	0.65519	0.64485	1.3523	1.1361	0.33738	0.61184	2.2898
Eu-152	-0.044597 U	0.00094534 U	0.033127 U	0.040666 U	0.057036 U	0.010767 U	-0.001754 U	0.0046044 U	-0.057085 U	-0.0040244 U
Eu-154	0.025539 U	0.011517 U	-0.016933 U	0.025354 U	0.045725 U	0.0025217 U	-0.022294 U	-0.025642 U	-0.040441 U	-0.0080925 U
Eu-155	0.18809 U	0.016284 U	0.0063809 U	0.094284 U	0.14978 U	0.082124 U	-0.014875 U	0.1181 U	-0.02225 U	0.022501 U
Mn-54	-0.0053199 U	-0.0071122 U	-0.013546 U	-0.00076519 U	-0.01625 U	-0.0010334 U	0.0031992 U	-0.0041124 U	0.0032273 U	-0.0041571 U
Nb-94	0.00048788 U	0.00044393 U	0.0053932 U	-0.0068154 U	-0.0074735 U	-0.0092193 U	0.0084713 U	-0.0011884 U	0.0080645 U	-0.00073258 U
Sb-125	0.003485 U	0.0097612 U	-0.030321 U	0.057956 U	-0.015932 U	-0.012191 U	-0.044584 U	-0.0052392 U	0.028681 U	0.0072641 U
Hard to Detect (pCi/g)										
C-14							-0.0697 U			
Cm-243							-0.00895 U			
Fe-55							-15.1 U			
H-3							1.28 U			
Ni-63							-0.567 U			
Pu-238							0.0137 U			
Pu-239							0.0399 U			
Pu-241							9.48 U			
Sr-90							0.0275 U			
Tc-99							0.311 U			

Station	OOL-08-07-009-F	OOL-08-07-010-F	OOL-08-07-011-F	OOL-08-07-012-F	OOL-08-07-013-F	OOL-08-07-014-F	OOL-08-07-015-F	OOL-08-07-016-F	OOL-08-07-017-F	OOL-10-01-001-F
gamma-spec (pCi/g)										
Ag-108m	-0.0019917 U	0.0081203 U	-0.0043231 U	0.013639 U	0.011753 U	-0.0023948 U	0.0079591 U	0.00050397 U	-0.0050722 U	0.00060955 U
Am-241	-0.031001 U	-0.0025896 U	-8.4755E-06 U	0.01526 U	-0.18805 U	0.012575 U	0.060346 U	-0.0011846 U	0.28647 U	-0.011983 U
Co-60	0.0071179 U	-0.0056889 U	-0.0050462 U	0.039403 U	0.025632 U	0.0094664 U	0.16511 U	0.0031218 U	0.010903 U	-0.00022083 U
Cs-134	-0.0091682 U	0.00018667 U	0.014642 U	0.016089 U	-0.0093244 U	0.0042975 U	-0.01264 U	-0.013067 U	0.0092877 U	0.014597 U
Cs-137	0.5783	0.37129	0.014798 U	2.6917	0.4147	-0.014577 U	1.1819	0.0013321 U	0.38575	0.015543 U
Eu-152	-0.015768 U	0.023621 U	0.031975 U	-0.0019113 U	-0.0011299 U	0.0019124 U	-0.003856 U	-0.00078678 U	-0.0026295 U	0.014258 U
Eu-154	-0.014092 U	0.0079457 U	-0.018052 U	-0.0065113 U	0.012848 U	-0.0037616 U	0.012753 U	-0.010237 U	-0.020613 U	-0.011108 U
Eu-155	0.004142 U	0.043272 U	0.14232 U	0.012841 U	-0.025946 U	-0.0092065 U	0.024523 U	0.026663 U	-0.0050812 U	0.0045597 U
Mn-54	0.0081618 U	0.010537 U	0.0092551 U	0.0028948 U	0.00080742 U	0.016624 U	-0.00022925 U	0.00060605 U	-0.0025626 U	-0.0010544 U
Nb-94	0.0025783 U	0.0054496 U	0.0010873 U	-0.00043416 U	0.007281 U	-0.003246 U	0.00053591 U	-0.00060154 U	0.0035584 U	-0.0032556 U
Sb-125	-0.0053177 U	-0.026651 U	0.065632 U	0.12284 U	0.095963 U	-0.030906 U	0.0032325 U	0.030576 U	0.013828 U	0.11354
Hard to Detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-10-01-002-F	OOL-10-01-003-F	OOL-10-01-004-F	OOL-10-01-005-F	OOL-10-01-006-F	OOL-10-01-007-F	OOL-10-01-008-F	OOL-10-01-009-F	OOL-10-01-010-F	OOL-10-01-011-F
gamma-spec (pCi/g)										
Ag-108m	-0.0098754 U	-0.00028259 U	-0.0099646 U	-0.0067452 U	0.023112 U	0.016276 U	-0.013123 U	-0.0014783 U	0.023191	-0.0024872 U
Am-241	-0.0033057 U	-0.17804 U	-0.024867 U	0.0072552 U	-0.05181 U	0.0087514 U	-0.098291 U	0.014019 U	-0.16737 U	0.14966 U
Co-60	0.0040005 U	-0.0026805 U	0.019039 U	-0.0028572 U	0.015911 U	0.0062089 U	-0.0097858 U	0.0083678 U	0.0077352 U	-0.011691 U
Cs-134	0.0080295 U	0.01656 U	0.010253 U	0.01474 U	-0.00067171 U	0.014163 U	-0.0082157 U	0.0081081 U	0.016814 U	0.023471 U
Cs-137	-0.0015705 U	0.011302 U	0.008185 U	0.023248 U	0.023919 U	0.023606 U	0.045955 U	0.015701 U	0.0066305 U	-0.0094248 U
Eu-152	-0.026576 U	0.053234 U	0.04414 U	0.010606 U	0.030835 U	0.0093226 U	-0.042721 U	0.014577 U	0.074115 U	-0.017884 U
Eu-154	0.01127 U	-0.00705 U	-0.0040293 U	-0.002088 U	-0.023935 U	0.013594 U	-0.031001 U	0.014959 U	-0.01567 U	0.01719 U
Eu-155	0.066054 U	-0.0090773 U	0.1627	-0.0015798 U	0.011634 U	-0.0081952 U	0.047612 U	-0.0034132 U	0.0090137 U	-0.018166 U
Mn-54	-0.0064342 U	0.00052209 U	-0.0097669 U	0.015475 U	-0.0088746 U	-0.00085015 U	0.0031729 U	0.014494 U	-0.003329 U	-0.0004446 U
Nb-94	0.0045296 U	0.0091814 U	0.0013943 U	0.0058728 U	0.0034827 U	0.0025684 U	-0.0023482 U	0.0097233 U	0.012796 U	0.05078 U
Sb-125	0.040148 U	0.060446 U	0.099252 U	0.052894 U	0.1259	0.076911 U	0.09998 U	0.094964 U	0.07593 U	-0.0020581 U
Hard to Detect (pCi/g)										
C-14							-0.0242 U			
Cm-243							-0.0317 U			
Fe-55							3.52 U			
H-3							0.629 U			
Ni-63							6.04 U			
Pu-238							0.0444 U			
Pu-239							-0.028 U			
Pu-241							-6.75 U			
Sr-90							0.0176 U			
Tc-99							0.181 U			

Station	OOL-10-01-012-F	OOL-10-01-013-F	OOL-10-01-014-F	OOL-10-01-015-F	OOL-10-01-016-F	OOL-10-01-017-F	OOL-10-01-018-F	OOL-10-01-019-F	OOL-10-01-020-F	OOL-10-01-021-F
gamma-spec (pCi/g)										
Ag-108m	0.00032635 U	-0.0067614 U	-0.00005257 U	-0.008675 U	0.0068677 U	0.00020591 U	0.011056 U	0.0017598 U	0.01458 U	-0.014704 U
Am-241	0.013683 U	-0.069798 U	-0.15308 U	-0.0047916 U	-0.030457 U	0.0058961 U	-0.0020013 U	-0.09658 U	0.0048769 U	-0.039323 U
Co-60	-0.0037768 U	0.014875 U	-0.00099668 U	0.018235 U	0.0057585 U	-0.0012913 U	0.0069744 U	0.00061632 U	0.0023576 U	-0.0037855 U
Cs-134	0.028305 U	-0.0040453 U	0.010768 U	-0.00088101 U	-0.0013134 U	-0.014025 U	0.026915 U	0.010632 U	0.027511 U	0.021101 U
Cs-137	-0.00094489 U	0.046003	0.022802 U	0.0070306 U	-0.0012336 U	0.0087784 U	0.026764 U	-0.0016879 U	-0.0067789 U	-0.0011195 U
Eu-152	-0.024736 U	-0.026623 U	0.004284 U	0.015788 U	0.0027943 U	-0.010588 U	0.033532 U	-0.0012443 U	-0.033347 U	0.014003 U
Eu-154	0.012118 U	-0.0119 U	0.0090418 U	0.037309 U	-0.00050738 U	-0.0097648 U	0.0001241 U	0.013028 U	-0.011228 U	-0.0078292 U
Eu-155	0.015876 U	0.077651 U	0.0022533 U	0.12919 U	0.054061 U	0.12477	0.0055245 U	-0.074644 U	0.13813 U	0.14649 U
Mn-54	0.011787 U	0.0084136 U	0.0011791 U	0.015556 U	-0.011369 U	-0.0009112 U	0.020204 U	0.022349 U	0.01294 U	0.021696 U
Nb-94	0.0066688 U	-0.0055717 U	0.0070743 U	0.0072461 U	0.0031176 U	-0.00054022 U	-0.00020147 U	0.012631 U	0.00058336 U	0.0021981 U
Sb-125	0.10893 U	-0.024033 U	-0.0072983 U	-0.005079 U	0.063989 U	0.08696	0.11289 U	0.017754 U	0.067948 U	0.065063 U
Hard to Detect (pCi/g)										
C-14						0.0264 U				
Cm-243						0.197 U				
Fe-55						18.7 U				
H-3						-0.6 U				
Ni-63						3.51 U				
Pu-238						-0.135 U				
Pu-239						0.0675 U				
Pu-241						-51.8 U				
Sr-90						-0.00693 U				
Tc-99						0.0421 U				

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	OOL-10-01-022-F	OOL-10-01-023-F	OOL-10-01-024-F	OOL-10-01-025-F	OOL-10-03-001-F	OOL-10-03-002-F	OOL-10-03-003-F
gamma-spec (pCi/g)							
Ag-108m	-0.00061061 U	-0.0071103 U	-0.00042214 U	-0.0026127 U	0.00083449 U	0.0060769 U	-0.0084312 U
Am-241	-0.066708 U	0.12583 U	0.0071059 U	0.0039091 U	-0.46895 U	0.019331 U	-0.2 U
Co-60	0.010021 U	-0.00034372 U	0.0076844 U	-0.0033471 U	0.0038086 U	0.0020669 U	0.0046062 U
Cs-134	0.014701 U	-0.014952 U	0.021841 U	-0.016337 U	-0.01028 U	0.014385 U	0.010176 U
Cs-137	0.0037511 U	-0.0076993 U	-0.0054379 U	-0.0026861 U	0.017113 U	0.0038523 U	0.0052903 U
Eu-152	-0.015706 U	-0.010578 U	-0.00055512 U	-0.023421 U	-0.0028711 U	-0.00014977 U	-0.0066513 U
Eu-154	0.018536 U	-0.0097193 U	0.1137 U	-0.010255 U	0.017522 U	0.0061534 U	-0.0085712 U
Eu-155	0.11956	0.066384 U	0.12597 U	0.085034 U	-0.0036264 U	R	0.00081004 U
Mn-54	-0.0086875 U	-0.0065884 U	0.00037466 U	-0.0064046 U	-0.0076605 U	-0.000062112 U	-0.013821 U
Nb-94	-0.000074493 U	-0.0010782 U	-0.0092273 U	0.0045966 U	-0.0014265 U	-0.00041942 U	-0.0036824 U
Sb-125	0.018603 U	0.078182 U	0.11189	0.11009	0.10454	0.060859 U	R
Hard to Detect (pCi/g)							
C-14						-0.111 U	
Cm-243						-0.0108 U	
Fe-55						-3.46 U	
H-3						-0.848 U	
Ni-63						-5.58 U	
Pu-238						-0.017 U	
Pu-239						-0.0382 U	
Pu-241						10.1 U	
Sr-90						-0.0311 U	
Tc-99						0.33 U	

Station	OOL-10-03-004-F	OOL-10-03-005-F	OOL-10-03-006-F	OOL-10-03-007-F	OOL-10-03-008-F	OOL-10-03-009-F	OOL-10-03-010-F	OOL-10-03-011-F	OOL-10-03-012-F	OOL-10-03-013-F
gamma-spec (pCi/g)										
Ag-108m	-0.0070091 U	-0.0035396 U	-0.010505 U	-0.016165 U	-0.014754 U	-0.0050982 U	-0.0078115 U	0.0071892 U	-0.0092721 U	0.0041385 U
Am-241	0.010422 U	-0.065431 U	0.25143 U	-0.023874 U	-0.069405 U	-0.054019 U	0.0072198 U	-0.10671 U	-0.15554 U	0.13338 U
Co-60	-0.0001889 U	-0.0022504 U	0.015784 U	0.0047843 U	-0.0073056 U	0.00013725 U	0.0084317 U	-0.000052585 U	-0.013261 U	-0.0038819 U
Cs-134	0.00017853 U	0.0086607 U	-0.017411 U	0.018051 U	0.020249 U	0.00081364 U	-0.01836 U	0.02485 U	0.00059405 U	0.014429 U
Cs-137	0.01166 U	0.0094391 U	0.030035 U	-0.010672 U	0.004997 U	0.027543 U	0.015075 U	0.0083354 U	-0.0012664 U	0.012436 U
Eu-152	0.018456 U	-0.0011659 U	0.088706 U	-0.00087202 U	-0.0036336 U	-0.0059356 U	0.016962 U	-0.0029908 U	0.17647 U	-0.034616 U
Eu-154	-0.018229 U	0.0068513 U	-0.0066773 U	0.03973 U	-0.0099791 U	-0.0069185 U	-0.014577 U	-0.00046703 U	0.035553 U	-0.024125 U
Eu-155	0.011019 U	0.10426 U	0.089531 U	0.092089 U	0.094495 U	0.18019 U	0.078042 U	-0.011928 U	0.12668 U	0.0046269 U
Mn-54	-0.0038391 U	0.0049355 U	0.026868 U	0.012635 U	0.0017105 U	0.0089381 U	0.019684	-0.006103 U	-0.014853 U	-0.00019356 U
Nb-94	0.010407 U	-0.0047787 U	0.0048838 U	-0.0073167 U	0.008659 U	0.00028895 U	-0.00032879 U	0.006964 U	-0.0039287 U	0.00019674 U
Sb-125	-0.023283 U	0.062936 U	0.095905	0.11012 U	R	0.02868 U	0.088629	0.088195 U	0.16781	0.0092959 U
Hard to detect (pCi/g)										
C-14							0.0476 U			
Cm-243							-0.0213 U			
Fe-55							-1.81 U			
H-3							-1.79 U			
Ni-63							-0.462 U			
Pu-238							-0.016 U			
Pu-239							-0.00192 U			
Pu-241							3.74 U			
Sr-90							-0.0133 U			
Tc-99							0.112 U			

Station	OOL-10-03-014-F	OOL-10-03-015-F	OOL-10-03-016-F	OOL-10-03-017-F	OOL-10-03-018-F	OOL-10-03-019-F	OOL-10-03-020-F	OOL-10-03-021-F	OOL-10-03-022-F	OOL-10-03-023-F
gamma-spec (pCi/g)										
Ag-108m	0.09834 U	0.0069901 U	0.0090416 U	0.0023199 U	0.01353 U	0.0016573 U	0.015261 U	-0.000703 U	-0.00498 U	-0.0054523 U
Am-241	0.026653 U	0.012966 U	-0.10741 U	0.00067668 U	0.29607 U	-0.17224 U	0.091243 U	0.0102 U	0.00217 U	-0.2409 U
Co-60	-0.00065166 U	0.021785 U	-0.0045695 U	-0.0011317 U	0.010128 U	-0.0010249 U	0.0047504 U	-0.00149 U	0.0174 U	-0.0019588 U
Cs-134	0.030421 U	0.015617 U	0.0033738 U	-0.020502 U	-0.011611 U	0.003649 U	0.016177 U	0.0321 U	0.0303 U	0.027871 U
Cs-137	0.010991 U	0.022493	0.0062471 U	0.0053261 U	0.02249 U	0.0019271 U	-0.001702 U	0.00711 U	0.0151 U	0.020523 U
Eu-152	-0.031352 U	-0.010439 U	-0.0093863 U	0.0035651 U	0.027246 U	0.054483 U	0.014903 U	-0.0109 U	0.00386 U	-0.002897 U
Eu-154	0.05278 U	-0.0064881 U	-0.018289 U	-0.0022749 U	0.0034484 U	0.018679 U	0.0084684 U	-0.0219 U	-0.0135 U	-0.017038 U
Eu-155	0.090738 U	R	-0.055563 U	0.10394 U	R	0.00083443 U	0.1614 U	0.0377 U	0.0232 U	0.072242 U
Mn-54	0.0080166 U	-0.0040533 U	-0.0018262 U	0.0081607 U	-0.0080342 U	-0.00077709 U	-0.0152 U	0.0132 U	0.013 U	0.020427 U
Nb-94	0.0058279 U	0.010916 U	-0.0052911 U	0.0095366 U	-0.00075743 U	0.0040551 U	0.015577 U	0.00314 U	0.00327 U	0.00098724 U
Sb-125	-0.034183 U	R	0.093722 U	R	R	0.1121 U	0.095273 U	0.0124 U	0.00302 U	R
Hard to detect (pCi/g)										
C-14								-0.0936 U	-0.141 U	
Cm-243								0.0302 U	-0.00279 U	
Fe-55								0.892 U	-6.81 U	
H-3								-4.93 U	1.38 U	
Ni-63								-5.46 U	0.866 U	
Pu-238								-0.00244 U	-0.00145 U	
Pu-239								-0.0342 U	-0.0282 U	
Pu-241								8.69 U	4.11 U	
Sr-90								-0.00757 U	0.00884 U	
Tc-99								0.135 U	0.0203 U	

Station	OOL-10-03-024-F	OOL-10-03-025-F	OOL-10-03-026-F	OOL-10-03-027-F	OOL-10-03-028-F	OOL-10-03-029-F	OOL-10-03-030-F	OOL-10-03-031-F	OOL-10-03-032-F	OOL-10-03-033-F
gamma-spec (pCi/g)										
Ag-108m	0.002824 U	0.013779 U	0.0062164 U	-0.0080792 U	0.0058654 U	-0.0053558 U	-0.008846 U	-0.013112 U	-0.0081165 U	0.00078422 U
Am-241	0.10167 U	-0.011856 U	0.022883 U	-0.07007 U	-0.0017819 U	-0.042699 U	-0.10083 U	-0.0018868 U	-0.086349 U	0.10321 U
Co-60	0.0003717 U	0.0061028 U	0.016776 U	0.016963 U	-0.023605 U	-0.0033678 U	0.0017214 U	-0.0019034 U	-0.00075706 U	-0.00004359 U
Cs-134	-0.0064495 U	0.014656 U	R	0.030626 U	-0.01255 U	-0.0016492 U	R	0.016136 U	-0.0027388 U	0.019303 U
Cs-137	0.017861 U	0.013526 U	0.015668 U	0.01683 U	0.0090986 U	-0.0009495 U	0.026648 U	-0.0095508 U	0.0014291 U	0.0084186 U
Eu-152	-0.029884 U	-0.0071118 U	-0.012509 U	-0.040167 U	-0.033493 U	-0.0037355 U	0.17854 U	0.0058818 U	-0.0014127 U	0.023652 U
Eu-154	0.020385 U	-0.00061834 U	-0.00028877 U	0.0021953 U	-0.033228 U	0.0056692 U	0.02567 U	-0.0059329 U	-0.015336 U	-0.020725 U
Eu-155	0.13232 U	0.11766 U	0.073634 U	0.12501 U	-0.079971 U	0.12491 U	0.26318 U	0.101 U	0.018329 U	0.10566 U
Mn-54	-0.011378 U	-0.0087896 U	0.013395 U	0.027706 U	-0.0019563 U	0.0093741 U	-0.00057957 U	-0.01099 U	-0.00030372 U	-0.00026799 U
Nb-94	0.014926 U	0.0020947 U	0.0046063 U	0.016047 U	0.0027548 U	0.00010449 U	0.0010593 U	-0.011302 U	0.015832 U	0.010907 U
Sb-125	0.15065	0.064303 U	0.054939 U	R	0.0053802 U	0.052971 U	R	0.083858	R	R
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-10-03-034-F	OOL-10-04-001-F	OOL-10-04-002-F	OOL-10-04-003-F	OOL-10-04-007-F	OOL-10-04-009-F	OOL-10-04-010-F	OOL-10-04-012-F	OOL-10-04-013-F	OOL-10-04-015-F
gamma-spec (pCi/g)										
Ag-108m	0.018416 U	0.012916 U	-0.011842 U	0.0015587 U	0.012815 U	-0.00063824 U	-0.023541 U	0.0023932 U	0.0083343 U	-0.00071151 U
Am-241	-0.026691 U	-0.024112 U	0.11773 U	-0.01026 U	-0.069199 U	0.026794 U	-0.079969 U	0.0034056 U	-0.066325 U	0.15087 U
Co-60	0.0045095 U	-0.011148 U	-0.002274 U	-0.0022748 U	0.012412 U	-0.002026 U	-0.0014497 U	0.0048071 U	-0.012277 U	0.0088885 U
Cs-134	-0.016841 U	0.0064362 U	0.025872 U	0.05025 U	-0.01157 U	0.015965 U	0.018641 U	0.007751 U	-0.012121 U	-0.02985 U
Cs-137	-0.00037391 U	0.032894	-0.0018223 U	0.014912 U	0.02262 U	-0.0014421 U	0.0095437 U	0.00081718 U	0.036095 U	0.068494
Eu-152	-0.034064 U	0.018734 U	-0.0010408 U	0.062543 U	-0.041248 U	-0.033412 U	-0.04571 U	0.060418 U	0.045721 U	0.060204 U
Eu-154	-0.027126 U	0.010264 U	0.0090828 U	0.012104 U	-0.028314 U	-0.01837 U	0.00016091 U	-0.0046771 U	0.037432 U	0.012687 U
Eu-155	0.11835 U	0.073245 U	-0.0066605 U	0.085228 U	0.12132 U	0.1278 U	0.038898 U	0.012576 U	0.068877 U	-0.012585 U
Mn-54	0.019822 U	0.001581 U	-0.0043723 U	-0.0093447 U	0.015858 U	0.015197 U	-0.010219 U	-0.00077062 U	-0.00031137 U	-0.0011964 U
Nb-94	0.00905 U	0.0053106 U	-0.0069458 U	-0.0016752 U	0.05352 U	0.00056048 U	0.00033735 U	0.0065249 U	0.014764 U	-0.0065369 U
Sb-125	0.068499 U	0.09679 U	0.11533 U	0.06543 U	0.095576 U	0.10074	0.074119 U	0.058612 U	-0.033752 U	0.085937 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-10-04-018-F	OOL-10-04-021-F	OOL-10-04-023-F	OOL-10-04-024-F	OOL-10-04-025-F	OOL-11-01-001-F	OOL-11-01-002-F	OOL-11-01-004-F	OOL-11-02-016-F	OOL-12-01-001-F
gamma-spec (pCi/g)										
Ag-108m	-0.019125 U	0.0089786 U	-0.0098746 U	-0.015142 U	0.0030439 U	-0.006142 U	0.001975 U	0.008783 U	0.00026044 U	0.016851 U
Am-241	-0.033908 U	-0.015191 U	-0.05562 U	0.12537 U	-0.044627 U	-0.1402 U	-0.161 U	0.09887 U	-0.15696 U	-0.0071292 U
Co-60	0.012726 U	0.0025366 U	0.0039144 U	0.0047061 U	-0.0039939 U	-0.003171 U	0.1109	-0.01329 U	-0.0010106 U	-0.0050206 U
Cs-134	0.011315 U	-0.016761 U	0.028242 U	0.016611 U	0.026659 U	0.01936 U	0.02057 U	0.02935 U	-0.0053845 U	0.015781 U
Cs-137	0.061871	0.11683	0.035831 U	0.091593	0.05377	0.01861 U	0.188	0.3423	0.10676	0.070541
Eu-152	-0.025303 U	-0.054849 U	-0.011409 U	0.067517 U	-0.020887 U	-0.001244 U	-0.00938 U	-0.04765 U	-0.050268 U	-0.044855 U
Eu-154	-0.00041425 U	0.030875 U	0.029382 U	-0.017204 U	0.0010901 U	-0.004375 U	-0.03438 U	-0.01527 U	0.039102 U	0.0023496 U
Eu-155	0.12821	0.042867 U	0.019433 U	0.20844 U	0.011741 U	0.02124 U	-0.02875 U	0.1479 U	0.11845 U	-0.0077047 U
Mn-54	0.011088 U	-0.00058702 U	-0.00035165 U	-0.0002983 U	0.0041469 U	0.0002471 U	-0.006671 U	-0.0004441 U	-0.00033444 U	-0.011586 U
Nb-94	-0.0032799 U	0.0063641 U	-0.002197 U	0.04404 U	-0.00035588 U	-0.006055 U	-0.007885 U	0.0106 U	-0.0029194 U	0.05379 U
Sb-125	0.082726	0.10194 U	0.0027767 U	0.12574	0.091138 U	0.09173 U	0.1255	0.05506 U	0.044837 U	0.011375 U
Hard to detect (pCi/g)										
C-14							0.0217 U			
Cm-243							0.00767 U			
Fe-55							-1.43 U			
H-3							1.69 U			
Ni-63							3.13 U			
Pu-238							-0.0282 U			
Pu-239							-0.0107 U			
Pu-241							2.07 U			
Sr-90							0.00995 U			
Tc-99							-0.0269 U			

Station	OOL-12-01-002-F	OOL-12-01-003-F	OOL-12-01-004-F	OOL-12-01-005-F	OOL-12-01-006-F	OOL-12-01-007-F	OOL-12-01-008-F	OOL-12-01-009-F	OOL-12-01-010-F	OOL-12-01-011-F
gamma-spec (pCi/g)										
Ag-108m	0.048763 U	-0.011981 U	0.013673 U	-0.017638 U	-0.0097408 U	0.0018002 U	0.00055585 U	-0.00032729 U	0.00014641 U	-0.010774 U
Am-241	-0.061076 U	0.00052116 U	0.0027692 U	-0.18972 U	-0.14756 U	-0.056275 U	-0.0011849 U	0.31875 U	0.034063 U	0.0077569 U
Co-60	0.28858	-0.0030232 U	0.000058923 U	0.016115 U	0.0256 U	0.012231 U	0.019742 U	-0.01288 U	0.0095999 U	0.0035534 U
Cs-134	0.016838 U	-0.023864 U	0.031413 U	-0.0024789 U	-0.0010304 U	0.01293 U	-0.0029365 U	-0.0045605 U	0.014794 U	0.020157 U
Cs-137	0.77969	0.015748 U	0.19631	0.11712	0.019372 U	0.081383	0.11246	0.051668 U	0.063312	0.004349 U
Eu-152	-0.0002492 U	-0.014368 U	-0.013831 U	0.047336 U	0.12356 U	0.000095287 U	-0.0015528 U	0.0099367 U	-0.017297 U	0.011728 U
Eu-154	-0.0047078 U	0.0037237 U	0.03696 U	-0.016326 U	-0.024149 U	0.01619 U	-0.0013379 U	-0.016678 U	-0.010343 U	0.0091312 U
Eu-155	-0.042956 U	0.098614 U	0.16038 U	0.11593 U	-0.017774 U	0.11119 U	0.124 U	0.00079864 U	0.052446 U	0.21182
Mn-54	-0.0049179 U	-0.0060604 U	-0.014519 U	0.01428 U	-0.00021795 U	0.0022688 U	0.01717 U	-0.015177 U	-0.00049379 U	0.0092352 U
Nb-94	0.01822 U	-0.0013586 U	0.022993 U	-0.010331 U	-0.0011506 U	0.010212 U	-0.00060407 U	-0.00020851 U	-0.0083747 U	-0.0077304 U
Sb-125	-0.027384 U	0.046676 U	0.13844 U	0.10095 U	0.077494 U	0.10988	0.0072843 U	0.12567 U	0.041271 U	0.13759
Hard to detect (pCi/g)										
C-14							-0.125 U			
Cm-243							0.0357 U			
Fe-55							-10.7 U			
H-3							-1.66 U			
Ni-63							-1.32 U			
Pu-238							-0.0227 U			
Pu-239							-0.0531 U			
Pu-241							13.6 U			
Sr-90							0.0154 U			
Tc-99							0.758			

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	SSS-01-01-001-F	SSS-01-01-002-F	SSS-01-01-003-F	SSS-01-01-004-F	SSS-01-01-005-F	SSS-01-01-006-F	SSS-01-01-007-F	SSS-01-01-008-F	SSS-01-01-009-F	SSS-01-01-010-F
gamma-spec (pCi/g)										
Ag-108m	-0.0017336 U	-0.012195 U	-0.011172 U	0.0015993 U	-0.017173 U	-0.018618 U	-0.01413 U	-0.011569 U	-0.0087287 U	0.0034145 U
Am-241	0.037063 U	0.014247 U	0.029925 U	0.17836 U	-0.2016 U	-0.0018266 U	-0.11063 U	0.098562 U	0.053793 U	-0.05949 U
Co-60	0.000039575 U	-0.011933 U	0.016865 U	-0.0031872 U	-0.0098191 U	-0.0043818 U	-0.0015058 U	0.0044196 U	-0.004386 U	0.0049664 U
Cs-134	0.000076845 U	0.02236 U	-0.0028265 U	0.019645 U	0.017101 U	0.025735 U	0.010697 U	0.02298 U	0.014838 U	R
Cs-137	-0.00084713 U	0.018742 U	0.018689 U	0.009953 U	0.014475 U	0.021557 U	0.00029171 U	0.0098104 U	0.0095102 U	0.016507 U
Eu-152	-0.0046658 U	-0.030086 U	0.027725 U	-0.021015 U	0.076927 U	0.11216 U	0.0024333 U	0.0082902 U	-0.002614 U	-0.022801 U
Eu-154	-0.029648 U	0.00085664 U	0.034498 U	-0.0015178 U	0.011575 U	0.0019374 U	-0.0015226 U	0.000056394 U	0.00029211 U	-0.0065219 U
Eu-155	0.095747 U	0.11962 U	0.011329 U	0.13772 U	0.21203 U	0.014708 U	0.17009 U	0.013239 U	0.13976 U	0.003634 U
Mn-54	-0.00015433 U	0.019405 U	-0.00083288 U	0.011317 U	-0.013295 U	-0.00074931 U	-0.013021 U	0.016779 U	0.0046885 U	-0.00011223 U
Nb-94	0.000031819 U	-0.0080016 U	-0.016545 U	0.000049463 U	0.011015 U	0.008164 U	0.015241 U	0.04463 U	-0.0047971 U	0.0075528 U
Sb-125	0.086272 U	0.11549 U	-0.0028117 U	R	R	0.087754 U	-0.0038411 U	0.076954 U	0.083992 U	0.097311 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	SSS-01-01-011-F	SSS-01-01-012-F	SSS-01-01-013-F	SSS-01-01-014-F	SSS-01-01-015-F	SSS-01-01-016-F	SSS-01-01-017-F	SSS-01-01-018-F	SSS-01-01-019-F	SSS-01-01-020-F
gamma-spec (pCi/g)										
Ag-108m	-0.0014071 U	0.056235	0.0027755 U	-0.018837 U	-0.0037106 U	0.0043545 U	0.014324 U	0.0012423 U	0.01443 U	-0.010833 U
Am-241	-0.12343 U	-0.012812 U	-0.0044092 U	-0.0094314 U	0.1881 U	-0.2148 U	0.16548 U	0.34941 U	0.18759 U	-0.065915 U
Co-60	0.020047 U	0.025967 U	-0.00018848 U	0.0089965 U	0.00067407 U	0.030852 U	0.0082658 U	-0.0049999 U	0.003725 U	0.015794 U
Cs-134	-0.00014612 U	-0.0064557 U	0.021249 U	0.013638 U	-0.0038368 U	0.016404 U	0.037146 U	0.023869 U	0.025585 U	-0.024094 U
Cs-137	0.15713	0.27837	0.024943 U	-0.0042503 U	0.1231	0.092438	0.011388 U	0.0067302 U	0.032444 U	0.18296
Eu-152	0.094355 U	0.020605 U	0.010881 U	-0.027581 U	0.036054 U	0.14309 U	-0.021395 U	-0.01847 U	0.0049413 U	0.00098518 U
Eu-154	0.0068971 U	0.085514 U	0.016269 U	-0.025346 U	-0.029134 U	0.036018 U	-0.030735 U	-0.012363 U	-0.050907 U	0.00096505 U
Eu-155	0.01178 U	0.17734 U	0.065042 U	0.11557 U	-0.001214 U	0.083947 U	0.017479 U	0.13797 U	0.052231 U	0.098567 U
Mn-54	0.002534 U	-0.011001 U	0.0053019 U	-0.00063565 U	0.00097787 U	0.00063878 U	-0.009484 U	-0.0026167 U	-0.00040164 U	-0.0061315 U
Nb-94	0.014737 U	0.06834 U	-0.010742 U	-0.0040736 U	-0.00014141 U	0.0097987 U	0.0053607 U	0.0094455 U	0.012385 U	0.0074431 U
Sb-125	-0.0030631 U	0.090203 U	-0.032294 U	0.095826 U	R	0.099261 U	R	0.097728 U	0.13542 U	0.079553 U
Hard to detect (pCi/g)										
C-14					0.158					0.112 U
Cm-243					0.00123 U					0.0764 U
Fe-55					-4.26 U					17.6 U
H-3					0.517 U					1.9 U
Ni-63					-1.31 U					1.4 U
Pu-238					0.0833 U					-0.0834 U
Pu-239					-0.0221 U					-0.0648 U
Pu-241					1.27 U					4.52 U
Sr-90					0.0232 U					0.0129 U
Tc-99					0.0401 U					0.0401 U

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	SSS-01-01-021-F	SSS-01-01-022-F	SSS-01-01-023-F	SSS-01-01-024-F	SSS-01-01-025-F	SSS-01-01-026-F	SSS-01-01-029-F	SSS-01-01-030-F	SSS-01-01-031-F	SSS-01-01-032-F
gamma-spec (pCi/g)										
Ag-108m	-0.0041565 U	0.00057577 U	-0.024152 U	-0.025573 U	0.0010161 U	-0.012973 U	-0.0083694 U	-0.0034221 U	0.013361 U	0.0027794 U
Am-241	0.010233 U	0.1266 U	-7.8369E-06 U	-0.0060881 U	0.12728 U	-0.0052833 U	-0.0021209 U	-0.11591 U	-0.22392 U	-0.011387 U
Co-60	-0.0057921 U	-0.0048748 U	0.010004 U	-0.00020316 U	-0.0040487 U	0.0095055 U	-0.0086897 U	-0.017176 U	-0.010256 U	0.026602 U
Cs-134	-0.038005 U	-0.0042215 U	-0.00094953 U	0.02159 U	0.031716 U	-0.013079 U	0.016964 U	-0.039595 U	0.025214 U	0.011272 U
Cs-137	0.020788 U	0.018805 U	0.068475	0.053013	0.011941 U	0.021698 U	0.0094296 U	-0.014508 U	0.11546	0.15252
Eu-152	0.010458 U	0.0048917 U	0.01248 U	-0.00041702 U	0.0014827 U	-0.019406 U	0.01593 U	0.028761 U	0.015984 U	-0.012874 U
Eu-154	-0.0087966 U	-0.00049922 U	0.023827 U	-0.02173 U	-0.055608 U	0.0062219 U	-0.0030284 U	0.00080876 U	-0.0059675 U	-0.0052327 U
Eu-155	0.10566 U	-0.07175 U	0.11881 U	0.13235 U	0.24983 U	0.14943 U	0.1286 U	0.177 U	0.037671 U	0.054035 U
Mn-54	0.025935 U	0.013991 U	0.00057703 U	0.0036058 U	-0.006032 U	0.018025 U	-0.0023482 U	-0.0075454 U	-0.0092961 U	-0.00023332 U
Nb-94	-0.010532 U	0.000095019 U	-0.00010496 U	-0.00021492 U	0.0058821 U	-0.0071462 U	-0.0065542 U	-0.0002378 U	0.0093267 U	0.000045372 U
Sb-125	0.059916 U	0.10689 U	0.095533 U	0.11549 U	0.08812 U	R	0.077032 U	0.083418 U	R	-0.024564 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.2
 Soil Sample Results - FSS Data
 YAEC BUD/TSCA
 YNPS Rowe, MA

Station	SSS-01-01-033-F	SSS-01-01-034-F	SSS-01-01-035-F	SSS-01-01-036-F	SSS-01-01-037-F	SSS-01-01-038-F
gamma-spec (pCi/g)						
Ag-108m	-0.015344 U	-0.0083579 U	0.0034236 U	0.0007084 U	-0.009121 U	-0.0028993 U
Am-241	0.048515 U	0.034036 U	0.024118 U	0.046754 U	-0.057978 U	-0.095059 U
Co-60	-0.0030396 U	0.012545 U	-0.012668 U	0.028925 U	-0.0031577 U	0.2206
Cs-134	0.012391 U	0.011356 U	0.01901 U	0.015364 U	0.015285 U	-0.026683 U
Cs-137	0.015189 U	0.0023107 U	0.018434 U	0.056043 U	0.022348 U	0.026066 U
Eu-152	-0.031878 U	0.017804 U	0.022268 U	-0.011646 U	-0.0038887 U	0.02111 U
Eu-154	-0.023349 U	-0.013629 U	0.025161 U	-0.0019517 U	0.0061075 U	0.0026606 U
Eu-155	0.049841 U	0.083393 U	0.077242 U	0.013647 U	0.090157 U	0.042997 U
Mn-54	-0.00031351 U	0.016038 U	0.028799 U	0.031359 U	-0.008238 U	0.0061971 U
Nb-94	0.00064518 U	0.0053283 U	0.006026 U	0.017919 U	-0.000081165 U	0.0042397 U
Sb-125	0.048594 U	0.074571 U	R	0.033328 U	0.052518 U	-0.017018 U
Hard to detect (pCi/g)						
C-14						
Cm-243						
Fe-55						
H-3						
Ni-63						
Pu-238						
Pu-239						
Pu-241						
Sr-90						
Tc-99						

Appendix Table B.1.3
 Soil Sample Results - FSS Data
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Station	OOL-09-01-026-F	OOL-09-01-027-F	OOL-09-01-028-F	OOL-09-02-027-F	OOL-09-02-028-F	OOL-09-03-016-F	OOL-09-03-017-F	OOL-09-03-018-F	OOL-09-03-019-F	OOL-09-04-001-F
gamma-spec (pCi/g)										
Ag-108m						-0.010849 U	0.0013851 U	-0.0074865 U	-0.011074 U	0.00022018 U
Am-241						-0.072729 U	-0.077804 U	0.065974 U	0.0048136 U	0.00040687 U
Co-60						-0.0025391 U	-0.00018643 U	0.0047606 U	-0.00025029 U	0.00028269 U
Cs-134						0.0019603 U	0.016646 U	0.01841 U	0.01109 U	0.0094984 U
Cs-137						0.029559 U	0.0049266 U	0.021808 U	0.0051637 U	0.01618 U
Eu-152						0.018996 U	-0.048197 U	0.0019 U	-0.0011783 U	0.012399 U
Eu-154						0.025032 U	0.038092 U	0.030029 U	-0.00096654 U	0.0022628 U
Eu-155						0.036902 U	0.071052 U	0.014523 U	0.045503 U	0.056464 U
Mn-54						-0.0040436 U	0.0048034 U	0.0073781 U	-0.0090245 U	-0.00063058 U
Nb-94						0.0024018 U	-0.010821 U	0.0063495 U	-0.0052761 U	-0.0061295 U
Sb-125						0.090716 U	0.075113 U	0.13298	0.0044337 U	0.053936 U
Hard to detect (pCi/g)										
C-14	-0.0278 U	1.86	1.63	3.92	1.55					
Cm-243										
Fe-55										
H-3	4.37 U	7.28 U	8.08 U	6.09	4.36 U					
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.3
 Soil Sample Results - FSS Data
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Station	OOL-09-04-002-F	OOL-09-04-003-F	OOL-09-04-004-F	OOL-09-04-006-F	OOL-09-04-008-F	OOL-09-04-009-F	OOL-09-04-010-F	OOL-09-04-011-F	OOL-09-04-012-F	OOL-09-04-014-F
gamma-spec (pCi/g)										
Ag-108m	-0.011643 U	-0.0032402 U	0.022682 U	-0.0085618 U	-0.0065616 U	-0.015381 U	-0.00077694 U	0.00045191 U	-0.024147 U	-0.00011242 U
Am-241	-0.041051 U	-0.0028317 U	-0.008846 U	0.049732 U	-0.0038542 U	0.069797 U	-0.037917 U	-0.12572 U	0.036613 U	0.055749 U
Co-60	0.013205 U	0.007349 U	-0.0072714 U	-0.0075375 U	0.0011591 U	-0.00018411 U	-0.003077 U	0.0044633 U	0.0064958 U	0.010827 U
Cs-134	0.023758	0.016017 U	0.030925 U	0.008125 U	0.021348 U	0.026963 U	-0.0082128 U	0.012345 U	0.010021 U	0.016659 U
Cs-137	0.047265	0.38006	0.022133 U	-0.0012353 U	0.0017337 U	0.01135 U	0.030538 U	0.014095 U	0.010879 U	0.0066321 U
Eu-152	-0.022772 U	-0.0094041 U	0.023792 U	-0.0084347 U	0.021277 U	-0.023591 U	0.014022 U	-0.0014296 U	0.091022 U	0.026588 U
Eu-154	-0.009754 U	0.0055432 U	0.019672 U	-0.0044277 U	0.0064298 U	-0.019139 U	0.0051291 U	0.00021179 U	-0.001487 U	-0.00026425 U
Eu-155	0.11493 U	0.17107	-0.001089 U	0.12939 U	0.040334 U	0.092311 U	0.14178 U	0.054642 U	0.19107 U	-0.056428 U
Mn-54	-0.0098538 U	-0.01062 U	0.01598 U	0.016152 U	0.012498 U	0.015692 U	-0.0069689 U	0.00061487 U	-0.0004249 U	-0.0083718 U
Nb-94	0.00086699 U	0.013926 U	-0.0063205 U	-0.0036073 U	0.07282 U	0.013156 U	0.00092665 U	0.0040407 U	0.0046311 U	0.012742 U
Sb-125	0.088533	0.10095	0.12819 U	0.12918	0.11269 U	0.15376	0.087538 U	0.1063	0.14157	0.084833 U
Hard to detect (pCi/g)										
C-14			-0.0819 U							
Cm-243			-0.0445 U							
Fe-55			17.1 U							
H-3			-0.822 U							
Ni-63			-1.26 U							
Pu-238			-0.0657 U							
Pu-239			-0.23 U							
Pu-241			-8.03 U							
Sr-90			0.00955 U							
Tc-99			0.139 U							

Appendix Table B.1.3
 Soil Sample Results - FSS Data
 YAEC SCFA/TSCA
 YNPS Rowe, MA

Station	OOL-09-05-010-F	OOL-09-05-014-F
gamma-spec (pCi/g)		
Ag-108m	-0.003576 U	-0.00071329 U
Am-241	0.0076594 U	0.0087422 U
Co-60	0.047154	0.0031928 U
Cs-134	0.011565 U	0.014052 U
Cs-137	0.12001	0.0153 U
Eu-152	0.00011192 U	0.00028751 U
Eu-154	-0.020007 U	-0.022101 U
Eu-155	0.077876 U	0.11074 U
Mn-54	0.00073968 U	0.00030815 U
Nb-94	-0.00036309 U	0.0081638 U
Sb-125	0.073399 U	0.077047 U
Hard to detect (pCi/g)		
C-14		
Cm-243		
Fe-55		
H-3		
Ni-63		
Pu-238		
Pu-239		
Pu-241		
Sr-90		
Tc-99		

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-08-01-001-F	OOL-08-01-006-F	OOL-08-01-017-F	OOL-08-01-018-F	OOL-08-01-019-F	OOL-08-01-021-R	OOL-08-01-022-R	OOL-08-01-023-R	OOL-08-01-024-R	OOL-08-01-025-R
LTP (pCi/g)										
Ag-108m	-0.02507 U	0.1253 U	0.00682 U	-0.02013 U	0.0005228 U	-0.0224 U	-0.007758 U	-0.01972 U	0.1293 U	-0.01622 U
Am-241	-0.115 U	0.0455 U	0.0681 U	0.06898 U	-0.008245 U	0.02815 U	-0.06335 U	0.03265 U	-0.06515 U	0.01748 U
Co-60	-0.0221 U	0.001583 U	0.0103 U	-0.03072 U	-0.0225 U	-0.005096 U	-0.01603 U	-0.03446 U	-0.00006456 U	-0.002196 U
Cs-134	0.002957 U	0.006797 U	0.0281 U	-0.0243 U	-0.004355 U	-0.01007 U	-0.01241 U	0.02925 U	-0.0292 U	0.002063 U
Cs-137	0.3179	0.5344	1.02	0.6358	0.2489	0.6265	0.3851	0.1221	0.6514	0.362
Eu-152	-0.001949 U	-0.005201 U	-0.0972 U	0.2247	0.07649 U	0.02032 U	-0.002943 U	0.001684 U	0.01114 U	0.003181 U
Eu-154	-0.01936 U	0.0006695 U	-0.0134 U	-0.01826 U	-0.0001489 U	-0.00632 U	0.006469 U	-0.006726 U	0.03206 U	0.01409 U
Eu-155	0.133 U	-0.002228 U	0.047 U	0.007741 U	0.01667 U	0.006086 U	0.06205 U	-0.01027 U	-0.007774 U	-0.0104 U
Mn-54	-0.01953 U	0.07379 U	0.0559 U	0.001505 U	0.02534 U	0.01515 U	0.004709 U	0.01415 U	0.002582 U	-0.007509 U
Nb-94	-0.003379 U	0.01195 U	-0.00829 U	-0.008852 U	-0.008019 U	0.009033 U	0.001185 U	0.008998 U	0.0003637 U	0.01872 U
Sb-125	0.08161 U	0.05899 U	0.0129 U	0.02553 U	-0.008547 U	0.2374 U	-0.003045 U	0.03973 U	0.0129 U	-0.003492 U
LTP_HTD (pCi/g)										
C-14			0.833 U							
Cm-243			0.0513 U							
Fe-55			1.13 U							
H-3										
Ni-63			0.185 U							
Pu-238			0.0629 U							
Pu-239			0.0408 U							
Pu-241			1.5 U							
Sr-90			0.0642 U							
Tc-99			-0.0397 U							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-08-03-001-F	OOL-08-03-001-P	OOL-08-03-002-F	OOL-08-03-002-P	OOL-08-03-003-F	OOL-08-03-003-P	OOL-08-03-004-F	OOL-08-03-005-F	OOL-08-03-006-F	OOL-08-03-007-F
LTP (pCi/g)										
Ag-108m	-0.007008 U	-0.000262 U	-0.004908 U	-0.00447 U	-0.01645 U	-0.00118 U	0.0288 U	-0.01249 U	-0.02055 U	0.01472 U
Am-241	0.0175 U	0.0257 U	-0.2521 U	0.127 U	0.3042 U	0.206 U	-0.1319 U	-0.3667 U	-0.1882 U	-0.04395 U
Co-60	-0.01091 U	0.00337 U	-0.0008915 U	0.000828 U	0.01524 U	0.0133 U	-0.001791 U	-0.0008855 U	-0.0009059 U	-0.009705 U
Cs-134	-0.01826 U	0.0312 U	-0.01827 U	0.0374 U	0.02876 U	0.0233 U	0.007734 U	0.03187 U	0.03658 U	0.0849 U
Cs-137	0.02287 U	0.0114 U	1.913	0.0194 U	0.3443	0.0252	0.7038	0.3467	0.7456	0.3135
Eu-152	0.0583 U	-0.00112 U	-0.06067 U	0.00575 U	-0.04591 U	0.00803 U	0.02558 U	0.106 U	-0.06662 U	0.0635 U
Eu-154	-0.03429 U	-0.0275 U	-0.04162 U	0.038 U	-0.001023 U	-0.0211 U	0.01992 U	0.006992 U	-0.002117 U	-0.02513 U
Eu-155	0.1697 U	0.0171 U	0.07751 U	0.0674 U	0.002676 U	0.014 U	0.01241 U	0.1231 U	-0.04036 U	-0.09915 U
Mn-54	-0.0009307 U	0.00497 U	-0.01215 U	0.0106 U	0.01074 U	0.00981 U	0.01047 U	0.002036 U	-0.005104 U	-0.0007834 U
Nb-94	-0.00637 U	0.00436 U	-0.01653 U	0.00608 U	-0.00005717 U	-0.00272 U	-0.002314 U	0.04279 U	0.02177 U	-0.01622 U
Sb-125	0.1405	0.00264 U	-0.01263 U	-0.00286 U	0.1431 U	-0.00205 U	0.05407 U	0.05606 U	0.1288 U	-0.01573 U
LTP_HTD (pCi/g)										
C-14		0.0281 U	0.212	0.0899 U		-0.145 U				
Cm-243		0.156 U	0.0333 U	0.0654 U		0.0138 U				
Fe-55		8.44 U	1.36 U	-1.87 U		24.4 U				
H-3		-0.0807 U	3.96 U	1.76 U		0.736 U				
Ni-63		-14.6 U	-1.42 U	-10 U		-15.8 U				
Pu-238		0.0139 U	0.0077 U	0.0357 U		0.0854 U				
Pu-239		0.00107 U	0.118 U	-0.00824 U		0.0265 U				
Pu-241		2.13 U	-0.725 U	2.81 U		-6.13 U				
Sr-90	0.00379 U	-0.0206 U	0.36	0.0518	0.0307 U	0.013 U	0.0462	0.0325 U	0.0931	-0.000622 U
Tc-99		0.169 U	-0.0404 U	0.207 U		0.123 U				

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-08-03-008-F	OOL-08-03-009-F	OOL-08-03-010-F	OOL-08-03-011-F	OOL-08-03-012-F	OOL-08-03-013-F	OOL-08-03-014-F	OOL-08-03-015-F	OOL-08-03-016-F	OOL-08-03-017-F
LTP (pCi/g)										
Ag-108m	-0.004416 U	-0.0203 U	-0.001854 U	-0.003891 U	0.002219 U	-0.002386 U	0.0002665 U	0.01329 U	0.01121 U	0.02166 U
Am-241	0.3346 U	-0.1117 U	0.004324 U	-0.03973 U	-0.1134 U	-0.2416 U	-0.1595 U	-0.408 U	-0.188 U	0.0131 U
Co-60	-0.003883 U	0.02123 U	-0.005611 U	0.0006894 U	0.005845 U	-0.004565 U	0.04604 U	0.005329 U	0.003886 U	0.0008351 U
Cs-134	0.009104 U	-0.008359 U	-0.0313 U	0.01445 U	-0.01332 U	-0.0164 U	0.01921 U	-0.004604 U	0.0229 U	0.04116 U
Cs-137	0.5323	1.59	1.21	0.6958	0.5848	2.226	0.9521	1.751	0.1063	1.012
Eu-152	0.1191 U	-0.009975 U	-0.06029 U	-0.06564 U	0.08385 U	-0.06917 U	-0.08479 U	-0.05193 U		-0.05212 U
Eu-154	-0.01621 U	0.0575 U	-0.02209 U	-0.0414 U	0.04911 U	-0.03763 U	-0.06945 U	0.0206 U	0.0127 U	-0.01237 U
Eu-155	0.1095 U	-0.2164 U	0.1967 U	-0.0697 U	0.08877 U	-0.002942 U	0.1964 U	-0.005118 U	0.04906 U	0.2813 U
Mn-54	-0.0009575 U	-0.00169 U	0.003844 U	0.01042 U	0.01169 U	-0.0168 U	-0.007346 U	0.02157 U	0.008554 U	-0.01035 U
Nb-94	0.06207 U	0.000666 U	0.0535 U	0.003442 U	0.01067 U	-0.01728 U	0.0009265 U	0.007717 U	-0.01073 U	0.09597 U
Sb-125	0.003343 U	-0.01974 U	-0.008959 U	0.1091 U	0.01039 U	0.008 U	-0.008716 U	0.04633 U	0.07415 U	0.02967 U
LTP_HTD (pCi/g)										
C-14							0.199			
Cm-243							0.036 U			
Fe-55							1.88 U			
H-3							9.27 U			
Ni-63							-1.7 U			
Pu-238							-0.018 U			
Pu-239							0.0975 U			
Pu-241							-2.1 U			
Sr-90	0.0298	0.0533	0.0366	0.0874	0.0479	0.147	0.516	0.0583		
Tc-99							-0.0587 U			

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-08-03-019-F	OOL-08-03-020-F	OOL-08-03-021-F	OOL-08-03-022-F	OOL-08-03-023-F	OOL-08-03-023-F-B	OOL-08-03-024-F	OOL-08-03-025-F	OOL-08-03-026-F	OOL-08-04-002-F
LTP (pCi/g)										
Ag-108m	-0.0042706 U	0.0057259 U	0.024611 U	0.04778 U			-0.013714 U	-5.0501E-06 U	0.00040431 U	-0.011339 U
Am-241	-0.27275 U	-0.0070899 U	0.29673 U	0.011555 U		-0.067036 U	-0.17236 U	-0.0083588 U	-0.011788 U	-0.11743 U
Co-60	-0.0054953 U	-0.0035258 U	-0.0011049 U	0.0021076 U		0.030053 U	0.042715 U	-0.014783 U	0.0030766 U	0.17629
Cs-134	0.00073838 U	-0.0002113 U	0.0089243 U	-0.0080133 U		-0.0036393 U	0.015757 U	0.007445 U	0.0037264 U	0.017481 U
Cs-137	0.51339	0.47549	0.39086	0.31668		0.52623	0.42895	0.60053	0.28356	0.33417
Eu-152	0.0023604 U	0.0024001 U	-0.050297 U	-0.0001307 U			-0.029948 U	0.016826 U	0.00053667 U	-0.01938 U
Eu-154	0.0023608 U	0.011577 U	-0.0012101 U	0.0027384 U			0.010515 U	0.0091551 U	0.0052205 U	-0.0043037 U
Eu-155	0.030085 U	-0.059583 U	-0.076165 U	0.027741 U			0.0090083 U	-0.077381 U	0.078495 U	0.051092 U
Mn-54	0.00069333 U	-0.0011671 U	-0.0020357 U	0.00012174 U		-0.0053184 U	-0.0098918 U	-0.0032875 U	-0.0014858 U	0.017057 U
Nb-94	-0.0017649 U	0.0052129 U	0.07267 U	-0.0072203 U		0.0023351 U	-0.006963 U	-0.014328 U	-0.0043015 U	-0.0038852 U
Sb-125	0.0049275 U	0.030996 U	-0.023964 U	-0.023664 U		-0.016261 U	-0.011656 U	0.063472 U	0.076563 U	0.10506 U
LTP_HTD (pCi/g)										
C-14						-1.21 U				
Cm-243										
Fe-55						-2.5 U				
H-3						1 U				
Ni-63						-0.2 U				
Pu-238										
Pu-239										
Pu-241										
Sr-90	0.311	0.692	0.807	0.597	0.258		0.978	0.063 U	0.06 U	
Tc-99					0.15 U					

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-08-04-004-F	OOL-08-04-008-F	OOL-08-04-010-F	OOL-08-04-011-F	OOL-08-04-013-F	OOL-09-01-001-F	OOL-09-01-002-F	OOL-09-01-003-F	OOL-09-01-004-F	OOL-09-01-005-F
LTP (pCi/g)										
Ag-108m	0.0041509 U	-0.0025347 U	0.08077 U	-0.0097715 U	0.0066671 U	-0.0016781 U	-0.0076912 U	0.0090351 U	-0.0049997 U	-0.003715 U
Am-241	0.010702 U	0.009253 U	0.12345 U	-0.027294 U	0.042944 U	0.035077 U	-0.0032604 U	0.027577 U	0.00051654 U	-0.038681 U
Co-60	0.13573	0.026733 U	-0.00025906 U	-0.0087898 U	0.0089582 U	0.012816 U	0.0078791 U	-0.0039255 U	0.042352 U	-0.0052959 U
Cs-134	0.00096365 U	0.019192 U	-0.016428 U	0.018358 U	0.000037255 U	0.022141 U	-0.030232 U	-0.015024 U	-0.0011453 U	-0.008169 U
Cs-137	0.26722	0.10264	0.12475	0.06118	-0.00033475 U	0.022278 U	0.023802 U	0.033066 U	1.1007	0.27267
Eu-152	0.0016786 U	0.0014644 U	-0.0016817 U	0.000768 U	-0.033406 U	0.024329 U	-0.041855 U	-0.011765 U	-0.00080919 U	0.008262 U
Eu-154	0.0095334 U	-0.0061183 U	0.0012636 U	-0.000070372 U	-0.021898 U	-0.030726 U	0.031686 U	-0.004662 U	-0.012235 U	-0.021508 U
Eu-155	0.16261 U	0.086701 U	-0.0091777 U	0.12821 U	0.038372 U	0.10577 U	0.19777	0.17786 U	0.075851 U	-0.046484 U
Mn-54	0.014233 U	-0.004422 U	-0.014957 U	-0.0057961 U	-0.00042631 U	-0.00015796 U	0.0018211 U	0.018325 U	-0.0016931 U	-0.00098548 U
Nb-94	-0.0058646 U	0.00084622 U	-0.00051767 U	0.007392 U	0.0098554 U	0.004791 U	-0.0080644 U	0.0081228 U	0.0056642 U	0.05286 U
Sb-125	0.079822 U	0.063467 U	0.031886 U	0.06614 U	0.13606 U	0.076351 U	0.096488 U	-0.0059886 U	-0.0076938 U	-0.0468 U
LTP_HTD (pCi/g)										
C-14	-0.0749 U	0.133 U				0.0235 U	0.107 U	0.0701 U	0.163	0.108 U
Cm-243	0.124 U	-0.0117 U						0.00738 U		
Fe-55	-6.52 U	-5.91 U						-23.2 U		
H-3	-1.71 U	8.25 U				1.96 U	-1.95 U	5.05 U	2.45 U	2.66 U
Ni-63	-3.7 U	-2.69 U						-0.409 U		
Pu-238	-0.00595 U	0.0921 U						-0.0209 U		
Pu-239	-0.0119 U	0.0258 U						0.0332 U		
Pu-241	21.2 U	1.48 U						0.5 U		
Sr-90	0.0125 U	0.016 U						0.00192 U		
Tc-99	-0.0518 U	0.0921 U						0.297 U		

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-01-006-F	OOL-09-01-007-F	OOL-09-01-008-F	OOL-09-01-009-F	OOL-09-01-010-F	OOL-09-01-011-F	OOL-09-01-012-F	OOL-09-01-013-F	OOL-09-01-014-F	OOL-09-01-015-F
LTP (pCi/g)										
Ag-108m	-0.0178 U	0.013145 U	0.011514 U	-0.0067752 U	-0.01989 U	-0.029405 U	-0.00077768 U	0.0061231 U	-0.00028126 U	-0.012713 U
Am-241	-0.0062716 U	-0.084155 U	0.24906 U	0.023693 U	-0.044941 U	-0.0022217 U	-0.011564 U	0.15483 U	0.029423 U	-0.1824 U
Co-60	-0.00024846 U	0.025597 U	0.027457 U	0.0029036 U	-0.0027667 U	0.013822 U	0.19286	0.0090208 U	-0.0061386 U	0.030547 U
Cs-134	-0.000078024 U	0.001528 U	-0.011167 U	0.036929 U	-0.029822 U	0.0030012 U	0.01393 U	0.032291 U	-0.003178 U	0.017543 U
Cs-137	0.033981 U	0.13748	1.4338	0.022429 U	0.013379 U	0.070219	0.11618	0.078164	0.22366	0.13943
Eu-152	0.00041419 U	0.0003138 U	0.11344 U	0.046144 U	0.0055471 U	-0.038559 U	0.069107 U	0.087644 U	0.050729 U	0.010079 U
Eu-154	0.01411 U	-0.00285 U	0.2361 U	0.035005 U	0.012976 U	0.019149 U	0.016719 U	-0.0021051 U	0.031004 U	0.0050188 U
Eu-155	0.060751 U	-0.010232 U	0.091162 U	-0.031811 U	0.12013 U	0.014064 U	0.033801 U	0.14232 U	0.18198 U	0.10737 U
Mn-54	0.024337 U	-0.00041639 U	0.0077996 U	-0.011312 U	0.017232 U	0.0036414 U	-0.0013645 U	-0.0097249 U	-0.0011862 U	-0.010594 U
Nb-94	-0.00015551 U	0.0064494 U	0.013191 U	-0.0084737 U	0.0025329 U	-0.0070104 U	-0.00895 U	0.007532 U	0.0025594 U	0.0011477 U
Sb-125	0.021581 U	0.019774 U	0.041373 U	0.10277 U	0.066452 U	0.097192 U	0.043821 U	0.10616 U	-0.0051504 U	0.086185 U
LTP_HTD (pCi/g)										
C-14	0.115 U	3.08	0.108 U	-0.0102 U	0.0595 U	0.258	0.0577 U	0.0498 U	0.648	0.597
Cm-243	0.06 U									
Fe-55	-5.48 U									
H-3	34.3	4.23 U	-6.65 U	-2.78 U	43.5	7.95	3.43 U	-0.0344 U	40.8	-0.37 U
Ni-63	-2.41 U									
Pu-238	-0.0106 U									
Pu-239	0.0266 U									
Pu-241	-3.6 U									
Sr-90	0.00113 U									
Tc-99	0.117 U									

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-01-016-F	OOL-09-01-017-F	OOL-09-01-018-F	OOL-09-01-019-F	OOL-09-01-020-F	OOL-09-01-021-F	OOL-09-01-022-F	OOL-09-01-023-F	OOL-09-01-024-F	OOL-09-01-025-F
LTP (pCi/g)										
Ag-108m	-0.003625 U	0.1443 U	-0.012656 U	0.0003565 U	-0.018643 U	-0.01486 U	0.024087	-0.015971 U	-0.0057729 U	-0.025829 U
Am-241	-0.2714 U	0.17953 U	-0.031438 U	-0.11434 U	-0.02351 U	0.016113 U	-0.041844 U	0.096092 U	0.11511 U	-0.021725 U
Co-60	-0.000030977 U	0.052958 U	0.0053192 U	-0.0038005 U	-0.0033793 U	0.011775 U	0.0098991 U	0.0082106 U	-0.0085343 U	0.010799 U
Cs-134	0.013724 U	0.0041105 U	-0.020955 U	0.025916 U	0.030673	0.023384 U	0.018835 U	0.017015 U	0.021067 U	-0.027346 U
Cs-137	0.0090594 U	0.73671	0.17294	0.11658	0.051205	-0.001291 U	0.097679	0.013839 U	0.042907	0.018818 U
Eu-152	0.0019527 U	0.033308 U	-0.002387 U	-0.043548 U	0.0059443 U	-0.01559 U	0.023891 U	0.039521 U	-0.040852 U	-0.0090345 U
Eu-154	0.025526 U	0.0053591 U	-0.028608 U	-0.029248 U	0.0079323 U	-0.014045 U	-0.0004186 U	0.028879 U	-0.02467 U	0.015641 U
Eu-155	0.019685 U	0.074892 U	0.011994 U	-0.053716 U	0.078139 U	0.1661 U	0.080127 U	0.1607 U	0.0025858 U	0.009383 U
Mn-54	-0.0068264 U	-0.002289 U	0.0030482 U	-0.021685 U	-0.0049365 U	0.0075978 U	0.01113 U	0.013226 U	-0.011454 U	-0.00068744 U
Nb-94	0.00013312 U	-0.00068538 U	-0.0070399 U	-0.0023836 U	0.0088691 U	0.0039314 U	-0.0024286 U	0.0029349 U	0.0074197 U	-0.00024944 U
Sb-125	-0.012509 U	0.0139 U	0.12166 U	-0.00051457 U	0.04368 U	0.11557 U	0.03525 U	0.080001 U	0.095351 U	0.062978 U
LTP_HTD (pCi/g)										
C-14	0.0577 U	0.108 U	0.0962 U	0.0668 U	0.0144 U	-0.0878 U	0.0334 U	0.0342 U	-0.0818 U	-0.0702 U
Cm-243										
Fe-55										
H-3	4.55 U	-2.09 U	-3.22 U	-0.0344 U	-0.127 U	5.23 U	2.63 U	1.86 U	3.26 U	3.31 U
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-02-001-F	OOL-09-02-002-F	OOL-09-02-003-F	OOL-09-02-004-F	OOL-09-02-005-F	OOL-09-02-006-F	OOL-09-02-007-F	OOL-09-02-008-F	OOL-09-02-009-F	OOL-09-02-010-F
LTP (pCi/g)										
Ag-108m	0.0058524 U	-0.018221 U	0.0090372 U	-0.019861 U	0.014604 U	-0.019653 U	-0.016982 U	-0.001855 U	0.014837 U	0.0078591 U
Am-241	-0.12889 U	-0.0013954 U	0.0079916 U	-0.0013907 U	-0.0019236 U	-0.0045628 U	0.17612 U	-0.01373 U	-0.13026 U	0.075076 U
Co-60	-0.0034854 U	0.0017322 U	-0.0016578 U	0.0042858 U	-0.0040939 U	-0.004205 U	-0.0071395 U	0.095116	0.014824 U	0.015961 U
Cs-134	0.0066068 U	0.036014	0.024503 U	0.035659 U	0.027097	0.016249 U	0.032841 U	0.033145	0.018045 U	0.025587 U
Cs-137	0.061296	0.010847 U	0.061995	0.002521 U	0.011907 U	0.00047627 U	0.026087 U	0.018231 U	-0.0020514 U	0.062346
Eu-152	0.082378 U	-0.02935 U	0.012128 U	-0.048737 U	0.019828 U	-0.039363 U	0.045058 U	-0.00024321 U	-0.020182 U	0.026628 U
Eu-154	-0.022586 U	0.00028982 U	0.019139 U	-0.033565 U	0.010201 U	0.00013825 U	0.024327 U	0.019742 U	-0.00049662 U	0.024076 U
Eu-155	0.15857 U	0.087151 U	0.020555 U	0.10828 U	0.084904 U	0.011955 U	0.16311 U	0.022075 U	0.079769 U	0.14652 U
Mn-54	0.0031341 U	-0.0012162 U	0.0090164 U	0.014157 U	-0.007188 U	0.018551 U	0.028485 U	0.00040793 U	-0.00442 U	0.00063766 U
Nb-94	0.0071037 U	-0.000096205 U	0.0044648 U	-0.00021435 U	-0.00020641 U	-0.0063218 U	-0.0011816 U	-0.00061716 U	0.0095678 U	0.007851 U
Sb-125	0.12366	0.09418	0.091128 U	0.084097 U	0.074797 U	0.093206 U	-0.028039 U	0.14783	0.1361	0.085704 U
LTP_HTD (pCi/g)										
C-14	0.00971 U	0.0154 U	0.417 U	0.0778 U	-0.266 U	0.426	0.754	0.115 U	-0.145 U	0.712
Cm-243										
Fe-55										
H-3	-2.46 U	-2.38 U	1.76 U	0.738 U	14.3	3 U	1.49 U	-0.208 U	-2.36 U	0.417 U
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-02-011-F	OOL-09-02-012-F	OOL-09-02-013-F	OOL-09-02-014-F	OOL-09-02-015-F	OOL-09-02-016-F	OOL-09-02-017-F	OOL-09-02-018-F	OOL-09-02-019-F	OOL-09-02-020-F
LTP (pCi/g)										
Ag-108m	0.0055706 U	-0.0014931 U	-0.014246 U	-0.017195 U	-0.0023706 U	-0.010086 U	-0.0064452 U	0.024135 U	0.013833 U	-0.0011488 U
Am-241	0.012904 U	0.005441 U	-0.0010468 U	-0.10402 U	0.84358 U	-0.0056182 U	0.019171 U	-0.01002 U	-0.15999 U	-0.00025752 U
Co-60	0.020765 U	0.0031011 U	0.036775 U	0.0061309 U	0.0096849 U	0.030967 U	0.018585 U	0.00050032 U	-0.00020896 U	0.0055278 U
Cs-134	0.0387 U	-0.012056 U	-0.0036202 U	-0.02554 U	-0.00086148 U	-0.022142 U	0.037139 U	0.00096785 U	0.015618 U	0.024569 U
Cs-137	0.014757 U	0.020379 U	0.027369 U	0.021633 U	0.057159	0.010983 U	0.07135 U	0.024016 U	-0.0018408 U	0.058721
Eu-152	-0.04661 U	-0.021926 U	0.019317 U	0.026898 U	0.0037668 U	-0.003617 U	-0.018992 U	-0.036896 U	0.051319 U	0.0041916 U
Eu-154	-0.0028329 U	-0.016415 U	0.0022078 U	0.016354 U	0.013655 U	-0.022145 U	-0.00024401 U	0.010089 U	0.035815 U	0.023537 U
Eu-155	0.084931 U	0.073573 U	0.15379 U	0.19271 U	0.14567 U	-0.010469 U	-0.0056932 U	-0.0083102 U	-0.014083 U	0.11776 U
Mn-54	-0.01239 U	0.0073488 U	-0.010626 U	-0.00076879 U	-0.0097824 U	0.011068 U	0.00057466 U	0.013552 U	-0.0023358 U	0.0061245 U
Nb-94	0.07654 U	-0.0038392 U	-0.00014075 U	-0.0031323 U	-0.005569 U	-0.0015994 U	-0.0014326 U	0.01203 U	-0.00167 U	0.0054506 U
Sb-125	0.10459 U	0.14859	0.15227 U	0.11687 U	0.084782 U	0.072836 U	-0.0034451 U	0.091232 U	0.10774 U	0.06108 U
LTP_HTD (pCi/g)										
C-14	0.131 U	-0.0976 U	0.362	0.0801 U	-0.0614 U	0.0401 U	-0.0392 U	0.107 U	0.177 U	0.151 U
Cm-243			-0.00304 U							
Fe-55			-2.77 U							
H-3	-0.542 U	0.645 U	2.09 U	-0.515 U	1.6 U	0.41 U	-3.03 U	-0.567 U	0.476 U	-0.602 U
Ni-63			0.253 U							
Pu-238			-0.0166 U							
Pu-239			-0.0249 U							
Pu-241			-3.44 U							
Sr-90			0.00444 U							
Tc-99			0.103 U							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-02-021-F	OOL-09-02-022-F	OOL-09-02-023-F	OOL-09-02-024-F	OOL-09-02-025-F	OOL-09-03-001-F	OOL-09-03-002-F	OOL-09-03-003-F	OOL-09-03-004-F	OOL-09-03-005-F
LTP (pCi/g)										
Ag-108m	0.0046742 U	-0.018235 U	-0.010776 U	-0.01047 U	-0.0023807 U	0.09253 U	0.05851 U	-0.0012851 U	-0.0020918 U	-0.018196 U
Am-241	0.0070058 U	0.045528 U	-0.4627 U	0.027895 U	0.021134 U	0.0096853 U	0.033096 U	-0.078498 U	-0.36973 U	-0.10668 U
Co-60	0.0016341 U	0.016793 U	0.010801 U	0.0018082 U	-0.010423 U	0.016705 U	-0.0063978 U	0.00073256 U	-0.0050553 U	-0.0074355 U
Cs-134	0.023843 U	-0.025657 U	0.028514 U	0.013364 U	0.026272	0.0052931 U	-0.0058629 U	-0.0069703 U	-0.012939 U	-0.015632 U
Cs-137	0.021626 U	0.035966 U	0.020425 U	0.022382 U	0.021323 U	0.2648	0.47083	0.5559	0.43162	2.6265
Eu-152	-0.0081061 U	-0.0010129 U	-0.020204 U	-0.020613 U	0.12953 U	0.0049781 U	-0.027912 U	-0.028306 U	-0.0055689 U	0.009571 U
Eu-154	-0.031035 U	0.004088 U	0.018734 U	0.012361 U	-0.0012412 U	-0.018752 U	0.013141 U	-0.015142 U	-0.0013819 U	-0.0007623 U
Eu-155	-0.0089619 U	0.18518	0.011854 U	0.050731 U	0.11688 U	0.0073105 U	0.050463 U	0.042674 U	0.0098895 U	0.0062969 U
Mn-54	-0.00039044 U	-0.0018492 U	-0.0014622 U	-0.0025321 U	-0.0082827 U	0.019312 U	0.001131 U	-0.014813 U	-0.0067241 U	-0.00067644 U
Nb-94	0.015376 U	-0.011381 U	-0.0089607 U	-0.00023126 U	0.0072637 U	-0.0078189 U	0.0096835 U	0.0099415 U	0.0056349 U	-0.0057515 U
Sb-125	-0.034119 U	0.11819 U	0.13223	0.019426 U	0.1414	-0.033325 U	-0.0052578 U	0.029997 U	-0.017521 U	0.11956 U
LTP_HTD (pCi/g)										
C-14	-0.0315 U	0.188	0.295 U	0.266 U	0.12 U					
Cm-243		0.0162 U								
Fe-55		-0.553 U								
H-3	-0.836 U	0.976 U	-1.03 U	1.35 U	0.191 U					
Ni-63		-0.753 U								
Pu-238		-0.0266 U								
Pu-239		-0.0236 U								
Pu-241		-4.17 U								
Sr-90		-0.00528 U								
Tc-99		0.077 U								

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-03-006-F	OOL-09-03-007-F	OOL-09-03-008-F	OOL-09-03-009-F	OOL-09-03-010-F	OOL-09-03-011-F	OOL-09-03-012-F	OOL-09-03-013-F	OOL-09-03-014-F	OOL-09-03-015-F
LTP (pCi/g)										
Ag-108m	0.01235 U	-0.00041893 U	0.011743 U	0.0072104 U	0.0035062 U	-0.0036981 U	0.000030655 U	-0.0016256 U	-0.0062256 U	0.04385 U
Am-241	-0.016711 U	0.060478 U	-0.047588 U	-0.21717 U	0.034173 U	0.007152 U	0.0069525 U	-0.026243 U	0.013392 U	-0.023469 U
Co-60	-0.0014324 U	-0.0010388 U	-0.0060614 U	-0.00018587 U	-0.0036195 U	0.012541 U	0.00065043 U	-0.011387 U	0.0045295 U	0.037842
Cs-134	0.011087 U	0.0014578 U	0.013052 U	0.019044 U	0.025279 U	-0.00049276 U	0.013338 U	-0.0004696 U	-0.0037754 U	-0.0016898 U
Cs-137	0.005797 U	0.45421	0.087647	0.057761	0.33328	0.3806	0.010593 U	0.38448	0.017206 U	0.50775
Eu-152	0.060766 U	0.0039898 U	-0.0009579 U	0.021963 U	-0.0008539 U	-0.0062023 U	0.014896 U	0.041282 U	0.060721 U	0.01351 U
Eu-154	-0.011008 U	-0.00038141 U	-0.0014303 U	-0.0079742 U	0.012022 U	-0.014767 U	-0.016354 U	-0.014587 U	0.03471 U	-0.022826 U
Eu-155	0.10134 U	0.11342 U	0.012752 U	0.0062709 U	0.18191 U	-0.0041354 U	0.021011 U	0.0087962 U	0.036988 U	0.015835 U
Mn-54	-0.0069228 U	0.010556 U	0.003811 U	-0.0089251 U	0.014517 U	-0.0026207 U	-0.0041646 U	0.0036854 U	-0.015926 U	0.0052793 U
Nb-94	-0.0052933 U	0.0062765 U	0.0068772 U	-0.0041595 U	0.013205 U	-0.00034061 U	0.0051207 U	-0.0029005 U	0.0019196 U	0.0041817 U
Sb-125	0.052328 U	0.070466 U	0.0034852 U	-0.0028735 U	0.070956 U	0.022484 U	0.062578 U	0.019581 U	0.11836 U	-0.010741 U
LTP_HTD (pCi/g)										
C-14								0.164 U		
Cm-243								-0.196 U		
Fe-55								16.3 U		
H-3								-1.55 U		
Ni-63								2.71 U		
Pu-238								-0.00714 U		
Pu-239								0.0464 U		
Pu-241								6.46 U		
Sr-90								0.0675		
Tc-99								0.381		

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-04-005-F	OOL-09-04-007-F	OOL-09-04-013-F	OOL-09-04-015-F	OOL-09-05-001-F	OOL-09-05-002-F	OOL-09-05-003-F	OOL-09-05-004-F	OOL-09-05-005-F	OOL-09-05-006-F
LTP (pCi/g)										
Ag-108m	0.0073148 U	0.0050708 U	0.011692 U	0.0046645 U	-0.009653 U	0.018956 U	-0.00025686 U	-0.0063818 U	-0.010683 U	0.06295 U
Am-241	-0.022934 U	0.38683 U	0.031826 U	-0.13642 U	0.029774 U	-0.036546 U	0.020002 U	0.058555 U	-0.034125 U	0.22285 U
Co-60	-0.00039688 U	-0.0040566 U	-0.0061 U	-0.0044875 U	0.0063023 U	-0.0079808 U	0.016405 U	-0.0079808 U	0.023736 U	0.00014697 U
Cs-134	-0.0079124 U	0.013816 U	-0.002625 U	0.027784 U	0.0204 U	0.0057429 U	-0.022127 U	0.019498 U	-0.00049963 U	0.017527 U
Cs-137	0.05169	0.21762	0.17537	0.05285 U	0.010764 U	0.10783	0.047887	0.02372 U	0.039324 U	-0.019159 U
Eu-152	-0.0019606 U	0.05561 U	-0.032962 U	0.045933 U	-0.0045845 U	0.024312 U	-0.025002 U	0.0090456 U	-0.0055213 U	0.029275 U
Eu-154	0.0085873 U	0.028385 U	0.0080197 U	0.025247 U	0.01969 U	-0.011136 U	-0.00057049 U	0.013275 U	-0.0025833 U	0.0047358 U
Eu-155	0.13307 U	0.085083 U	0.11346 U	-0.0012018 U	0.075203 U	0.21112 U	-0.0025756 U	0.10756 U	0.10731 U	0.13387 U
Mn-54	-0.0063943 U	0.022742 U	0.0084483 U	-0.014519 U	0.011041 U	-0.016137 U	0.028483 U	0.020312 U	-0.014118 U	0.0056843 U
Nb-94	-0.00018173 U	0.013185 U	-5.7578E-06 U	0.0033959 U	0.0083595 U	0.0018011 U	-0.00021769 U	0.0088075 U	0.013075 U	0.00068151 U
Sb-125	0.10216 U	-0.011374 U	0.097449 U	-0.034946 U	0.076389 U	0.072556 U	0.12048 U	0.08596	0.075702 U	0.040822 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-05-007-F	OOL-09-05-008-F	OOL-09-05-009-F	OOL-09-05-011-F	OOL-09-05-012-F	OOL-09-05-013-F	OOL-09-05-015-F
LTP (pCi/g)							
Ag-108m	-0.011052 U	0.018425 U	-0.0129 U	0.0021448 U	0.0014892 U	-0.0096435 U	0.0025982 U
Am-241	-0.033023 U	0.023305 U	-0.094974 U	0.09855 U	-0.049282 U	-0.10186 U	0.0016784 U
Co-60	-0.0033053 U	0.027133 U	0.061663	0.025711 U	0.00965 U	-0.00020077 U	0.0027924 U
Cs-134	0.011652 U	-0.020176 U	-0.016213 U	-0.012385 U	0.010232 U	0.011792 U	0.022333 U
Cs-137	0.13019	0.069581	0.15822	-0.0037769 U	0.023616 U	0.025334 U	0.039031 U
Eu-152	0.020698 U	-0.0053411 U	-0.057042 U	-0.033513 U	-0.000099926 U	-0.042887 U	-0.0016032 U
Eu-154	0.00027376 U	0.004127 U	-0.039374 U	0.0050713 U	-0.00018649 U	-0.032544 U	-0.002826 U
Eu-155	0.12959	0.13184 U	0.15438 U	0.17326 U	0.11447 U	0.13373 U	0.017543 U
Mn-54	0.011197 U	-0.00082239 U	0.013279 U	-0.00039577 U	0.0033338 U	-0.012043 U	0.010997 U
Nb-94	0.013167 U	0.00067993 U	-0.0067866 U	0.01097 U	0.0011359 U	-0.0017773 U	-0.00021351 U
Sb-125	0.051103 U	0.09076 U	0.064311 U	0.078908 U	0.09149	0.093855 U	0.082345 U
LTP_HTD (pCi/g)							
C-14	-0.0876 U					-0.0543 U	
Cm-243	-0.0105 U					0.0607 U	
Fe-55	0.588 U					-5.97 U	
H-3	5.17 U					2.11 U	
Ni-63	1.84 U					2.31 U	
Pu-238	0.0834 U					0.083 U	
Pu-239	0.0833 U					-0.0661 U	
Pu-241	14.9 U					1.42 U	
Sr-90	0.0264 U					0.0315 U	
Tc-99	-0.0703 U					0.0194 U	

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-09-05-016-F	OOL-09-05-017-F	OOL-09-05-018-F	OOL-09-05-019-F	OOL-09-05-020-F	OOL-10-02-017-F	OOL-10-02-019-F	OOL-10-02-020-F	OOL-11-01-003-F	OOL-11-01-005-F
LTP (pCi/g)										
Ag-108m	-0.022418 U	-0.013023 U	-0.0031744 U	-0.024854 U	-0.0030277 U	0.014825 U	-0.013529 U	0.00019549 U	-0.006218 U	0.01583 U
Am-241	0.066459 U	0.02288 U	0.19049 U	-0.097092 U	0.1402 U	0.19874 U	0.077214 U	0.0076626 U	0.2163 U	-0.0782 U
Co-60	0.016745 U	0.040576 U	-0.0028632 U	-0.00018784 U	0.0062133 U	0.017296 U	-0.0002725 U	-0.0095329 U	-0.0002049 U	0.04901 U
Cs-134	0.017328 U	0.0040817 U	0.0011162 U	0.019314 U	0.02752 U	0.00057967 U	0.0059645 U	0.030338 U	0.01724 U	0.002339 U
Cs-137	0.032223 U	0.029197 U	0.023764 U	0.022356 U	0.017463 U	0.33092	-0.004819 U	-0.00072883 U	0.4344	0.2813
Eu-152	-0.0014495 U	-0.001072 U	-0.028981 U	0.015423 U	-0.0051117 U	0.016811 U	-0.004671 U	0.014114 U	-0.001331 U	-0.005584 U
Eu-154	0.038912 U	0.017381 U	-0.0030589 U	0.012327 U	0.0093156 U	0.021478 U	0.013223 U	0.027895 U	-0.02903 U	-0.01319 U
Eu-155	-0.013422 U	0.11883 U	0.11509 U	0.069418 U	0.14265 U	-0.0013199 U	-0.049848 U	0.12825 U	0.003143 U	0.1947 U
Mn-54	-0.0075246 U	0.01279 U	-0.0014936 U	0.0040537 U	-0.00015168 U	0.0023929 U	-0.010541 U	-0.0083797 U	-0.00783 U	-0.006856 U
Nb-94	-0.0096816 U	0.008363 U	0.0011436 U	0.013148 U	0.0062502 U	0.0011994 U	0.0088244 U	0.0063609 U		-0.00001368 U
Sb-125	0.13221	0.10345 U	0.10219	0.05687 U	0.10091	0.014954 U	0.030914 U	0.12163	-0.00733 U	0.04507 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-11-01-006-F	OOL-11-01-007-F	OOL-11-01-008-F	OOL-11-01-009-F	OOL-11-01-010-F	OOL-11-01-011-F	OOL-11-01-012-F	OOL-11-01-013-F	OOL-11-01-014-F	OOL-11-01-015-F
LTP (pCi/g)										
Ag-108m	-0.01848 U	-0.0188 U	0.001721 U	0.002352 U	0.02213 U	-0.01319 U	0.003022 U	0.004757 U	0.01023 U	-0.004379 U
Am-241	0.1375 U	-0.06245 U	0.04827 U	-0.2748 U	0.139 U	0.2937 U	0.06832 U	-0.03951 U	-0.08193 U	0.009494 U
Co-60	0.07872	-0.0002878 U	0.141	-0.003266 U	0.001857 U	0.1039	0.02823 U	-0.004989 U	0.1946	-0.0009809 U
Cs-134	0.01746 U	0.01832 U	-0.01267 U	-0.001591 U	0.0001796 U	0.01053 U	0.1046 U	0.03668 U	-0.01234 U	0.004267 U
Cs-137	0.2118	-0.01046 U	0.6321	0.06599	0.09998	0.1893	0.4438	0.1339	0.3563	0.1401
Eu-152	-0.002894 U	-0.04136 U	-0.05262 U	-0.02289 U	-0.03431 U	0.04418 U	-0.004199 U	0.09625 U	0.04744 U	-0.03516 U
Eu-154	0.03209 U	0.03451 U	-0.04172 U	-0.01496 U	-0.02098 U	-0.01906 U	0.03417 U	-0.02579 U	-0.03246 U	0.05011 U
Eu-155	0.211 U	0.2528 U	-0.005456 U	0.002557 U	0.1194 U	0.09467 U	0.0422 U	0.2495 U	-0.03467 U	-0.09513 U
Mn-54	0.0005498 U	-0.0005306 U	-0.01577 U	0.02364 U	-0.009029 U	-0.002121 U	-0.0007628 U	0.02177 U	-0.01114 U	-0.001655 U
Nb-94	0.008808 U	-0.001922 U	0.01022 U	0.002907 U	-0.01264 U	-0.002729 U	-0.01282 U	-0.002554 U	0.01345 U	-0.00005811 U
Sb-125	0.08323 U	-0.0009419 U	0.09165 U	0.1458	-0.005412 U	0.1457	0.07833 U	0.102 U	-0.04382 U	0.1042 U
LTP_HTD (pCi/g)										
C-14		-0.166 U				0.126 U				
Cm-243		0.00365 U				0.0104 U				
Fe-55		0.024 U				0.043 U				
H-3		9.63				-0.267 U				
Ni-63		-0.737 U				-0.397 U				
Pu-238		0.00957 U				-0.00641 U				
Pu-239		-0.0229 U				0.0368 U				
Pu-241		1.56 U				3.21 U				
Sr-90		0.00383 U				0.0137 U				
Tc-99		0.147 U				0.0255 U				

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-11-01-016-F	OOL-11-01-017-F	OOL-11-01-018-F	OOL-11-01-019-F	OOL-11-01-020-F	OOL-11-02-001-F	OOL-11-02-001-P	OOL-11-02-002-F	OOL-11-02-002-P	OOL-11-02-003-P
LTP (pCi/g)										
Ag-108m	0.005416 U	-0.001879 U	0.01593 U	-0.005121 U	0.003261 U	0.0062885 U	-0.0041 U	0.015281 U	-0.00542 U	0.00177 U
Am-241	0.08571 U	-0.1565 U	0.1941 U	0.171 U	0.008264 U	-0.093186 U	0.0115 U	0.18994 U	-0.116 U	-0.0161 U
Co-60	0.003345 U	0.08597	0.07578	-0.001485 U	0.09474	0.029184 U	0.000177 U	-0.00030568 U	0.00601 U	0.0137 U
Cs-134	0.03083 U	0.02146 U	-0.008142 U	0.02817 U	0.02644 U	0.025476 U	0.0464 U	-0.01253 U	0.0339 U	0.0259 U
Cs-137	0.1386	1.052	0.1457	0.2405	0.2779	0.21667	0.00539 U	0.40168	0.00153 U	0.0207 U
Eu-152	0.002942 U	-0.08636 U	0.1124 U		-0.006828 U	0.0069368 U	0.016 U	-0.033629 U	0.0118 U	0.00245 U
Eu-154	0.02492 U	-0.01179 U	-0.01262 U	-0.02123 U	0.0009762 U	0.00035384 U	-0.018 U	-0.015643 U	-0.0173 U	0.00796 U
Eu-155	-0.001541 U	0.01476 U	0.004159 U	0.1356 U	0.198 U	0.0087233 U	0.0239 U	0.1136 U	0.0375 U	0.00404 U
Mn-54	0.03014 U	0.007119 U	0.01289 U	0.009077 U	-0.008691 U	-0.015021 U	0.0148 U	0.011725 U	0.0059 U	-0.00561 U
Nb-94	0.0805 U	-0.00594 U	-0.001434 U	0.006514 U	-0.006325 U	0.0089396 U	0.000804 U	0.00028129 U	0.012 U	-0.000167 U
Sb-125	-0.01971 U	0.009417 U	0.04834 U	0.06691 U	0.03482 U	0.1247 U	0.0149 U	0.090772 U	0.0152 U	-0.00487 U
LTP_HTD (pCi/g)										
C-14							-0.0951 U		0.0184 U	0.0746 U
Cm-243							-0.0702 U		0.1 U	0.239 U
Fe-55							38.4 U		9.6 U	-0.131 U
H-3							1.07 U		-0.832 U	1.56 U
Ni-63							-12.7 U		-28.7 U	-13.5 U
Pu-238							0.0557 U		-0.0116 U	0.00812 U
Pu-239							-0.0601 U		-0.0813 U	0.0151 U
Pu-241							1.53 U		-5.23 U	5.33 U
Sr-90							0.0582		0.03 U	0.0617
Tc-99							0.329 U		0.285 U	0.381 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-11-02-004-F	OOL-11-02-005-F	OOL-11-02-006-F	OOL-11-02-007-F	OOL-11-02-008-F	OOL-11-02-009-F	OOL-11-02-010-F	OOL-11-02-011-F	OOL-11-02-012-F	OOL-11-02-013-F
LTP (pCi/g)										
Ag-108m	-0.015104 U	0.0020007 U	0.0076249 U	-0.0072399 U	-0.0018662 U	0.008454 U	-0.010113 U	-0.0019921 U	0.00071258 U	-0.013849 U
Am-241	-0.048763 U	0.059406 U	0.0074594 U	0.087718 U	-0.23693 U	0.054699 U	-0.014777 U	0.013018 U	0.026884 U	-0.006489 U
Co-60	-0.0064977 U	-0.0040387 U	0.023597 U	-0.0033325 U	-0.0032173 U	0.0079587 U	-0.00017543 U	0.010235 U	-0.00099861 U	0.005987 U
Cs-134	-0.0036274 U	0.017202 U	-0.0033094 U	0.07182 U	0.018669 U		-0.015755 U	0.06943 U	0.044906	-0.0012368 U
Cs-137	0.039949 U	0.2272	0.79096	0.094277	0.061123	0.83324	0.074634	0.11593	0.089077	0.075814
Eu-152	0.036932 U	0.00022864 U	0.0049305 U	0.073454 U	-0.03592 U	-0.020467 U	0.0023664 U	-0.0013671 U	-0.046376 U	0.023665 U
Eu-154	0.013458 U	0.015807 U	-0.019557 U	-0.0045948 U	0.012285 U	-0.012218 U	-0.00040264 U	-0.032777 U	0.094888 U	0.0090769 U
Eu-155	0.12618 U	0.080744 U	0.075845 U	0.18631 U	0.00027303 U	0.15284 U		0.096965 U	0.14448 U	0.094862 U
Mn-54	0.013975 U	-0.012174 U	0.003198 U	-0.015057 U	0.010099 U	0.00089405 U	-0.00056968 U	-0.0085134 U	-0.0078255 U	-0.013982 U
Nb-94	-0.0094537 U	-0.0039576 U	-0.011861 U	0.025216 U	-0.0008467 U	0.0066059 U	-0.00018554 U	0.0074991 U	0.011442 U	-0.007084 U
Sb-125	-0.032217 U	0.096075 U	0.0031005 U	0.1223 U	0.089303 U	-0.0014521 U	0.053105 U	0.11569 U	0.14688 U	-0.0056196 U
LTP_HTD (pCi/g)										
C-14						-0.0139 U				
Cm-243						0.0139 U				
Fe-55						6.09 U				
H-3						-0.695 U				
Ni-63						-7.3 U				
Pu-238						0.019 U				
Pu-239						0.0293 U				
Pu-241						6.15 U				
Sr-90						0.0192 U				
Tc-99						0.0836 U				

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-11-02-014-F	OOL-11-02-015-F	OOL-11-02-017-F	OOL-11-02-018-F	OOL-11-02-019-F	OOL-11-02-020-F	OOL-11-02-021-F	OOL-11-02-022-F	OOL-11-02-023-F	OOL-11-02-024-F
LTP (pCi/g)										
Ag-108m	0.0066064 U	-0.000094457 U	-0.0049212 U	-0.0021261 U	0.0020471 U	0.00099506 U	-0.018671 U	0.0047189 U	0.0053459 U	0.08707 U
Am-241	-0.19418 U	-0.090942 U	0.15898 U	0.067438 U	0.15124 U	-0.0053676 U	-0.037897 U	-0.0062137 U	-0.13813 U	0.0040773 U
Co-60	0.004738 U	0.0056696 U	-0.0023263 U	-0.0039293 U	0.01745 U	0.029248 U	-0.0037502 U	0.023249 U	-0.0060299 U	0.024328 U
Cs-134	0.016412 U	0.028126 U	0.014589 U	0.00083378 U	-0.0084807 U	0.0086497 U	-0.017572 U	-0.013725 U	0.013663 U	
Cs-137	0.12192	0.54197	0.099033	0.15989	0.40176	0.12138	0.087419	0.28369	0.11179	0.19325
Eu-152	-0.0099875 U	-0.023224 U	0.017082 U	0.039651 U	-0.0058594 U	-0.021903 U	0.013561 U	0.0045988 U	0.018484 U	0.0015306 U
Eu-154	-0.011984 U	0.032612 U	-0.016785 U	-0.018183 U	0.0022869 U	0.0093603 U	0.0083883 U	-0.01885 U	0.021399 U	-0.013242 U
Eu-155	0.076049 U	0.10331 U	-0.0069888 U	0.038162 U	0.0043802 U	0.066498 U	0.083445 U	-0.013154 U	0.010768 U	0.087982 U
Mn-54	-0.0082757 U	0.00057573 U	-0.0062322 U	0.015909 U	-0.0035868 U	0.01582 U	0.0014319 U	0.017718 U	-0.00031518 U	-0.013669 U
Nb-94	0.0016855 U	-0.012009 U	-0.0058879 U	0.06643 U	-0.01177 U	0.007268 U	0.012874 U	-0.0002154 U	0.0038177 U	0.002068 U
Sb-125	-0.029616 U	0.11025 U		-0.017615 U	-0.0079049 U	-0.000065946 U	0.067507 U	0.030739 U	0.090989 U	0.035597 U
LTP_HTD (pCi/g)										
C-14			-0.125 U							
Cm-243			0.0732 U							
Fe-55			3.27 U							
H-3			-1.26 U							
Ni-63			-4.39 U							
Pu-238			-0.0364 U							
Pu-239			-0.0372 U							
Pu-241			4.61 U							
Sr-90			0.00203 U							
Tc-99			0.118 U							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Northeast
 YNPS Rowe, MA

Station	OOL-11-02-025-F	OOL-14-01-008-F	OOL-14-01-012-F
LTP (pCi/g)			
Ag-108m	0.015921 U	-0.014322 U	0.002171 U
Am-241	-0.011884 U	-0.23886 U	0.0020668 U
Co-60	0.023088 U	-0.0085774 U	0.022994 U
Cs-134	-0.014921 U	-0.00022322 U	-0.026088 U
Cs-137	0.24879	0.31958	0.13372
Eu-152	-0.0029264 U	-0.019928 U	0.0013835 U
Eu-154	-0.0046323 U	-0.014401 U	0.0088947 U
Eu-155	0.090456 U	-0.013594 U	0.0066299 U
Mn-54	0.016245 U	0.021614 U	0.010174 U
Nb-94	0.000058141 U	-0.0046541 U	-0.0023146 U
Sb-125	0.088817 U	-0.0098205 U	0.0025858 U
LTP_HTD (pCi/g)			
C-14			
Cm-243			
Fe-55			
H-3			
Ni-63			
Pu-238			
Pu-239			
Pu-241			
Sr-90			
Tc-99			

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-08-01-030-R	OOL-08-02-001-F	OOL-08-02-002-F	OOL-08-02-003-F	OOL-08-02-004-F	OOL-08-02-006-F	OOL-08-02-007-F	OOL-08-02-008-F	OOL-08-02-009-F	OOL-08-02-010-F
LTP (pCi/g)										
Ag-108m	-0.002605 U	-0.0023537 U	-0.0043342 U	-0.0021973 U	-0.025738 U	0.1125 U	-0.0011377 U	-0.0095464 U	-0.0076413 U	0.012149 U
Am-241	0.07794 U	-0.046318 U	0.10015 U	-0.20666 U	0.27246 U	0.059926 U	0.017045 U	-0.0041405 U	0.068739 U	-0.09891 U
Co-60	0.008192 U	0.0083182 U	0.012488 U	0.00043776 U	-0.0052039 U	0.020541 U	0.0027683 U	0.022906 U	-0.00025849 U	0.0086206 U
Cs-134	0.0002322 U	0.0073123 U	-0.008672 U	0.0059619 U	-0.0034001 U	-0.0034849 U	-0.012735 U	-0.0044345 U	0.026288 U	0.0021671 U
Cs-137	0.1385	0.058196	0.019237 U	0.016291 U	0.17801	1.9701	0.04872 U	0.01258 U	0.040193 U	0.89337
Eu-152	-0.001558 U	0.0023453 U	0.069465 U	0.025981 U	-0.0034794 U	0.025062 U	-0.018802 U	-0.027981 U	0.010413 U	0.020103 U
Eu-154	0.01761 U	-0.0033462 U	-0.035725 U	-0.021411 U	0.0013278 U	0.0072264 U	-0.019305 U	0.011033 U	0.0069537 U	0.0059396 U
Eu-155	0.004698 U	0.097147 U	0.020353 U	0.00080204 U	-0.019247 U	0.12881 U	0.017779 U	-0.0014826 U	0.041117 U	-0.0067113 U
Mn-54	-0.0004355 U	0.0024473 U	0.032991 U	-0.00037846 U	0.011824 U	-0.0019021 U	0.012362 U	-0.00311 U	-0.00083485 U	-0.0132 U
Nb-94	-0.01057 U	0.0025524 U	-0.011212 U	0.0034955 U	0.0058184 U	0.0090738 U	0.017302 U	0.0008813 U	-0.0092289 U	0.021122 U
Sb-125	-0.004835 U	0.058577 U	0.040102 U	0.11791 U	0.019429 U	0.0574 U	0.098891 U	0.026725 U	0.034091 U	0.043338 U
LTP_HTD (pCi/g)										
C-14							-0.0401 U			
Cm-243							0.0564 U			
Fe-55							-0.695 U			
H-3							-2.24 U			
Ni-63							4.41 U			
Pu-238							-0.00577 U			
Pu-239							0.0461 U			
Pu-241							31.6 U			
Sr-90							0.0052 U			
Tc-99							-0.0372 U			

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-08-02-014-F	OOL-08-02-015-F	OOL-08-02-016-F	OOL-08-02-019-F	OOL-08-02-020-F	OOL-08-03-018-F	OOL-08-06-001-F	OOL-08-06-002-F	OOL-08-06-003-F	OOL-08-06-007-F
LTP (pCi/g)										
Ag-108m	0.0049805 U	0.015469 U	0.012486 U	0.0080842 U	-0.010859 U	0.004829 U	-0.014714 U	0.1225 U	0.0018622 U	-0.00091106 U
Am-241	0.16883 U	-0.19375 U	0.049004 U	-0.070564 U	-0.26751 U	0.02639 U	0.12031 U	0.0080751 U	0.036946 U	-0.026105 U
Co-60	0.0026563 U	0.017651 U	0.045109 U	0.0036413 U	-0.0078353 U	0.002357 U	0.010989 U	0.015588 U	0.016813 U	0.0041842 U
Cs-134	-0.016499 U	0.0865 U	0.0019226 U	0.023415 U	0.017547 U	0.006019 U	-0.0078995 U	0.021957 U	0.017556 U	0.017744 U
Cs-137	0.17032	-0.011459 U	1.2294	0.029824 U	0.053052	0.5796	0.51329	0.55021	0.015948 U	0.066922
Eu-152	-0.046796 U	-0.064825 U	0.0186 U	-0.0047215 U	0.11355 U	-0.02704 U	0.0078685 U	0.061096 U	-0.021286 U	0.015315 U
Eu-154	0.033076 U	-0.053821 U	0.0078696 U	-0.0010423 U	0.010984 U	0.01966 U	0.005728 U	0.042899 U	0.0020262 U	0.01396 U
Eu-155	-0.01427 U	-0.01568 U	-0.002553 U	0.13759 U	0.12719 U	0.003846 U	0.16788 U	-0.0025197 U	0.10652 U	0.11493 U
Mn-54	-0.0038154 U	-0.0042088 U	0.016644 U	0.011873 U	0.013792 U	0.004929 U	0.0031141 U	0.0054406 U	-0.00076336 U	0.017843 U
Nb-94	0.014592 U	0.0052171 U	-0.012418 U	0.0028048 U	0.0086631 U	0.002106 U	0.0040629 U	-0.0034943 U	0.007536 U	-0.0049509 U
Sb-125	-0.047576 U	0.11884 U	-0.035914 U	-0.0029742 U	0.068013 U	-0.01469 U	0.050526 U	-0.026381 U	0.012962 U	0.063679 U
LTP_HTD (pCi/g)										
C-14										0.0783 U
Cm-243										0.318 U
Fe-55										-34.9 U
H-3										1.89 U
Ni-63										3.36 U
Pu-238										0.114 U
Pu-239										-0.0912 U
Pu-241										7.55 U
Sr-90										0.0628
Tc-99										-0.0572 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-10-02-001-F	OOL-10-02-002-F	OOL-10-02-003-F	OOL-10-02-004-F	OOL-10-02-005-F	OOL-10-02-006-F	OOL-10-02-007-F	OOL-10-02-008-F	OOL-10-02-009-F	OOL-10-02-010-F
LTP (pCi/g)										
Ag-108m	-0.013972 U	-0.015364 U	-0.0060549 U	-0.0016561 U	0.0022999 U	-0.012108 U	-0.012211 U	-0.02741 U	0.07157 U	-0.0058824 U
Am-241	-0.038211 U	0.00068278 U	-0.0073115 U	0.0093789 U	0.32753 U	-0.16282 U	0.013997 U	-0.054465 U	0.039774 U	-0.045918 U
Co-60	0.0085292 U	0.17981	-0.0052914 U	0.0038612 U	0.0016192 U	0.00033801 U	0.093779	0.013323 U	-0.00065071 U	-0.00074778 U
Cs-134	0.019751 U	-0.013714 U	0.016099 U	0.027387 U	0.019749 U	-0.003291 U	0.0026749 U	0.014082 U	0.028746 U	0.029958 U
Cs-137	0.0013248 U	0.082685	0.014178 U	-0.0038337 U	0.091287	0.0037673 U	0.024763 U	0.0096598 U	0.0073143 U	-0.0010378 U
Eu-152	-0.0043011 U	0.019027 U	0.078747 U	0.0023292 U	-0.0025455 U	-0.071085 U	0.015439 U	-0.035126 U	-0.049005 U	-0.019952 U
Eu-154	-0.011123 U	0.0001115 U	0.013056 U	-0.019545 U	-0.001455 U	0.00060978 U	-0.024662 U	-0.00028249 U	-0.034311 U	0.060235 U
Eu-155	0.10421 U	0.06112 U	0.014301 U	0.010503 U	-0.04851 U	0.018992 U	-0.0077839 U	0.13956 U	0.17809 U	0.12965 U
Mn-54	0.0050754 U	0.0026766 U	-0.0054099 U	-0.0099823 U	-0.0024888 U	0.0043353 U	0.0030174 U	0.021688 U	-0.00050215 U	0.0018214 U
Nb-94	0.00049229 U	-0.0017812 U	-0.0057991 U	-0.007371 U	-0.0064361 U	-0.0012146 U	-0.00022043 U	-0.0032513 U	-0.0084512 U	-0.0019019 U
Sb-125	0.083254	-0.0017859 U	0.097544 U	0.14134	0.092001 U	0.12066 U	-0.011355 U	0.078979 U	-0.044844 U	0.13877
LTP_HTD (pCi/g)										
C-14							-0.00636 U			
Cm-243							0.054 U			
Fe-55							-11.7 U			
H-3							-1.74 U			
Ni-63							-3.8 U			
Pu-238							0.0899 U			
Pu-239							-0.0398 U			
Pu-241							-15.7 U			
Sr-90							-0.0157 U			
Tc-99							0.13 U			

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-10-02-011-F	OOL-10-02-012-F	OOL-10-02-013-F	OOL-10-02-014-F	OOL-10-02-015-F	OOL-10-02-016-F	OOL-10-02-018-F	OOL-10-04-004-F	OOL-10-04-005-F	OOL-10-04-006-F
LTP (pCi/g)										
Ag-108m	0.014705 U	0.017858 U	-0.0043608 U	-0.010617 U	-0.016158 U	0.0011186 U	0.0041454 U	0.0014598 U	0.05578 U	-0.013844 U
Am-241	-0.095204 U	-0.024471 U	0.029534 U	-0.050974 U	-0.019468 U	0.023463 U	-0.0049507 U	0.0065112 U	-0.054185 U	-0.0010056 U
Co-60	0.019824 U	0.0084457 U	-0.0076762 U	0.010521 U	0.00038148 U	0.046722 U	-0.0021476 U	0.00075551 U	-0.0017685 U	-0.0028161 U
Cs-134	0.022588 U	-0.010277 U	0.029386 U	0.019882 U	0.016731 U	0.028212 U	0.03051 U	-0.014824 U	0.021223 U	0.012411 U
Cs-137	-0.0016507 U	0.01518 U	0.03972 U	-0.0054808 U	0.098209	0.00090873 U	0.036132 U	-0.0086807 U	0.06818	0.090556
Eu-152	0.026682 U	-0.023981 U	-0.028253 U	0.032081 U	0.018062 U	-0.0049978 U	-0.015675 U	0.017909 U	0.035417 U	-0.01562 U
Eu-154	-0.030849 U	0.0076757 U	-0.018851 U	-0.00033147 U	0.0068206 U	-0.016889 U	0.019897 U	-0.044806 U	-0.0073343 U	0.017089 U
Eu-155	0.0017985 U	-0.0031402 U	0.11003 U	0.16514	0.10813 U	-0.0079561 U	-0.0079404 U	-0.0030144 U	0.1382	0.090749 U
Mn-54	-0.011994 U	-0.01216 U	-0.010393 U	-0.0024482 U	-0.00065177 U	-0.0038148 U	0.0051666 U	-0.00081962 U	0.021281 U	-0.0051093 U
Nb-94	-0.0013863 U	-0.0029637 U	0.0025041 U	-0.0057011 U	0.0059388 U	-0.0085806 U	0.0093118 U	-0.0014382 U	-0.00174 U	-0.000037583 U
Sb-125	0.055716 U	0.092036 U	0.027729 U	0.092941	-0.0092541 U	0.11821 U	0.12253 U	-0.0035485 U	0.088991	0.081036
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-10-04-008-F	OOL-10-04-011-F	OOL-10-04-014-F	OOL-10-04-016-F	OOL-10-04-017-F	OOL-10-04-019-F	OOL-10-04-020-F	OOL-10-04-022-F
LTP (pCi/g)								
Ag-108m	-0.0079147 U	0.0042111 U	-0.00059499 U	0.000059672 U	0.0063751 U	0.0039299 U	-0.000043759 U	-0.015556 U
Am-241	-0.08655 U	-0.0045096 U	0.035061 U	-0.004445 U	-0.067212 U	0.018795 U	-0.034456 U	-0.061469 U
Co-60	0.015589 U	0.013062 U	0.00013378 U	-0.00016893 U	0.0087073 U	-0.00017648 U	-0.0037126 U	-0.0095309 U
Cs-134	0.020231 U	-0.017595 U	0.015617 U	-0.014575 U	0.026885 U	0.024722 U	-0.018915 U	-0.011181 U
Cs-137	-0.0095264 U	0.047166	0.0045018 U	-0.001246 U	0.00022732 U	0.011293 U	0.0040472 U	0.15617
Eu-152	0.067391 U	-0.00097616 U	-0.027437 U	0.028844 U	0.091256 U	-0.026596 U	-0.00036753 U	0.050166 U
Eu-154	-0.0011242 U	-0.020466 U	-0.0076986 U	0.021449 U	0.025343 U	-0.015811 U	0.0065528 U	-0.0038568 U
Eu-155	-0.04628 U	0.1491 U	0.13225	0.017997 U	-0.00033203 U	0.14753 U	0.12182	-0.017996 U
Mn-54	-0.00045563 U	0.00011833 U	-0.0058666 U	-0.00054506 U	-0.00056559 U	-0.0064434 U	0.011341 U	-0.00706 U
Nb-94	0.06757 U	-0.0059901 U	0.0030186 U	0.011125 U	0.0024552 U	-0.0000748 U	-0.0013919 U	0.014757 U
Sb-125	0.091092 U	0.062759 U	0.075953	0.10184	-0.019001 U	0.092288 U	0.097594	0.09657 U
LTP_HTD (pCi/g)								
C-14	-0.0112 U				-0.0054 U			
Cm-243	-0.0463 U				0.215 U			
Fe-55	1.57 U				-0.91 U			
H-3	-0.762 U				1.7 U			
Ni-63	2.79 U				1.75 U			
Pu-238	-0.0186 U				-0.00522 U			
Pu-239	0.0134 U				0.0136 U			
Pu-241	-0.495 U				-11 U			
Sr-90	0.00588 U				-0.0000841 U			
Tc-99	0.0718 U				0.181 U			

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-02-03-001-F	OOL-02-03-002-F	OOL-02-03-003-F	OOL-02-03-004-F	OOL-02-03-005-F	OOL-02-03-006-F	OOL-02-03-008-F	OOL-02-03-010-F	OOL-05-04-041-F	OOL-05-04-044-F
LTP (pCi/g)										
Ag-108m	-0.014322 U	-0.011888 U	-0.015123 U	-0.0071865 U	-0.0092181 U	0.049595	-0.0066355 U	-0.0060808 U	0.00005168 U	-0.01697 U
Am-241	0.023427 U	-0.028388 U	0.035156 U	-0.12799 U	0.0015723 U	0.029013 U	-0.21479 U	-0.059172 U	-0.002591 U	-0.1732 U
Co-60	-0.0002181 U	0.0019503 U	-0.013126 U	0.0089623 U	-0.006521 U	0.007348 U	-0.0086887 U	-0.00028924 U	-0.005981 U	-0.009709 U
Cs-134	-0.0043169 U	0.009455 U	-0.014506 U	0.018232 U	0.013579 U	0.031058	0.0093764 U	0.00782 U	-0.002771 U	-0.00683 U
Cs-137	0.030197 U	-0.0017154 U	0.014054 U	-0.015716 U	0.12021	0.3256	-0.0097655 U	0.18662	0.02397 U	0.03107 U
Eu-152	0.023096 U	0.018216 U	-0.014891 U	0.0039231 U	-0.023628 U	-0.033783 U	-0.00049821 U	0.037327 U	-0.00149 U	0.03129 U
Eu-154	0.012097 U	-0.0051527 U	-0.0016579 U	-0.000074028 U	0.016565 U	-0.00056253 U	0.01698 U	0.020151 U	-0.01741 U	0.02674 U
Eu-155	0.0095671 U	0.11133 U	0.066051 U	0.03566 U	0.080162 U	0.086001 U	0.041112 U	-0.016758 U	0.007737 U	0.06813 U
Mn-54	0.005325 U	-0.013828 U	0.011981 U	-0.00034432 U	0.010906 U	0.0018324 U	0.0031801 U	-0.0014277 U	-0.0004216 U	-0.006794 U
Nb-94	0.0058454 U	0.000048612 U	-0.0007639 U	0.010331 U	0.0026453 U	0.0043766 U	0.00010645 U	-0.0027022 U	-0.0007514 U	0.007184 U
Sb-125	0.093015 U	0.082177 U	0.083273	0.14934	0.010259 U	0.060582 U	-0.0017983 U	0.15192 U	0.02923 U	-0.02628 U
LTP_HTD (pCi/g)										
C-14				-0.0459 U			0.267 U			-0.0562 U
Cm-243				-0.0123 U			-0.0144 U			0.0283 U
Fe-55				5.04 U			-2.47 U			0.139 U
H-3				-0.345 U			1.03 U			-0.63 U
Ni-63				-0.106 U			-5.61 U			0.298 U
Pu-238				0.0216 U			0.0131 U			-0.00282 U
Pu-239				0.00756 U			-0.00604 U			-0.0135 U
Pu-241				-1.92 U			1.67 U			-3.71 U
Sr-90				0.00864 U			-0.00327 U			0.0409 U
Tc-99				0.174 U			0.124 U			0.185 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-05-04-046-F	OOL-05-04-047-F	OOL-05-08-001-F	OOL-06-01-001-F	OOL-06-01-002-F	OOL-06-01-003-F	OOL-06-01-004-F	OOL-06-01-005-F	OOL-06-01-006-F	OOL-06-01-007-F
LTP (pCi/g)										
Ag-108m	0.01516 U	-0.004126 U	-0.011069 U	0.030583 U	0.0057177 U	-0.00078908 U	0.0007025 U	0.00029836 U	0.068 U	0.05209 U
Am-241	-0.2288 U	0.04452 U	0.063895 U	0.060215 U	-0.16142 U	-0.015911 U	-0.0024981 U	-0.059048 U	0.039252 U	0.068175 U
Co-60	0.0114 U	-0.004271 U	-0.00019056 U	0.000096723 U	0.01518 U	0.017999 U	-0.0060346 U	-0.0073024 U	0.0026135 U	-0.005582 U
Cs-134	-0.004525 U	0.0863 U	-0.0092799 U	0.00025651 U	-0.0049155 U	0.026401 U	-0.014863 U	-0.017861 U	0.017572 U	-0.0077793 U
Cs-137	0.0284 U	0.2651	0.010365 U	0.84847	0.65057	0.014361 U	0.40544	0.84417	1.0434	0.78272
Eu-152	0.002675 U	-0.0507 U	-0.038842 U	-0.01174 U	0.0038142 U	0.014548 U	0.03616 U	-0.00051531 U	0.016699 U	-0.0018774 U
Eu-154	-0.001877 U	0.0007483 U	0.006165 U	-0.020828 U	0.0044857 U	-0.037887 U	0.013224 U	0.013749 U	0.0078899 U	-0.013512 U
Eu-155	0.01085 U	-0.06513 U	0.10132 U	0.074659 U	-0.0045547 U	0.0034743 U	-0.00029905 U	-0.020382 U	0.028668 U	-0.054787 U
Mn-54	0.01469 U	-0.009462 U	-0.0073882 U	-0.0007682 U	-0.0062999 U	-0.011608 U	0.0083537 U	-0.010156 U	0.0013616 U	-0.0079133 U
Nb-94	-0.008713 U	-0.004529 U	-0.00025248 U	-0.0045928 U	-0.006251 U	0.013088 U	-0.00015648 U	0.012697 U	0.06548 U	-0.0054553 U
Sb-125	0.01102 U	0.06077 U	0.063823 U	-0.015026 U	-0.014973 U	0.007528 U	-0.029706 U	0.0077019 U	0.00028627 U	-0.046762 U
LTP_HTD (pCi/g)										
C-14										0.139 U
Cm-243										-0.0203 U
Fe-55										-7.04 U
H-3										-2.84 U
Ni-63										0.484 U
Pu-238										0.00113 U
Pu-239										0.128 U
Pu-241										7.38 U
Sr-90										0.0924
Tc-99										0.438

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-06-01-008-F	OOL-06-01-009-F	OOL-06-01-010-F	OOL-06-01-011-F	OOL-06-02-001-F	OOL-06-02-002-F	OOL-06-02-003-F	OOL-06-02-004-F	OOL-06-02-005-F	OOL-06-02-006-F
LTP (pCi/g)										
Ag-108m	-0.0089776 U	0.007836 U	-0.0085969 U	0.03243 U	0.0054587 U	0.0030937 U	0.011007 U	0.0020993 U	0.00031606 U	0.022126 U
Am-241	0.20769 U	-0.033274 U	-0.0040101 U	0.079881 U	-0.072629 U	-0.028906 U	-0.021749 U	0.02718 U	-0.0012098 U	0.011235 U
Co-60	0.0086529 U	0.017937 U	-0.007387 U	-0.00052778 U	0.035203 U	-0.0074564 U	-0.00026952 U	0.0095782 U	-0.0032292 U	-0.00081924 U
Cs-134	0.017192 U	-0.0048591 U	0.0033139 U	-0.000011888 U	-0.010518 U	-0.0031393 U	-0.0056077 U	-0.010351 U	-0.0084584 U	-0.014907 U
Cs-137	0.065962	0.71927	0.48597	0.23517	0.4575	0.61398	0.29055	0.018948 U	0.086698	0.65329
Eu-152	0.01847 U	0.019507 U	-0.0059783 U	0.024339 U	-0.021695 U	-0.0044733 U	-0.03782 U	0.09937 U	0.0069327 U	0.00068522 U
Eu-154	0.025086 U	0.0039607 U	-0.014685 U	0.017897 U	0.029787 U	0.027996 U	-0.00042402 U	-0.00096561 U	-0.021215 U	-0.0060718 U
Eu-155	0.16927 U	0.083692 U	0.12676 U	0.11128 U	-0.029014 U	0.053514 U	0.10933 U	0.12586 U	0.046653 U	0.076319 U
Mn-54	0.017759 U	0.0072416 U	0.0012116 U	-0.00097652 U	-0.0083418 U	-0.0075455 U	0.011291 U	0.0019513 U	0.012533 U	-0.00194 U
Nb-94	0.0097502 U	-0.0036519 U	-0.0038639 U	0.0024054 U	-0.0099427 U	0.0056773 U	0.0030225 U	-0.0030333 U	-0.000089462 U	-0.01213 U
Sb-125	0.02175 U	0.0022309 U	0.022029 U	-0.023141 U	0.0074963 U	-0.019734 U	-0.039368 U	0.07303 U	0.034042 U	0.0087121 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-06-02-007-F	OOL-06-02-008-F	OOL-06-02-009-F	OOL-06-02-010-F	OOL-06-02-011-F	OOL-06-02-012-F	OOL-06-02-013-F	OOL-06-02-014-F	OOL-06-02-015-F	OOL-06-02-016-F
LTP (pCi/g)										
Ag-108m	0.0076081 U	-0.007015 U	0.0041782 U	-0.0067701 U	-0.00063692 U	0.0025164 U	0.0032633 U	0.001482 U	0.0052595 U	0.011662 U
Am-241	0.12518 U	0.0064522 U	-0.073514 U	-0.096407 U	0.0063192 U	-0.031697 U	-0.043418 U	-0.020171 U	0.11508 U	-0.019804 U
Co-60	0.030318 U	0.001154 U	0.00062924 U	0.0071166 U	-0.006085 U	-0.00037528 U	0.021044 U	-0.00021847 U	-0.0084834 U	0.0040303 U
Cs-134	-0.0021386 U	-0.01702 U	-0.0088009 U	-0.011876 U	-0.00023282 U	-0.0028894 U	-0.0062876 U	0.024461 U	0.01696 U	-0.0088935 U
Cs-137	0.79754	0.012784 U	0.0048285 U	0.056367	0.068502	0.047578	0.2735	0.099897	0.1997	0.12976
Eu-152	-0.035437 U	0.034033 U	0.0022897 U	-0.012453 U	0.017439 U	-0.01812 U	-0.012969 U	0.015225 U	0.1252 U	-0.015631 U
Eu-154	-0.0021884 U	-0.0060783 U	0.01211 U	0.009375 U	0.01007 U	-0.006856 U	0.017807 U	-0.0027185 U	-0.016011 U	0.023114 U
Eu-155	0.0074164 U	0.03084 U	0.10888 U	0.090962 U	0.056272 U	-0.0064607 U	-0.017344 U	0.0095291 U	0.18985 U	-0.091957 U
Mn-54	0.028022 U	0.0021326 U	0.0071445 U	0.0087973 U	0.0045097 U	-0.0085911 U	-0.004986 U	0.029664 U	0.024924 U	-0.00042642 U
Nb-94	0.0026327 U	0.0039858 U	0.0039327 U	-0.0033991 U	0.00031034 U	0.0026636 U	-0.0059439 U	0.0036288 U	0.0017844 U	-0.01925 U
Sb-125	-0.023076 U	-0.0003912 U	0.013183 U	-0.0037978 U	0.038318 U	-0.0073675 U	0.0044811 U	-0.0073288 U	0.11131 U	0.029357 U
LTP_HTD (pCi/g)										
C-14	0.0797 U									
Cm-243	0.0924 U									
Fe-55	-9.08 U									
H-3	-0.68 U									
Ni-63	-8.32 U									
Pu-238	0.0223 U									
Pu-239	-0.0686 U									
Pu-241	126									
Sr-90	-0.00472 U									
Tc-99	0.953									

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-06-02-017-F	OOL-06-02-018-F	OOL-06-02-019-F	OOL-06-02-020-F	OOL-06-02-021-F	OOL-06-02-023-F	OOL-06-02-024-F	OOL-06-02-025-F	OOL-06-03-001-F	OOL-06-03-002-F
LTP (pCi/g)										
Ag-108m	-0.019194 U	-0.0022862 U	-0.028905 U	-0.00091475 U	-0.0067594 U	0.0016356 U	0.0017594 U	0.0034936 U	-0.010126 U	-0.0095944 U
Am-241	0.018799 U	-0.080357 U	-0.044147 U	0.16818 U	-0.0038523 U	-0.044202 U	0.061048 U	-0.0021028 U	0.18012 U	-0.0030572 U
Co-60	0.080608	0.009269 U	0.013883 U	0.0044722 U	-0.00020828 U	0.0066096 U	0.020272 U	-0.0053782 U	-0.0048895 U	0.016784 U
Cs-134	0.014217 U	-0.0097232 U	0.026333 U	0.01528 U	0.030294 U	-0.041631 U	-0.017192 U	-0.023636 U	0.012453 U	-0.0062263 U
Cs-137	0.50387	0.0018553 U	0.029641 U	0.031065 U	0.0436 U	0.08725	0.034737 U	-0.0086892 U	0.029335 U	0.0019516 U
Eu-152	-0.021657 U	-0.024063 U	-0.038591 U	-0.015095 U	-0.014988 U	0.026118 U	-0.020587 U	0.027223 U	0.045472 U	0.023794 U
Eu-154	-0.018856 U	0.012027 U	-0.0039918 U	0.033684 U	0.015905 U	0.0036297 U	-0.01181 U	-0.013311 U	0.019403 U	-0.0033779 U
Eu-155	0.12173 U	-0.01578 U	0.002443 U	0.11955 U	0.11345 U	0.10384 U	-0.009851 U	R	-0.0043991 U	0.00033846 U
Mn-54	0.018205 U	-0.0052503 U	-0.0037226 U	0.015975 U	-0.016923 U	0.0078403 U	-0.012061 U	0.007176 U	-0.0075438 U	-0.00062024 U
Nb-94	0.018835 U	0.0048628 U	0.0041144 U	0.0032568 U	0.020343 U	0.0049763 U	0.014709 U	-0.0036928 U	0.0012932 U	0.012 U
Sb-125	0.092364 U	-0.0039256 U	0.10463 U	0.07238 U	0.1465 U	R	0.11314 U	R	0.047843 U	0.053813 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-06-03-003-F	OOL-06-03-004-F	OOL-06-03-005-F	OOL-06-03-006-F	OOL-06-03-007-F	OOL-06-03-008-F	OOL-06-03-009-F	OOL-06-03-010-F	OOL-06-03-011-F	OOL-06-03-012-F
LTP (pCi/g)										
Ag-108m	0.06165 U	0.014976 U	0.06139 U	0.0005998 U	-0.0061611 U	0.00035337 U	-0.010115 U	-0.013561 U	-0.030003 U	0.0016815 U
Am-241	0.02584 U	-0.018942 U	-0.067185 U	-0.1075 U	-0.118 U	0.039172 U	0.013739 U	0.083654 U	0.046998 U	-0.25518 U
Co-60	0.0086117 U	-0.0019346 U	0.0041077 U	-0.0030532 U	-0.0030045 U	0.012701 U	0.0004648 U	0.011098 U	0.000014233 U	-0.0014963 U
Cs-134	-0.0086982 U	-0.002774 U	-0.0023255 U	-0.0026391 U	0.013219 U	-0.016868 U	-0.011401 U	-0.00071032 U	0.0028306 U	0.0099854 U
Cs-137	-0.0017032 U	0.0077037 U	-0.0080824 U	0.0074669 U	0.0033985 U	-0.011257 U	0.00011847 U	0.013755 U	0.01084 U	0.0083736 U
Eu-152	-0.032136 U	0.0029588 U	0.020343 U	0.068106 U	0.093473 U	0.0096109 U	-0.024679 U	0.033738 U	0.11103 U	0.057662 U
Eu-154	-0.0052575 U	-0.019817 U	-0.001566 U	0.020986 U	-0.00080204 U	0.0037797 U	-0.018912 U	0.020285 U	0.00022666 U	-0.014555 U
Eu-155	0.041637 U	0.087515 U	0.013922 U	0.057903 U	0.1165 U	0.042305 U	-0.023571 U	-0.011056 U	0.072527 U	0.17762 U
Mn-54	-0.00035987 U	0.00045406 U	0.011897 U	0.0067693 U	0.0066725 U	0.022372 U	-0.00041775 U	0.0070524 U	0.011047 U	-0.0094125 U
Nb-94	0.0036242 U	0.0067414 U	0.0027605 U	0.009317 U	0.0080627 U	-0.0097187 U	-0.0073352 U	0.0093632 U	-0.0041126 U	-0.0078621 U
Sb-125	-0.0012727 U	0.051331 U	0.030199 U	0.073445 U	0.05156 U	0.0012005 U	0.00099056 U	-0.0018072 U	R	0.09442
LTP_HTD (pCi/g)										
C-14			-0.0645 U							
Cm-243			-0.00699 U							
Fe-55			11.4 U							
H-3			4.46 U							
Ni-63			-1.31 U							
Pu-238			0.0546 U							
Pu-239			0.0354 U							
Pu-241			1.23 U							
Sr-90			-0.0063 U							
Tc-99			0.247 U							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-06-03-013-F	OOL-06-03-014-F	OOL-06-03-015-F	OOL-06-03-016-F	OOL-06-03-017-F	OOL-06-03-018-F	OOL-07-02-001-F	OOL-07-02-001-P	OOL-07-02-002-F	OOL-07-02-002-P
LTP (pCi/g)										
Ag-108m	0.0018586 U	-0.01329 U	-0.01306 U	0.0103 U	0.000325 U	-0.0012 U	0.0091891 U	-0.000439 U	-0.01892 U	-0.00551 U
Am-241	0.018677 U	-0.0044488 U	-0.010138 U	-0.0189 U	0.0000194 U	0.0221 U	-0.017896 U	-0.0384 U	-0.16699 U	0.0219 U
Co-60	0.00078786 U	0.025384 U	-0.0031564 U	0.00217 U	-0.00214 U	0.00039 U	-0.0039379 U	-0.00549 U	-0.0029487 U	-0.0159 U
Cs-134	-0.0013355 U	0.012143 U	0.0034903 U	0.0251 U	0.0213 U	0.0128 U	0.01996 U	0.0352 U	0.023859 U	0.0357 U
Cs-137	0.028464 U	-0.0012442 U	0.0048394 U	0.0249 U	-0.0042 U	0.0092 U	-0.0021965 U	0.00451 U	-0.0058134 U	-0.00123 U
Eu-152	-0.0013146 U	0.010319 U	0.02691 U	-0.0089 U	-0.013 U	-0.0197 U	-0.018227 U	-0.00619 U	0.03681 U	0.0408 U
Eu-154	-0.0091935 U	0.000001064 U	-0.038942 U	0.0384 U	0.00396 U	0.00411 U	-0.0092889 U	0.0155 U	-0.0095158 U	0.00203 U
Eu-155	0.15244 U	0.089002 U	0.045404 U	0.014 U	0.0286 U	0.0705 U	0.13084 U	0.029 U	-0.017937 U	0.0214 U
Mn-54	-0.0059134 U	0.014975 U	-0.0002913 U	0.0099 U	-0.00281 U	0.012 U	-0.00027032 U	0.0106 U	-0.0038718 U	0.0229 U
Nb-94	-0.0067714 U	-0.0089563 U	0.00084336 U	-0.00283 U	0.00392 U	-0.00379 U	-0.008084 U	0.0123 U	0.03718 U	0.0103 U
Sb-125	0.10248 U	R	0.0080935 U	-0.00979 U	0.00298 U	0.00555 U	0.085502 U	0.021 U	0.098177 U	-0.00878 U
LTP_HTD (pCi/g)										
C-14								-0.0921 U		-0.0033 U
Cm-243								-0.126 U		0.106 U
Fe-55								21.7 U		-84 U
H-3								2.59 U		-0.841 U
Ni-63								-14.3 U		-16.9 U
Pu-238								-0.0224 U		-0.0146 U
Pu-239								-0.119 U		0.114 U
Pu-241								-3.17 U		-1.43 U
Sr-90								-0.00126 U		0.031 U
Tc-99								0.13 U		0.167 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-07-02-003-F	OOL-07-02-004-F	OOL-07-02-005-F	OOL-07-02-006-F	OOL-07-02-007-F	OOL-07-02-008-F	OOL-07-02-009-F	OOL-07-02-010-F	OOL-07-02-011-F	OOL-07-02-012-F
LTP (pCi/g)										
Ag-108m	0.0019161 U	-0.012682 U	0.029412 U	0.0040487 U	-0.019738 U	-0.014067 U	-0.0091758 U	-0.0052568 U	-0.010634 U	-0.0042086 U
Am-241	0.09741 U	0.037639 U	-0.070759 U	-0.011585 U	-0.0068793 U	-0.03977 U	-0.07449 U	0.090839 U	0.068603 U	0.0020681 U
Co-60	0.015496 U	0.0015861 U	0.006827 U	-0.0017951 U	-0.00010735 U	-0.0035428 U	0.01055 U	-0.0030064 U	-0.00035877 U	-0.00029066 U
Cs-134	-0.017826 U	-0.015373 U	-0.0030237 U	0.021939 U	0.015096 U	0.00049251 U	0.011363 U	0.0094955 U	-0.0063053 U	0.022082 U
Cs-137	0.059043	0.092776	0.044074 U	0.024572 U	0.019188 U	0.013765 U	0.02343 U	0.011174 U	0.00028769 U	0.015905 U
Eu-152	-0.028741 U	-0.018452 U	0.10725 U	0.013006 U	-0.0080746 U	0.075824 U	0.043816 U	0.00026441 U	-0.027973 U	-0.0031749 U
Eu-154	0.0044064 U	0.007641 U	0.021632 U	-0.0088686 U	-0.0071891 U	-0.025207 U	0.0033486 U	-0.013815 U	-0.0099759 U	-0.0023119 U
Eu-155	0.059257 U	-0.0012994 U	0.16194 U	0.1244 U	0.11847 U	0.051426 U	0.074088 U	-0.0077131 U	0.012396 U	0.0085355 U
Mn-54	-0.0012886 U	0.0087127 U	0.012263 U	-0.00025979 U	0.00046751 U	0.023052 U	0.0058085 U	-0.0062948 U	-0.013235 U	-0.0021962 U
Nb-94	-0.00070228 U	0.0019286 U	0.01184 U	0.0018871 U	-0.0039403 U	0.0095226 U	2.8611E-06 U	-0.0019711 U	0.0075749 U	-0.0086055 U
Sb-125	0.066694 U	-0.0039761 U	0.072398 U	0.065507 U	0.064874 U	0.17313	0.025702 U	0.015987 U	0.12408	0.1135
LTP_HTD (pCi/g)										
C-14										-0.0931 U
Cm-243										-0.00787 U
Fe-55										-3.06 U
H-3										1.15 U
Ni-63										-3.35 U
Pu-238										-0.00755 U
Pu-239										-0.0453 U
Pu-241										-0.899 U
Sr-90										0.0107 U
Tc-99										0.0918 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-07-02-013-F	OOL-07-02-014-F	OOL-07-02-015-F	OOL-07-02-016-F	OOL-07-02-017-F	OOL-07-02-018-F	OOL-07-02-019-F	OOL-07-02-020-F	OOL-07-03-001-F	OOL-07-03-002-F
LTP (pCi/g)										
Ag-108m	-0.012388 U	0.0013818 U	0.0011782 U	-0.0018415 U	-0.012566 U	-0.014505 U	-0.013423 U	-0.0052364 U	0.010501 U	0.0082007 U
Am-241	-0.0033797 U	-0.00049131 U	-0.034895 U	-0.068053 U	-0.0042277 U	0.031792 U	0.11717 U	-0.058215 U	0.23894 U	0.070203 U
Co-60	-0.00018873 U	0.006803 U	0.00055978 U	0.0054467 U	0.0030974 U	0.00053132 U	-0.0002257 U	-0.0025098 U	0.024213 U	0.081322
Cs-134	-0.033282 U	0.01909 U	0.0096781 U	0.027455 U	0.014644 U	-0.0094872 U	0.012425 U	0.010582 U	0.037128 U	-0.037003 U
Cs-137	0.019856 U	0.015153 U	0.017501 U	-0.001766 U	0.10965	0.019217 U	0.002471 U	-0.0043323 U	0.097353	0.14105
Eu-152	0.030583 U	-0.028032 U	0.014633 U	-0.031666 U	0.0010052 U	-0.066733 U	-0.016561 U	0.029326 U	0.013091 U	-0.009733 U
Eu-154	0.027252 U	0.0069275 U	-0.02785 U	0.02438 U	0.014954 U	0.02216 U	0.0025727 U	-0.024943 U	0.0022641 U	0.012878 U
Eu-155	0.0082787 U	0.12521 U	-0.0068572 U	-0.0011587 U	0.016937 U	0.10735 U	0.078948 U	0.099524 U	-0.0021313 U	0.018843 U
Mn-54	0.012537 U	-0.0016326 U	0.01898 U	-0.0075003 U	-0.011095 U	-0.001258 U	0.022066 U	-0.0064578 U	-0.00037061 U	-0.0060256 U
Nb-94	0.00028384 U	0.0082275 U	0.024028 U	0.0038102 U	0.00068778 U	0.0027508 U	0.01614 U	0.008573 U	0.014713 U	0.0058043 U
Sb-125	0.092749 U	0.07257 U	0.12249 U	0.15669	0.095751 U	0.00078326 U	0.10304 U	0.0061686 U	0.087477 U	-0.0058097 U
LTP_HTD (pCi/g)										
C-14			-0.0886 U							
Cm-243			0.0294 U							
Fe-55			0.158 U							
H-3			-1.27 U							
Ni-63			-2.01 U							
Pu-238			-0.0134 U							
Pu-239			0.0213 U							
Pu-241			6.39 U							
Sr-90			0.00844 U							
Tc-99			0.135 U							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-07-03-003-F	OOL-07-03-004-F	OOL-07-03-005-F	OOL-07-03-006-F	OOL-07-03-007-F	OOL-07-03-008-F	OOL-07-03-009-F	OOL-07-03-010-F	OOL-07-03-011-F	OOL-07-03-012-F
LTP (pCi/g)										
Ag-108m	-0.020756 U	0.010179 U	-0.025952 U	-0.0053098 U	-0.00096891 U	0.0027 U	-0.013662 U	0.0034488 U	-0.0024834 U	-0.022701 U
Am-241	-0.047842 U	0.12831 U	0.03103 U	-0.025363 U	-0.31362 U	-0.15087 U	-0.12066 U	0.010147 U	-0.1301 U	-0.084396 U
Co-60	-0.0041224 U	-0.0058408 U	-0.0033551 U	-0.0037126 U	0.013085 U	0.0021925 U	0.016944 U	-0.004178 U	-0.00027024 U	0.0068736 U
Cs-134	0.020706 U	0.016943 U	0.012421 U	0.014302 U	-0.0026197 U	0.020962 U	-0.019326 U	0.019333 U	0.029264 U	0.014822 U
Cs-137	0.060448	0.04254	0.037823	-0.0044982 U	0.018793 U	0.019331 U	0.1111	0.017538 U	-0.011882 U	0.034739 U
Eu-152	-0.013454 U	0.025122 U	0.023926 U	-0.0023213 U	0.0022216 U	0.032844 U	0.00045988 U	-0.015075 U	-0.061201 U	0.020847 U
Eu-154	0.011753 U	0.019005 U	0.020045 U	-0.002975 U	0.019152 U	0.010027 U	0.0062923 U	-0.0011442 U	-0.014609 U	-0.012519 U
Eu-155	0.086296 U	0.098281 U	0.089356 U	0.1222 U	0.0019024 U	-0.062707 U	-0.0090376 U	0.093617 U	0.1309 U	0.082368 U
Mn-54	0.00057021 U	-0.0063526 U	0.0090238 U	-0.011025 U	0.011499 U	0.0069338 U	-0.0019466 U	-0.0074783 U	-0.015491 U	-0.011009 U
Nb-94	-0.00010136 U	-0.0013234 U	-0.0065389 U	0.04658 U	-0.000097757 U	0.0073287 U	0.016097 U	0.0071411 U	-0.0034798 U	-0.014432 U
Sb-125	0.071587 U	-0.025621 U	0.05328 U	-0.00016102 U	0.094971	0.031458 U		0.10285	0.18957	0.081485 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-07-03-013-F	OOL-07-03-014-F	OOL-07-03-015-F	OOL-07-03-016-F	OOL-07-03-017-F	OOL-07-03-018-F	OOL-07-03-019-F	OOL-07-03-020-F	OOL-08-01-002-F	OOL-08-01-003-F
LTP (pCi/g)										
Ag-108m	-0.0084928 U	-0.0046312 U	0.0061026 U	0.000043301 U	0.0038222 U	-0.016188 U	0.001062 U	0.04382	-0.008709 U	-0.000009184 U
Am-241	0.037639 U	0.12784 U	0.0071833 U	-0.066753 U	0.16273 U	-0.013956 U	-0.28353 U	0.0054109 U	-0.042 U	-0.05943 U
Co-60	-0.0035344 U	-0.0029446 U	-0.0046058 U	0.0095909 U	-0.0012227 U	-0.0036114 U	0.0035126 U	-0.0026549 U	0.01442 U	-0.008047 U
Cs-134	0.011371 U	0.032213 U	0.016876 U	-0.044389 U	0.019582 U	0.0084356 U	0.022697 U	-0.018973 U	-0.007218 U	-0.004058 U
Cs-137	0.013039 U	0.034705 U	0.052952	0.065706	0.0088719 U	0.060693	-0.0018467 U	0.03419	0.6181	0.3331
Eu-152	-0.028021 U	0.00044705 U	0.0042689 U	-0.001366 U	-0.0022976 U	-0.0088316 U	0.079917 U	0.0019315 U	0.01632 U	-0.008579 U
Eu-154	-0.019222 U	-0.0056557 U	-0.019974 U	0.0035665 U	-0.0073495 U	-0.000070777 U	0.0019222 U	-0.0010281 U	-0.0005338 U	-0.01758 U
Eu-155	0.11098 U	0.25487 U	0.1063 U	0.068192 U	0.086429 U	0.11541 U	0.11236 U	0.087652 U	0.002121 U	-0.0004244 U
Mn-54	0.0063198 U	-0.0050755 U	0.0045057 U	-0.00023686 U	0.015399 U	0.013629 U	0.0020828 U	-0.0039529 U	-0.004034 U	0.0001471 U
Nb-94	-0.00069749 U	0.011811 U	0.0026389 U	0.0021306 U	0.00050835 U	-0.00012038 U	-0.00081279 U	0.0067121 U	0.006155 U	-0.00742 U
Sb-125	0.072742		0.062545 U	0.069688 U	0.075264 U	0.065545 U	0.056442 U	0.064167 U	-0.0213 U	-0.03239 U
LTP_HTD (pCi/g)										
C-14		-0.108 U				-0.0735 U				0.479 U
Cm-243		0.0929 U				-0.00841 U				-0.0204 U
Fe-55		-5.7 U				-1.88 U				-0.238 U
H-3		1.75 U				0.947 U				
Ni-63		-2.95 U				-2.1 U				-0.0612 U
Pu-238		-0.0203 U				0.0321 U				-0.00623 U
Pu-239		-0.158 U				0.0642 U				0.0394 U
Pu-241		5.92 U				-0.232 U				2.73 U
Sr-90		-0.000622 U				0.00348 U				0.034 U
Tc-99		0.0868 U				0.0955 U				-0.319 U

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-08-01-004-F	OOL-08-01-005-F	OOL-08-01-007-F	OOL-08-01-008-F	OOL-08-01-009-F	OOL-08-01-010-F	OOL-08-01-011-F	OOL-08-01-012-F	OOL-08-01-013-F	OOL-08-01-014-F
LTP (pCi/g)										
Ag-108m	-0.01569 U	-0.01241 U	-0.003602 U	-0.001099 U	0.0008252 U	-0.02086 U	-0.01954 U	-0.0002649 U	-0.01167 U	-0.0004164 U
Am-241	0.0545 U	-0.01135 U	0.122 U	0.08015 U	-0.009844 U	0.04536 U	0.1237 U	-0.001136 U	0.1062 U	-0.001045 U
Co-60	-0.003814 U	-0.003435 U	-0.003382 U	0.008896 U	0.003211 U	0.003668 U	-0.03728 U	0.00325 U	-0.02074 U	-0.01705 U
Cs-134	-0.03275 U	0.0008968 U	0.01024 U	0.0819 U	-0.02826 U	-0.002118 U	0.1215 U	-0.003781 U	0.02256 U	-0.01678 U
Cs-137	0.02659 U	0.433	1.044	0.3138	0.4182	0.9575	0.2552	0.219	0.1376	0.2202
Eu-152	-0.04219 U	-0.01255 U	-0.03327 U	-0.002757 U	-0.004486 U	-0.03222 U	0.002105 U	-0.001454 U	-0.01183 U	0.02991 U
Eu-154	0.01769 U	-0.01973 U	0.01626 U	0.01927 U	0.1168 U	0.004718 U	0.0182 U	-0.01408 U	-0.007495 U	0.02397 U
Eu-155	0.04716 U	0.08002 U	0.09144 U	0.03018 U	0.01024 U	0.1991 U	0.008926 U	0.08122 U	0.08242 U	0.09154 U
Mn-54	0.006272 U	-0.01011 U	-0.0003138 U	-0.002163 U	-0.002295 U	0.001572 U	0.01324 U	-0.0001407 U	0.01625 U	-0.008009 U
Nb-94	0.008906 U	-0.007363 U	0.0001772 U	0.06807 U	0.001572 U	-0.002861 U	-0.0002223 U	0.00008857 U	0.003748 U	0.006622 U
Sb-125	0.1463 U	0.1234	-0.03212 U	-0.0313 U	0.03995 U	-0.008051 U	-0.0001828 U	0.0002383 U	0.03391 U	0.01057 U
LTP_HTD (pCi/g)										
C-14				-0.0914 U						
Cm-243				-0.00564 U						
Fe-55				-2.9 U						
H-3										
Ni-63				0.122 U						
Pu-238				-0.00684 U						
Pu-239				0.0216 U						
Pu-241				-2.8 U						
Sr-90				0.116 U						
Tc-99				-0.347 U						

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Southwest
 YNPS Rowe, MA

Station	OOL-08-01-015-F	OOL-08-01-016-F	OOL-08-01-020-F	OOL-08-01-026-R	OOL-08-01-027-R	OOL-08-01-028-R	OOL-08-01-029-R
LTP (pCi/g)							
Ag-108m	-0.007706 U	0.0005028 U	-0.01412 U	-0.01204 U	-0.02066 U	-0.00334 U	-0.01225 U
Am-241	0.005773 U	-0.02493 U	0.1438 U	-0.03285 U	-0.1205 U	-0.07197 U	0.06965 U
Co-60	-0.005674 U	0.0001721 U	-0.001417 U	0.05796 U	0.07681 U	-0.007354 U	0.001123 U
Cs-134	-0.006487 U	0.004871 U	0.0083 U	-0.04571 U	-0.0003382 U	-0.0004046 U	0.00228 U
Cs-137	0.6036	0.2038	0.4134	0.6818	1.411	0.4709	0.7981
Eu-152	-0.03309 U	0.0635 U	0.002009 U	-0.01909 U	-0.01395 U	0.01086 U	-0.02338 U
Eu-154	-0.001607 U	-0.03291 U	-0.001456 U	-0.02447 U	-0.0002664 U	0.01764 U	0.02632 U
Eu-155	0.06076 U	0.001601 U	-0.006015 U	0.01021 U	0.03306 U	0.09392 U	0.02428 U
Mn-54	0.01465 U	0.06163 U	-0.000551 U	-0.00003233 U	0.01416 U	-0.008624 U	-0.001179 U
Nb-94	0.01151 U	-0.00795 U	-0.004477 U	-0.0006868 U	-0.005021 U	0.009128 U	0.05706 U
Sb-125	0.1794 U	-0.01318 U	0.0477 U	0.0277 U	0.07596 U	0.1983 U	-0.05109 U
LTP_HTD (pCi/g)							
C-14							
Cm-243							
Fe-55							
H-3							
Ni-63							
Pu-238							
Pu-239							
Pu-241							
Sr-90							
Tc-99							

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-16-01-001-F	OOL-16-01-002-F	OOL-16-01-003-F	OOL-16-01-004-F	OOL-16-01-005-F	OOL-16-01-006-F	OOL-16-01-007-F	OOL-16-01-008-F	OOL-16-01-009-F	OOL-16-01-010-F
gamma-spec (pCi/g)										
Ag-108m	0.0071679 U	0.0633 U	-0.0053252 U	-0.016871 U	-0.011174 U	-0.012421 U	-0.006633 U	0.002284 U	-0.011835 U	-0.012839 U
Am-241	-0.0015447 U	0.00094597 U	-0.14243 U	-0.069009 U	-0.096163 U	-0.043943 U	0.0003722 U	0.047719 U	-0.079778 U	0.035223 U
Co-60	0.025311 U	-0.00021974 U	0.0022354 U	0.0036235 U	-0.0033006 U	0.0075642 U	0.0096693 U	0.0097604 U	-0.0081374 U	-0.0029116 U
Cs-134	-0.0070142 U	0.020364 U	0.01177 U	0.015729 U	-0.005014 U	-0.017241 U	-0.0039466 U	-0.006684 U	0.017594 U	0.0062468 U
Cs-137	0.026621 U	0.063286	0.022607 U	0.016783 U	0.006966 U	-0.004661 U	-0.0031053 U	0.005011 U	-0.00054143 U	0.004202 U
Eu-152	0.030145 U	0.055274 U	0.11607 U	0.071786 U	-0.020306 U	0.0013744 U	-0.019315 U	-0.00053905 U	0.03888 U	-0.012791 U
Eu-154	-0.0013683 U	0.047444 U	-0.0072994 U	-0.00080326 U	-0.013167 U	-0.0047839 U	-0.00060078 U	-0.007521 U	0.0012519 U	-0.0084305 U
Eu-155	-0.012725 U	0.12341 U	0.11238 U	0.14679	-0.068291 U	0.083901 U	0.02402 U	0.090669 U	0.085471 U	-0.0048293 U
Mn-54	-0.010562 U	-0.0048921 U	0.011681 U	-0.00044568 U	-0.00027151 U	-0.0078665 U	-0.00057045 U	-0.0021014 U	0.0038926 U	-0.001806 U
Nb-94	0.0070085 U	-0.0060726 U	0.0030594 U	-0.0012981 U	-0.0041052 U	-0.0029111 U	0.0045853 U	0.0038955 U	0.00009486 U	0.00018691 U
Sb-125	0.05866 U	-0.0070061 U	0.063451 U	0.054711 U	0.050477 U	0.073194 U	0.040361 U	0.08534 U	0.058262 U	0.065155 U
Hard to detect (pCi/g)										
C-14								-0.046 U		
Cm-243								0.0951 U		
Fe-55								9.35 U		
H-3								1.35 U		
Ni-63								-1.35 U		
Pu-238								0.0919 U		
Pu-239								-0.0312 U		
Pu-241								-7.37 U		
Sr-90								-0.00364 U		
Tc-99								0.0331 U		

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-16-01-011-F	OOL-16-01-012-F	OOL-16-01-013-F	OOL-16-01-014-F	OOL-16-01-015-F	OOL-16-01-016-F	OOL-16-01-017-F	OOL-16-01-018-F	OOL-16-01-019-F	OOL-16-01-020-F
gamma-spec (pCi/g)										
Ag-108m	0.0020571 U	0.0050094 U	-0.012956 U	-0.015595 U	-0.00055867 U	-0.0092533 U	0.0029582 U	0.0064105 U	-0.0020409 U	-0.014457 U
Am-241	-0.15537 U	-0.012804 U	0.00085887 U	0.010033 U	-0.058125 U	0.26601 U	0.0022062 U	0.021113 U	0.15351 U	0.053559 U
Co-60	-0.010362 U	-0.0002209 U	-0.0025082 U	-0.00016677 U	0.0011481 U	-0.004441 U	-0.0026953 U	0.0089844 U	0.0082611 U	0.0067809 U
Cs-134	0.023607	0.0049446 U	0.022118 U	0.017411 U	0.015684 U	0.016834 U	-0.035419 U	0.015097 U	0.0085214 U	0.028733 U
Cs-137	0.077308	0.0067928 U	0.0032644 U	-0.0069927 U	0.010642 U	0.17406	0.028243	-0.0054359 U	0.08395 U	-0.0064607 U
Eu-152	-0.036669 U	-0.013246 U	0.020004 U	0.015112 U	-0.039354 U	0.011991 U	0.032113 U	0.026491 U	-0.00058816 U	0.015994 U
Eu-154	0.011937 U	0.012199 U	0.021745 U	-0.015249 U	-0.020944 U	-0.0018065 U	0.00011399 U	-0.0056441 U	0.00070785 U	0.0094823 U
Eu-155	0.0040442 U	0.049203 U	0.089722 U	0.085276 U	0.13991 U	0.10018 U	0.076274 U	0.0029052 U	-0.010207 U	-0.0040871 U
Mn-54	0.0052071 U	-0.0027444 U	0.015674 U	0.0021981 U	-0.00069931 U	-0.00035738 U	-0.0093211 U	0.009449 U	-0.0031295 U	-0.0059614 U
Nb-94	0.0022835 U	-0.00023418 U	0.0067584 U	0.0017477 U	-0.001458 U	0.0050909 U	0.0063194 U	-0.0091499 U	-0.0023806 U	0.014454 U
Sb-125	0.095536 U	0.0013864 U	0.10629	0.10916	-0.00080296 U	0.079191 U	0.047231 U	0.07639 U	0.078385 U	0.02072 U
Hard to detect (pCi/g)										
C-14								-0.16 U		
Cm-243								0.118 U		
Fe-55								20.3 U		
H-3								0.999 U		
Ni-63								2.53 U		
Pu-238								-0.021 U		
Pu-239								-0.014 U		
Pu-241								-5.77 U		
Sr-90								0.0195 U		
Tc-99								0.348 U		

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-17-01-001-F	OOL-17-01-002-F	OOL-17-01-003-F	OOL-17-01-004-F	OOL-17-01-005-F	OOL-17-01-006-F	OOL-17-01-007-F	OOL-17-01-008-F	OOL-17-01-009-F	OOL-17-01-010-F
gamma-spec (pCi/g)										
Ag-108m	0.013492 U	-0.0065829 U	0.015231 U	0.00044 U	-0.014203 U	-0.0013319 U	0.0091938 U	-0.009487 U	-0.01929 U	0.004457 U
Am-241	-0.077568 U	-0.023688 U	0.12039 U	0.040372 U	-0.032879 U	-0.042856 U	-0.23719 U	-0.035747 U	0.10257 U	0.0029399 U
Co-60	-0.0053648 U	-0.0013961 U	0.0062733 U	0.0096713 U	0.0012239 U	0.0023546 U	0.0046217 U	0.031449 U	0.0051869 U	0.00076373 U
Cs-134	0.0003785 U	-0.00040153 U	-0.010728 U	0.014546 U	0.019185	0.00037163 U	0.011912 U	0.019534 U	0.0082799 U	-0.012678 U
Cs-137	0.10327	0.014267 U	-0.00069714 U	0.0089021 U	0.11493	-0.0020118 U	0.0058058 U	0.11557	0.010672 U	-0.00067573 U
Eu-152	-0.012755 U	0.0039213 U	0.001899 U	0.018841 U	0.00075475 U	0.018169 U	0.084428 U	-0.035131 U	-0.0070711 U	-0.00055915 U
Eu-154	0.010612 U	0.006954 U	0.038695 U	-0.0067737 U	-0.00116 U	-0.010165 U	0.017207 U	0.0032777 U	0.0048352 U	0.004548 U
Eu-155	-0.0062116 U	0.10059 U	-0.022249 U	0.074345 U	0.09157 U	0.080624 U	0.017557 U	-0.035506 U	0.074944 U	0.0034666 U
Mn-54	0.0085532 U	0.029386 U	-0.0031871 U	-0.00098365 U	0.0091966 U	0.011437 U	0.011495 U	-0.0029798 U	-0.0080236 U	-0.0061663 U
Nb-94	0.012477 U	-0.0045873 U	0.0090586 U	-0.00021965 U	-0.0047549 U	0.0017267 U	0.0061687 U	0.0010894 U	-0.0065102 U	-0.00013052 U
Sb-125	0.13542 U	0.053331 U	0.020694 U	0.063935 U	0.068517 U	0.083177	0.061484 U	0.079967 U	0.082352 U	0.087189 U
Hard to detect (pCi/g)										
C-14						-0.0055 U				
Cm-243						-0.03 U				
Fe-55						-31.6 U				
H-3						1.37 U				
Ni-63						-1.68 U				
Pu-238						-0.0314 U				
Pu-239						0.046 U				
Pu-241						6.02 U				
Sr-90						0.0315 U				
Tc-99						0.0907 U				

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-17-01-011-F	OOL-17-01-012-F	OOL-17-01-013-F	OOL-17-01-014-F	OOL-17-01-015-F	OOL-17-01-016-F	OOL-17-01-017-F	OOL-17-01-018-F	OOL-17-01-019-F	OOL-17-01-020-F
gamma-spec (pCi/g)										
Ag-108m	0.0018474 U	0.04516 U	0.03972 U	-0.00040953 U	0.0052307 U	-0.0070097 U	0.014356 U	-0.0057193 U	0.0045841 U	0.024182 U
Am-241	-0.11917 U	0.5208 U	-0.0031142 U	0.043161 U	-0.22125 U	0.21706 U	-0.0041431 U	-0.041849 U	0.0042587 U	0.028478 U
Co-60	-0.0025577 U	-0.0047153 U	0.0044971 U	-0.0030303 U	-0.00083127 U	-0.0045345 U	0.0058611 U	-0.0019186 U	-0.0036476 U	-0.0044096 U
Cs-134	-0.0037619 U	-0.0056101 U	0.0065427 U	-0.0094501 U	-0.008061 U	0.016496 U	-0.0080676 U	-0.010281 U	-0.00066392 U	-0.0056566 U
Cs-137	0.04404 U	0.0061058 U	0.0078242 U	0.0035413 U	0.058731	0.01475 U	0.0011509 U	-0.0017755 U	-0.01036 U	-0.0051309 U
Eu-152	-0.0051063 U	-0.03868 U	0.024641 U	0.028454 U	-0.0011248 U	0.005577 U	0.0024677 U	-0.004094 U	0.066926 U	0.003192 U
Eu-154	0.0049662 U	-0.023926 U	0.01715 U	0.0080016 U	0.0027074 U	-0.015662 U	-0.015729 U	0.027865 U	-0.00031037 U	0.00026898 U
Eu-155	0.0016734 U	0.075081 U	0.053526 U	0.055755 U	0.017254 U	0.11696 U	0.091176 U	0.11617 U	0.0068664 U	0.054007 U
Mn-54	0.0039129 U	0.012768 U	0.0020797 U	-0.0011549 U	0.0015473 U	-0.0015688 U	-0.0054206 U	-0.00078024 U	0.0016331 U	0.012718 U
Nb-94	-0.00057356 U	0.001837 U	-0.0044829 U	-0.0006505 U	0.004132 U	-0.00056345 U	-0.0062663 U	0.011224 U	0.0012036 U	-0.00027365 U
Sb-125	-0.0029481 U	-0.017607 U	0.011394 U	0.065644 U	-0.020427 U	0.048173 U	0.015799 U	-0.0091636 U	0.055818 U	0.067769 U
Hard to detect (pCi/g)										
C-14									-0.0969 U	
Cm-243									0.0829 U	
Fe-55									1.43 U	
H-3									-0.265 U	
Ni-63									3.55 U	
Pu-238									-0.00607 U	
Pu-239									-0.00606 U	
Pu-241									3.51 U	
Sr-90									-0.0246 U	
Tc-99									0.0303 U	

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-17-01-021-F	OOL-17-01-022-F	OOL-17-01-023-F	OOL-17-01-024-F	OOL-17-01-025-F	OOL-17-01-026-F	OOL-17-01-027-F	OOL-17-01-028-F	OOL-17-01-029-F	OOL-17-01-030-F
gamma-spec (pCi/g)										
Ag-108m	-0.006241 U	-0.0090305 U	0.0752 U	0.07057 U	0.0060163 U	-0.003487 U	0.00025907 U	0.06774 U	-0.012572 U	0.08559 U
Am-241	-0.071954 U	-0.001357 U	-0.094173 U	-0.13647 U	0.29161 U	0.013855 U	0.10359 U	-0.00073858 U	0.024887 U	-0.036452 U
Co-60	0.0061683 U	0.0069501 U	-0.0028112 U	-0.010616 U	-0.009685 U	-0.0026766 U	-0.00021093 U	0.0037072 U	0.0068615 U	0.01816 U
Cs-134	-0.0226 U	R	0.030986 U	0.030977 U	0.019107 U	0.0021098 U	0.029628 U	-0.0098808 U	0.020294	-0.0014572 U
Cs-137	0.031646 U	0.011955 U	-0.0083099 U	0.060138 U	-0.00043648 U	0.019722 U	0.049327 U	0.013453 U	-0.0017229 U	0.012108 U
Eu-152	-0.057986 U	0.034259 U	-0.010366 U	0.020214 U	0.044873 U	0.092253 U	0.0029425 U	-0.039053 U	-0.030108 U	-0.0023049 U
Eu-154	0.045811 U	-0.0029065 U	-0.0073448 U	0.011707 U	0.0085386 U	0.0064036 U	0.029718 U	-0.024542 U	0.0050245 U	0.01949 U
Eu-155	0.13086 U	0.020724 U	0.19056 U	-0.083883 U	0.017986 U	0.018123 U	0.070607 U	-0.056845 U	0.035327 U	0.10926 U
Mn-54	0.0020889 U	0.0014216 U	-0.0003778 U	-0.010238 U	0.016514 U	-0.0066776 U	-0.0061126 U	-0.00040052 U	-0.0078994 U	-0.0055759 U
Nb-94	0.0052359 U	-0.0039643 U	0.002703 U	0.015529 U	0.0084281 U	0.010056 U	-0.013536 U	0.015006 U	-0.000081815 U	-0.0081341 U
Sb-125	0.071022 U	-0.018818 U	0.12862 U	R	R	0.073779 U	-0.008135 U	0.11632 U	0.010393 U	0.099318 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-17-01-031-F	OOL-17-01-032-F	OOL-17-01-033-F	OOL-17-01-034-F	OOL-17-01-035-F	OOL-17-01-036-F	OOL-17-01-037-F	OOL-17-01-038-F	OOL-17-01-039-F	OOL-18-01-001-F
gamma-spec (pCi/g)										
Ag-108m	0.002219 U	0.0057099 U	-0.019611 U	-0.0081073 U	-0.0027003 U	0.05506 U	-0.015263 U	-0.0171 U	-0.016774 U	-0.0059639 U
Am-241	0.11268 U	0.026826 U	0.065767 U	-0.0090284 U	0.027171 U	0.16551 U	-0.064247 U	0.1989 U	-0.031348 U	0.008655 U
Co-60	-0.0031365 U	-0.010006 U	0.00039409 U	0.038735 U	0.0013182 U	0.0054685 U	0.0027443 U	0.0089632 U	-0.014794 U	0.0068641 U
Cs-134	0.026545 U	0.0055563 U	-0.009753 U	-0.024189 U	0.00026686 U	0.01012 U	0.016759 U	R	0.0311 U	0.010925 U
Cs-137	0.014177 U	0.012768 U	0.1105	0.0070626 U	-0.0063279 U	-0.00322 U	0.0091324 U	0.0082404 U	0.016631 U	0.0071778 U
Eu-152	0.041212 U	0.03394 U	-0.023116 U	0.020245 U	0.016608 U	0.00054872 U	0.12304 U	0.082327 U	-0.0036264 U	0.0015534 U
Eu-154	0.0044923 U	0.032187 U	-0.022292 U	0.012338 U	-0.00074001 U	0.0018695 U	-0.0084282 U	0.1322 U	-0.0043643 U	0.003105 U
Eu-155	0.14281 U	0.152 U	0.12028 U	-0.016471 U	0.043473 U	0.12422 U	0.16681 U	0.010255 U	0.024918 U	0.010141 U
Mn-54	-0.01082 U	0.012372 U	-0.0032554 U	0.0031581 U	0.0012271 U	-0.0011565 U	0.012245 U	-0.0088873 U	0.004634 U	-0.0044794 U
Nb-94	-0.007652 U	-0.000094593 U	-0.0022414 U	-0.0043533 U	0.00094064 U	-0.0021806 U	0.00010577 U	-0.0089638 U	-0.00017768 U	-0.00034553 U
Sb-125	0.079911 U	R	0.065074 U	0.084403 U	0.035492 U	0.070833 U	0.094864 U	R	0.13174 U	-0.00067493 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-18-01-002-F	OOL-18-01-003-F	OOL-18-01-004-F	OOL-18-01-005-F	OOL-18-01-006-F	OOL-18-01-007-F	OOL-18-01-008-F	OOL-18-01-009-F	OOL-18-01-010-F	OOL-18-01-011-F
gamma-spec (pCi/g)										
Ag-108m	-0.00050881 U	-0.0036859 U	0.04152 U	0.01111 U	-0.0071033 U	0.0034568 U	-0.0061683 U	0.020174 U	0.0088633 U	-0.015167 U
Am-241	0.09476 U	-0.0038615 U	0.013854 U	0.18955 U	0.043693 U	-0.12956 U	-0.15116 U	-0.04922 U	-0.0077162 U	0.039321 U
Co-60	-0.0027628 U	-0.0059327 U	-0.0047665 U	0.00087328 U	0.008024 U	-0.010565 U	-0.00028403 U	-0.0065493 U	-0.00024919 U	0.0025392 U
Cs-134	-0.0018949 U	-0.0058354 U	0.00068019 U	0.08269 U	0.0070112 U	0.023876 U	0.0044486 U	-0.0010225 U	-0.006244 U	-0.0010747 U
Cs-137	0.0070827 U	0.29978	0.0023228 U	0.17609	0.0038523 U	0.0015043 U	0.096077	0.017133 U	-0.0088279 U	-0.010723 U
Eu-152	0.027843 U	-0.0064426 U	0.025154 U	-0.00014042 U	-0.0007832 U	-0.013864 U	-0.0093184 U	-0.016649 U	0.031134 U	-0.021927 U
Eu-154	0.014963 U	-0.00050775 U	0.019021 U	0.027831 U	0.010756 U	-0.00089356 U	-0.00030079 U	-0.025464 U	0.021679 U	-0.013195 U
Eu-155	0.0844 U	0.0011861 U	0.051798 U	0.090996 U	0.1309 U	0.09428 U	-0.0069077 U	0.068343 U	0.097957 U	-0.0022252 U
Mn-54	0.006063 U	-0.0086546 U	0.0082055 U	-0.0069562 U	-0.00054403 U	0.000275 U	-0.000068039 U	0.013284 U	0.0036988 U	0.00012922 U
Nb-94	-0.0021427 U	-0.0014168 U	-0.0023422 U	-0.001345 U	0.0024892 U	-0.0013716 U	0.06227 U	-0.00021993 U	-0.00017222 U	0.0049032 U
Sb-125	0.04404 U	-0.0042852 U	0.050261 U	0.12483 U	0.063465 U	0.091794 U	-0.032519 U	0.058 U	0.090613 U	0.08046 U
Hard to detect (pCi/g)										
C-14									-0.145 U	
Cm-243									0.048 U	
Fe-55									0.953 U	
H-3									0.193 U	
Ni-63									-0.48 U	
Pu-238									-0.00294 U	
Pu-239									-0.00235 U	
Pu-241									7.95 U	
Sr-90									0.000111 U	
Tc-99									0.0538 U	

Appendix Table B.1.4
 Soil Sample Results - FSS Data
 YAEC Non-BUD/TSCA -- Outlying Areas
 YNPS Rowe, MA

Station	OOL-18-01-012-F	OOL-18-01-013-F	OOL-18-01-014-F	OOL-18-01-015-F	OOL-18-01-016-F	OOL-18-01-017-F	OOL-18-01-018-F	OOL-18-01-019-F	OOL-18-01-020-F
gamma-spec (pCi/g)									
Ag-108m	-0.010263 U	-0.0027426 U	0.000055225 U	-0.0016783 U	-0.010971 U	-0.022782 U	-0.00088643 U	-0.020728 U	0.020293 U
Am-241	-0.025864 U	-0.01149 U	0.04806 U	-0.019571 U	-0.28311 U	0.011632 U	-0.00206 U	-0.0098975 U	-0.0072997 U
Co-60	0.0014649 U	0.007588 U	0.0045038 U	-0.0027621 U	0.00028402 U	-0.0032065 U	-0.0019908 U	-0.010184 U	0.016932 U
Cs-134	R	0.021763 U	0.0032074 U	0.014749 U	-0.0034129 U	0.011757 U	-0.027109 U	0.043623 U	-0.011723 U
Cs-137	0.0026837 U	-0.010363 U	0.00019502 U	0.0035975 U	0.027754 U	0.02014 U	0.025623 U	0.017139 U	0.13531
Eu-152	-0.0084385 U	-0.0013079 U	-0.01963 U	0.010935 U	-0.028516 U	0.018216 U	-0.015222 U	0.12524 U	0.0080286 U
Eu-154	-0.0080499 U	-0.00021763 U	-0.014535 U	0.0044511 U	0.033049 U	0.016545 U	-0.0067049 U	0.031452 U	0.020088 U
Eu-155	0.073419 U	0.065848 U	0.066809 U	0.089279 U	0.22298 U	0.076647 U	0.11558 U	0.24059 U	0.095308 U
Mn-54	-0.0063502 U	-0.0055911 U	0.019464 U	0.0010534 U	-0.0025404 U	0.018127 U	-0.0023776 U	0.014146 U	-0.010866 U
Nb-94	0.0053244 U	-0.0050756 U	-0.0080599 U	0.0023374 U	-0.000396 U	-0.00010279 U	-0.0032169 U	0.01198 U	0.0048985 U
Sb-125	0.053199 U	0.089002 U	0.08941 U	R	-0.0044461 U	0.041171 U	0.10509 U	0.16859	0.027785 U
Hard to detect (pCi/g)									
C-14									0.0123 U
Cm-243									0.0958 U
Fe-55									2.98 U
H-3									-1.11 U
Ni-63									-4.52 U
Pu-238									-0.0254 U
Pu-239									-0.0482 U
Pu-241									0.602 U
Sr-90									-0.00555 U
Tc-99									0.021 U

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-02-05-005-F	OOL-02-05-009-F	OOL-02-05-010-F	OOL-02-05-011-F	OOL-02-05-012-F	OOL-02-05-013-F	OOL-02-05-018-F	OOL-02-05-019-F	OOL-03-01-008-F	OOL-03-02-001-F
gamma-spec (pCi/g)										
Ag-108m	-0.013074 U	0.000014176 U	-0.015716 U	0.00069248 U	-0.011023 U	0.00095188 U	-0.0023842 U	-0.0097381 U	-0.007414 U	-0.0032816 U
Am-241	0.019301 U	-0.24645 U	-0.19349 U	0.0069384 U	-0.11525 U	0.13947 U	0.010728 U	0.000097413 U	-0.01165 U	-0.019887 U
Co-60	0.0011866 U	-0.0036444 U	0.00074037 U	-0.0097241 U	0.0029089 U	0.0094523 U	0.0068364 U	-0.00020514 U	0.01393 U	-0.0046516 U
Cs-134	-0.025647 U	-0.017692 U	0.0015724 U	0.020081 U	0.020147 U	0.025527 U	0.017371 U	0.020322 U	0.01976 U	0.018244 U
Cs-137	0.019502 U	0.011892 U	0.015167 U	0.016689 U	0.020517 U	0.011623 U	0.01914 U	-0.0091368 U	0.009497 U	-0.0078771 U
Eu-152	-0.011637 U	0.13917 U	0.066133 U	0.070841 U	-0.0064518 U	-0.037771 U	-0.0036906 U	0.0067468 U	-0.004067 U	0.022551 U
Eu-154	-0.013738 U	-0.0028719 U	0.014914 U	0.042153 U	0.02666 U	-0.00020349 U	0.016594 U	0.010614 U	0.01701 U	0.0030198 U
Eu-155	0.17783 U	0.0041715 U	0.12408 U	0.078607 U	0.1581 U	-0.015765 U	-0.10184 U	-0.011321 U	0.2009 U	0.17481 U
Mn-54	-0.012162 U	0.011433 U	0.013524 U	-0.011316 U	-0.0058193 U	0.0078779 U	-0.01243 U	-0.014484 U	0.007447 U	0.0042574 U
Nb-94	0.018745 U	-0.0023172 U	0.0093546 U	0.01231 U	-0.0035268 U	-0.0085179 U	0.00086376 U	0.019652 U	0.0005159 U	-0.00206 U
Sb-125	0.061858 U	0.091145 U	0.10997 U	R	R	-0.0035281 U	0.19604	0.11642 U	0.1048 U	0.12168
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-03-02-002-F	OOL-03-02-003-F	OOL-03-02-004-F	OOL-03-02-005-F	OOL-03-02-006-F	OOL-03-02-007-F	OOL-03-02-008-F	OOL-03-02-009-F	OOL-03-02-010-F	OOL-03-02-011-F
gamma-spec (pCi/g)										
Ag-108m	0.0020036 U	-0.020232 U	-0.018897 U	0.0091913 U	-0.018934 U	0.00052141 U	0.09204 U	-0.010067 U	0.003117 U	0.011544 U
Am-241	0.12087 U	-0.034807 U	-0.05323 U	-0.22445 U	-0.0094133 U	-0.15441 U	-0.087907 U	-0.013429 U	0.0031951 U	-0.0075298 U
Co-60	-0.00022636 U	-0.0030117 U	0.0080867 U	0.00096431 U	-0.0042539 U	-0.0043478 U	-0.00020267 U	0.021694 U	0.013149 U	-0.000181 U
Cs-134	0.0063617 U	0.025144	-0.016589 U	0.021947 U	0.022276 U	0.023927 U	0.017658 U	0.0273 U	-0.0030475 U	0.019658 U
Cs-137	-0.0034182 U	0.051463	0.011395 U	0.043063	0.020192 U	-0.0013088 U	0.01676 U	0.026684 U	0.025872 U	0.036813 U
Eu-152	0.011123 U	0.019695 U	0.0013501 U	0.017592 U	-0.00098648 U	-0.048582 U	0.041954 U	-0.016039 U	-0.017365 U	0.0026244 U
Eu-154	0.019799 U	0.017533 U	-0.0034921 U	0.021189 U	-0.0048228 U	-0.025272 U	-0.01502 U	-0.0015906 U	0.017593 U	-0.0046418 U
Eu-155	0.00092715 U	0.11979 U	0.094999 U	0.020682 U	0.13644	-0.0040485 U	0.18403	0.022664 U	0.016652 U	0.099999 U
Mn-54	0.0030563 U	0.001236 U	-0.0077267 U	-0.000044397 U	0.0047438 U	-0.0094378 U	0.0072443 U	-0.0021662 U	0.00097376 U	0.0030468 U
Nb-94	0.06031 U	-0.00032295 U	0.002631 U	-0.00098666 U	-0.00080169 U	-0.00756 U	0.0019845 U	-0.0083634 U	-0.00020116 U	0.0035843 U
Sb-125	0.077105 U	0.061325 U	0.087011	0.11664	0.11877	0.14395	0.09416 U	0.1385	0.054279 U	0.11751 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-03-02-012-F	OOL-03-02-013-F	OOL-03-02-014-F	OOL-03-02-015-F	OOL-03-02-020-F	OOL-03-02-021-F	OOL-03-02-022-F	OOL-03-02-023-F	OOL-03-02-028-F	OOL-03-02-029-F
gamma-spec (pCi/g)										
Ag-108m	0.023558 U	0.00025919 U	0.011952 U	0.0045873 U	-0.0104 U	-0.0060637 U	0.05572 U	0.0016468 U	0.0077572 U	0.0021909 U
Am-241	-0.13793 U	-0.06788 U	-0.14382 U	0.028731 U	0.0038851 U	-0.35707 U	-0.029556 U	-0.00063239 U	0.12911 U	0.022407 U
Co-60	-0.0099668 U	0.0042184 U	-0.0071932 U	-0.0015862 U	-0.00058724 U	0.0032684 U	-0.005624 U	-0.0051903 U	-0.013188 U	0.0084466 U
Cs-134	0.03011 U	0.035759 U	0.013014 U	0.022721 U	0.014181 U	0.015927 U	-0.022485 U	-0.00051364 U	0.013844 U	0.021732 U
Cs-137	0.0018449 U	0.017579 U	0.022909 U	0.010257 U	0.0045077 U	0.020182 U	0.019669 U	0.016968 U	0.030569 U	0.12169
Eu-152	0.0056194 U	0.041021 U	-0.0025211 U	0.041442 U	-0.0020819 U	-0.0009993 U	-0.034363 U	-0.044849 U	-0.038942 U	-0.016983 U
Eu-154	0.0033741 U	0.0011397 U	0.019304 U	0.0021435 U	0.017944 U	0.0076099 U	0.013069 U	-0.035781 U	-0.018376 U	-0.0007084 U
Eu-155	0.040366 U	0.19858 U	0.0033197 U	0.0029212 U	0.12623 U	0.0052012 U	0.087151 U	0.010443 U	0.15656 U	0.11239 U
Mn-54	0.015437 U	0.01255 U	0.00059408 U	0.0089184 U	-0.0013295 U	-0.0041284 U	-0.00061365 U	0.02801 U	0.00084395 U	0.0044107 U
Nb-94	0.010386 U	-0.00029063 U	-0.0048471 U	0.0007295 U	0.0021637 U	-0.000079632 U	-0.00008095 U	0.00080412 U	0.0082457 U	0.0044799 U
Sb-125	R	0.13456 U	0.098735 U	0.12106 U	0.078835 U	0.074544 U	0.077856 U	0.11373 U	0.017569 U	R
Hard to detect (pCi/g)										
C-14		-0.0526 U								
Cm-243		0.0185 U								
Fe-55		-33.3 U								
H-3		-3.93 U								
Ni-63		-2.3 U								
Pu-238		0.0244 U								
Pu-239		0.0565 U								
Pu-241		3.73 U								
Sr-90		0.00835 U								
Tc-99		0.157 U								

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-03-02-035-F	OOL-03-03-001-F	OOL-03-03-002-F	OOL-03-03-003-F	OOL-03-03-005-F	OOL-03-03-006-F	OOL-03-03-007-F	OOL-03-03-008-F	OOL-03-03-009-F	OOL-03-03-010-F
gamma-spec (pCi/g)										
Ag-108m	-0.021751 U	0.07097 U	-0.0031634 U	-0.015049 U	0.0011325 U	0.000026506 U	0.016595 U	0.0020411 U	-0.0036717 U	-0.01412 U
Am-241	-0.015448 U	-0.025416 U	-0.072843 U	0.0046543 U	0.033386 U	-0.002512 U	-0.033033 U	0.31147 U	-0.25586 U	-0.0095928 U
Co-60	0.017151 U	-0.0037739 U	0.013079 U	-0.0061563 U	-0.015641 U	0.013653 U	0.015016 U	-0.008162 U	-0.0075523 U	0.00067479 U
Cs-134	0.010569 U	0.017678 U	0.040511 U	-0.017316 U	0.028362 U	-0.0011969 U	-0.0026449 U	0.00082397 U	0.024754 U	-0.016621 U
Cs-137	0.014746 U	0.055202 U	0.022757 U	0.014411 U	0.025222 U	0.022377 U	0.024308 U	0.03089 U	0.027168 U	0.043242 U
Eu-152	0.048598 U	0.01825 U	0.010173 U	-0.03488 U	0.0038743 U	-0.028087 U	0.087134 U	-0.013287 U	-0.032783 U	-0.00031859 U
Eu-154	-0.0018945 U	0.0038485 U	0.039504 U	0.02581 U	0.0016341 U	-0.00093627 U	-0.013935 U	-0.033179 U	-0.028101 U	0.048014 U
Eu-155	0.16495 U	0.12765 U	-0.03259 U	0.088957 U	0.073497 U	0.051001 U	-0.0072758 U	0.069435 U	0.20429 U	0.030586 U
Mn-54	-0.014407 U	0.010572 U	0.00020258 U	0.016471 U	-0.0082173 U	0.00044431 U	-0.00092705 U	-0.0078824 U	-0.002214 U	0.022862 U
Nb-94	-0.0079048 U	0.00094155 U	0.024881 U	0.010718 U	-0.0016405 U	0.015912 U	0.016079 U	-0.0046174 U	-0.0078478 U	-0.016715 U
Sb-125	0.010511 U	0.099094	R	0.073497 U	0.067871 U	R	0.14122 U	0.065625 U	0.09259 U	0.080388 U
Hard to detect (pCi/g)										
C-14							-0.0193 U			
Cm-243							0.202 U			
Fe-55							14.2 U			
H-3							3.42 U			
Ni-63							2.88 U			
Pu-238							-0.0344 U			
Pu-239							-0.0573 U			
Pu-241							8.14 U			
Sr-90							-0.00294 U			
Tc-99							-0.107 U			

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-03-03-012-F	OOL-03-03-016-F	OOL-08-04-014-F	OOL-08-04-015-F	OOL-12-01-012-F	OOL-12-01-013-F	OOL-12-01-014-F	OOL-12-01-015-F	OOL-12-01-016-F	OOL-12-01-017-F
gamma-spec (pCi/g)										
Ag-108m	0.00031929 U	-1.4616E-06 U	-0.01309 U	-0.011454 U	0.0591 U	0.0015146 U	-0.0186 U	-0.0074977 U	-0.016579 U	0.010241 U
Am-241	-0.0021946 U	-0.49066 U	-0.060214 U	0.00079043 U	-0.013087 U	-0.03048 U	0.04891 U	-0.037355 U	0.080444 U	-0.027917 U
Co-60	-0.0089267 U	-0.00029958 U	0.01681 U	0.013607 U	0.010424 U	-0.0039437 U	-0.0014719 U	0.032398 U	-0.0025224 U	0.0012837 U
Cs-134	-0.022725 U	0.012462 U	0.015757 U	-0.010434 U	0.023309 U	0.0095296 U	0.013852 U	0.0072869 U	0.016161 U	0.018373 U
Cs-137	0.026644 U	0.08958	0.090944	-0.003479 U	0.033956	-0.011059 U	0.063546	0.035442 U	0.027876 U	-0.0022747 U
Eu-152	0.13415 U	-0.017711 U	-0.0041413 U	0.0057091 U	0.02282 U	-0.053445 U	0.007869 U	-0.0099828 U	0.020945 U	-0.0070445 U
Eu-154	0.0082394 U	0.0088025 U	0.0066125 U	-0.01927 U	0.00020256 U	-0.00538 U	0.001613 U	-0.013153 U	0.0085735 U	-0.00020046 U
Eu-155	0.1289 U	0.10246 U	0.089431 U	-0.0015302 U	0.096361 U	0.059466 U	0.075701 U	0.010007 U	0.13686 U	0.15851 U
Mn-54	-0.00036056 U	-0.00052549 U	-0.008824 U	0.013164 U	0.015251 U	-0.00033153 U	0.0023372 U	0.011319 U	-0.0090215 U	-0.0031451 U
Nb-94	0.01012 U	-0.0043657 U	-0.00291 U	0.0086434 U	0.0095335 U	0.00010934 U	-0.0055411 U	-0.0080423 U	0.00071199 U	-0.0050078 U
Sb-125	0.11897	0.10051 U	0.074671 U	0.11671 U	0.10999	0.088899 U	0.045935 U	0.053481 U	R	0.10637 U
Hard to detect (pCi/g)										
C-14									-0.0956 U	
Cm-243									0.145	
Fe-55									-14.7 U	
H-3									4.08 U	
Ni-63									-0.897 U	
Pu-238									-0.0326 U	
Pu-239									-0.0244 U	
Pu-241									16 U	
Sr-90									-0.0114 U	
Tc-99									0.909	

Appendix Table B.1.5
 Soil Sample Results
 TransCanada Inside BUD Area
 YNPS Rowe, MA

Station	OOL-12-01-018-F	OOL-12-01-019-F	OOL-12-01-020-F	OOL-12-01-021-F	OOL-12-01-022-F	OOL-12-01-023-F	OOL-13-01-001-F	OOL-13-01-003-F
gamma-spec (pCi/g)								
Ag-108m	-0.02563 U	-0.0025201 U	0.0048703 U	0.0059433 U	-0.0092427 U	-0.0096457 U	0.0014217 U	-0.0089223 U
Am-241	0.20376 U	-0.025961 U	0.0054818 U	-0.054133 U	-0.23565 U	0.00015981 U	-0.051774 U	-0.0046377 U
Co-60	-0.0015928 U	0.023109 U	-0.0023557 U	0.060104	0.034789 U	0.025429 U	0.013404 U	-0.017071 U
Cs-134	0.01621 U	0.020984 U	-0.011977 U	0.032726 U	0.06623 U	0.028305 U	0.015742 U	0.026846 U
Cs-137	0.094698	0.045501 U	-0.014299 U	0.34753	0.173	0.10492	0.062739	0.008939 U
Eu-152	0.11592 U	-0.033722 U	0.024953 U	-0.023024 U	-0.015811 U	-0.0001054 U	0.0034295 U	-0.0075573 U
Eu-154	0.018539 U	-0.017407 U	-0.017311 U	-0.018739 U	0.052537 U	-0.0016267 U	0.00079166 U	-0.001265 U
Eu-155	-0.010432 U	0.044342 U	-0.0044043 U	-0.0011845 U	0.10274 U	R	0.10856 U	0.017164 U
Mn-54	0.00057586 U	0.024636 U	0.0080089 U	-0.00037648 U	0.023283 U	-0.0057162 U	0.0059735 U	-0.00090614 U
Nb-94	0.0052298 U	-0.0036064 U	0.06207 U	0.0011723 U	-0.000015328 U	0.010669 U	-0.005868 U	-0.0050408 U
Sb-125	0.077487 U	0.049872 U	0.1425 U	0.15693 U	0.074099 U	0.071255 U	0.048206 U	-0.0028869 U
Hard to detect (pCi/g)								
C-14								
Cm-243								
Fe-55								
H-3								
Ni-63								
Pu-238								
Pu-239								
Pu-241								
Sr-90								
Tc-99								

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-09-014-F	OOL-05-09-015-F	OOL-05-09-016-F	OOL-05-09-017-F	OOL-05-09-018-F	OOL-05-09-019-F	OOL-05-09-020-F	OOL-05-10-001-F	OOL-05-10-002-F	OOL-05-10-003-F
gamma-spec (pCi/g)										
Ag-108m	-0.012281 U	-0.0099223 U	-0.0056849 U	0.05788 U	-0.00082917 U	-0.0044458 U	0.021363 U	-0.010501 U	-0.017466 U	0.00024837 U
Am-241	0.03822 U	-0.0029212 U	-0.0060729 U	-0.1348 U	0.062585 U	0.046162 U	-0.049602 U	0.11196 U	-0.28513 U	-0.12877 U
Co-60	0.0019455 U	0.00026847 U	-0.00020571 U	0.0046992 U	0.0035137 U	-0.0069373 U	0.00052604 U	-0.0041813 U	0.004726 U	0.0077834 U
Cs-134	-0.00082781 U	0.012536 U	-0.0019949 U	-0.0054683 U	-0.015873 U	-0.0063224 U	0.021241 U	0.015743 U	-0.043786 U	0.018703 U
Cs-137	0.016201 U	0.024706 U	0.00017264 U	0.0057075 U	0.094749	-0.0059846 U	-0.001282 U	0.03347	0.0092932 U	0.012663 U
Eu-152	0.018906 U	-0.000095812 U	0.012244 U	-0.030936 U	-0.0061482 U	-0.0017856 U	0.035569 U	-0.0059544 U	-0.0011025 U	0.035385 U
Eu-154	-0.022584 U	0.019443 U	0.00076972 U	-0.021939 U	0.00043 U	-0.012127 U	0.026143 U	-0.0021914 U	-0.0094066 U	-0.028124 U
Eu-155	0.14743	0.033267 U	0.10218 U	0.02046 U	0.028181 U	0.065129 U	-0.0086891 U	0.086522 U	-0.0064324 U	0.0725 U
Mn-54	0.014725 U	0.0086207 U	0.0014631 U	0.0043499 U	-0.00058186 U	-0.0046313 U	0.018898 U	0.0053761 U	0.021258 U	0.004472 U
Nb-94	0.00026903 U	0.00288 U	0.01173 U	0.0010431 U	-0.002411 U	-0.0071168 U	-0.0083298 U	0.00044224 U	0.00055067 U	-0.0071639 U
Sb-125	0.019266 U	0.023527 U	0.028063 U	0.08581 U	0.012323 U	-0.0079331 U	0.046859 U	0.078513 U	0.057822 U	0.048185 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-10-004-F	OOL-05-10-005-F	OOL-05-10-006-F	OOL-05-10-007-F	OOL-05-10-008-F	OOL-05-10-009-F	OOL-05-10-010-F	OOL-05-10-011-F	OOL-05-10-012-F	OOL-05-10-013-F
gamma-spec (pCi/g)										
Ag-108m	-0.0064724 U	-0.0089337 U	-0.0039088 U	0.00017976 U	0.007973 U	-0.008111 U	0.019688 U	0.00085682 U	0.0040884 U	0.00017928 U
Am-241	0.14118 U	-0.22946 U	0.0020642 U	-0.037658 U	-0.0006071 U	0.012072 U	0.0273 U	-0.00094761 U	0.079446 U	0.0025538 U
Co-60	0.0067898 U	-0.0036572 U	0.0018522 U	0.0022322 U	0.0032583 U	-0.010339 U	0.029598 U	0.006499 U	-0.012889 U	-0.0030137 U
Cs-134	0.028831 U	0.018232 U	-0.011003 U	-0.0046433 U	0.0084997 U	0.016875 U	-0.0043364 U	0.014435 U	0.0099881 U	-0.021032 U
Cs-137	0.0017046 U	0.027539 U	0.008754 U	0.0069335 U	0.010332 U	-0.0029662 U	0.0119 U	-0.0093273 U	-0.0010746 U	0.058656
Eu-152	0.02152 U	0.098143 U	0.0098003 U	-0.0055236 U	-0.0041977 U	-0.0028067 U	0.023324 U	-0.012414 U	-0.0099189 U	-0.03158 U
Eu-154	0.0019837 U	-0.003776 U	-0.014267 U	0.011681 U	-0.017242 U	0.019744 U	0.0082187 U	0.01226 U	-0.010173 U	-0.024445 U
Eu-155	0.068727 U	-0.0042666 U	-0.005688 U	0.014285 U	0.008643 U	0.056057 U	0.0036557 U	0.028296 U	0.058542 U	0.074076 U
Mn-54	0.0041011 U	-0.0019993 U	0.011773 U	0.0078405 U	-0.002409 U	-0.0071584 U	0.0014852 U	-0.0006138 U	0.014757 U	-0.0002451 U
Nb-94	-0.010574 U	-0.000065888 U	0.0021402 U	0.0086064 U	-0.0030186 U	0.010738 U	-0.0029057 U	-0.0019559 U	0.0028418 U	-0.0032305 U
Sb-125	0.045465 U	0.10567	0.083291 U	0.13786	0.0036503 U	0.12404 U	0.10536 U	0.018938 U	-0.022436 U	0.051286 U
Hard to detect (pCi/g)										
C-14			-0.0189 U							
Cm-243			-0.0146 U							
Fe-55			37 U							
H-3			-0.639 U							
Ni-63			0.605 U							
Pu-238			0.00896 U							
Pu-239			-0.0371 U							
Pu-241			4 U							
Sr-90			0.0239 U							
Tc-99			0.0297 U							

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-10-014-F	OOL-05-10-015-F	OOL-05-10-016-F	OOL-05-10-017-F	OOL-05-10-018-F	OOL-07-01-001-F	OOL-07-01-001-R	OOL-07-01-002-F	OOL-07-01-002-R	OOL-07-01-003-F
gamma-spec (pCi/g)										
Ag-108m	-0.011292 U	0.0037538 U	-0.015174 U	-0.0011438 U	-0.0080218 U	0.0001538 U	-0.015056 U	-0.01552 U	-0.013607 U	-0.01288 U
Am-241	0.0028102 U	-0.00079927 U	-0.29255 U	-0.062872 U	-0.0016008 U	0.02556 U	0.50971 U	-0.2161 U	0.064402 U	-0.03634 U
Co-60	-0.0025411 U	-0.0025291 U	-0.0081384 U	-0.0052316 U	0.0055932 U	0.002335 U	0.0012084 U	0.007244 U	0.0059881 U	-0.007232 U
Cs-134	0.00069058 U	0.010618 U	0.003072 U	0.00019596 U	-0.0056932 U	-0.01852 U	0.023254 U	0.02635 U	-0.002136 U	-0.008923 U
Cs-137	0.00065971 U	0.0070852 U	0.01496 U	-0.012374 U	0.0075317 U	0.04841 U	0.092649	0.005754 U	0.18287	0.07364
Eu-152	0.0039284 U	-0.011065 U	0.026074 U	-0.048036 U	-0.02414 U	-0.004713 U	0.052645 U	0.002057 U	0.04284 U	-0.01043 U
Eu-154	-0.012033 U	0.0028175 U	-0.008416 U	-0.0058198 U	-0.0056834 U	-0.02293 U	0.037802 U	-0.002761 U	-0.00086841 U	-0.01129 U
Eu-155	0.04223 U	0.044364 U	0.0081722 U	-0.0092138 U	0.12397 U	0.1507 U	0.0976 U	0.1823 U	-0.012976 U	-0.00107 U
Mn-54	0.0053004 U	0.00042692 U	-0.00038365 U	-0.000063354 U	0.015067 U	-0.000656 U	0.025898 U	0.01172 U	0.00064836 U	0.03447 U
Nb-94	0.0034706 U	-0.0028484 U	0.0094966 U	0.0063555 U	-0.0012751 U	-0.00001827 U	-0.0066766 U	-0.01089 U	-0.0047607 U	0.01551 U
Sb-125	0.010844 U	-0.00025941 U	0.019249 U	0.020418 U	0.034682 U	0.00176 U	0.084259 U	-0.03448 U	0.10464 U	0.0002917 U
Hard to detect (pCi/g)										
C-14						-0.0824 U				
Cm-243						-0.065 U				
Fe-55						17.6				
H-3						1.67 U				
Ni-63						0.306 U				
Pu-238						0.0229 U				
Pu-239						0.0436 U				
Pu-241										
Sr-90						0.0136 U				
Tc-99						0.29 U				

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-07-01-003-R	OOL-07-01-004-F	OOL-07-01-004-R	OOL-07-01-005-F	OOL-07-01-005-R	OOL-07-01-006-F	OOL-07-01-006-R	OOL-07-01-007-F	OOL-07-01-007-R	OOL-07-01-008-F
gamma-spec (pCi/g)										
Ag-108m	-0.0039834 U	-0.0001162 U	0.0022873 U	-0.01005 U	-0.0035498 U	-0.03674 U	-0.015301 U	-0.03228 U	0.0051717 U	-0.0223 U
Am-241	-0.24147 U	0.09428 U	-0.019243 U	-0.006645 U	-0.0085839 U	-0.00451 U	-0.0424 U	-0.01943 U	0.021776 U	0.0004931 U
Co-60	0.004027 U	-0.00575 U	-0.010457 U	-0.0002003 U	-0.00033273 U	-0.0001953 U	-0.004002 U	0.02013 U	0.020496 U	0.01838 U
Cs-134	0.0018992 U	0.01868 U	-0.0038945 U	-0.001976 U	-0.015614 U	0.0005114 U	0.014427 U	0.03129 U	-0.0086605 U	-0.008895 U
Cs-137	0.13124	0.02184 U	0.035305 U	0.02242 U	0.07406	0.03156 U	0.09074	0.01795 U	0.01911 U	0.00074 U
Eu-152	-0.0070955 U	0.02614 U	-0.033791 U	0.01517 U	0.051407 U	-0.02279 U	0.048848 U	0.03341 U	-0.002283 U	0.02611 U
Eu-154	-0.020827 U	0.01546 U	0.016398 U	-0.01195 U	0.016295 U	0.008396 U	0.035838 U	0.02016 U	0.013471 U	-0.008259 U
Eu-155	-0.015714 U	0.09538 U	0.052227 U	0.152 U	0.093063 U	0.02652 U	0.2874 U	0.1237 U	0.019216 U	0.06693 U
Mn-54	-0.00050042 U	-0.0002458 U	0.0014844 U	0.009089 U	0.011178 U	0.01169 U	-0.00045424 U	-0.005898 U	-0.00040589 U	0.02167 U
Nb-94	0.016652 U	-0.01493 U	0.024607 U	-0.004867 U	0.014485 U	0.005436 U	0.0042683 U	0.006828 U	0.0075218 U	0.002008 U
Sb-125	-0.028055 U	0.1346	0.0010254 U	0.08303 U	0.037933 U	-0.02261 U	0.10167 U	0.09193 U	0.070515 U	-0.04248 U
Hard to detect (pCi/g)										
C-14		-0.378 U								
Cm-243		-0.0743 U								
Fe-55		18								
H-3		1.95 U								
Ni-63		2.35								
Pu-238		0.0385 U								
Pu-239		-0.00459 U								
Pu-241										
Sr-90		-0.00705 U								
Tc-99		1.44 U								

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-07-01-008-R	OOL-07-01-009-F	OOL-07-01-009-R	OOL-07-01-010-F	OOL-07-01-010-R	OOL-07-01-011-F	OOL-07-01-011-R	OOL-07-01-012-F	OOL-07-01-012-R	OOL-07-01-013-F
gamma-spec (pCi/g)										
Ag-108m	-0.0088749 U	-0.01661 U	-0.016794 U	0.000302 U	-0.0069607 U	-0.01255 U	-0.012457 U	-0.02374 U	-0.0037234 U	0.008992 U
Am-241	-0.088834 U	-0.1071 U	0.084893 U	0.00736 U	-0.086926 U	-0.0937 U	0.075248 U	0.07864 U	-0.043174 U	0.05185 U
Co-60	0.0096356 U	0.01707 U	-0.00053061 U	0.02311 U	0.0035181 U	-0.0002068 U	0.0050663 U	-0.005009 U	0.016679 U	0.02872 U
Cs-134	-0.0025571 U	0.02774 U	0.020133	0.02282 U	0.006483 U	-0.007074 U	0.013091 U	0.02398 U	0.0016374 U	0.02203 U
Cs-137	0.046197 U	0.01907 U	0.0074658 U	0.009955 U	0.0070772 U	0.03644 U	0.007674 U	0.0297 U	0.028538 U	0.01753 U
Eu-152	-0.0010608 U	-0.01194 U	0.0001316 U	-0.001938 U	0.009728 U	0.0005631 U	-0.015724 U	0.007821 U	0.003073 U	-0.003336 U
Eu-154	-0.0034116 U	-0.0167 U	-0.0020935 U	0.01972 U	0.01021 U	-0.02332 U	0.00055514 U	-0.009984 U	-0.034931 U	0.01637 U
Eu-155	0.098367 U	0.1773 U	0.079415 U	0.06738 U	0.042478 U	0.07517 U	0.0015566 U	0.04013 U	-0.0025959 U	-0.01815 U
Mn-54	0.0040645 U	-0.009541 U	0.0055142 U	-0.01424 U	-0.0008415 U	-0.009743 U	0.00013701 U	-0.003675 U	-0.0006652 U	-0.00186 U
Nb-94	-0.00027581 U	-0.006264 U	0.0069198 U	-0.004143 U	-0.0042611 U	0.0102 U	-0.00023325 U	-0.009471 U	-0.0027723 U	0.006802 U
Sb-125	0.047433 U	0.05166 U	-0.00056366 U	0.09487 U	-0.0044593 U	0.06549 U	0.052671 U	-0.03346 U	0.085675 U	-0.01631 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-07-01-013-R	OOL-07-01-014-F	OOL-07-01-014-R	OOL-07-01-015-F	OOL-07-01-015-R	OOL-07-01-016-F	OOL-07-01-016-R	OOL-07-01-017-F	OOL-07-01-017-R	OOL-07-01-018-F
gamma-spec (pCi/g)										
Ag-108m	-0.013546 U	-0.01528 U	-0.0053501 U	-0.01064 U	-0.0049242 U	0.007873 U	-0.0052742 U	-0.01387 U	-0.0079315 U	0.001018 U
Am-241	0.0072259 U	-0.1333 U	-0.2435 U	-0.1191 U	0.14794 U	0.07657 U	-0.0018014 U	-0.003048 U	-0.029775 U	-0.07795 U
Co-60	-0.008842 U	0.02465 U	0.006065 U	-0.0002055 U	-0.0096188 U	0.003546 U	0.0099818 U	-0.001198 U	0.0013269 U	0.01622 U
Cs-134	-0.0019528 U	0.001404 U	-0.016822 U	-0.004595 U	0.020356 U	-0.02957 U	0.00072685 U	0.02093 U	-0.0018898 U	0.01664 U
Cs-137	-0.0041645 U	0.01442 U	0.0072704 U	0.02817 U	0.0213 U	0.02262 U	0.025748 U	0.009052 U	0.045938 U	-0.0107 U
Eu-152	-0.00095776 U	0.03896 U	0.00040838 U	-0.006529 U	0.025232 U	0.007724 U	0.10242 U	0.02858 U	0.015898 U	0.03095 U
Eu-154	-0.00035216 U	0.02388 U	0.015878 U	0.03359 U	-0.043442 U	-0.01194 U	0.024358 U	0.01594 U	0.0088358 U	-0.03153 U
Eu-155	0.078025 U	0.06009 U	-0.013031 U	0.01288 U	0.00096519 U	-0.003041 U	-0.0072545 U	0.09565 U	0.12202 U	0.1235 U
Mn-54	0.0081542 U	0.01751 U	0.0088565 U	0.003809 U	0.0052772 U	-0.000354 U	0.010822 U	0.01149 U	-0.00026929 U	-0.01527 U
Nb-94	0.00013175 U	0.001701 U	0.00034519 U	-0.005041 U	0.008427 U	0.0003483 U	-0.00082982 U	0.002449 U	-0.0085875 U	0.006512 U
Sb-125	0.056448 U	0.05383 U	0.080174 U	0.08289 U	0.085703 U	0.02173 U	0.11199	0.004745 U	-0.0039188 U	0.1497
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-07-01-018-R	OOL-07-01-019-F	OOL-07-01-019-R	OOL-07-01-020-F	OOL-07-01-021-F	OOL-07-01-022-F	OOL-07-01-023-F	OOL-07-01-024-F	OOL-07-01-025-F	OOL-07-01-026-F
gamma-spec (pCi/g)										
Ag-108m	0.016831 U	0.01507 U	-0.0089206 U	-0.01101 U	-0.01104 U	0.0001597 U	0.02405 U	-0.03341 U	-0.002857 U	-0.0001775 U
Am-241	-0.0030269 U	0.09651 U	0.011871 U	-0.001938 U	0.007632 U	0.01162 U	-0.02748 U	0.08029 U	-0.005951 U	-0.03194 U
Co-60	0.0087943 U	-0.00019 U	-0.0082589 U	0.002897 U	-0.00938 U	0.03758 U	0.001988 U	0.02079 U	-0.0002181 U	-0.0002214 U
Cs-134	0.015103 U	-0.01351 U	0.00051962 U	0.02602 U	0.02526 U	-0.02595 U	0.003664 U	0.03505 U	0.0007906 U	-0.05706 U
Cs-137	0.014715 U	0.03771 U	0.01709 U	0.005827 U	0.0162 U	0.02913 U	0.02453 U	0.04248 U	0.03439 U	0.04587
Eu-152	-0.048137 U	0.04084 U	-0.025535 U	0.07064 U	0.02528 U	0.02421 U	0.001998 U	0.01212 U	0.001267 U	0.009061 U
Eu-154	-0.00025359 U	0.008377 U	0.03848 U	-0.01755 U	-0.01632 U	0.00002553 U	0.01942 U	-0.02419 U	0.01949 U	0.0004957 U
Eu-155	-0.045453 U	0.1325 U	0.012813 U	0.1183 U	0.004657 U	0.1036 U	0.09175 U	0.0902 U	0.1623 U	0.06514 U
Mn-54	0.025093 U	-0.0003502 U	0.0011476 U	0.007567 U	0.01761 U	0.00127 U	0.01448 U	0.03316 U	-0.0139 U	-0.0004095 U
Nb-94	0.0064942 U	-0.001584 U	-0.0029937 U	0.0167 U	-0.0001251 U	-0.004297 U	0.01047 U	-0.01363 U	0.0009425 U	0.01298 U
Sb-125	0.10478 U	0.07178 U	0.014385 U	-0.0008 U	0.02243 U	0.1014 U	0.118 U	0.1376 U	0.04533 U	0.1008 U
Hard to detect (pCi/g)										
C-14		-0.167 U								
Cm-243		0.147 U								
Fe-55		12.8								
H-3		0.999 U								
Ni-63		1.86 U								
Pu-238		0.0269 U								
Pu-239		0.00084 U								
Pu-241										
Sr-90		-0.0154 U								
Tc-99		0.925 U								

Station	OOL-05-04-051-F	OOL-05-04-052-F	OOL-05-04-053-F	OOL-05-04-054-F	OOL-05-04-055-F	OOL-05-04-056-F	OOL-05-04-057-F	OOL-05-04-058-F	OOL-05-04-059-F	OOL-05-04-060-F
LTP (pCi/g)										
Ag-108m	-0.03489 U	-0.02158 U	0.002683 U	-0.00324 U	-0.01196 U	-0.01495 U	-0.007831 U	0.0006353 U	-0.02803 U	0.02195 U
Am-241	0.02582 U	-0.0131 U	-0.01225 U	0.008944 U	0.009983 U	0.06508 U	-0.1739 U	-0.01964 U	0.02649 U	0.004896 U
Co-60	0.00004063 U	0.01769 U	-0.001724 U	-0.008797 U	-0.002458 U	0.05599	-0.001648 U	0.01483 U	-0.002488 U	0.01099 U
Cs-134	0.02056 U	0.01713 U	0.01985 U	0.01952 U	0.01631 U	0.01112 U	0.01605 U	0.01389 U	0.01428 U	0.01956 U
Cs-137	0.04754 U	0.03959	-0.0009577 U	-0.00478 U	0.01609 U	0.07379	0.06362	0.05443	0.1741	0.1155
Eu-152	-0.001265 U	-0.002534 U	0.01151 U	-0.02107 U	0.1147 U	0.07725 U	0.04567 U	-0.001482 U	0.01524 U	-0.0007271 U
Eu-154	0.01815 U	-0.008546 U	0.0006083 U	-0.001413 U	0.015 U	0.01043 U	0.03164 U	0.00474 U	-0.01188 U	-0.01404 U
Eu-155	-0.01223 U	0.06947 U	0.1222 U	0.117 U	0.03826 U	0.1477 U	-0.0117 U	0.07832 U	0.07986 U	0.08569 U
Mn-54	0.001799 U	0.01045 U	0.01463 U	0.002083 U	0.02053 U	0.01143 U	-0.0004995 U	0.001107 U	-0.001617 U	0.00751 U
Nb-94	-0.0117 U	-0.006695 U	0.03823 U	-0.009256 U	0.008887 U	-0.0002333 U	-0.00407 U	0.00128 U	0.00689 U	-0.00008462 U
Sb-125	0.08436 U	0.08198	0.09776 U	0.09975	0.1192	0.06436 U	0.02714 U	0.05422 U	0.05885 U	0.09648
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-04-061-F	OOL-05-04-065-F	OOL-05-04-066-F	OOL-05-04-067-F	OOL-05-04-068-F	OOL-05-04-069-F	OOL-05-04-070-F	OOL-05-04-071-F	OOL-05-04-072-F	OOL-05-04-073-F
LTP (pCi/g)										
Ag-108m	-0.006676 U	-0.01944 U	-0.01889 U	-0.02393 U	-0.01281 U	-0.0008085 U	-0.016421 U	-0.0039818 U	0.0036217 U	0.006016 U
Am-241	0.05699 U	-0.0779 U	-0.02145 U	0.09385 U	0.0791 U	-0.01083 U	0.048553 U	0.0035677 U	0.3664 U	0.068811 U
Co-60	0.03199	0.0063 U	0.007725 U	0.006449 U	0.03116 U	0.08173	-0.00019614 U	0.018318 U	-0.0040172 U	-0.012366 U
Cs-134	0.01506 U	0.0178 U	0.01977 U	0.01862 U	-0.001331 U	0.01921 U	0.016762 U	0.018206 U	0.020759 U	-0.0081135 U
Cs-137	0.09454	0.02178 U	1.112	0.08145	0.07301	0.4265	0.0069792 U	0.10898	0.30888	0.13008
Eu-152	0.05912 U	0.03532 U	-0.02305 U	-0.00255 U	-0.002632 U	0.01391 U	0.0028104 U	0.015564 U	-0.00098805 U	0.02148 U
Eu-154	-0.008591 U	-0.003626 U	0.01629 U	-0.002634 U	-0.018 U	-0.0006645 U	-0.0093226 U	0.00024457 U	0.020783 U	-0.026869 U
Eu-155	0.08599 U	0.1087 U	0.1436 U	0.07851 U	-0.04138 U	0.1234 U	0.12438 U	0.1158 U	0.11097 U	0.080401 U
Mn-54	-0.01221 U	0.005106 U	-0.01534 U	-0.004109 U	-0.006227 U	0.0004046 U	0.019819 U	-0.00024981 U	0.044989	-0.0078916 U
Nb-94	-0.005742 U	0.007973 U	-0.000114 U	0.002882 U	-0.002715 U	-0.002412 U	-0.0012931 U	0.0041819 U	0.00033433 U	-0.0020426 U
Sb-125	0.05785 U	0.1045	0.1369	0.1198	0.077 U	0.08912 U	0.073593 U	0.12804	0.10608 U	0.11451 U
LTP_HTD (pCi/g)										
C-14							-0.121 U			
Cm-243							0.107 U			
Fe-55							43.5 U			
H-3							-0.837 U			
Ni-63							0.136 U			
Pu-238							0.029 U			
Pu-239							0.0424 U			
Pu-241							6.92 U			
Sr-90							-0.0025 U			
Tc-99							0.351 U			

Station	OOL-05-04-074-F	OOL-05-04-075-F	OOL-05-04-076-F	OOL-05-04-077-F	OOL-05-04-078-F	OOL-05-04-079-F	OOL-05-04-080-F	OOL-05-04-081-F	OOL-05-04-082-F	OOL-05-04-083-F
LTP (pCi/g)										
Ag-108m	0.0014133 U	0.0085547 U	0.00097786 U	-0.017248 U	0.012268 U	0.016856 U	-0.0058169 U	-0.0054115 U	-0.02735 U	-0.015525 U
Am-241	-0.06566 U	0.018776 U	0.085274 U	-0.38145 U	0.018346 U	-0.044096 U	0.12902 U	0.02664 U	0.00069117 U	-0.0027593 U
Co-60	-0.0072643 U	-0.0036345 U	-0.0031699 U	0.16308	0.015351 U	-0.0087887 U	-0.00024909 U	0.056584	0.021282 U	-0.0017351 U
Cs-134	0.010075 U	-0.010281 U	0.013668 U	0.08074 U	-0.00074166 U	-0.0090045 U	0.011266 U	0.021813 U	-0.0013424 U	0.0095958 U
Cs-137	-0.000035294 U	0.069412 U	0.0092812 U	0.24178	0.021305 U	0.071349 U	0.0035875 U	0.16255	0.092704	0.1604
Eu-152	-0.0021353 U	-0.03894 U	-0.02811 U	0.0029586 U	0.014445 U	0.02571 U	-0.0049954 U	-0.00010445 U	0.0029551 U	0.024528 U
Eu-154	-0.00021805 U	-0.000052833 U	0.000082229 U	-0.004415 U	-0.010932 U	0.036186 U	0.00052278 U	0.0056898 U	0.0027865 U	0.01905 U
Eu-155	0.088847 U	0.1499 U	0.101 U	-0.012781 U	0.094919 U	-0.017636 U	0.075956 U	0.13702 U	0.13541 U	0.12989
Mn-54	-0.00036749 U	-0.0016946 U	-0.0045812 U	0.0065737 U	0.015515 U	-0.0013453 U	-0.008517 U	-0.009971 U	0.01203 U	-0.0058518 U
Nb-94	-0.0060985 U	-0.00069672 U	0.007436 U	-0.0017839 U	0.00814 U	-0.0016075 U	0.0069944 U	0.00403 U	-0.011543 U	0.0062804 U
Sb-125	0.036966 U	0.019275 U	-0.0033244 U	0.063545 U	0.0059267 U	0.012703 U	-0.02006 U	0.088099 U	-0.037025 U	0.057294 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-05-04-084-F	OOL-05-04-085-F	OOL-05-04-086-F	OOL-05-05-001-F	OOL-05-05-002-F	OOL-05-05-003-F	OOL-05-05-004-F	OOL-05-05-005-F	OOL-05-05-006-F	OOL-05-05-007-F
LTP (pCi/g)										
Ag-108m	0.013546 U	-0.003097 U	0.0026973 U	0.00088976 U	0.05131 U	0.000017436 U	0.0093628 U	0.00079516 U	0.010947 U	-0.0014686 U
Am-241	0.17785 U	-0.038755 U	-0.048656 U	-0.21529 U	0.030004 U	-0.10388 U	-0.10521 U	0.0050092 U	0.082621 U	0.054625 U
Co-60	-0.0019923 U	0.039351 U	0.021346 U	0.014072 U	-0.0014732 U	-0.0081259 U	-0.014828 U	0.0097282 U	0.0027742 U	-0.007635 U
Cs-134	-0.011972 U	0.017631 U	-0.0035035 U	-0.0084405 U	0.019802 U	0.024709 U	0.0055105 U	0.0078065 U	-0.0012497 U	0.019318 U
Cs-137	0.017107 U	0.15332	0.11362	0.028342 U	-0.0081042 U	0.0075956 U	-0.0075218 U	0.0027047 U	-0.0064239 U	-0.01347 U
Eu-152	0.016703 U	-0.00091397 U	0.032642 U	-0.0040339 U	-0.020607 U	0.078893 U	-0.00083076 U	-0.0013935 U	-0.031541 U	0.0054601 U
Eu-154	-0.01365 U	0.020024 U	-0.02404 U	0.0035833 U	-0.011191 U	0.0022668 U	0.019174 U	-0.0036775 U	-0.016566 U	0.045383 U
Eu-155	0.071323 U	0.08643 U	0.055967 U	-0.0028745 U	0.097385 U	0.015638 U	-0.01362 U	0.09355 U	-0.07192 U	0.0069829 U
Mn-54	0.011484 U	-0.0078117 U	-0.00018996 U	-0.00035826 U	0.018504 U	0.022964 U	-0.01426 U	-0.0094025 U	0.016649 U	0.0064309 U
Nb-94	0.02946 U	-0.0081327 U	0.00082903 U	0.0065197 U	-0.0051552 U	-0.00060111 U	0.0025848 U	0.0088476 U	0.04459 U	0.0020026 U
Sb-125	0.053259 U	0.020088 U	0.05668 U	0.016043 U	0.085677	0.060613 U	0.022838 U	0.091226	-0.035492 U	0.10084 U
LTP_HTD (pCi/g)										
C-14	-0.173 U				0.0558 U					
Cm-243	-0.00742 U				-0.063 U					
Fe-55	6.13 U				5.86 U					
H-3	-1.14 U				1.1 U					
Ni-63	0.408 U				0.959 U					
Pu-238	-0.0466 U				0.0263 U					
Pu-239	-0.0122 U				-0.0126 U					
Pu-241	-11.7 U				-0.307 U					
Sr-90	-0.00111 U				-0.00685 U					
Tc-99	0.384 U				0.221 U					

Station	OOL-05-05-008-F	OOL-05-05-009-F	OOL-05-05-010-F	OOL-05-05-011-F	OOL-05-05-012-F	OOL-05-05-013-F	OOL-05-05-014-F	OOL-05-05-015-F	OOL-05-05-016-F	OOL-05-05-017-F
LTP (pCi/g)										
Ag-108m	0.00563 U	0.05238 U	0.001156 U	-0.016526 U	-0.017489 U	-0.00067857 U	-0.012518 U	-0.0043897 U	-0.0045199 U	-0.0033906 U
Am-241	-0.02433 U	-0.05861 U	0.15007 U	-0.20589 U	-0.024119 U	-0.10776 U	-0.011489 U	-0.16519 U	-0.030651 U	0.0073207 U
Co-60	-0.0028825 U	-0.0060355 U	-0.010116 U	-0.0035422 U	-0.0057269 U	-0.00034451 U	0.0015037 U	-0.013458 U	-0.0050747 U	-0.00018545 U
Cs-134	-0.014499 U	0.01104 U	-0.00079672 U	0.015466 U	0.014605 U	0.00039934 U	-0.0050327 U	0.0069717 U	0.020865 U	0.017181 U
Cs-137	-0.001689 U	0.067301	0.0056273 U	0.011827 U	0.037267	0.037355 U	-0.0053935 U	0.010017 U	-0.00034012 U	0.0085941 U
Eu-152	-0.0074272 U	0.011541 U	-0.017293 U	0.030819 U	0.0019671 U	-0.01674 U	0.004825 U	0.0018169 U	0.036572 U	0.022243 U
Eu-154	0.0087621 U	-0.011299 U	-0.0067402 U	0.021924 U	-0.01732 U	-0.018269 U	-0.025417 U	0.0042356 U	0.013544 U	0.021392 U
Eu-155	0.013586 U	0.096305 U	0.054484 U	0.13918 U	0.079676 U	0.040896 U	0.074924 U	-0.032319 U	-0.0055409 U	0.057886 U
Mn-54	0.0010092 U	0.0034769 U	-0.00036266 U	0.0090058 U	0.0011625 U	-0.0089092 U	-0.00020159 U	-0.00059434 U	0.001233 U	-0.0012343 U
Nb-94	0.0057383 U	0.0052518 U	0.0029397 U	-0.0014461 U	-0.0059817 U	0.00032475 U	-0.0011634 U	0.0388 U	-0.0024438 U	-0.0073247 U
Sb-125	0.1086 U	0.042065 U	0.061761 U	0.091174	0.076768	0.09561 U	0.062516 U	0.080815 U	-0.020183 U	0.0023872 U
LTP_HTD (pCi/g)										
C-14							-0.094 U			
Cm-243							-0.0753 U			
Fe-55							26.1 U			
H-3							-0.436 U			
Ni-63							-0.336 U			
Pu-238							-0.0217 U			
Pu-239							-0.0866 U			
Pu-241							-5 U			
Sr-90							0.0212 U			
Tc-99							0.261 U			

Station	OOL-05-05-018-F	OOL-05-05-019-F	OOL-05-05-020-F	OOL-05-06-001-F	OOL-05-06-002-F	OOL-05-06-003-F	OOL-05-06-004-F	OOL-05-06-005-F	OOL-05-06-006-F	OOL-05-06-007-F
LTP (pCi/g)										
Ag-108m	-0.0022237 U	0.0497 U	-0.0083285 U	-0.011418 U	-0.0035377 U	-0.0024416 U	-0.0089831 U	-0.00015704 U	-0.0086633 U	-0.0088639 U
Am-241	-0.038701 U	-0.17209 U	-0.047592 U	-0.048216 U	0.030802 U	-0.0049626 U	-0.26904 U	0.011614 U	-0.16238 U	-0.18239 U
Co-60	-0.0084597 U	-0.0030279 U	0.012299 U	-0.00074448 U	-0.00030832 U	-0.00031202 U	0.0038936 U	-0.0071649 U	-0.0061862 U	-0.00016682 U
Cs-134	0.017853 U	-0.0078437 U	0.023747 U	-0.0081228 U	0.0059852 U	-0.0035861 U	0.01968 U	0.0076606 U	0.017463 U	0.0081886 U
Cs-137	0.048035	0.016029 U	0.0067224 U	-0.0038875 U	-0.0075779 U	0.0011985 U	-0.0081463 U	-0.0021643 U	0.081477	0.008045 U
Eu-152	-0.020128 U	0.012406 U	0.00072197 U	-0.035776 U	0.026781 U	-0.00094259 U	0.0021084 U	-0.00011781 U	0.018637 U	-0.027361 U
Eu-154	-0.015284 U	-0.0032623 U	0.0083378 U	-0.022247 U	0.018064 U	-0.010951 U	-0.010469 U	0.00086053 U	0.0075593 U	-0.0013933 U
Eu-155	0.077734 U	0.1138 U	0.15372 U	0.055395 U	0.10797 U	0.070875 U	0.024361 U	0.0079671 U	0.23692 U	0.0065933 U
Mn-54	0.018839 U	0.016759 U	-0.013001 U	-0.00033845 U	0.0039868 U	-0.0022543 U	-0.0099142 U	0.0059404 U	0.018626 U	-0.015363 U
Nb-94	-0.0068019 U	0.0074088 U	0.0073837 U	0.04887 U	0.06083 U	0.03269 U	-0.007101 U	-0.0092636 U	0.0012825 U	0.0020318 U
Sb-125	0.065058 U	-0.02032 U	0.081861 U	0.032315 U	-0.016056 U	0.07192	0.12199	0.021038 U	0.044059 U	0.092292 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-06-008-F	OOL-05-06-009-F	OOL-05-06-010-F	OOL-05-06-011-F	OOL-05-06-012-F	OOL-05-06-013-F	OOL-05-06-014-F	OOL-05-06-015-F	OOL-05-06-016-F	OOL-05-06-017-F
LTP (pCi/g)										
Ag-108m	-0.012754 U	-0.0071607 U	-0.0016907 U	0.0089331 U	0.0017405 U	0.0016233 U	-0.019238 U	0.0028293 U	-0.01128 U	0.000039833 U
Am-241	-0.12598 U	-0.026802 U	-0.049938 U	0.0047224 U	-0.12284 U	0.05864 U	0.042833 U	-0.23088 U	-0.44 U	0.034161 U
Co-60	0.0013559 U	-0.0084651 U	0.0036536 U	-0.0056884 U	0.010378 U	0.016477 U	-0.011819 U	0.007945 U	-0.0017102 U	-0.00020991 U
Cs-134	-0.0090119 U	0.015421 U	-0.021728 U	0.018067 U	-0.00079553 U	-0.016448 U	0.013288 U	-0.030388 U	-0.0022666 U	-0.0036094 U
Cs-137	0.01169 U	-0.0026819 U	0.11997	0.0057399 U	-0.0068201 U	-0.0034505 U	-0.019564 U	-0.012654 U	0.011933 U	0.00090731 U
Eu-152	0.023552 U	0.02247 U	0.023065 U	-0.014969 U	0.035842 U	-0.034841 U	-0.026245 U	-0.0041934 U	0.039855 U	-0.012261 U
Eu-154	-0.0082459 U	0.016518 U	0.014783 U	0.025525 U	-0.02506 U	-0.017418 U	-0.01659 U	0.1038 U	-0.0083362 U	0.0014512 U
Eu-155	0.0098096 U	0.10119 U	0.148	-0.001571 U	0.0041976 U	0.13697 U	0.15171 U	0.14805 U	0.13271 U	0.0073957 U
Mn-54	-0.007567 U	-0.0022075 U	-0.0068246 U	0.022853 U	-0.0014931 U	-0.0007329 U	0.0181 U	0.0034672 U	0.00063038 U	-0.00098972 U
Nb-94	0.004637 U	0.0065872 U	-0.0026913 U	-0.00019769 U	-0.00014235 U	-0.00024144 U	0.00026244 U	0.03353 U	-0.0003209 U	-0.006544 U
Sb-125	-0.039441 U	0.073388	0.037772 U	0.048727 U	0.12139 U	-0.025423 U	-0.0010157 U	0.056726 U	0.064764 U	0.060147 U
LTP_HTD (pCi/g)										
C-14		0.0128 U								
Cm-243		-0.0829 U								
Fe-55		21.5 U								
H-3		1.64 U								
Ni-63		3.37 U								
Pu-238		-0.0196 U								
Pu-239		0.0142 U								
Pu-241		4.49 U								
Sr-90		0.0465 U								
Tc-99		0.294 U								

Station	OOL-05-06-018-F	OOL-05-06-019-F	OOL-05-06-020-F	OOL-05-06-021-F	OOL-05-07-001-F	OOL-05-07-002-F	OOL-05-07-003-F	OOL-05-07-004-F	OOL-05-07-005-F	OOL-05-07-006-F
LTP (pCi/g)										
Ag-108m	0.012888 U	0.0036153 U	-0.019816 U	-0.012889 U	-0.010441 U	0.00049003 U	0.05015 U	-0.0041267 U	-0.016675 U	-0.0018207 U
Am-241	-0.047655 U	0.010146 U	0.1166 U	0.022551 U	-0.12135 U	-0.018229 U	-0.10338 U	-0.00047617 U	-0.022415 U	0.02288 U
Co-60	-0.015427 U	-0.011209 U	0.0036464 U	-0.0046979 U	0.020602 U	-0.015465 U	0.11356	0.004951 U	0.099417	0.010595 U
Cs-134	-0.025103 U	0.018834 U	0.017474 U	0.00971 U	0.1019 U	0.013145 U	-0.0080147 U	-0.028258 U	0.030607	-0.019091 U
Cs-137	0.019709 U	0.0029976 U	-0.0049469 U	0.0089026 U	0.34322	0.40866	0.51865	-0.0057513 U	0.1182	0.36699
Eu-152	0.019533 U	-0.000095554 U	0.030002 U	0.0073021 U	0.0087791 U	-0.030603 U	-0.036127 U	0.025939 U	0.013932 U	0.063014 U
Eu-154	-0.017594 U	-0.00026985 U	0.026872 U	0.010844 U	0.0024334 U	-0.030142 U	0.030282 U	0.015505 U	0.0074975 U	0.044082 U
Eu-155	0.038847 U	0.10391 U	0.060626 U	0.097263 U	-0.014506 U	0.13942 U	-0.058131 U	0.072163 U	0.11332 U	0.021283 U
Mn-54	0.0046454 U	0.016068 U	0.0075932 U	-0.0055766 U	-0.0025132 U	-0.00014903 U	-0.0006415 U	-0.00034032 U	0.0098153 U	-0.0079673 U
Nb-94	-0.0011512 U	-0.0040331 U	0.010729 U	-0.00008383 U	0.0075733 U	-0.0044138 U	-0.0048725 U	0.0010875 U	-0.010053 U	-0.0085779 U
Sb-125	-0.025804 U	0.10718	0.10244 U	0.013038 U	0.02547 U	0.008298 U	-0.034827 U	0.2669	0.13563 U	0.11034
LTP_HTD (pCi/g)										
C-14		-0.0655 U						-0.0506 U		
Cm-243		0.197 U						0.0143 U		
Fe-55		14 U						27.1 U		
H-3		0.957 U						0.513 U		
Ni-63		-2.29 U						-1.59 U		
Pu-238		-0.00674 U						-0.00642 U		
Pu-239		-0.00673 U						0.0267 U		
Pu-241		-7.86 U						-0.62 U		
Sr-90		0.0196 U						0.0134 U		
Tc-99		0.227 U						0.2 U		

Station	OOL-05-07-007-F	OOL-05-07-008-F	OOL-05-07-009-F	OOL-05-07-010-F	OOL-05-07-011-F	OOL-05-07-012-F	OOL-05-07-013-F	OOL-05-07-014-F	OOL-05-07-015-F	OOL-05-07-016-F
LTP (pCi/g)										
Ag-108m	-0.025137 U	0.010751 U	-0.000096136 U	-0.00819 U	0.00005253 U	-0.000071408 U	-0.013372 U	-0.01276 U	-0.0094203 U	-0.0013097 U
Am-241	0.033795 U	-0.0040553 U	0.0091851 U	-0.019248 U	-0.071738 U	-0.028196 U	0.064458 U	-0.058504 U	-0.18756 U	-0.032715 U
Co-60	0.01102 U	0.012065 U	-0.0098372 U	0.088329	-0.0078816 U	-0.0039529 U	0.0094591 U	0.00030475 U	-0.006248 U	0.028599 U
Cs-134	0.025059 U	-0.0027433 U	-0.036746 U	0.025145	0.0030826 U	-0.042244 U	0.012074 U	0.025725 U	0.016102 U	-0.00098395 U
Cs-137	0.18088	0.26667	0.0019456 U	0.080901	-0.011728 U	-0.0054308 U	0.46723	0.45188	1.3195	0.32734
Eu-152	0.023068 U	0.002554 U	0.019904 U	0.086306 U	-0.0030508 U	0.005778 U	-0.023267 U	0.045083 U	-0.015309 U	-0.053852 U
Eu-154	-0.01623 U	-0.00065644 U	-0.000045982 U	0.0011252 U	-0.014287 U	-0.023726 U	0.0082417 U	-0.0034159 U	0.018196 U	-0.029845 U
Eu-155	0.1477 U	0.01719 U	0.15045	0.11925 U	0.06574 U	0.098838 U	-0.0052241 U	-0.03041 U	0.026758 U	-0.022148 U
Mn-54	-0.0099329 U	0.025507 U	0.0061965 U	0.000086981 U	0.00054215 U	0.0054731 U	-0.0011306 U	0.0040301 U	0.0096952 U	0.020087 U
Nb-94	-0.014601 U	-0.0076703 U	0.0041981 U	0.009111 U	-0.00015347 U	0.0080826 U	-0.0090902 U	-0.0020167 U	0.010514 U	0.01007 U
Sb-125	0.088238 U	-0.016075 U	0.4708	0.10132	0.35543	0.51232	-0.025101 U	0.09011 U	0.03412 U	0.066003 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-05-07-017-F	OOL-05-07-018-F	OOL-05-07-019-F	OOL-05-08-002-F	OOL-05-08-003-F	OOL-05-08-004-F	OOL-05-08-005-F	OOL-05-08-006-F	OOL-05-08-007-F	OOL-05-08-008-F
LTP (pCi/g)										
Ag-108m	0.1187 U	-0.000063473 U	0.0604 U	-0.010412 U	-0.0068547 U	-0.011763 U	-0.0067423 U	-0.018991 U	-0.00042724 U	-0.014536 U
Am-241	-0.13646 U	0.045396 U	0.23714 U	-0.14082 U	0.02562 U	-0.0804 U	-0.041129 U	-0.046188 U	-0.05256 U	-0.43773 U
Co-60	0.21251	0.0028119 U	0.0091794 U	0.017416 U	0.011671 U	-0.0002177 U	-0.0058511 U	0.0061826 U	-0.0079855 U	-0.010681 U
Cs-134	0.03683 U	-0.030108 U	0.023551 U	-0.023503 U	0.0036385 U	-0.017883 U	-0.01086 U	0.0083071 U	-0.014223 U	0.0029275 U
Cs-137	0.29125	-0.0029084 U	0.034315 U	0.20579	0.015178 U	0.014462 U	0.066427	0.2667	0.0051223 U	0.079971
Eu-152	0.018476 U	0.01698 U	-0.02547 U	-0.018214 U	0.0018841 U	-0.023377 U	-0.033744 U	-0.0022174 U	-0.036086 U	0.026644 U
Eu-154	0.02447 U	0.011869 U	-0.015801 U	0.022885 U	-0.0014548 U	-0.024699 U	-0.02302 U	-0.016417 U	-0.00021023 U	0.0032356 U
Eu-155	0.28657 U	0.081608 U	0.1542 U	0.003271 U	0.057305 U	0.0098537 U	0.03058 U	0.058216 U	0.10064 U	0.12544 U
Mn-54	-0.013849 U	-0.00038562 U	-0.002233 U	-0.00046611 U	-0.00060443 U	-0.00069949 U	0.023191 U	0.0092902 U	-0.0054803 U	-0.015299 U
Nb-94	0.0045395 U	0.0089275 U	-0.00080764 U	0.0087194 U	0.0085154 U	0.0052915 U	-0.00012164 U	0.0068827 U	-0.003136 U	-0.0050324 U
Sb-125	0.095146 U	0.34509	0.1072	0.14891	0.0063602 U	0.10228 U	-0.020005 U	-0.021708 U	0.034943 U	-0.018159 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Station	OOL-05-08-009-F	OOL-05-08-010-F	OOL-05-08-011-F	OOL-05-08-012-F	OOL-05-08-013-F	OOL-05-08-014-F	OOL-05-08-015-F	OOL-05-08-016-F	OOL-05-08-017-F	OOL-05-08-018-F
LTP (pCi/g)										
Ag-108m	-0.001019 U	-0.01297 U	-0.010903 U	-0.0011501 U	0.0052894 U	0.005116 U	-0.0068829 U	-0.0010939 U	-0.014249 U	0.05262 U
Am-241	-0.08044 U	-0.049058 U	-0.11355 U	0.25979 U	-0.11627 U	0.11232 U	0.0010738 U	-0.13427 U	-0.065428 U	0.01552 U
Co-60	-0.0099176 U	-0.0020323 U	0.011434 U	-0.0045968 U	0.0056287 U	-0.00021118 U	0.0020989 U	0.011007 U	-0.0015373 U	-0.0040299 U
Cs-134	0.0030118 U	0.0098893 U	0.012839 U	0.01866 U	0.014217 U	-0.012787 U	-0.0095897 U	0.013708 U	-0.001331 U	0.013177 U
Cs-137	0.06478	0.027799 U	0.0013554 U	0.023115 U	0.05181 U	0.0074561 U	0.023508 U	0.0050186 U	0.010744 U	0.0073423 U
Eu-152	-0.042864 U	0.007782 U	-0.015379 U	0.084403 U	0.033423 U	0.044008 U	0.021757 U	0.0029279 U	-0.0082326 U	0.000015348 U
Eu-154	-0.018646 U	0.00050707 U	-0.00079148 U	0.0035494 U	-0.024148 U	-0.021297 U	0.014668 U	0.035056 U	0.0040966 U	0.0030511 U
Eu-155	0.13862 U	0.076297 U	-0.018756 U	0.016735 U	0.13618 U	0.15087 U	0.048394 U	0.10728 U	0.056352 U	0.060329 U
Mn-54	-0.0069499 U	0.010423 U	-0.00048279 U	0.021701 U	0.018735 U	-0.00038907 U	0.0066191 U	0.011578 U	0.010989 U	0.011556 U
Nb-94	0.0025272 U	-0.000027158 U	0.0012973 U	-0.005348 U	0.014994 U	0.0092364 U	0.0053832 U	-0.0096177 U	-0.0003828 U	0.0030009 U
Sb-125	-0.030409 U	0.073204 U	0.0013755 U	0.08732 U	0.0040881 U	0.10561 U	0.066543 U	0.10474	0.0090762 U	0.066545 U
LTP_HTD (pCi/g)										
C-14	-0.092 U							-0.0813 U		
Cm-243	-0.023 U							-0.00736 U		
Fe-55	-9.68 U							-13.7 U		
H-3	1.41 U							1.49 U		
Ni-63	0.402 U							0.201 U		
Pu-238	0.0823 U							0.00866 U		
Pu-239	0.0389 U							-0.0655 U		
Pu-241	8.7 U							1.31 U		
Sr-90	-0.021 U							-0.00483 U		
Tc-99	0.199 U							0.2 U		

Station	OOL-05-08-019-F	OOL-05-08-020-F	OOL-05-08-021-F	OOL-05-08-022-F	OOL-05-09-001-F	OOL-05-09-002-F	OOL-05-09-003-F	OOL-05-09-004-F	OOL-05-09-005-F	OOL-05-09-006-F
LTP (pCi/g)										
Ag-108m	-0.00011156 U	-0.0072805 U	0.06603 U	-0.0061077 U	-0.010348 U	-0.0059558 U	-0.010229 U	0.014935 U	0.0071201 U	-0.011411 U
Am-241	-0.10244 U	0.030924 U	-0.0091411 U	-0.000073031 U	-0.0049742 U	-0.11364 U	0.021293 U	-0.011927 U	0.025845 U	-0.058354 U
Co-60	-0.008137 U	0.00037212 U	-0.0045698 U	-0.0065839 U	0.010362 U	-0.00055135 U	0.0028064 U	0.0095045 U	-0.0013841 U	0.0054742 U
Cs-134	0.05816 U	0.018093 U	-0.0083585 U	0.021812 U	0.0040564 U	0.0066001 U	-0.0098243 U	0.00061682 U	-0.023472 U	0.01108 U
Cs-137	0.042442 U	0.03091 U	0.013253 U	0.015013 U	0.10715	0.011504 U	0.024085 U	0.044375 U	0.022051 U	0.082603
Eu-152	-0.037476 U	-0.028265 U	0.01678 U	-0.033713 U	-0.039239 U	0.024851 U	-0.0067454 U	0.014986 U	-0.015862 U	0.0083505 U
Eu-154	0.049977 U	0.0059925 U	-0.0065948 U	0.00096148 U	0.0002048 U	0.020856 U	-0.0010762 U	-0.044802 U	-0.012499 U	-0.0043315 U
Eu-155	-0.0060989 U	0.1438 U	0.1328 U	-0.02427 U	0.060507 U	-0.0070448 U	0.045839 U	0.15634 U	-0.0025179 U	0.06066 U
Mn-54	0.0029481 U	0.030283 U	-0.0035178 U	-0.013289 U	0.0028321 U	0.0047238 U	-0.00031225 U	-0.00049182 U	-0.0022037 U	0.0056426 U
Nb-94	0.0049417 U	0.001686 U	-0.0041485 U	-0.0078207 U	-0.0018647 U	0.0079073 U	0.0014719 U	0.014754 U	0.00065197 U	0.0054057 U
Sb-125	0.076995 U	0.11078 U	0.10453 U	0.1136 U	0.0021887 U	0.06883 U	0.029321 U	0.12039 U	0.0010129 U	0.074926
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-09-007-F	OOL-05-09-008-F	OOL-05-09-009-F	OOL-05-09-010-F	OOL-05-09-011-F	OOL-05-09-012-F	OOL-05-09-013-F
LTP (pCi/g)							
Ag-108m	0.010255 U	-0.010247 U	-0.0026767 U	0.05824 U	0.0017087 U	-0.0241 U	-0.0063241 U
Am-241	0.0054451 U	-0.18409 U	0.20348 U	-0.012764 U	0.023154 U	0.28043 U	0.064611 U
Co-60	-0.0080362 U	-0.0032894 U	-0.00017971 U	0.0067626 U	0.01279 U	0.0092065 U	0.00042276 U
Cs-134	-0.0014032 U	0.0054311 U	0.017138 U	0.014824 U	-0.0007406 U	0.01888 U	0.0049532 U
Cs-137	0.016651 U	0.06154	0.018513 U	0.017807 U	0.0083349 U	0.041365	0.019873 U
Eu-152	0.14434 U	0.03041 U	-0.00093461 U	0.000095113 U	-0.0010083 U	0.10189 U	-0.0028014 U
Eu-154	0.030004 U	0.018112 U	0.020654 U	-0.0006874 U	0.020656 U	0.018924 U	0.03164 U
Eu-155	0.11699 U	0.20406 U	-0.022364 U	0.07992 U	-0.0099072 U	0.10564 U	-0.028066 U
Mn-54	-0.0023533 U	-0.0012557 U	-0.00030479 U	0.011648 U	0.021204 U	-0.0051591 U	0.00021508 U
Nb-94	0.00011954 U	0.0097003 U	-6.5197E-06 U	0.0051957 U	0.014231 U	0.00044486 U	-0.0046803 U
Sb-125	0.14469 U	0.092305 U	0.060362 U	0.049754 U	0.11583	0.023154 U	0.076901 U
LTP_HTD (pCi/g)							
C-14	-0.0642 U						-0.124 U
Cm-243	0.0202 U						0.0251 U
Fe-55	14.4 U						-19.2 U
H-3	1.51 U						0.952 U
Ni-63	3.45 U						0.969 U
Pu-238	-0.0144 U						-0.0125 U
Pu-239	0.0527 U						-0.0468 U
Pu-241	2.46 U						11.6 U
Sr-90	0.00296 U						-0.00594 U
Tc-99	0.135 U						0.0109 U

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-01-001-F	OOL-04-01-002-F	OOL-04-01-003-F	OOL-04-01-004-F	OOL-04-01-005-F	OOL-04-01-006-F	OOL-04-01-007-F	OOL-04-01-008-F	OOL-04-01-009-F	OOL-04-01-010-F
LTP (pCi/g)										
Ag-108m	-0.06172 U	-0.01716 U	0.00558 U	-0.03388 U	-0.02194 U	-0.001886 U	-0.00111 U	-0.0317 U	-0.01457 U	0.03871 U
Am-241	0.00692 U	-0.06367 U	-0.008998 U	-0.09751 U	-0.0009792 U	-0.01841 U	-0.02835 U	-0.0194 U	-0.0368 U	0.07474 U
Co-60	-0.001679 U	-0.0008547 U	0.01577 U	0.01424 U	-0.002332 U	-0.01309 U	0.008797 U	0.02632 U	-0.001759 U	-0.001016 U
Cs-134	0.005869 U	0.02625 U	-0.02145 U	0.0472 U	0.004032 U	0.003158 U	-0.001133 U	-0.0154 U	-0.004743 U	0.03484 U
Cs-137	0.366	0.2697	0.1583	0.3764	0.2389	0.0004273 U	0.06304 U	0.3991	0.01727 U	0.1101
Eu-152	0.04732 U	0.02903 U	-0.02638 U	0.002416 U	0.0005367 U	-0.001097 U	-0.06083 U	0.2152 U	-0.01869 U	-0.003377 U
Eu-154	-0.04837 U	0.02809 U	-0.0174 U	0.02684 U	0.02349 U	0.001095 U	-0.04086 U	0.01522 U	-0.00009582 U	0.005201 U
Eu-155	0.02344 U	0.1921 U	0.1327 U	0.171 U	-0.006036 U	0.007518 U	-0.005029 U	0.2846	0.214 U	-0.03226 U
Mn-54	-0.007601 U	0.01364 U	0.02617 U	-0.02116 U	0.02642 U	0.0269 U	0.0152 U	0.003562 U	-0.01103 U	0.04479 U
Nb-94	0.00004091 U	0.003451 U	0.004199 U	0.008222 U	0.07437 U	0.001835 U	-0.006581 U	-0.003069 U	0.009592 U	-0.0193 U
Sb-125	0.1472 U	0.1317 U	0.1024 U	0.1518 U	0.2037	0.1032 U	0.1078 U	-0.04749 U	0.05455 U	0.1147 U
LTP_HTD (pCi/g)										
C-14				-0.0222 U						
Cm-243				0.0531 U						
Fe-55				-2.75 U						
H-3	0.431 U	-0.312 U	3.01 U		1.45 U	1.55 U	4.34 U		0.245 U	0.961 U
Ni-63				0.634 U						
Pu-238				-0.034 U						
Pu-239				0.00737 U						
Pu-241				1.48 U						
Sr-90				0.0157 U						
Tc-99				0.00413 U						

Station	OOL-04-01-011-F	OOL-04-01-012-F	OOL-04-01-013-F	OOL-04-01-014-F	OOL-04-01-015-F	OOL-04-01-016-F	OOL-04-01-017-F	OOL-04-01-018-F	OOL-04-01-019-F	OOL-04-01-020-F
LTP (pCi/g)										
Ag-108m	0.0158 U	0.005115 U	-0.01779 U	0.0004223 U	0.001669 U	-0.0014 U	0.1276 U	0.001865 U	-0.01786 U	0.003204 U
Am-241	-0.07514 U	0.05713 U	-0.06176 U	-0.01724 U	-0.1468 U	-0.07327 U	-0.003457 U	0.0004987 U	-0.005295 U	0.4032 U
Co-60	-0.02815 U	-0.02119 U	0.001751 U	0.008772 U	-0.01482 U	-0.03235 U	-0.008453 U	0.008494 U	0.01286 U	-0.01936 U
Cs-134	0.01424 U	-0.03055 U	-0.0004753 U	-0.03053 U	-0.002401 U	-0.006661 U	0.01923 U	0.1782 U	0.04077 U	0.04522 U
Cs-137	0.1877	0.021 U	0.07278 U	0.1036	0.2601	0.3427	0.4264	0.2086	0.2223	0.1798
Eu-152	-0.02707 U	-0.0006484 U	0.1083 U	0.01209 U	-0.02884 U	0.2157 U	-0.03721 U	0.1607 U	0.03495 U	-0.03656 U
Eu-154	-0.02329 U	0.01684 U	0.1142 U	-0.01246 U	0.0003132 U	-0.0183 U	0.05467 U	0.1712	0.03176 U	0.003188 U
Eu-155	0.001673 U	-0.01766 U	0.1913 U	0.1305 U	-0.01438 U	0.1684 U	0.2814	0.2238	0.2323 U	0.335
Mn-54	-0.006313 U	0.02134 U	0.0008475 U	0.01105 U	-0.009132 U	0.08443 U	0.001196 U	0.002153 U	0.02707 U	0.02244 U
Nb-94	0.02603 U	-0.0005536 U	-0.01761 U	-0.00111 U	0.0854 U	0.004761 U	-0.008958 U	0.0004153 U	-0.0002523 U	-0.002414 U
Sb-125	0.147 U	0.1267 U	0.01193 U	0.06737 U	0.222	0.132 U	0.1115 U	0.05288 U	0.2194	-0.01838 U
LTP_HTD (pCi/g)										
C-14					0.0488 U					
Cm-243					0.0138 U					
Fe-55					-2.73 U					
H-3		0.685 U	1.01 U	0.122 U		0.241 U	0.906 U	-0.852 U	1.7 U	
Ni-63					0.187 U					
Pu-238					-0.0052 U					
Pu-239					0.0197 U					
Pu-241					-1.64 U					
Sr-90					0.0101 U					
Tc-99					0.0997 U					

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-01-021-F	OOL-04-01-022-F	OOL-04-01-023-F	OOL-04-01-024-F	OOL-04-01-025-F	OOL-04-02-001-F	OOL-04-02-002-F	OOL-04-02-003-F	OOL-04-02-004-F	OOL-04-02-005-F
LTP (pCi/g)										
Ag-108m	0.1606 U	-0.02305 U	0.002099 U	-0.01678 U		0.004214 U	-0.01897 U	-0.01323 U	-0.007431 U	-0.002438 U
Am-241	-0.01801 U	-0.01757 U	-0.02687 U	-0.1039 U		0.1953 U	0.08172 U	0.03747 U	-0.01354 U	-0.2042 U
Co-60	0.03688 U	-0.00903 U	0.02645 U	0.00006931 U		-0.007805 U	-0.001106 U	-0.0003405 U	-0.01283 U	-0.003705 U
Cs-134	-0.03928 U	0.02959 U	-0.03092 U	0.001981 U		0.01023 U	0.01844 U	0.02724 U	0.02207 U	-0.003575 U
Cs-137	0.3206	0.06425	-0.0002594 U	0.1282		0.1352	0.01393 U	0.2331	0.2999	0.2947
Eu-152	-0.002368 U	-0.03525 U	-0.02844 U	-0.04444 U		-0.002913 U	0.01791 U	0.05303 U	0.003078 U	-0.003071 U
Eu-154	0.006506 U	-0.01696 U	0.00996 U	-0.004756 U		0.01928 U	0.01957 U	0.0002502 U	0.01199 U	0.04042 U
Eu-155	-0.007749 U	0.00336 U	0.2465	0.04478 U		0.02517 U	0.1098 U	0.01821 U	-0.02051 U	0.003466 U
Mn-54	0.01156 U	0.01416 U	0.008651 U	-0.002289 U		0.006832 U	-0.009631 U	0.028 U	0.01016 U	0.01535 U
Nb-94	-0.00546 U	0.07859 U	0.006526 U	-0.0009113 U		0.009328 U	0.009236 U	-0.01518 U	-0.005662 U	-0.009481 U
Sb-125	0.1505 U	0.1032 U	0.1234 U	0.09675 U		0.05505 U	0.08343 U	0.1856 U	-0.01185 U	0.01657 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3	1.51 U	1.23 U	1.41 U	2.17 U	1.18 U					
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-02-006-F	OOL-04-02-007-F	OOL-04-02-008-F	OOL-04-02-009-F	OOL-04-02-010-F	OOL-04-02-011-F	OOL-04-02-012-F	OOL-04-02-013-F	OOL-04-02-014-F	OOL-04-02-015-F
LTP (pCi/g)										
Ag-108m	0.00197 U	-0.01169 U	-0.01551 U	0.1263 U	-0.01688 U	-0.01624 U	0.1263 U	-0.007207 U	0.1285 U	-0.006551 U
Am-241	0.007563 U	0.5226 U	-0.05343 U	-0.07952 U	0.07069 U	-0.1154 U	0.1166 U	0.2866 U	0.2055 U	-0.1656 U
Co-60	-0.0004758 U	-0.006088 U	-0.01151 U	0.009424 U	-0.004816 U	0.02171 U	-0.0003006 U	0.007053 U	0.0001288 U	-0.01001 U
Cs-134	-0.01568 U	-0.03152 U	0.01809 U	-0.003935 U	0.03016 U	-0.004197 U	0.002103 U	-0.01932 U	-0.02378 U	0.001713 U
Cs-137	0.3974	0.233	0.03242 U	0.1946	0.02209 U	0.003195 U	0.2417	0.1831	0.1762	0.03221 U
Eu-152	-0.01452 U	-0.002285 U	0.01501 U	0.07624 U	0.1037 U	0.006136 U	-0.002811 U	-0.005592 U	0.0138 U	0.0666 U
Eu-154	0.04476 U	0.01978 U	-0.03862 U	-0.03449 U	0.006542 U	0.001127 U	0.02262 U	-0.01566 U	0.02863 U	0.04452 U
Eu-155	-0.0243 U	-0.01429 U	0.08146 U	0.1946 U	-0.01097 U	-0.001156 U	0.2117 U	0.08685 U	0.111 U	0.094 U
Mn-54	-0.001635 U	-0.01441 U	0.002976 U	0.01527 U	0.02168 U	0.01646 U	0.02022 U	0.01764 U	-0.0004742 U	-0.0006513 U
Nb-94	-0.009137 U	-0.005452 U	0.01655 U	-0.007805 U	0.01469 U	0.00447 U	0.1002 U	0.008488 U	0.0005929 U	-0.009545 U
Sb-125	0.02629 U	0.1839 U	0.09388 U	0.03026 U	0.1058 U	0.06649 U	0.111 U	0.1183 U	0.02449 U	-0.02721 U
LTP_HTD (pCi/g)										
C-14	0.0329 U									
Cm-243	0.00108 U									
Fe-55	3.98 U									
H-3	-0.634 U									
Ni-63	0.688 U									
Pu-238	-0.0209 U									
Pu-239	-0.0209 U									
Pu-241	5.18 U									
Sr-90	0.0217 U									
Tc-99	0.0925 U									

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-02-016-F	OOL-04-02-017-F	OOL-04-02-018-F	OOL-04-02-019-F	OOL-04-02-020-F	OOL-04-02-021-F	OOL-04-04-001-F	OOL-04-04-002-F	OOL-04-04-003-F	OOL-04-04-004-F
LTP (pCi/g)										
Ag-108m	-0.0104 U	-0.01397 U	-0.02333 U	-0.02113 U	-0.001898 U	-0.02513 U	0.00077426 U	0.015503 U	-0.030061 U	0.012068 U
Am-241	0.01301 U	-0.09262 U	0.00499 U	-0.08234 U	0.018 U	-0.05063 U	-0.04162 U	0.47404 U	-0.0042859 U	0.010893 U
Co-60	0.001652 U	0.009414 U	-0.0002371 U	-0.01063 U	-0.007747 U	-0.003299 U	0.0046582 U	0.00066389 U	0.0012644 U	0.01437 U
Cs-134	-0.02042 U	0.01115 U	0.01006 U	0.003287 U	-0.01269 U	-0.01804 U	0.016144 U	0.023678 U	R	0.016912 U
Cs-137	0.01858 U	0.006016 U	0.001795 U	0.0197 U	0.109	0.1066	0.03759	0.47364	0.074055	0.022407 U
Eu-152	-0.01252 U	-0.04867 U	0.01617 U	0.004782 U	-0.01598 U	0.05409 U	-0.012329 U	-0.054992 U	0.018416 U	-0.0014462 U
Eu-154	0.00685 U	0.0005768 U	-0.01488 U	-0.002329 U	0.01575 U	0.03055 U	-0.010163 U	-0.042027 U	0.0070812 U	-0.0033643 U
Eu-155	-0.007483 U	0.05117 U	0.2069 U	0.00311 U	0.1388 U	0.101 U	0.1045 U	0.012457 U	0.12296 U	0.032982 U
Mn-54	-0.0003886 U	0.0119 U	-0.01173 U	0.008464 U	0.008765 U	0.02354 U	-0.0062243 U	-0.0014413 U	0.02149 U	0.014703 U
Nb-94	0.0002048 U	0.002005 U	-0.01412 U	0.002378 U	0.00679 U	-0.01241 U	-0.000095307 U	0.0010754 U	-0.0091401 U	-0.0051875 U
Sb-125	0.1014 U	0.1137 U	0.1444 U	-0.03306 U	0.08158 U	0.1389 U	R	-0.045327 U	0.060103 U	0.097323 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-04-005-F	OOL-04-04-006-F	OOL-04-04-007-F	OOL-04-04-008-F	OOL-04-04-009-F	OOL-04-04-010-F	OOL-04-04-011-F	OOL-04-04-012-F	OOL-04-04-013-F	OOL-04-04-014-F
LTP (pCi/g)										
Ag-108m	-0.0095156 U	-0.015658 U	0.00075673 U	0.09203 U	0.0031535 U	0.0695 U	-0.0045507 U	-0.0028393 U	-0.015745 U	0.015785 U
Am-241	-0.21889 U	0.0051504 U	0.039451 U	-0.025655 U	-0.0028472 U	0.0081043 U	-0.0025217 U	0.0076664 U	0.11304 U	-0.0041682 U
Co-60	-0.0087554 U	-0.0025113 U	0.0039156 U	0.011397 U	-0.0075395 U	-0.0045982 U	0.0054817 U	0.0075085 U	0.023019 U	0.014282 U
Cs-134	-0.021304 U	-0.020924 U	0.014191 U	0.01569 U	0.016144 U	0.0634 U	-0.011952 U	0.0059921 U	0.021153 U	0.0092068 U
Cs-137	0.019339 U	0.1318	-0.0077873 U	0.10421	0.031951 U	-0.0019193 U	0.0049895 U	0.059675	0.033766 U	0.11955
Eu-152	0.04265 U	0.034298 U	0.12819 U	-0.018834 U	0.09589 U	-0.039074 U	-0.000039647 U	-0.021287 U	-0.0022087 U	-0.018332 U
Eu-154	0.029205 U	-0.020185 U	-0.0088287 U	-0.015607 U	0.0045795 U	-0.027368 U	0.00047519 U	-0.0012445 U	-0.035699 U	0.0029725 U
Eu-155	0.026265 U	-0.0013394 U	0.15699 U	0.022496 U	0.046549 U	0.10975 U	0.031931 U	0.12231	-0.035164 U	0.10077 U
Mn-54	0.026008 U	-0.00088815 U	-0.0027096 U	-0.019634 U	0.0006179 U	-0.0061152 U	-0.0037556 U	-0.00012409 U	-0.008166 U	-0.00048808 U
Nb-94	-0.00093739 U	0.0041865 U	-0.000057344 U	-0.013188 U	0.03782 U	0.0014538 U	-0.0037861 U	-0.0028029 U	0.016626 U	0.0053927 U
Sb-125	0.097268 U	-0.0012428 U	0.095868 U	0.16536	0.11495	0.023523 U	0.0359 U	0.056783 U	0.14212 U	0.01451 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-04-04-015-F	OOL-04-04-016-F	OOL-04-04-017-F	OOL-04-04-018-F	OOL-04-04-019-F	OOL-04-04-020-F	OOL-05-01-001-F	OOL-05-01-002-F	OOL-05-01-003-F	OOL-05-01-004-F
LTP (pCi/g)										
Ag-108m	0.0068825 U	0.01307 U	0.014844 U	-0.0090154 U	0.011592 U	-0.0016538 U	-0.009574 U	-0.02226 U	0.1223 U	-0.01471 U
Am-241	-0.12683 U	0.00050912 U	-0.021271 U	0.040664 U	-0.056213 U	0.073398 U	-0.04513 U	-0.01163 U	-0.01078 U	-0.1231 U
Co-60	-0.0003097 U	-0.00030646 U	-0.00027789 U	0.0074651 U	0.0023423 U	-0.0062341 U	-0.0001483 U	-0.001004 U	-0.0161 U	-0.01125 U
Cs-134	0.029557 U	-0.00018324 U	0.019871 U	0.017706 U	0.020439 U	0.017411 U	-0.005632 U	0.01712 U	-0.02386 U	-0.0006188 U
Cs-137	-0.0020237 U	0.2466	0.17748	0.21149	-0.010512 U	0.14217	0.3546	0.3344	0.1334	0.3557
Eu-152	0.00031901 U	0.0083455 U	-0.0019016 U	0.0017681 U	-0.042744 U	0.023954 U	-0.03007 U	-0.03245 U	-0.006012 U	0.03762 U
Eu-154	-0.013625 U	0.00072571 U	-0.013398 U	-0.016517 U	0.00037419 U	0.00052101 U	0.02815 U	-0.02032 U	0.001441 U	-0.02786 U
Eu-155	-0.021506 U	-0.067154 U	0.17599	0.10113 U	0.095909 U	0.15729 U	0.1388 U	0.05812 U	0.007444 U	0.09033 U
Mn-54	-0.01297 U	0.0045314 U	-0.000012096 U	-0.0060691 U	0.011926 U	-0.00044369 U	0.002355 U	-0.007392 U	-0.01887 U	0.02394 U
Nb-94	0.017287 U	0.0036834 U	-0.0050074 U	-0.0041154 U	0.0086133 U	-0.00012472 U	-0.007211 U	0.05134 U	-0.005599 U	0.07439 U
Sb-125	-0.0073209 U	-0.0058767 U	0.077547 U	0.086959 U	0.097881 U	0.12226	0.03312 U	0.1109 U	0.1381 U	-0.05098 U
LTP_HTD (pCi/g)										
C-14	0.0485 U						0.202 U			
Cm-243	0.04 U						-0.11 U			
Fe-55	2.5 U						-0.72 U			
H-3	2.32 U						-2.83 U			
Ni-63	0.875 U						-0.355 U			
Pu-238	-0.0262 U						-0.0113 U			
Pu-239	-0.012 U						-0.00566 U			
Pu-241	-15.3 U						0.225 U			
Sr-90	0.00297 U						0.0182 U			
Tc-99	0.373 U						-0.399 U			

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-01-005-F	OOL-05-01-006-F	OOL-05-01-007-F	OOL-05-01-008-F	OOL-05-01-009-F	OOL-05-01-010-F	OOL-05-01-011-F	OOL-05-01-012-F	OOL-05-01-013-F	OOL-05-01-014-F
LTP (pCi/g)										
Ag-108m	-0.006523 U	0.05614 U	-0.0002587 U	-0.003157 U	0.002661 U	-0.02684 U	0.0057 U	-0.07042 U	-0.01663 U	-0.002692 U
Am-241	0.01782 U	-0.001138 U	-0.07289 U	0.004078 U	0.02082 U	0.002894 U	-0.03538 U	0.1827 U	-0.002192 U	-0.000723 U
Co-60	-0.005061 U	-0.006103 U	-0.01677 U	-0.02344 U	-0.004796 U	-0.01318 U	0.01294 U	0.01916 U	-0.004654 U	-0.001703 U
Cs-134	0.03535 U	-0.002076 U	0.01628 U	0.0292 U	-0.001191 U	0.03419 U	-0.005572 U	-0.08523 U	0.01935 U	-0.006362 U
Cs-137	0.1522	0.5454	0.008702 U	0.4677	-0.004061 U	0.08128	0.4117	0.7976	0.3212	0.8442
Eu-152	0.02452 U	0.01664 U	-0.01957 U	-0.0331 U	0.0362 U	-0.006994 U	0.07923 U	-0.002614 U	-0.004666 U	-0.009477 U
Eu-154	0.03571 U	-0.01639 U	-0.0008406 U	-0.001194 U	0.02515 U	-0.01187 U	0.0571 U	0.06059 U	-0.02308 U	-0.01736 U
Eu-155	0.01231 U	0.07056 U	-0.001152 U	0.02126 U	0.003318 U	0.1738 U	0.0014 U	0.03028 U	0.08406 U	0.01627 U
Mn-54	0.001118 U	0.01145 U	-0.001548 U	-0.005163 U	0.006403 U	0.02507 U	0.005999 U	-0.01804 U	-0.01549 U	0.001293 U
Nb-94	0.0001113 U	-0.01208 U	0.004075 U	-0.000427 U	0.003254 U	0.007575 U	-0.0008022 U	0.003841 U	-0.01403 U	0.0009462 U
Sb-125	0.1507 U	-0.03801 U	0.1399	0.2012	0.0705 U	0.09807 U	-0.003285 U	0.5398	0.1147 U	0.003471 U
LTP_HTD (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-01-015-F	OOL-05-01-016-F	OOL-05-01-017-F	OOL-05-01-018-F	OOL-05-01-019-F	OOL-05-01-020-F	OOL-05-01-021-F	OOL-05-01-022-F	OOL-05-03-001-F	OOL-05-03-002-F
LTP (pCi/g)										
Ag-108m	-0.01749 U	-0.004868 U	-0.0188 U	0.001547 U	-0.0008039 U	0.1044 U	-0.01533 U	-0.01179 U	0.031588	0.011911 U
Am-241	0.04912 U	0.06695 U	-0.08326 U	-0.1364 U	-0.05032 U	0.001201 U	0.02854 U	0.0474 U	0.0026959 U	0.094317 U
Co-60	-0.0125 U	-0.007353 U	-0.03232 U	-0.0182 U	0.003901 U	-0.0171 U	-0.001807 U	0.006186 U	0.0060798 U	0.031279 U
Cs-134	-0.002857 U	-0.003162 U	0.1741 U	0.001046 U	-0.01976 U	0.02016 U	-0.01547 U	-0.01307 U	-0.027466 U	0.029797 U
Cs-137	0.04326 U	0.4124	0.669	0.4151	0.6576	0.0129 U	0.01667 U	0.0004412 U	0.29882	0.054488 U
Eu-152	-0.03787 U	-0.0007727 U	0.03528 U	-0.003194 U	-0.05066 U	-0.0004639 U	0.003109 U	-0.02415 U	-0.030955 U	-0.016721 U
Eu-154	-0.02489 U	0.009338 U	0.002278 U	-0.004974 U	0.03617 U	-0.02465 U	0.007494 U	0.0004067 U	0.013695 U	0.025432 U
Eu-155	-0.005593 U	0.1657 U	0.08361 U	-0.02642 U	0.08649 U	0.005082 U	0.1525 U	0.1298 U	0.11406 U	0.077945 U
Mn-54	-0.01328 U	-0.01054 U	0.02209 U	0.0003375 U	0.07251 U	0.02222 U	-0.0002079 U	-0.001673 U	0.011389 U	-0.00095042 U
Nb-94	-0.004573 U	-0.009389 U	-0.01482 U	0.07029 U	0.05621 U	0.0125 U	0.001556 U	0.002598 U	0.012769 U	0.0077033 U
Sb-125	0.1246 U	0.1705	0.002336 U	0.07487 U	0.1129 U	-0.01517 U	0.09055 U	0.07879 U	0.084339 U	0.12186 U
LTP_HTD (pCi/g)										
C-14	0.236 U									
Cm-243	-0.0895 U									
Fe-55	-1.2 U									
H-3	-0.898 U									
Ni-63	-0.914 U									
Pu-238	0.00863 U									
Pu-239	0.0485 U									
Pu-241	1.87 U									
Sr-90	0.00813 U									
Tc-99	-0.391 U									

Station	OOL-05-03-003-F	OOL-05-03-004-F	OOL-05-03-005-F	OOL-05-03-006-F	OOL-05-03-007-F	OOL-05-03-008-F	OOL-05-03-009-F	OOL-05-03-010-F	OOL-05-03-011-F	OOL-05-03-012-F
LTP (pCi/g)										
Ag-108m	0.1485 U	-0.0019594 U	-0.0041535 U	-0.029305 U	0.0829 U	-0.009222 U	-0.004295 U	0.0014129 U	-0.015972 U	0.013408 U
Am-241	0.14293 U	0.065835 U	-0.0011218 U	-0.015892 U	-0.13634 U	0.034401 U	0.056852 U	0.49693 U	0.0024846 U	0.024821 U
Co-60	0.00032072 U	0.014175 U	0.008352 U	0.00010891 U	-0.0054346 U	-0.0020459 U	-0.013104 U	0.013661 U	0.0052458 U	0.00042135 U
Cs-134	-0.031267 U	0.0056002 U	0.0039671 U	0.028126 U	0.012558 U	0.016654 U	0.0023718 U	0.033207 U	0.018537 U	0.01865 U
Cs-137	0.28787	0.067287 U	0.020606 U	0.48021	0.42134	0.016473 U	0.54602	0.3521	0.016847 U	0.00057152 U
Eu-152	0.025645 U	0.00031547 U	0.0046609 U	R	0.019439 U	0.024113 U	-0.0023578 U	0.034372 U	-0.034155 U	-0.025751 U
Eu-154	0.030709 U	-0.0070092 U	-0.013933 U	-0.014151 U	-0.0072945 U	-0.00011276 U	-0.011358 U	0.02594 U	-0.023782 U	-0.025097 U
Eu-155	0.072055 U	0.2729 U	0.011109 U	0.13 U	0.17678 U	-0.011174 U	-0.0021006 U	0.17527 U	0.084923 U	-0.0078688 U
Mn-54	0.024229 U	-0.0019425 U	-0.00089646 U	0.015995 U	-0.00052592 U	0.0031945 U	-0.0014708 U	-0.0011381 U	-0.0010762 U	-0.0083905 U
Nb-94	0.013679 U	0.00064368 U	0.010706 U	0.0035288 U	0.0021296 U	0.0074776 U	-0.018755 U	-0.0038501 U	0.0080366 U	-0.0033276 U
Sb-125	0.11983 U	0.14662 U	-0.0042549 U	-0.044712 U	0.065 U	0.05481 U	0.14413 U	0.096579 U	0.047204 U	0.087893 U
LTP_HTD (pCi/g)										
C-14							0.051 U			
Cm-243							-0.0834 U			
Fe-55							-4.02 U			
H-3							-1.03 U			
Ni-63							-2.19 U			
Pu-238							0.0489 U			
Pu-239							-0.0912 U			
Pu-241							-5.01 U			
Sr-90							0.0355 U			
Tc-99							0.239 U			

Station	OOL-05-03-013-F	OOL-05-03-014-F	OOL-05-03-015-F	OOL-05-03-016-F	OOL-05-03-017-F	OOL-05-03-018-F	OOL-05-04-001-P	OOL-05-04-002-C	OOL-05-04-002-P	OOL-05-04-003-P
LTP (pCi/g)										
Ag-108m	0.029463 U	-0.01976 U	0.04578 U	-0.0056625 U	0.0002946 U	-0.017113 U	-0.003 U		-0.00661 U	-0.00347 U
Am-241	-0.33724 U	-0.0023227 U	0.039251 U	-0.097396 U	-0.23549 U	-0.013937 U	-0.0167 U		-0.0345 U	-0.0348 U
Co-60	-0.001436 U	0.018303 U	-0.0054594 U	-0.004865 U	-0.0016096 U	0.0016238 U	0.00641 U		-0.00502 U	-0.00303 U
Cs-134	0.022195 U	0.012896 U	-0.0026658 U	0.0065693 U	0.029954 U	0.011966 U	0.0445 U		0.0216 U	0.00499 U
Cs-137	0.75258	0.21759	-0.011555 U	0.060006	0.05863	0.11961	0.0322 U		0.0252 U	0.0439
Eu-152	0.10218 U	-0.016096 U	-0.020047 U	-0.035246 U	0.11509 U	0.063067 U	0.0218 U		0.00027 U	-0.0245 U
Eu-154	0.060651 U	-0.0027953 U	0.04993 U	-0.0064697 U	-0.013644 U	0.0014039 U	0.0207 U		0.00478 U	0.0262 U
Eu-155	0.20349 U	0.07812 U	0.06353 U	-0.0037871 U	0.0065793 U	-0.011632 U	0.0533 U		0.0277 U	0.0315 U
Mn-54	-0.036752 U	0.018077 U	0.0016254 U	-0.0064547 U	0.068119	0.0055564 U	0.00905 U		0.000386 U	0.00477 U
Nb-94	-0.028022 U	0.0054877 U	0.0047529 U	-0.0036541 U	0.0028577 U	-0.012008 U	-0.0038 U		0.000958 U	0.000899 U
Sb-125	-0.020427 U	0.094326 U	0.0025487 U	-0.039204 U	0.071182 U	0.11821 U	-0.00278 U		-0.000387 U	0.0184 U
LTP_HTD (pCi/g)										
C-14						-0.0298 U	-0.167 U	-0.0689 U	-0.321 U	0.016 U
Cm-243						0.152 U	0.0112 U	0.0148 U	-0.034 U	0.0811 U
Fe-55						9.5 U	69.6	-1.66 U	14.9 U	8.85 U
H-3						0.714 U	2.61 U	-1.18 U	1.06 U	4.19 U
Ni-63						0.924 U	-17.9 U	-0.581 U	-24.4 U	-15 U
Pu-238						-0.0123 U	0.0347 U	-0.0125 U	-0.0208 U	-0.0131 U
Pu-239						-0.00617 U	0.00972 U	0.00836 U	0.0381 U	0.0558 U
Pu-241						-0.272 U	-1.65 U	4.56 U	-2.02 U	3.49 U
Sr-90						0.013 U	0.0851	0.00979 U	0.0371	0.155
Tc-99						0.0762 U	0.0882 U	-0.0463 U	0.168 U	0.295 U

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-04-004-C	OOL-05-04-005-C	OOL-05-04-006-C	OOL-05-04-007-C	OOL-05-04-033-F	OOL-05-04-034-F	OOL-05-04-035-F	OOL-05-04-036-F	OOL-05-04-037-F	OOL-05-04-038-F
LTP (pCi/g)										
Ag-108m					-0.00113 U	-0.01022 U	0.01895 U	-0.008647 U	-0.001284 U	0.08095 U
Am-241					0.01778 U	0.1426 U	-0.1669 U	0.02862 U	0.01352 U	0.1665 U
Co-60					0.0246 U	0.0121 U	-0.003474 U	0.02484 U	-0.0002497 U	0.002656 U
Cs-134					-0.004783 U	-0.0007772 U	-0.004587 U	0.01938 U	-0.009987 U	-0.0009411 U
Cs-137					0.01355 U	0.01419 U	0.01562 U	0.08406	0.2622	0.07313
Eu-152					-0.002392 U	-0.01833 U	0.05665 U	0.1101 U	-0.05173 U	-0.01635 U
Eu-154					0.003388 U	0.009518 U	0.0004061 U	0.0186 U	-0.001691 U	-0.0002905 U
Eu-155					-0.01062 U	-0.02505 U	0.06729 U	0.08644 U	0.07046 U	0.09742 U
Mn-54					-0.01326 U	0.002154 U	0.0001587 U	0.01968 U	-0.01383 U	-0.0004875 U
Nb-94					0.0006092 U	0.0107 U	0.000115 U	0.0004754 U	0.004941 U	0.00857 U
Sb-125					0.133 U	-0.01088 U	0.04501 U	0.111	-0.02053 U	0.02033 U
LTP_HTD (pCi/g)										
C-14	-0.0911 U	0.0671 U	-0.0201 U	0.027 U						
Cm-243	0.0428 U	-0.0102 U	0.0329 U	-0.00608 U						
Fe-55	-1.18 U	0.14 U	-1.12 U	-0.787 U						
H-3	-1.73 U	-1.02 U	-0.885 U	0.549 U						
Ni-63	-0.889 U	-0.742 U	0.261 U	-0.969 U						
Pu-238	-0.0141 U	0.00901 U	0.023 U	0.0324 U						
Pu-239	-0.0132 U	-0.045 U	-0.0623 U	0.00622 U						
Pu-241	3.45 U	3.28 U	25.5	4.01 U						
Sr-90	0.00324 U	-0.0123 U	0.0191 U	0.0222 U						
Tc-99	-0.0303 U	0.0993 U	-0.0783 U	-0.0201 U						

Appendix Table B.1.6
 Soil Sample Results - FSS Data
 TransCanada Property
 YNPS Rowe, MA

Station	OOL-05-04-039-F	OOL-05-04-040-F	OOL-05-04-042-F	OOL-05-04-043-F	OOL-05-04-045-F	OOL-05-04-049-F	OOL-05-04-050-F
LTP (pCi/g)							
Ag-108m	0.08804 U	0.00421 U	-0.01037 U	0.03189 U	-0.01304 U	0.006496 U	-0.01422 U
Am-241	0.1442 U	0.1593 U	-0.005381 U	-0.2165 U	-0.1645 U	-0.01015 U	0.1346 U
Co-60	-0.0003302 U	0.0205 U	0.002404 U	-0.003767 U	0.009977 U	0.4358	0.0354 U
Cs-134	0.01967 U	0.1055 U	0.01448 U	0.02479 U	0.02278 U	0.02522 U	0.02025 U
Cs-137	0.02638 U	0.00359 U	0.03492 U	0.009829 U	0.0644	0.1645	0.09072
Eu-152	0.1013 U	-0.003434 U	0.01633 U	-0.005879 U	0.08107 U	-0.01109 U	0.005081 U
Eu-154	0.02438 U	-0.0002525 U	0.0007236 U	0.008812 U	0.003847 U	0.03644 U	-0.007979 U
Eu-155	0.1314 U	-0.003755 U	0.009511 U	0.1309 U	0.1162 U	0.1207 U	0.1057 U
Mn-54	0.0006882 U	0.01495 U	0.01826 U	0.02596 U	-0.005518 U	-0.01095 U	0.01604 U
Nb-94	-0.00003529 U	0.03276 U	0.008657 U	0.008661 U	-0.007156 U	0.01554 U	-0.003197 U
Sb-125	0.09543 U	0.1766	0.09659 U	0.1387	0.1065 U	0.05846 U	0.0648 U
LTP_HTD (pCi/g)							
C-14							
Cm-243							
Fe-55							
H-3							
Ni-63							
Pu-238							
Pu-239							
Pu-241							
Sr-90							
Tc-99							

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-02-05-017-F	OOL-02-05-020-F	OOL-03-01-001-F	OOL-03-01-002-F	OOL-03-01-003-F	OOL-03-01-004-F	OOL-03-01-005-F	OOL-03-01-006-F	OOL-03-01-007-F	OOL-03-01-009-F
gamma-spec (pCi/g)										
Ag-108m	-0.0018305 U	0.011276 U	0.001756 U	-0.01744 U	-0.001121 U	-0.007826 U	-0.003442 U	0.009922 U	-0.03025 U	-0.02152 U
Am-241	0.058499 U	-0.090344 U	0.0458 U	0.04889 U	-0.2625 U	-0.042 U	-0.01742 U	-0.01406 U	-0.2065 U	0.004846 U
Co-60	0.02263 U	-0.014001 U	0.01129 U	0.001432 U	0.001652 U	0.002058 U	-0.003115 U	0.004192 U	0.003917 U	0.006957 U
Cs-134	0.039361 U	0.012353 U	0.0194 U	-0.0002109 U	-0.0004565 U	0.002853 U	-0.002772 U	-0.01013 U	0.03145 U	-0.01796 U
Cs-137	0.037101 U	0.017271 U	0.3372	0.1874	0.135	0.08257	0.02373 U	0.165	0.2314	0.1639
Eu-152	-0.005425 U	0.049336 U	-0.05341 U	0.0209 U	0.0293 U	-0.06019 U	-0.012 U	-0.03975 U	-0.003487 U	-0.02992 U
Eu-154	0.0065718 U	-0.022409 U	-0.01824 U	0.06003 U	-0.02359 U	-0.04784 U	-0.02739 U	0.01999 U	0.01151 U	-0.02148 U
Eu-155	0.15115 U	-0.022531 U	0.1757 U	0.1415 U	-0.01539 U	0.08648 U	0.05909 U	-0.006995 U	-0.01064 U	0.1283 U
Mn-54	-0.0055786 U	0.021247 U	-0.004536 U	-0.0005848 U	0.008137 U	0.0005938 U	0.009106 U	-0.008288 U	-0.0004456 U	-0.01949 U
Nb-94	0.018776 U	0.0018229 U	-0.008705 U	-0.0009748 U	0.0122 U	0.008523 U	-0.00143 U	0.006908 U	0.01773 U	0.01984 U
Sb-125	0.01889 U	0.15142 U	0.04792 U	0.1426 U	0.1177 U	0.006949 U	0.1031 U	0.1594 U	-0.003406 U	0.1115 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-01-010-F	OOL-03-01-011-F	OOL-03-01-012-F	OOL-03-01-013-F	OOL-03-01-014-F	OOL-03-01-015-F	OOL-03-01-016-F	OOL-03-01-017-F	OOL-03-01-018-F	OOL-03-01-019-F
gamma-spec (pCi/g)										
Ag-108m	-0.009611 U	-0.0104 U	-0.02442 U	-0.02331 U	-0.001082 U	-0.009135 U	-0.02795 U	-0.01478 U	0.001725 U	-0.01151 U
Am-241	-0.1452 U	0.2945 U	-0.09439 U	0.1017 U	-0.2334 U	-0.1492 U	-0.07979 U	0.003898 U	0.1317 U	0.3452 U
Co-60	0.0009171 U	0.00241 U	0.003656 U	0.02062 U	0.01219 U	-0.00475 U	0.0139 U	-0.0001853 U	-0.003025 U	0.0007815 U
Cs-134	0.01959 U	-0.002223 U	0.003898 U	-0.02048 U	0.0113 U	0.02269 U	0.023 U	-0.0223 U	-0.02733 U	0.09449 U
Cs-137	0.01948 U	0.1052	0.2753	0.2151	-0.001109 U	0.01718 U	0.01069 U	0.01398 U	0.01477 U	0.02625 U
Eu-152	-0.0307 U	0.01354 U	-0.02185 U	0.02176 U	-0.02414 U	-0.03296 U	-0.006411 U	0.01708 U	0.08101 U	0.02028 U
Eu-154	0.02044 U	-0.01399 U	0.03032 U	-0.002811 U	0.01304 U	-0.01912 U	-0.01834 U	-0.02393 U	0.02755 U	-0.001835 U
Eu-155	0.01058 U	0.1377 U	0.2984 U	0.09765 U	0.1068 U	0.1064 U	0.04438 U	-0.02304 U	0.1207 U	-0.04861 U
Mn-54	0.01348 U	-0.009127 U	0.008606 U	0.01532 U	0.01716 U	-0.01214 U	-0.008841 U	-0.005467 U	0.01294 U	0.01377 U
Nb-94	0.01058 U	0.008653 U	-0.006074 U	0.001734 U	-0.006364 U	0.001794 U	0.006054 U	-0.00376 U	-0.0002081 U	-0.004635 U
Sb-125	0.1308	0.04431 U	0.005324 U	-0.008997 U	0.09073	0.01775 U	0.1223 U	-0.001206 U	0.02185 U	0.0127 U
Hard to detect (pCi/g)										
C-14			-0.0665 U							
Cm-243			-0.0204 U							
Fe-55			-4.19 U							
H-3			0.364 U							
Ni-63			-0.328 U							
Pu-238			0.00717 U							
Pu-239			0.00386 U							
Pu-241			0.831 U							
Sr-90			0.0195							
Tc-99			0.162 U							

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-01-020-P	OOL-03-01-021-P	OOL-03-01-022-P	OOL-03-02-016-F	OOL-03-02-017-F	OOL-03-02-018-F	OOL-03-02-019-F	OOL-03-02-024-F	OOL-03-02-025-F	OOL-03-02-026-F
gamma-spec (pCi/g)										
Ag-108m	0.0040529 U	-0.0071652 U	-0.012037 U	0.014645 U	0.010468 U	0.01519 U	-0.0070024 U	0.0013558 U	-0.0053794 U	0.0090592 U
Am-241	-0.012851 U	0.018597 U	-0.0057725 U	-0.058311 U	0.098634 U	0.010286 U	-0.11962 U	-0.058294 U	-0.03555 U	0.026561 U
Co-60	0.00042405 U	-0.008261 U	-0.00684 U	-0.00084792 U	-0.0057634 U	0.013261 U	-0.0081241 U	0.021889 U	0.013299 U	0.00078202 U
Cs-134	-0.00026816 U	-0.002493 U	-0.010864 U	-0.017809 U	-0.00027795 U	0.016226 U	-0.0010536 U	0.00053937 U	0.013696 U	0.08173 U
Cs-137	0.070779	0.051326	0.063045	0.038582	0.13137	0.04308	0.082164	0.095293	0.3072	0.23422
Eu-152	-0.0055317 U	-0.0097699 U	0.0159 U	-0.0056199 U	-0.0017643 U	-0.036937 U	0.0081172 U	0.0012401 U	0.060144 U	-0.019158 U
Eu-154	0.022879 U	0.0090072 U	0.014683 U	0.10104	-0.024553 U	-0.0052683 U	0.0022459 U	-0.0036249 U	0.020553 U	-0.015966 U
Eu-155	0.00084674 U	0.068518 U	0.070947 U	0.086136 U	0.026349 U	0.098476 U	0.13449 U	0.12722 U	0.11298 U	0.15156 U
Mn-54	0.015543 U	0.00067897 U	-0.00023947 U	0.013772 U	-0.011065 U	-0.0066065 U	0.018044 U	-0.00066431 U	0.011581 U	0.0063756 U
Nb-94	-0.0059348 U	-0.002294 U	-0.00049739 U	-0.0020825 U	-0.011494 U	-0.0026942 U	0.0058771 U	0.0068253 U	0.0014991 U	0.021837 U
Sb-125	0.064598 U	0.0062511 U	0.047175 U	0.086568	-0.034169 U	0.08282 U	-0.046183 U	-0.031482 U	0.077604 U	0.14629 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90								0.00955 U		
Tc-99										

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-02-027-F	OOL-03-02-030-F	OOL-03-02-031-F	OOL-03-02-032-F	OOL-03-02-033-F	OOL-03-02-034-F	OOL-03-02-036-F	OOL-03-02-037-F	OOL-03-02-038-F	OOL-03-02-039-F
gamma-spec (pCi/g)										
Ag-108m	-0.020711 U	0.0013263 U	0.0044307 U	0.006519 U	-0.013476 U	-0.0035372 U	0.05425 U	0.10089	0.053159	0.010952 U
Am-241	0.012963 U	0.050717 U	-0.1449 U	-0.10821 U	-0.011101 U	-0.19629 U	0.033088 U	0.070206 U	0.24292 U	-0.070601 U
Co-60	0.047736 U	0.0048955 U	-0.011155 U	0.025522 U	-0.0098661 U	-0.012376 U	0.023477 U	0.90626	0.20402	-0.0014359 U
Cs-134	0.019638 U	-0.023247 U	0.024692 U	0.012846 U	-0.0047481 U	-0.0065735 U	0.012049 U	0.032441 U	0.017624 U	0.025585 U
Cs-137	0.15755	0.05613	0.13693	0.16084	0.039924 U	0.20954	0.15566	2.7893	1.082	0.1592
Eu-152	-0.021483 U	-0.011698 U	0.012418 U	0.049684 U	0.0044016 U	0.0020497 U	0.0089814 U	0.17209 U	-0.040286 U	0.034572 U
Eu-154	0.0013996 U	-0.010488 U	0.0080002 U	0.018123 U	0.0026737 U	0.011918 U	0.0088379 U	R	0.040056 U	0.021685 U
Eu-155	0.13898 U	R	-0.074022 U	0.069219 U	0.1768 U	0.11328 U	0.093094 U	0.20953 U	0.013077 U	0.19509 U
Mn-54	-0.0080043 U	-0.00034528 U	0.0007297 U	0.018119 U	-0.0082092 U	-0.014884 U	0.0049541 U	0.018535 U	0.0015922 U	0.016837 U
Nb-94	-0.00028364 U	-0.000055663 U	-0.011866 U	0.0083098 U	0.0031311 U	-0.01257 U	0.0014374 U	-0.0067023 U	0.0063738 U	0.009501 U
Sb-125	0.028495 U	0.060479 U	-0.024304 U	-0.015549 U	0.11432 U	0.016199 U	0.066433 U	0.12293 U	0.12942 U	0.10723 U
Hard to detect (pCi/g)										
C-14	0.13 U									
Cm-243	0.0311 U									
Fe-55	-40.8 U									
H-3	-0.688 U									
Ni-63	0.166 U									
Pu-238	-0.00746 U									
Pu-239	0.0236 U									
Pu-241	11.7 U									
Sr-90	0.00993 U	0.00845 U	0.0112 U	0.0103 U			0.0717	0.333	0.29	
Tc-99	0.123 U									

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-02-040-F	OOL-03-02-042-F	OOL-03-02-054-F	OOL-03-02-057-F	OOL-03-02-060-F	OOL-03-02-062-F	OOL-03-02-063-F	OOL-03-02-064-F	OOL-03-02-069-F	OOL-03-02-079-F
gamma-spec (pCi/g)										
Ag-108m	-0.01145 U	0.16251	0.079089 U	0.19312	0.074583	0.00013266 U	0.1053	0.20359	0.20953	0.001024 U
Am-241	-0.025183 U	-0.13706 U	-0.0018149 U	-0.10799 U	-0.021511 U	-0.27801 U	-0.090564 U	0.066751 U	0.369 U	-0.013836 U
Co-60	0.05418 U	0.56647	1.0082	0.61153	0.84007	1.0523	0.98207	1.1597	1.7819	0.20123
Cs-134	-0.0041807 U	0.020342 U	-0.0063241 U	0.025337 U	-0.050077 U	-0.018676 U	0.04566 U	0.025162 U	0.017372 U	-0.042207 U
Cs-137	0.30082	2.6513	3.1394	2.0318	1.8868	0.93651	2.5175	3.9711	9.5969	0.67907
Eu-152	0.058524 U	-0.016246 U	-0.0046189 U	0.04327 U	0.022391 U	-0.027801 U	0.019184 U	-0.038459 U	0.040898 U	-0.019661 U
Eu-154	-0.0022837 U	0.16352	0.15153 U	0.11458 U	0.1199	-0.010429 U	0.074235 U	0.14156	0.16776 U	-0.010809 U
Eu-155	0.09389 U	-0.0086462 U	-0.024921 U	0.097976 U	0.16074 U	0.067096 U	0.090978 U	0.1842 U	0.15315 U	0.1083 U
Mn-54	0.0032577 U	0.01092 U	0.036664 U	0.0022426 U	-0.00054444 U	0.00061092 U	-0.003727 U	0.015562 U	-0.019268 U	0.00052938 U
Nb-94	-0.0099422 U	-0.012729 U	-0.0019693 U	0.022303 U	0.00070615 U	0.00041203 U	0.014352 U	-0.010141 U	-0.00049738 U	0.0129 U
Sb-125	0.12904 U	R	-0.045819 U	0.069973 U	0.1182 U	-0.042257 U	0.023817 U	0.14414 U	-0.036246 U	0.068953 U
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-02-080-F	OOL-03-02-081-F	OOL-03-02-082-F	OOL-03-03-004-F	OOL-03-03-011-F	OOL-03-03-013-F	OOL-03-03-014-F	OOL-03-03-015-F	OOL-03-03-017-F	OOL-03-03-018-F
gamma-spec (pCi/g)										
Ag-108m	0.054712	0.12271	0.073206	0.0702 U	0.028458 U	-0.025039 U	-0.025623 U	-0.021938 U	-0.025042 U	-0.0063637 U
Am-241	0.036178 U	0.035133 U	-0.027771 U	0.071255 U	0.57043 U	-0.22847 U	-0.044298 U	0.040177 U	-0.075412 U	-0.11969 U
Co-60	0.43229	1.0262	0.45213	0.010964 U	0.21423	-0.0038934 U	0.0055412 U	-0.00010597 U	0.017992 U	0.0013577 U
Cs-134	0.024351 U	0.024225 U	-0.019464 U	0.011134 U	0.028722 U	-0.013067 U	0.0050728 U	0.021392 U	-0.0043386 U	0.0054536 U
Cs-137	1.1037	2.8616	1.4563	0.16472	0.86017	0.01227 U	0.154	0.34618	0.0024683 U	0.62006
Eu-152	0.0033137 U	-0.0011465 U	0.015841 U	-0.028289 U	0.05098 U	0.12107 U	-0.022751 U	0.034931 U	-0.052655 U	0.021679 U
Eu-154	0.06136 U	0.14739	0.084851	-0.02016 U	-0.067082 U	0.0061567 U	0.021717 U	-0.0112 U	-0.034128 U	-0.019813 U
Eu-155	0.084018 U	0.09647 U	0.096031 U	0.090051 U	-0.010405 U	0.14604 U	0.17885 U	0.13681 U	0.18184 U	0.21019 U
Mn-54	0.0027803 U	0.031437 U	-0.0022993 U	-0.00016124 U	0.0075686 U	0.021206 U	-0.0023545 U	0.010933 U	0.010837 U	0.025774 U
Nb-94	0.012321 U	-0.0015573 U	0.011043 U	-0.008851 U	-0.000043867 U	-0.0049714 U	-0.008222 U	-0.0087552 U	-0.00028635 U	0.0040666 U
Sb-125	0.061066 U	0.20265 U	0.082318 U	0.023299 U	0.20889 U	0.12858	0.056615 U	0.084846	0.10627 U	0.082491 U
Hard to detect (pCi/g)										
C-14		-0.123 U								
Cm-243		-0.00582 U								
Fe-55		-10.1 U								
H-3		0.513 U								
Ni-63		-1.37 U								
Pu-238		-0.024 U								
Pu-239		0.019 U								
Pu-241		-7.12 U								
Sr-90		0.127								
Tc-99		0.0646 U								

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-03-03-019-F	OOL-03-03-020-F	OOL-13-01-002-F	OOL-13-01-004-F	OOL-13-01-005-F	OOL-13-01-006-F	OOL-13-01-007-F	OOL-13-01-008-F	OOL-13-01-009-F	OOL-13-01-010-F
gamma-spec (pCi/g)										
Ag-108m	0.0056897 U	0.0098269 U	0.00082323 U	-0.01695 U	0.014612 U	-0.0093956 U	0.013603 U	0.025041 U	-0.023573 U	-0.022474 U
Am-241	0.067932 U	-0.077498 U	0.10478 U	-0.0019647 U	-0.022703 U	-0.10673 U	-0.018931 U	-0.053818 U	-0.10928 U	-0.068032 U
Co-60	-0.0054686 U	0.0022889 U	-0.0030532 U	-0.0030095 U	-0.0045435 U	0.014615 U	-0.013868 U	0.0092041 U	0.00067459 U	-0.0005469 U
Cs-134	0.0086502 U	-0.021636 U	0.016361 U	-0.0018359 U	0.017377 U	-0.0058698 U	0.016456 U	0.031132	-0.016119 U	0.010998 U
Cs-137	0.28468	0.071793	0.090397	-0.0028082 U	0.046358	0.18432	0.083999	0.02227 U	0.049461 U	0.030096 U
Eu-152	-0.00094094 U	-0.026331 U	0.011399 U	-0.02616 U	-0.0011417 U	-0.04478 U	0.051054 U	0.023631 U	-0.0095429 U	-0.050491 U
Eu-154	-0.0047055 U	-0.022502 U	0.0088765 U	0.010304 U	0.030355 U	0.037909 U	0.035369 U	0.03291 U	-0.0018432 U	0.024313 U
Eu-155	0.022065 U	0.16359	0.10014 U	-0.0023392 U	0.087319 U	0.011284 U	-0.014333 U	0.04327 U	0.059579 U	-0.0065111 U
Mn-54	0.018561 U	0.014961 U	0.01242 U	-0.010425 U	-0.00031934 U	-0.001021 U	0.014552 U	-0.0011503 U	-0.013209 U	0.013687 U
Nb-94	0.0099914 U	0.0088961 U	0.0069392 U	-0.0019116 U	0.011082 U	0.00058391 U	0.0054091 U	-0.0045605 U	0.0061686 U	0.00036768 U
Sb-125	0.1255	0.066513 U	0.093442	-0.0064035 U	0.089267 U	0.028618 U	-0.038364 U	0.091803 U	0.056341 U	0.098882
Hard to detect (pCi/g)										
C-14									-0.00866 U	
Cm-243									0.245 U	
Fe-55									12.1 U	
H-3									0.204 U	
Ni-63									-2.21 U	
Pu-238									-0.0201 U	
Pu-239									-0.107 U	
Pu-241									2.54 U	
Sr-90									-0.0163 U	
Tc-99									0.138 U	

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-13-01-011-F	OOL-13-01-012-F	OOL-13-01-013-F	OOL-13-01-014-F	OOL-13-01-015-F	OOL-13-01-016-F	OOL-13-01-017-F	OOL-14-01-001-F	OOL-14-01-003-F	OOL-14-01-004-F
gamma-spec (pCi/g)										
Ag-108m	-0.0085893 U	0.01214 U	0.01907 U	-0.0036331 U	-0.0079257 U	0.0009849 U	-0.010855 U	-0.00081728 U	-0.016315 U	-0.012885 U
Am-241	0.00017769 U	0.37951 U	0.0087741 U	-0.14018 U	-0.084255 U	-0.000069321 U	-0.048374 U	0.0022308 U	-0.068614 U	-0.027727 U
Co-60	0.0056917 U	-0.0053297 U	0.024857 U	-0.0185 U	-0.00048476 U	-0.003037 U	0.0020131 U	-0.0046261 U	-0.0033481 U	0.021846 U
Cs-134	-0.013774 U	-0.028447 U	0.001669 U	0.024103 U	0.01086 U	0.023444 U	0.03535 U	0.014911 U	-0.010211 U	0.016212 U
Cs-137	0.026551 U	0.16447	0.076994	0.025109 U	-0.0084604 U	0.046346	0.060668	0.087333	0.094629	0.11979
Eu-152	-0.040931 U	0.16336	-0.022621 U	0.0077704 U	0.1871	-0.025686 U	0.015927 U	0.0049617 U	-0.0063455 U	-0.001186 U
Eu-154	-0.02149 U	0.065838 U	-0.016485 U	0.0022558 U	0.010514 U	0.0027306 U	0.0082153 U	-0.0018484 U	-0.0022782 U	-0.014782 U
Eu-155	0.12506 U	0.20627 U	0.030041 U	0.035437 U	0.068364 U	0.13442	0.0031627 U	0.081781 U	0.12048 U	0.068198 U
Mn-54	0.0035746 U	0.014877 U	-0.0083745 U	-0.0053278 U	0.014656 U	-0.017331 U	0.0067977 U	-0.0067241 U	-0.0053301 U	-0.0013816 U
Nb-94	-0.00096403 U	0.0010844 U	-0.011582 U	-0.0006511 U	0.028707 U	0.0066983 U	-0.000212 U	-0.0034973 U	-0.0045323 U	0.0086193 U
Sb-125	0.020137 U	-0.024271 U	0.11795 U	0.090311 U	0.070507 U	0.1035	0.10451 U	0.067395 U	0.10982 U	0.076705
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-14-01-005-C	OOL-14-01-005-F	OOL-14-01-006-F	OOL-14-01-007-F	OOL-14-01-010-F	OOL-14-01-011-F	OOL-14-01-013-F	OOL-14-01-014-F	OOL-14-01-016-F	OOL-14-01-017-F
gamma-spec (pCi/g)										
Ag-108m	0.1076 U	-0.015383 U	-0.00021017 U	-0.000040986 U	-0.0075741 U	-0.013288 U	-0.0069867 U	0.0062464 U	0.0097479 U	-0.00037369 U
Am-241	-0.003354 U	0.021288 U	0.14116 U	-0.062284 U	-0.02806 U	0.089087 U	0.025531 U	-0.14992 U	0.019403 U	-0.00070669 U
Co-60	0.0001259 U	-0.01661 U	-0.0066417 U	0.00057518 U	-0.0041082 U	-0.0051839 U	0.012627 U	-0.0074151 U	0.012443 U	0.023983 U
Cs-134	0.002722 U	0.00049424 U	0.017759 U	-0.0027341 U	-0.0047664 U	0.027837 U	0.001692 U	-0.0016692 U	0.0031227 U	-0.0095029 U
Cs-137	0.03645 U	0.93804	0.03672	0.11926	0.17077	0.00068364 U	0.22886	0.094076	0.042789 U	0.099453
Eu-152	-0.003599 U	-0.035457 U	-0.011607 U	0.00080091 U	0.033483 U	0.17632	-0.0053278 U	-0.00035633 U	-0.032613 U	-0.039261 U
Eu-154	-0.005624 U	0.0052473 U	-0.00070848 U	-0.0056388 U	0.02854 U	0.04435 U	0.015002 U	0.032226 U	-0.018427 U	-0.026984 U
Eu-155	0.1381 U	-0.22118 U	0.10848 U	0.0030732 U	0.017895 U	0.13888 U	0.11721 U	0.1173 U	0.12741 U	0.090662 U
Mn-54	-0.000306 U	-0.014682 U	0.016279 U	-0.00078629 U	-0.00211 U	0.00020108 U	-0.00097669 U	0.00014802 U	-0.0078479 U	-0.0070621 U
Nb-94	0.05497 U	-0.0076879 U	-0.002443 U	-0.0037356 U	-0.01134 U	0.0014532 U	0.003705 U	0.0013191 U	-0.0071522 U	0.022219 U
Sb-125	0.115 U	-0.012455 U	0.074072 U	-0.054756 U	0.083884 U	0.10931	0.11235 U	0.057092 U	-0.041561 U	0.093884 U
Hard to detect (pCi/g)										
C-14		0.0332 U								
Cm-243		0.157 U								
Fe-55		7.86 U								
H-3		-2.45 U								
Ni-63		-0.415 U								
Pu-238		-0.0427 U								
Pu-239		0.00142 U								
Pu-241		0.898 U								
Sr-90		0.0171 U								
Tc-99		0.444								

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-14-01-018-F	OOL-14-01-019-F	OOL-14-01-020-F	OOL-14-01-021-F	OOL-14-01-022-F	OOL-15-01-001-F	OOL-15-01-002-F	OOL-15-01-003-F	OOL-15-01-004-F	OOL-15-01-005-F
gamma-spec (pCi/g)										
Ag-108m	-0.017766 U	-0.00040591 U	-0.0089548 U	-0.015177 U	-0.0055436 U	-0.01249 U	-0.01347 U	-0.02196 U	0.01518 U	-0.02206 U
Am-241	-0.019679 U	0.17441 U	0.8358 U	-0.051367 U	0.054214 U	-0.0763 U	-0.02258 U	-0.03301 U	0.06838 U	-0.0693 U
Co-60	-0.0018188 U	0.00063571 U	-0.0029446 U	0.091588	-0.0038315 U	-0.02099 U	0.00006621 U	-0.01817 U	-0.01435 U	-0.02108 U
Cs-134	0.013002 U	-0.0029173 U	0.016621 U	0.01381 U	0.015003 U	0.01933 U	-0.008866 U	-0.01753 U	0.01988 U	-0.02984 U
Cs-137	0.087547	0.16428	0.041242 U	0.2545	0.16797	0.3141	0.04889 U	0.4358	0.01418 U	0.1269
Eu-152	0.00020329 U	0.024952 U	-0.017362 U	0.00032494 U	-0.0044437 U	0.0295 U	-0.00978 U	0.04245 U	-0.0006344 U	-0.01337 U
Eu-154	-0.013299 U	-0.024873 U	-0.0049834 U	-0.020328 U	-0.029205 U	0.02082 U	0.001801 U	-0.03115 U	-0.01105 U	0.01164 U
Eu-155	0.096183 U	-0.016489 U	-0.024346 U	0.2474 U	0.15785 U	-0.00473 U	0.1275 U	-0.01117 U	0.007362 U	0.1796 U
Mn-54	0.0035603 U	-0.011391 U	-0.014345 U	0.0092127 U	0.014616 U	-0.006996 U	0.008877 U	0.009444 U	0.06381 U	0.008542 U
Nb-94	-0.0057476 U	0.00050135 U	-0.0051882 U	-0.007937 U	-0.00016652 U	0.005121 U	-0.008265 U	-0.01579 U	0.002895 U	-0.0003371 U
Sb-125	0.068519	0.012551 U	0.17364	0.098543 U	0.10502 U	0.005541 U	0.01222 U	-0.03148 U	0.1089 U	0.1008 U
Hard to detect (pCi/g)										
C-14										0.0787 U
Cm-243										0.0879 U
Fe-55										-0.199 U
H-3										0.223 U
Ni-63										-0.376 U
Pu-238										-0.0206 U
Pu-239										0.0542 U
Pu-241										-0.779 U
Sr-90										-0.0364 U
Tc-99										0.136 U

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-15-01-006-F	OOL-15-01-007-F	OOL-15-01-008-F	OOL-15-01-009-F	OOL-15-01-010-F	OOL-15-01-011-F	OOL-15-01-012-F	OOL-15-01-013-F	OOL-15-01-014-F	OOL-15-01-015-F
gamma-spec (pCi/g)										
Ag-108m	-0.03153 U	0.04543 U	0.00169 U	-0.01163 U	-0.009714 U	-0.005704 U	0.1951 U	-0.02306 U	0.002127 U	0.1409 U
Am-241	0.08145 U	-0.002931 U	0.08506 U	0.006257 U	-0.004033 U	0.06888 U	0.06566 U	0.0543 U	-0.06869 U	-0.001481 U
Co-60	-0.01667 U	0.009316 U	-0.02288 U	0.02509 U	-0.01438 U	-0.0002457 U	-0.002643 U	0.04402 U	0.02109 U	-0.00161 U
Cs-134	0.01464 U	-0.001289 U	0.02085 U	-0.01293 U	0.0241 U	0.115 U	0.2402 U	-0.02605 U	0.04834 U	-0.005631 U
Cs-137	0.2223	0.03286 U	0.02418 U	0.04137 U	0.1628	0.07744	0.564	0.564	0.3703	0.45
Eu-152	0.008211 U	-0.04159 U	0.01664 U	-0.003242 U	-0.05745 U	-0.02579 U	0.1606 U	-0.02237 U	0.01016 U	0.0001792 U
Eu-154	-0.0001363 U	0.01112 U	-0.002474 U	0.03736 U	0.03242 U	0.1123 U	0.1082 U	0.002997 U	0.02775 U	0.02875 U
Eu-155	0.07958 U	0.06858 U	0.1404 U	0.004596 U	0.1618 U	0.1825 U	0.01317 U	0.0041 U	0.1506 U	0.003307 U
Mn-54	0.005169 U	0.008205 U	0.0005139 U	-0.01077 U	0.06585	0.0194 U	0.01251 U	0.005429 U	0.02371 U	0.0006645 U
Nb-94	0.01804 U	-0.009581 U	-0.0007808 U	-0.008952 U	-0.004106 U	0.01166 U	-0.01163 U	-0.0001208 U	0.001054 U	-0.01207 U
Sb-125	0.02844 U	0.1889	0.1432 U	0.132	0.2111	0.1644	0.1068 U	-0.006068 U	0.1521 U	-0.01732 U
Hard to detect (pCi/g)										
C-14					0.0097 U					
Cm-243					0.0279 U					
Fe-55					-0.0431 U					
H-3					0.665 U					
Ni-63					0.146 U					
Pu-238					0.0227 U					
Pu-239					0.0236 U					
Pu-241					1.69 U					
Sr-90					-0.011 U					
Tc-99					-0.0789 U					

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-15-01-016-F	OOL-15-01-017-P	OOL-15-01-018-P	OOL-15-01-019-P	OOL-15-01-020-P	OOL-15-01-021-P	OOL-15-01-022-P	OOL-15-01-023-P	OOL-15-01-024-P	OOL-15-01-025-P
gamma-spec (pCi/g)										
Ag-108m	-0.005516 U	0.004833 U	0.00363 U	-0.004251 U	-0.02783 U	-0.02671 U	-0.02016 U	-0.001081 U	-0.01967 U	0.006734 U
Am-241	0.04986 U	-0.03254 U	-0.002049 U	-0.001249 U	0.397 U	-0.05164 U	0.08207 U	-0.1026 U	0.002869 U	-0.01806 U
Co-60	-0.005093 U	-0.009946 U	0.007408 U	-0.0003748 U	0.003113 U	0.02724 U	-0.007647 U	0.006188 U	0.004851 U	-0.00521 U
Cs-134	0.007644 U	0.001181 U	-0.001223 U	-0.008287 U	0.00196 U	0.01996 U	0.1136 U	0.0007713 U	0.0184 U	0.01438 U
Cs-137	0.5787	0.005477 U	0.01647 U	0.0843	0.2488	0.02117 U	0.008222 U	0.02698 U	0.04409	0.01391 U
Eu-152	-0.002276 U	-0.004544 U	-0.002789 U	-0.00208 U	-0.0216 U	0.1028 U	-0.03977 U	-0.01081 U	-0.005708 U	0.03351 U
Eu-154	-0.02604 U	-0.01685 U	-0.01318 U	-0.01452 U	-0.00931 U	-0.02371 U	0.02758 U	0.005385 U	-0.01999 U	-0.008859 U
Eu-155	0.01579 U	0.01523 U	0.003975 U	0.1119 U	0.1543 U	0.1788 U	0.1474 U	0.1773 U	0.144	-0.003454 U
Mn-54	-0.00206 U	-0.007469 U	0.03235 U	0.01811 U	0.02223 U	0.02146 U	-0.0159 U	0.01532 U	-0.00233 U	0.0006053 U
Nb-94	-0.009473 U	0.06154 U	-0.0002628 U	-0.004886 U	0.07926 U	-0.004317 U	0.05705 U	-0.001923 U	-0.00005072 U	-0.005735 U
Sb-125	0.1371 U	0.1077 U	0.09216 U	0.005709 U	0.1045 U	0.1095 U	0.08842 U	0.08402 U	0.0722 U	0.1158
Hard to detect (pCi/g)										
C-14										
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90										
Tc-99										

Appendix Table B.1.7
 Soil Sample Results
 TransCanada Shoreline
 YNPS Rowe, MA

Station	OOL-15-01-026-P	OOL-15-01-027-P	OOL-15-01-028-P
gamma-spec (pCi/g)			
Ag-108m	-0.0080327 U	0.016316 U	0.0009201 U
Am-241	-0.10249 U	-0.16879 U	0.35799 U
Co-60	0.023674 U	0.0064621 U	0.0014959 U
Cs-134	0.004296 U	0.0083568 U	0.018031 U
Cs-137	0.32274	0.0067913 U	0.0078741 U
Eu-152	-0.0015751 U	0.11516 U	-0.011308 U
Eu-154	-0.0050323 U	0.0086244 U	0.0086349 U
Eu-155	0.15947 U	0.090095 U	0.12371 U
Mn-54	0.0097267 U	0.029543	0.014317 U
Nb-94	0.013719 U	-0.0041813 U	0.00050067 U
Sb-125	0.098686 U	0.10658	0.10144
Hard to detect (pCi/g)			
C-14			
Cm-243			
Fe-55			
H-3			
Ni-63			
Pu-238			
Pu-239			
Pu-241			
Sr-90			
Tc-99			

Appendix Table B.2.1
Sediment Sample Results - FSS Data
Reference 02 Area
YNPS Rowe, MA

Station	REF-02-01-001-B	REF-02-01-001-B-W	REF-02-01-002-B	REF-02-01-002-B-W	REF-02-01-003-B	REF-02-01-003-B-W	REF-02-01-004-B	REF-02-01-004-B-W	REF-02-01-005-B	REF-02-01-005-B-W
LTP (pCi/g)										
Ag-108m	-0.01233 U	0.00499 U	-0.006783 U	-0.0148 U	-0.01559 U	0.00745 U	0.1056 U	-0.00828 U	0.002173 U	-0.0172 U
Am-241	0.02453 U	0.0563 U	-0.01433 U	0.0194 U	-0.04042 U	0.0417 U	0.07202 U	0.0433 U	0.03401 U	-0.00493 U
Co-60	-0.0002807 U	0.0187 U	-0.0003236 U	-0.00387 U	-0.007178 U	-0.00281 U	-0.0002355 U	0.000574 U	0.01847 U	-0.0105 U
Cs-134	-0.0138 U	0.0742 U	-0.018 U	0.0382 U	0.1455 U	0.0366 U	-0.005199 U	0.0261 U	0.02582 U	0.0493 U
Cs-137	0.1457	0.242	0.2915	0.357	0.4384	0.286	0.2794	0.125	0.398	0.449
Eu-152	0.02012 U	0.0221 U	-0.05674 U	0.101 U	-0.01527 U	-0.00502 U	-0.002589 U	0.00574 U	0.01568 U	-0.0296 U
Eu-154	-0.03519 U	-0.03 U	-0.03585 U	0.0128 U	0.01587 U	0.00768 U	-0.005819 U	-0.0185 U	-0.001143 U	-0.0103 U
Eu-155	-0.01231 U	0.128 U	0.1228 U	0.0941 U	-0.009394 U	0.0557 U	0.01181 U	0.0354 U	0.1654 U	0.076 U
Mn-54	-0.0116 U	0.00259 U	-0.008985 U	-0.00595 U	0.02138 U	0.0243 U	-0.002726 U	-0.00141 U	-0.003289 U	-0.000516 U
Nb-94	-0.01075 U	0.004 U	-0.01285 U	-0.0174 U	0.01506 U	0.015 U	0.007769 U	0.0013 U	0.006998 U	0.00471 U
Sb-125	0.06286 U	0.0284 U	0.1334 U	0.00706 U	0.1325 U	-0.0109 U	-0.03202 U	0.0231 U	0.04977 U	-0.0468 U
LTP_HTD (pCi/g)										
C-14		-0.041 U		0.00232 U		-0.0218 U		0.00951 U		-0.0636 U
H-3		1.12 U		-0.339 U		-3.2 U		-1.82 U		0.434 U
Sr-90		0.0112 U		-0.00754 U		0.0412		-0.00000775 U		0.032

Appendix Table B.2.1
 Sediment Sample Results - FSS Data
 Reference 02 Area
 YNPS Rowe, MA

Station	REF-02-01-006-B	REF-02-01-006-B-W	REF-02-01-007-B	REF-02-01-007-B-W	REF-02-01-008-B	REF-02-01-008-B-W	REF-02-01-009-B	REF-02-01-009-B-W	REF-02-01-010-B	REF-02-01-010-B-W
LTP (pCi/g)										
Ag-108m	-0.02193 U	0.000523 U	-0.0223 U	0.00259 U	0.02234 U	-0.00662 U	-0.003342 U	0.00706 U	-0.02325 U	0.00377 U
Am-241	0.1811 U	-0.0159 U	0.1868 U	0.00329 U	-0.2367 U	-0.0138 U	0.1409 U	0.0506 U	1.153 U	0.228 U
Co-60	-0.01481 U	0.00929 U	0.01407 U	0.0133 U	0.01511 U	-0.0016 U	0.0004372 U	-0.0136 U	0.004193 U	0.00726 U
Cs-134	0.00296 U	0.0516 U	0.02516 U	0.0594 U	-0.02127 U	0.0483 U	0.005091 U	0.0453 U	-0.0247 U	0.0442 U
Cs-137	1.381	1.65	0.06295 U	0.0239 U	0.2476	0.174	0.4906	0.372	0.6317	0.936
Eu-152	-0.01143 U	-0.0261 U	-0.001958 U	-0.0409 U	0.03623 U	0.0125 U	-0.002363 U	0.0676 U	-0.04357 U	-0.0709 U
Eu-154	0.006014 U	0.0144 U	-0.03022 U	0.0153 U	0.01745 U	0.0207 U	0.02498 U	0.0765 U	-0.01318 U	-0.0851 U
Eu-155	-0.005767 U	0.0365 U	0.01904 U	0.0752 U	-0.04035 U	0.0866 U	0.005373 U	0.102 U	0.2016 U	0.0901 U
Mn-54	-0.002452 U	0.0191 U	0.01318 U	-0.0242 U	0.0001016 U	0.0103 U	0.0006605 U	0.0128 U	-0.0004155 U	-0.0164 U
Nb-94	0.01618 U	0.0289 U	-0.00008654 U	0.00519 U	-0.001268 U	0.00556 U	0.004582 U	0.00938 U	-0.00008811 U	-0.00964 U
Sb-125	-0.04699 U	-0.076 U	0.1455	0.0312 U	0.05853 U	0.0373 U	0.0119 U	0.0769 U	-0.08303 U	-0.242 U
LTP_HTD (pCi/g)										
C-14		-0.0214 U		0.171		-0.0306 U		0.127 U		0.0507 U
H-3		0.556 U		2.32 U		1.74 U		-1.95 U		-1.57 U
Sr-90		0.0344		-0.00245 U		0.01 U		0.0128 U		0.0219 U

Appendix Table B.2.1
Sediment Sample Results - FSS Data
Reference 02 Area
YNPS Rowe, MA

Station	REF-02-01-011-B	REF-02-01-011-B-W	REF-02-01-012-B	REF-02-01-012-B-W	REF-02-01-013-B	REF-02-01-013-B-W	REF-02-01-014-B	REF-02-01-014-B-W	REF-02-01-015-B	REF-02-01-015-B-W
LTP (pCi/g)										
Ag-108m	-0.02297 U	-0.00585 U	-0.000679 U	0.021 U	0.008382 U	0.0156 U	-0.005642 U	0.00493 U	-0.01225 U	0.00218 U
Am-241	0.0111 U	-0.0258 U	-0.117 U	0.0264 U	-0.1679 U	0.0408 U	-0.05796 U	-0.00314 U	0.06908 U	-0.0139 U
Co-60	-0.0006324 U	0.023 U	0.005256 U	0.0119 U	0.00526 U	0.0305 U	0.01113 U	0.0148 U	0.007768 U	-0.0461 U
Cs-134	0.005246 U	0.0702 U	0.04525	0.09 U	-0.02614 U	0.0475 U	0.01177 U	0.0343 U	-0.04471 U	0.0827 U
Cs-137	0.5241	1.19	0.8147	1.52	0.3537	0.395	0.3827	0.436	0.5631	0.825
Eu-152	-0.003079 U	-0.0288 U	0.0123 U	0.146 U	0.02526 U	0.0564 U	-0.01075 U	-0.0277 U	0.008901 U	0.0377 U
Eu-154	-0.0002088 U	-0.0766 U	0.002119 U	0.0948 U	-0.03008 U	-0.0536 U	0.02313 U	0.00518 U	0.003279 U	0.0563 U
Eu-155	0.2084 U	0.156 U	-0.001867 U	0.0944 U	0.1094 U	0.0372 U	0.1028 U	-0.00492 U	0.1477 U	0.111 U
Mn-54	0.008643 U	0.051 U	0.02248 U	0.00148 U	0.0126 U	0.0137 U	-0.007692 U	-0.00225 U	0.01603 U	0.0486 U
Nb-94	0.06761 U	0.00264 U	-0.004859 U	-0.0404 U	0.002735 U	0.00384 U	0.008435 U	0.00756 U	-0.006177 U	-0.0497 U
Sb-125	0.03422 U	-0.0745 U	-0.004989 U	0.0351 U	-0.03223 U	0.0424 U	0.04351 U	-0.0167 U	0.01727 U	0.0307 U
LTP_HTD (pCi/g)										
C-14		0.0621 U		0.073 U		0.0537 U		-0.0418 U		0.0988 U
H-3		-0.761 U		0.946 U		-0.429 U		2.12 U		0.677 U
Sr-90		0.0902		0.0354		0.0186 U		0.00278 U		0.0348

Appendix Table B.2.1
 Sediment Sample Results - FSS Data
 Reference 02 Area
 YNPS Rowe, MA

Station	REF-02-01-016-B	REF-02-01-016-B-W	REF-02-01-017-B	REF-02-01-017-B-W	REF-02-01-018-B	REF-02-01-018-B-W	REF-02-01-019-B	REF-02-01-019-B-W	REF-02-01-020-B	REF-02-01-020-B-W
LTP (pCi/g)										
Ag-108m	-0.01465 U	0.00146 U	-0.0149 U	-0.00853 U	-0.01194 U	-0.000195 U	0.01902 U	-0.0272 U	-0.0009777 U	-0.0276 U
Am-241	-0.05786 U	-0.0684 U	0.2335 U	-0.401 U	-0.006816 U	0.0166 U	0.01788 U	0.000562 U	-0.01959 U	0.0659 U
Co-60	0.02188 U	0.0605 U	0.02731 U	0.0177 U	0.01468 U	0.0158 U	0.008926 U	0.0202 U	-0.003715 U	0.00424 U
Cs-134	0.01076 U	0.0693 U	-0.04525 U	0.0579 U	-0.005364 U	0.0305 U	0.04201 U	0.0837 U	-0.001743 U	0.0822 U
Cs-137	0.268	0.683	0.9483	1.09	0.1914	0.14	0.8769	0.598	0.2049	0.681
Eu-152	-0.01809 U	-0.0234 U	-0.0168 U	-0.124 U	-0.001081 U	-0.00288 U	-0.03065 U	0.0947 U	0.02331 U	0.0156 U
Eu-154	-0.001663 U	-0.031 U	0.001203 U	0.0716 U	0.007848 U	-0.0277 U	0.0638 U	0.0348 U	-0.001099 U	-0.105 U
Eu-155	0.09485 U	0.142 U	-0.007336 U	0.13 U	0.09421 U	0.0318 U	0.1758 U	0.168 U	0.1376 U	0.173 U
Mn-54	0.008551 U	0.0476 U	0.03263 U	-0.0634 U	-0.008594 U	0.0219 U	-0.01705 U	0.00667 U	0.003067 U	0.0224 U
Nb-94	-0.0002281 U	0.00217 U	0.0122 U	0.0961 U	-0.0002455 U	0.0259 U	-0.01189 U	-0.00696 U	0.01574 U	-0.00728 U
Sb-125	0.03152 U	0.0675 U	0.01644 U	0.00191 U	0.083 U	-0.00297 U	0.1588 U	0.0547 U	0.1358 U	0.0307 U
LTP_HTD (pCi/g)										
C-14		0.102 U		0.0567 U		-0.0109 U		-0.0693 U		0.0492 U
H-3		0.637 U		1.58 U		-1.55 U		-0.564 U		-2.04 U
Sr-90		0.0106 U		0.0682		0.00713 U		0.0276 U		0.0183 U

Appendix Table B.2.1
Sediment Sample Results - Phase II
Background
YNPS Rowe, MA

Station	SD-407	SD-407	SD-407	SD-407	SD-408	SD-408	SD-409	SD-409	SD-410	SD-410	SD-411
Date Sampled	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006	6/2/2006
LTP (pCi/g)											
Ag-108m	-0.0036 U	0.0121 U	0.00813 U	0.000975 U	0.000951 U	-0.00963 U	0.0176 U	0.00619 U	0.00441 U	0.00729 U	0.00618 U
Am-241	0.151 U	0.0511 U	0.0229 U	0.0436 U	-0.0126 U	-0.161 U	0.0409 U	0.0268 U	-0.0389 U	-0.0159 U	-0.00984 U
Co-60	0.00374 U	-0.00994 U	-0.00629 U	-0.00616 U	0.0228 U	-0.00185 U	-0.0152 U	0.00751 U	-0.000374 U	-0.00445 U	-0.0162 U
Cs-134	0.0569 U	0.0244 U	0 U	0 U	0.036 U	0.033 U	0 U	0 U	0 U	0.04 U	0.0266 U
Cs-137	0.0807	0.0353 U	0.118	0.0537	0.103	0.111	0.122	0.168	0.043 U	0.111	0.0972
Eu-152	-0.0195 U	-0.0433 U	-0.00648 U	0.00466 U	-0.00277 U	-0.0419 U	0.0141 U	0.00155 U	-0.0722 U	-0.0148 U	-0.0335 U
Eu-154	-0.0234 U	0.0627 U	-0.0206 U	0.0309 U	-0.0413 U	-0.0277 U	0.00536 U	-0.0188 U	-0.0899 U	-0.0084 U	0.0105 U
Eu-155	0.115 U	0.0706 U	-0.000284 U	0.0536 U	0.0101 U	0.0353 U	0.068 U	0.0181 U	0.0567 U	0.04545 U	0.0205 U
Mn-54	0.0108 U	0.0144 U	0 U	-0.0106 U	-0.0104 U	0.016 U	0.0139 U	-0.00709 U	0.0381 U	-0.00934 U	-0.0117 U
Nb-94	0.00776 U	-0.015 U	0.000419 U	0.00609 U	-0.00674 U	-0.000727 U	-0.00523 U	-0.0002 U	-0.018 U	0.0339 U	-0.0095 U
Sb-125	-0.00567 U	-0.0077 U	0.0379 U	-0.018 U	-0.00519 U	-0.0986 U	0.0343 U	0.0498 U	-0.0266 U	-0.0544 U	0.00695 U
LTP_HTD (pCi/g)											
C-14	0.0938 U	0.024 U	-0.017 U	-0.0548 U			0.0584 U	0.00493 U			
Cm-243/244	-0.0222 U	0.0253 U	-0.0147 U	-0.0113 U			0.0117 U	0.0536 U			
Fe-55	323	1.62 U	0.31 U	0.766 U			1.27 U	0.959 U			
H-3	-2.73 U	-0.489 U	2.47 U	3.89 U			-0.58 U	0 U			
Ni-63	0.603 U	-1.9 U	-0.26 U	0.525 U			-1.06 U	-3.98 U			
Pu-238	0.17	-0.0186 U	0.354	0.0167 U			0.611	-0.0126 U			
Pu-239/240	0.0641 U	-0.0124 U	0.195 U	-0.0191 U			0.0197 U	0 U			
Pu-241	5.65 U	1.78 U	4.29 U	0 U			10.3 U	0.962 U			
Sr-90	0.0198 U	-0.00443 U	-0.00342 U	0.00188 U			0.00793 U	-0.00384 U			
Tc-99	-0.0382 U	0.0576 U	-0.0283 U	0.0167 U			-0.0535 U	0.173 U			

Appendix Table B.2.1
 Sediment Sample Results - Phase II
 Background
 YNPS Rowe, MA

Station	SD-411	SD-412	SD-412
Date Sampled	6/2/2006	6/2/2006	6/2/2006
LTP (pCi/g)			
Ag-108m	0.00795 U	-0.00215 U	-0.0128 U
Am-241	0.0201 U	0.0919 U	-0.00322 U
Co-60	0.00556 U	0.00000713 U	0.0183 U
Cs-134	0 U	0.0185 U	0.0417 U
Cs-137	0.221	0.0819	0.13
Eu-152	-0.0826 U	-0.00757 U	0.00352 U
Eu-154	0.059 U	-0.00389 U	0.0064 U
Eu-155	0.0439 U	0.0269 U	0.0566 U
Mn-54	-0.00214 U	0.00937 U	0.0142 U
Nb-94	-0.0032 U	-0.0132 U	-0.00974 U
Sb-125	-0.0395 U	0.0205 U	0.0115 U
LTP_HTD (pCi/g)			
C-14			
Cm-243/244			
Fe-55			
H-3			
Ni-63			
Pu-238			
Pu-239/240			
Pu-241			
Sr-90			
Tc-99			

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-01-001-F	OOL-01-01-002-F	OOL-01-01-003-F	OOL-01-01-004-F	OOL-01-01-005-F	OOL-01-01-006-F	OOL-01-01-007-F	OOL-01-01-008-F	OOL-01-01-009-F	OOL-01-01-010-F
gamma-spec (pCi/g)										
Ag-108m	0.007941 U	-0.1046 U	-0.03568 U	-0.008099 U	-0.02395 U	-0.002538 U	0.002402 U	-0.02026 U	-0.007757 U	0.07112 U
Am-241	-0.7143 U	-1.158 U	-0.1221 U	-0.2486 U	-0.1121 U	0.06319 U	-0.7423 U	-0.01026 U	0.3009 U	0.1653 U
Co-60	0.95	1.112	0.2151	-0.01143 U	0.01802 U	0.05632	0.6827	0.0175 U	0.1097	0.1007
Cs-134	-0.09346 U	-0.00434 U	0.01135 U	-0.009108 U	0.02457 U	0.008263 U	0.06024 U	0.02255 U	-0.001594 U	0.004716 U
Cs-137	1.106	1.38	0.2807	0.03145 U	0.3145	0.3138	0.7967	0.04592	0.3658	0.1685
Eu-152	0.03574 U	0.09578 U	0.1941 U	0.08494 U	0.0322 U	0.0001341 U	-0.1131 U	-0.008375 U	0.1002 U	0.0736 U
Eu-154	0.1725 U	0.00005642 U	0.0147 U	0.000938 U	-0.0181 U	0.01842 U	-0.06391 U	0.003277 U	-0.009416 U	0.000004022 U
Eu-155	0.8525 U	0.4587 U	0.2939 U	0.1178 U	0.1642 U	-0.009764 U	0.4034 U	0.03673 U	0.2202 U	0.00932 U
Mn-54	0.0724 U	0.03466 U	0.0004707 U	0.01377 U	0.01091 U	0.02215 U	0.03592 U	0.003556 U	0.02548 U	0.01563 U
Nb-94	0.03847 U	0.002485 U	0.01539 U	-0.007335 U	0.01501 U	0.01265 U	0.001141 U	-0.008938 U	0.001024 U	0.004062 U
Sb-125	0.6562	0.8419	0.1783	0.08124 U	0.08892 U	0.01886 U	0.2655 U	0.07569 U	-0.01713 U	0.09554 U
Hard to detect (pCi/g)										
C-14	0.227	0.119 U	0.327	0.134 U	0.133 U	0.448	0.213	0.198	0.367	0.277
Cm-243		0.00674 U								
Fe-55		-3.32 U								
H-3										
Ni-63		0.553 U								
Pu-238		-0.0227 U								
Pu-239		0.0539 U								
Pu-241		5.9 U								
Sr-90	0.07	0.1	0.0114 U	0.00395 U	0.012 U	0.00621 U	0.0213 U	-0.00345 U	-0.00815 U	-0.00525 U
Tc-99		0.107 U								

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-01-011-F	OOL-01-01-012-F	OOL-01-01-013-F	OOL-01-01-014-F	OOL-01-01-015-F	OOL-01-01-016-F	OOL-01-01-017-F	OOL-01-01-018-F	OOL-01-01-019-F	OOL-01-01-020-F
gamma-spec (pCi/g)										
Ag-108m	-0.001661 U	0.00192 U	-0.004727 U	0.002069 U	-0.01681 U	-0.0581 U	0.00052978 U	0.0095187 U	-0.03184 U	-0.010889 U
Am-241	-0.04513 U	-0.3211 U	0.7464 U	0.03194 U	0.03539 U	-0.3011 U	0.00416 U	0.024133 U	0.013433 U	-0.13534 U
Co-60	0.1923	0.2402	0.3483	0.02337 U	0.005549 U	0.009075 U	0.26252	0.10826	0.065484	0.067299 U
Cs-134	0.01874 U	-0.01092 U	0.079 U	0.0008398 U	0.01658 U	0.001917 U	-0.0096903 U	-0.034811 U	0.0016707 U	0.042568 U
Cs-137	0.3016	0.4415	0.4502	0.0901	0.05575	0.2159	0.42386	0.41066	0.25691	0.4189
Eu-152	-0.006373 U	0.1906 U	0.08509 U	0.09044 U	0.08604 U	0.1359 U	0.00034598 U	-0.0077545 U	0.075544 U	-0.0027951 U
Eu-154	0.02823 U	0.004517 U	0.05262 U	0.02715 U	0.008789 U	0.03018 U	0.020483 U	0.011966 U	0.1483 U	-0.019797 U
Eu-155	0.343 U	0.02267 U	0.02789 U	0.002556 U	0.1116 U	0.1866 U	0.18089	0.16811	0.2186 U	0.24109 U
Mn-54	0.01661 U	0.02701 U	0.004246 U	0.01145 U	0.01269 U	0.02776 U	0.04565 U	-0.00030992 U	0.040344 U	-0.045117 U
Nb-94	-0.01175 U	-0.0008497 U	-0.009846 U	0.01397 U	-0.004201 U	-0.001444 U	-0.00070176 U	0.015011 U	0.0036602 U	-0.013064 U
Sb-125	0.2519	0.2224	-0.04801 U	0.06627 U	0.08856 U	0.1301 U	0.11049 U	0.14271	0.18543	0.23576
Hard to detect (pCi/g)										
C-14	0.213	0.365	0.172	0.155	0.0879 U	0.127 U	0.09 U	-0.216 U	-0.075 U	-0.171 U
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90	0.00503 U	0.0202 U	0.0553	-0.006 U	-0.00553 U	-0.00268 U	0.149 U	-0.174 U	-0.109 U	-0.137 U
Tc-99										

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-01-021-F	OOL-01-01-022-F	OOL-01-01-023-F	OOL-01-01-033-F	OOL-01-01-035-F	OOL-01-01-036-F	OOL-01-01-037-F	OOL-01-01-038-F	OOL-01-01-039-F	OOL-01-01-040-F
gamma-spec (pCi/g)										
Ag-108m	0.0029547 U	-0.0086988 U	0.06905 U	0.0080323 U	-0.0078201 U	-0.012154 U	-0.028583 U	0.0065621 U	0.012435 U	-0.000069675 U
Am-241	-0.33826 U	0.036129 U	0.18992 U	-0.002612 U	0.032373 U	0.0062494 U	0.085981 U	-0.087201 U	0.0037233 U	-0.1636 U
Co-60	0.042967 U	0.060271 U	1.1436 U	-0.0010376 U	0.02652 U	0.056801 U	0.38293 U	-0.00021475 U	0.051375 U	0.036426 U
Cs-134	-0.0062059 U	0.0010424 U	0.0019095 U	-0.0013388 U	0.030143 U	-0.0079073 U	0.033982 U	0.05816 U	-0.01019 U	0.018432 U
Cs-137	0.11048 U	0.22973 U	1.1355 U	0.22101 U	0.16864 U	0.18157 U	0.54386 U	0.00081396 U	0.18911 U	0.11419 U
Eu-152	0.037599 U	-0.012755 U	0.057016 U	0.065333 U	-0.0027959 U	-0.00080562 U	0.022152 U	-0.01379 U	0.036627 U	0.13763 U
Eu-154	0.033536 U	0.0015315 U	0.046743 U	-0.0215 U	-0.015897 U	0.0012574 U	-0.000029476 U	0.041408 U	0.026727 U	0.010469 U
Eu-155	0.2471 U	0.11173 U	-0.31985 U	0.26061 U	0.17741 U	0.095 U	0.22826 U	0.10085 U	0.089161 U	-0.017747 U
Mn-54	0.017037 U	0.018615 U	-0.014852 U	0.021386 U	-0.021509 U	-0.00025584 U	0.0084196 U	-0.0085119 U	0.013951 U	-0.010015 U
Nb-94	-0.00094652 U	0.0030549 U	-0.0052967 U	-0.0040411 U	-0.010427 U	0.0038787 U	-0.0027654 U	0.0090972 U	-0.0010345 U	-0.0046362 U
Sb-125	0.044456 U	0.075671 U	0.044492 U	0.17919 U	0.10167 U	0.08217 U	0.13571 U	-0.0012781 U	0.11962 U	0.076577 U
Hard to detect (pCi/g)										
C-14	-0.05 U	-0.046 U	0.4 U	-0.033 U	0.083 U	0.15 U	0.36 U	0.143 U	0.19 U	0.053 U
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90	-0.128 U	-0.122 U	0.266 U	-0.158 U	-0.159 U	0.013 U	0.012 U	0.151 U	-0.064 U	0.042 U
Tc-99										

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-01-041-F	OOL-01-01-042-F	OOL-01-01-043-F	OOL-01-01-044-F	OOL-01-01-045-F	OOL-01-01-046-F	OOL-01-01-047-F	OOL-01-01-048-F	OOL-01-01-049-F	OOL-01-02-001-F
gamma-spec (pCi/g)										
Ag-108m	-0.016584 U	-0.0058204 U	-0.014095 U	-0.001147 U	-0.0088064 U	-0.0023007 U	0.0001109 U	-0.005612 U	-0.00020918 U	0.003058 U
Am-241	1.045 U	0.033714 U	-0.079037 U	0.046976 U	0.075983 U	0.21357 U	-0.032642 U	0.026134 U	0.0038853 U	-0.05753 U
Co-60	0.052041 U	0.0020559 U	0.032306 U	0.033569	0.044851 U	0.021241 U	0.08767	0.035105 U	0.070001	-0.004416 U
Cs-134	0.030923 U	0.0087543 U	0.016552 U	0.017259 U	0.016938 U	0.026415	0.01183 U	0.015701 U	-0.013654 U	0.0116 U
Cs-137	0.23243	0.064789	0.27701	0.097867	0.26991	0.23908	0.35831	0.38461	0.2465	0.1259
Eu-152	0.0004732 U	-0.02077 U	-0.027658 U	0.0020589 U	-0.012131 U	-0.023152 U	-0.0024348 U	0.031999 U	0.026939 U	-0.01875 U
Eu-154	-0.006249 U	-0.0073405 U	0.025813 U	0.037274 U	-0.010703 U	-0.019395 U	-0.012564 U	0.024457 U	0.017959 U	-0.001224 U
Eu-155	0.17772 U	0.11079 U	0.066179 U	0.1366 U	-0.0055064 U	0.11454 U	0.095461 U	-0.085315 U	0.037896 U	0.07463 U
Mn-54	-0.0006342 U	-0.0026215 U	0.0064457 U	0.014698 U	-0.0072702 U	-0.00023242 U	-0.0010719 U	0.019416 U	-0.0027079 U	0.0004576 U
Nb-94	-0.00065383 U	-0.0039595 U	0.011643 U	0.0030069 U	0.013484 U	0.03186 U	-0.004909 U	-0.0099058 U	-0.0084119 U	-0.006939 U
Sb-125	0.15194 U	0.0039509 U	0.1478	0.096886 U	0.14223	0.1016	0.04009 U	0.073377 U	0.14222	0.07563
Hard to detect (pCi/g)										
C-14	0.048 U	-0.021 U	-0.062 U	-0.04 U	-0.273 U	-0.158 U	-0.296 U	-0.157 U	-0.142 U	0.0368 U
Cm-243										
Fe-55	-0.1 U									
H-3	0.9 U									
Ni-63	-0.4 U									
Pu-238										
Pu-239										
Pu-241										
Sr-90	-0.013 U	0.133	0.081 U	0.329	0.032 U	-0.017 U	0.004 U	-0.012 U	-0.01 U	-0.0000347 U
Tc-99	-0.013 U									

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-02-002-F	OOL-01-02-003-F	OOL-01-02-004-F	OOL-01-02-005-F	OOL-01-02-006-F	OOL-01-02-007-F	OOL-01-02-008-F	OOL-01-02-009-F	OOL-01-02-010-F	OOL-01-02-011-F
gamma-spec (pCi/g)										
Ag-108m	0.003622 U	-0.02257 U	-0.0007399 U	-0.02034 U	0.008243 U	-0.02343 U	-0.02617 U	-0.01132 U	0.007781 U	0.05233 U
Am-241	-0.1288 U	-0.04159 U	-0.06765 U	-0.03093 U	-0.00538 U	-0.1504 U	0.01026 U	-0.1779 U	0.02651 U	-0.2893 U
Co-60	0.001075 U	0.002123 U	-0.003138 U	0.02259 U	0.01228 U	0.01125 U	-0.0004228 U	-0.003988 U	0.0113 U	-0.006458 U
Cs-134	-0.0009814 U	-0.004251 U	-0.00068 U	-0.019 U	0.01261 U	-0.03042 U	0.00107 U	0.008956 U	-0.0002568 U	-0.006742 U
Cs-137	0.3725	0.2358	0.3585	0.5094	0.2172	0.03566 U	0.176	0.4004	0.1756	0.06703
Eu-152	0.001169 U	-0.009132 U	0.02231 U	0.005237 U	0.03035 U	-0.001282 U	-0.02523 U	-0.0198 U	0.03991 U	-0.0289 U
Eu-154	-0.0009211 U	-0.002983 U	-0.01987 U	0.003368 U	-0.03285 U	-0.0374 U	0.000236 U	-0.005002 U	0.01813 U	-0.0149 U
Eu-155	0.07536 U	0.1295 U	-0.007319 U	0.1982 U	-0.001137 U	-0.002934 U	-0.01547 U	0.06535 U	0.01673 U	0.07217 U
Mn-54	-0.0005124 U	-0.002565 U	0.008166 U	-0.0006337 U	0.002481 U	0.01876 U	-0.004199 U	-0.008406 U	-0.005734 U	0.01037 U
Nb-94	-0.0002258 U	-0.002677 U	0.007344 U	0.006344 U	-0.0001916 U	-0.003029 U	-0.0001498 U	0.0001323 U	0.01606 U	0.001339 U
Sb-125	0.1161 U	0.08774 U	0.02255 U	0.1176 U	0.05691 U	0.03053 U	-0.006402 U	0.06898 U	-0.0357 U	0.05368 U
Hard to detect (pCi/g)										
C-14	0.0618 U	-0.0365 U	-0.0612 U		-0.0475 U	0.0362 U	0.0382 U		-0.0316 U	-0.0219 U
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90	-0.0116 U	-0.000667 U	0.0248 U		0.00851 U	-0.0229 U	0.014 U		0.0114 U	0.00828 U
Tc-99										

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-02-012-F	OOL-01-02-013-F	OOL-01-02-014-F	OOL-01-02-015-F	OOL-01-02-016-F	OOL-01-02-017-F	OOL-01-02-018-F	OOL-01-02-019-F	OOL-01-03-001-F	OOL-01-03-002-F
gamma-spec (pCi/g)										
Ag-108m	-0.003593 U	-0.009996 U	-0.0005089 U	-0.006029 U	-0.008299 U	-0.0232 U	0.01771 U	0.08049 U	0.0035035 U	0.0050751 U
Am-241	-0.11 U	0.3375 U	0.2351	0.01843 U	-0.001795 U	-0.07119 U	0.005138 U	0.02658 U	-0.010549 U	0.015329 U
Co-60	-0.005878 U	-0.001032 U	0.01295 U	-0.001551 U	-0.0001958 U	0.021 U	0.004212 U	-0.0004709 U	-0.002853 U	0.0076595 U
Cs-134	-0.00888 U	-0.01288 U	0.001708 U	-0.002012 U	0.001939 U	0.02451 U	-0.01689 U	-0.0204 U	0.013562 U	0.016204 U
Cs-137	0.09771	0.08432	0.1301	0.1288	0.107	0.5893	0.1806	0.1331	0.111	0.082212
Eu-152	-0.002151 U	-0.02639 U	0.0001184 U	0.04903 U	-0.02202 U	-0.003434 U	0.002408 U	-0.0188 U	-0.035463 U	-0.00055755 U
Eu-154	-0.02177 U	-0.00975 U	-0.03109 U	-0.01855 U	-0.01168 U	-0.01797 U	0.008308 U	-0.01252 U	0.040092 U	0.0034301 U
Eu-155	0.0341 U	0.002414 U	0.001206 U	-0.02045 U	-0.003027 U	0.2263	0.07264 U	0.1049 U	0.081403 U	0.074282 U
Mn-54	-0.00213 U	0.0003743 U	0.04093	-0.004073 U	-0.005452 U	-0.001554 U	0.007314 U	-0.005609 U	0.0043882 U	0.005081 U
Nb-94	-0.003347 U	-0.007186 U	-0.000203 U	-0.0004891 U	-0.003807 U	0.001129 U	-0.002011 U	-0.002323 U	0.0078959 U	0.0056224 U
Sb-125	0.09741 U	0.04966 U	0.07754 U	0.1225	0.01291 U	0.1515	0.05282 U	0.1172	0.0549 U	0.08202
Hard to detect (pCi/g)										
C-14	-0.0673 U	-0.0489 U	-0.0858 U	0.0357 U	-0.0933 U	-0.00213 U	0.0607 U	-0.057 U	-0.016 U	-0.076 U
Cm-243	-0.00603 U									
Fe-55	-3.9 U									
H-3	-0.659 U									
Ni-63	-0.467 U									
Pu-238	0.0344 U									
Pu-239	0.0127 U									
Pu-241	-1.32 U									
Sr-90	0.00363 U	0.0283 U	0.00817 U	0.0187 U	0.0271 U	-0.00535 U	-0.00151 U	0.0204 U	0.05 U	0.09 U
Tc-99	-0.0612 U									

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-03-003-F	OOL-01-03-004-F	OOL-01-03-005-F	OOL-01-03-006-F	OOL-01-03-007-F	OOL-01-03-008-F	OOL-01-03-009-F	OOL-01-03-010-F	OOL-01-03-011-F	OOL-01-03-012-F
gamma-spec (pCi/g)										
Ag-108m	0.0028687 U	-0.012978 U	-0.017684 U	-0.018398 U	-0.1139 U	-0.0029243 U	0.0033326 U	0.009651 U	-0.012482 U	-0.0087184 U
Am-241	-0.053383 U	0.11497 U	-0.0028533 U	-0.0098189 U	-0.29511 U	-0.31925 U	-0.12839 U	0.026869 U	-0.29407 U	0.27623 U
Co-60	0.024804 U	0.081873	0.047484 U	0.20017	0.23855	0.4692	0.1805	0.12191	-0.0084987 U	0.11133
Cs-134	-0.00066591 U	0.033673 U	0.019482 U	-0.04833 U	0.10383	0.0078218 U	0.040582 U	0.0010486 U	0.041527 U	0.021611 U
Cs-137	0.32368	0.9402	0.68301	0.91251	1.2721	1.357	1.2985	0.20179	0.23766	0.20772
Eu-152	0.089613 U	0.00092179 U	0.0066247 U	-0.020403 U	0.057771 U	-0.0044693 U	0.31698 U	-0.039281 U	-0.048156 U	0.024248 U
Eu-154	-0.0058576 U	0.0013163 U	-0.0013086 U	-0.0042707 U	-0.043764 U	-0.00815 U	0.0082057 U	-0.028631 U	-0.010906 U	0.0032405 U
Eu-155	0.0091979 U	0.14845 U	0.19116 U	0.35447 U	0.62251	-0.0060149 U	0.022742 U	0.0085628 U	0.050942 U	0.087088 U
Mn-54	0.01419 U	-0.0075628 U	-0.0036385 U	-0.012933 U	-0.029507 U	-0.0089724 U	0.0013313 U	-0.010463 U	-0.00070307 U	0.0055604 U
Nb-94	-0.0057702 U	0.010273 U	-0.0086325 U	-0.006076 U	-0.020596 U	-0.0011912 U	0.046262 U	-0.0025565 U	0.014294 U	-0.009032 U
Sb-125	0.0029118 U	0.15074 U	0.099901 U	0.28468	0.40511 U	0.45151 U	-0.080267 U	0.037348 U	0.11416 U	0.015964 U
Hard to detect (pCi/g)										
C-14	0.107 U	-0.004 U	-0.023 U	-0.77 U	-0.02 U	0.05 U		-0.25 U	-0.02 U	-0.06 U
Cm-243	-0.00083 U									
Fe-55	-1.2 U									
H-3	-1.04 U									
Ni-63	-0.13 U									
Pu-238	-0.0018 U									
Pu-239	-0.0018 U									
Pu-241										
Sr-90	-0.029 U	0.062 U	-0.034 U	0.263	0.682	0.086 U		-0.076 U	-0.106 U	0.009 U
Tc-99	-0.024 U									

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-03-013-F	OOL-01-03-014-F	OOL-01-03-015-F	OOL-01-03-016-F	OOL-01-03-017-F	OOL-01-03-018-F	OOL-01-03-019-F	OOL-01-03-020-F	OOL-01-04-001-F	OOL-01-04-002-F
gamma-spec (pCi/g)										
Ag-108m	-0.0025462 U	-0.0028065 U	-0.0078675 U	0.3948 U	-0.0017401 U	0.003454 U	-0.00018436 U	-0.0072636 U	0.0094374 U	-0.0096578 U
Am-241	1.2079 U	0.0064218 U	-0.067484 U	-0.0084443 U	0.053845 U	0.07618 U	-0.16335 U	-0.034992 U	-0.06431 U	-0.058156 U
Co-60	0.92532	0.0060864 U	0.016541 U	0.33372	0.49971	0.2822	-0.0047208 U	0.092819 U	-0.00021458 U	-0.013889 U
Cs-134	0.043568 U	0.012605 U	-0.00075745 U	-0.0026154 U	-0.031209 U	0.048763 U	0.015526 U	0.060205	-0.010061 U	-0.0098067 U
Cs-137	1.4281	0.078901	0.096187	0.64227	1.0293	0.44553	0.22451	0.35982	0.31147	0.079882
Eu-152	0.073652 U	-0.016802 U	-0.035699 U	0.088439 U	0.24975 U	0.26102 U	-0.055729 U	-0.048381 U	-0.0010518 U	-0.0035609 U
Eu-154	0.042595 U	0.0075658 U	-0.00092554 U	-0.031223 U	0.056621 U	0.020815 U	0.034897 U	0.051731 U	-0.0026694 U	-0.030907 U
Eu-155	0.018218 U	-0.0065884 U	0.0039667 U	0.1778 U	0.014364 U	0.34391 U	0.18723 U	0.0015563 U	0.11112 U	0.14213 U
Mn-54	-0.0048685 U	-0.00037983 U	0.01218 U	-0.0043112 U	-0.00074682 U	0.0045394 U	-0.0028195 U	-0.015108 U	-0.0003976 U	0.019178 U
Nb-94	0.029131 U	0.05556 U	-0.0042365 U	-0.0013993 U	0.029947 U	-0.0075573 U	0.008241 U	0.016244 U	-0.0010523 U	0.0078744 U
Sb-125	0.31932 U	0.12485 U	0.10285 U	0.14701 U	0.34471	0.24027	0.079982 U	0.14094 U	0.0927 U	0.11744 U
Hard to detect (pCi/g)										
C-14	-0.67 U	0.07 U	-0.109 U		0.01 U	-0.21 U	0.056 U	-0.13 U	-0.242 U	-0.226 U
Cm-243	-0.00076 U									
Fe-55	-2.5 U									
H-3	-1.27 U									
Ni-63	1.3 U									
Pu-238	-0.00079 U									
Pu-239	-0.0016 U									
Pu-241										
Sr-90		-0.026 U	-0.13 U		0.096	0.09 U	0.092 U		0.00893 U	0.0103 U
Tc-99										

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-04-003-F	OOL-01-04-004-F	OOL-01-04-005-F	OOL-01-04-006-F	OOL-01-04-007-F	OOL-01-04-008-F	OOL-01-04-009-F	OOL-01-04-010-F	OOL-01-04-011-F	OOL-01-04-012-F
gamma-spec (pCi/g)										
Ag-108m	0.0014165 U	0.00086155 U	0.010248 U	-0.0065156 U	-0.0077274 U	0.05095 U	0.02095 U	-0.0023882 U	0.0074548 U	-0.014588 U
Am-241	-0.51956 U	0.011613 U	-0.034231 U	-0.05978 U	-0.027757 U	-0.066398 U	-0.002019 U	-0.070454 U	-0.36789 U	-0.084633 U
Co-60	-0.0064935 U	-0.0046013 U	-0.013394 U	0.007247 U	-0.0028484 U	-0.00025632 U	-0.0083398 U	-0.0019438 U	0.006108 U	0.0038327 U
Cs-134	0.015217 U	0.0023318 U	0.0020134 U	-0.006025 U	-0.002266 U	0.013499 U	0.043634 U	-0.0017033 U	0.013269 U	-0.026161 U
Cs-137	1.4636	0.4886	0.37219	0.061199 U	0.66027	0.07772	0.91399	0.19129	0.77199	0.073922
Eu-152	0.083308 U	0.023053 U	0.0053024 U	0.038108 U	0.048368 U	0.0010954 U	0.014167 U	0.020853 U	0.046682 U	0.00077213 U
Eu-154	0.017227 U	0.020013 U	-0.00705 U	0.001385 U	0.041364 U	0.0057447 U	-0.0026875 U	0.010672 U	0.025646 U	0.013811 U
Eu-155	0.13694 U	0.075274 U	0.0096084 U	0.024865 U	-0.0093808 U	-0.081576 U	0.16635 U	0.14132 U	0.18565 U	0.13929 U
Mn-54	0.01145 U	-0.012008 U	-0.0060098 U	-0.0017794 U	-0.017153 U	-0.0086239 U	-0.0011346 U	-0.0073495 U	-0.00058199 U	0.0020459 U
Nb-94	-0.0068918 U	0.0036106 U	-0.0041569 U	-0.00072392 U	-0.0098869 U	-0.010196 U	0.013427 U	-0.0064176 U	0.00073919 U	0.0058731 U
Sb-125	0.20379	0.085984 U	0.019054 U	0.0978 U	0.078864 U	-0.0039637 U	0.18653	0.0049676 U	0.014356 U	0.089991 U
Hard to detect (pCi/g)										
C-14	-0.149 U	-0.0936 U	-0.188 U	-0.126 U	-0.0958 U	-0.172 U	-0.211 U		-0.167 U	-0.401 U
Cm-243										
Fe-55										
H-3										
Ni-63										
Pu-238										
Pu-239										
Pu-241										
Sr-90	0.0571 U	0.0173 U	0.036 U	0.00677 U	0.0366 U	0.00709 U	0.00091 U		0.0162 U	-0.0144 U
Tc-99										

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-04-013-F	OOL-01-04-014-F	OOL-01-04-015-F	OOL-01-04-016-F	OOL-01-04-017-F	OOL-01-04-018-F	OOL-01-04-019-F	OOL-01-04-020-F	OOL-01-05-001-F	OOL-01-05-002-F
gamma-spec (pCi/g)										
Ag-108m	-0.0054146 U	-0.0095274 U	0.153 U	-0.045737 U	0.1209 U	0.0066367 U	0.07981 U	0.0010083 U	-0.0066679 U	-0.041947 U
Am-241	-0.006169 U	-0.013739 U	-0.066438 U	0.059079 U	-0.080755 U	0.062552 U	-0.013145 U	0.08138 U	-0.083445 U	-0.029243 U
Co-60	-0.00056683 U	0.023625 U	-0.00043588 U	-0.0026475 U	0.0005495 U	-0.0005514 U	0.0003839 U	0.0046631 U	0.0002014 U	0.0021806 U
Cs-134	0.024237 U	-0.0040145 U	-0.001578 U	0.020866 U	0.024761 U	-0.042104 U	0.017146 U	0.020528 U	0.023193 U	0.021161 U
Cs-137	1.008	0.91952	0.88117	0.81195	0.38817	0.45785	0.48141	0.06193	0.10109	0.054403
Eu-152	-0.042595 U	-0.0040671 U	-0.019786 U	0.074995 U	0.0011379 U	-0.0054287 U	-0.0015561 U	0.031848 U	-0.047135 U	-0.010406 U
Eu-154	-0.034022 U	0.01504 U	0.0050402 U	0.1983 U	0.01576 U	-0.013538 U	-0.020025 U	0.044763 U	-0.00035498 U	-0.0027098 U
Eu-155	0.091271 U	0.15651 U	0.10445 U	0.29552 U	0.19849 U	0.23696 U	0.12597 U	0.13028 U	0.057542 U	0.11522 U
Mn-54	0.012944 U	0.01043 U	-0.011872 U	0.038176 U	-0.01226 U	0.017059 U	0.00091863 U	-0.0035927 U	-0.0037975 U	-0.015967 U
Nb-94	-0.00014656 U	0.0041977 U	-0.0011374 U	0.0059291 U	0.011884 U	0.0020298 U	0.0092955 U	-0.0031798 U	0.07056 U	0.0016741 U
Sb-125	0.086039 U	0.14328 U	0.18886 U	0.045257 U	-0.016015 U	0.14716 U	0.082426 U	0.087665 U	0.02093 U	0.076283 U
Hard to detect (pCi/g)										
C-14	-0.157 U	-0.211 U	-0.0762 U	0.12 U	-0.0941 U	-0.125 U	-0.0553 U	-0.157 U	-0.074 U	-0.056 U
Cm-243				0.0747 U					0.155 U	0.23 U
Fe-55				-12.5 U					-5.68 U	0.337 U
H-3				7.87 U					-1.59 U	1.12 U
Ni-63				-11.5 U					2.99 U	8.65
Pu-238				0.0437 U					0.104 U	-0.0101 U
Pu-239				0.086					-0.00916 U	0.0218 U
Pu-241				-13 U					0.44 U	2.68 U
Sr-90	0.0293 U	0.0185 U	0.092	-0.0121 U	0.0242 U	-0.00695 U	-0.00994 U	0.0186 U	0.00395 U	-0.0176 U
Tc-99				0.218 U					-0.00456 U	-0.0768 U

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-05-003-F	OOL-01-05-004-F	OOL-01-05-005-F	OOL-01-05-006-F	OOL-01-05-007-F	OOL-01-05-008-F	OOL-01-05-009-F	OOL-01-05-010-F	OOL-01-05-011-F	OOL-01-05-012-F
gamma-spec (pCi/g)										
Ag-108m	-0.0067472 U	0.06739 U	0.0016699 U	-0.0094156 U	0.0032978 U	0.0058587 U	-0.015593 U	0.010941 U	-0.013445 U	0.02021 U
Am-241	0.054555 U	0.060651 U	0.44918 U	0.051503 U	-0.0033167 U	0.17476 U	0.04294 U	-0.077011 U	0.014475 U	-0.1374 U
Co-60	-0.0046275 U	0.010171 U	0.01567 U	0.0061048 U	-0.0022926 U	0.047529 U	0.016869 U	0.016257 U	-0.0040337 U	0.16251
Cs-134	-0.0097063 U	0.019889 U	0.022756 U	-0.013255 U	-0.017997 U	-0.011861 U	-0.020542 U	0.017629 U	0.020947 U	-0.011876 U
Cs-137	0.11201	0.080216	0.88919	0.085478	0.079504	0.55004	0.41009	0.013516 U	0.09152	0.71508
Eu-152	0.13609 U	-0.043413 U	-0.013597 U	0.002306 U	0.0010551 U	0.042232 U	0.012637 U	-0.024419 U	-0.01211 U	0.042309 U
Eu-154	-0.016772 U	0.02113 U	0.027934 U	-0.0034112 U	0.0065147 U	-0.003174 U	-0.00059455 U	-0.0021469 U	-0.014093 U	0.028985 U
Eu-155	-0.053139 U	0.1281 U	0.0065614 U	0.067278 U	0.10008 U	0.065118 U	-0.0010439 U	-0.0098862 U	0.15111 U	0.051149 U
Mn-54	-0.00044382 U	-0.0084031 U	-0.0021421 U	-0.0058482 U	0.009974 U	-0.0011186 U	-0.0068914 U	0.0012865 U	0.011264 U	-0.0088741 U
Nb-94	-0.0026841 U	0.0013752 U	-0.0042218 U	-0.0048513 U	-0.0016978 U	-0.0061043 U	-0.00026932 U	0.002067 U	-0.0047583 U	-0.0054109 U
Sb-125	0.0026448 U	0.082464 U	0.083815 U	0.077506	0.076342	0.0078615 U	0.13621 U	0.0081368 U	0.098086	0.032282 U
Hard to detect (pCi/g)										
C-14	-0.125 U	0.0288 U	0.0189 U	-0.0134 U	-0.0591 U	-0.0184 U	0.0239 U	0.0497 U	-0.000822 U	0.127 U
Cm-243	-0.0075 U	-0.0134 U	-0.123 U	0.0349 U	-0.00871 U	-0.0866 U	-0.0112 U	-0.0986 U	0.0017 U	-0.0251 U
Fe-55	-5.49 U	0.201 U	-5.9 U	-0.00864 U	-9.4 U	-11.9 U	-12.2 U	-6.57 U	4.28 U	-8.04 U
H-3	1.64 U	2.5 U	1.95 U	-0.322 U	-2.24 U	-0.179 U	1.41 U	-2.32 U	1.31 U	-2.82 U
Ni-63	0.63 U	6.99 U	6.53 U	4.14 U	4.38 U	2.91 U	2.72 U	-1.3 U	-0.99 U	-0.794 U
Pu-238	-0.0171 U	-0.00816 U	0.0959 U	-0.0189 U	-0.00701 U	0.0341 U	-0.0341 U	0.081 U	0.0174 U	-0.00715 U
Pu-239	-0.0256 U	-0.00815 U	-0.0326 U	-0.114 U	0.0584 U	-0.0872 U	-0.00711 U	0.00119 U	-0.087 U	0.0453 U
Pu-241	1.52 U	0.994 U	4.25 U	-0.274 U	-0.221 U	6.52 U	2.07 U	-3.58 U	1.54 U	-1.66 U
Sr-90	-0.00309 U	0.00796 U	0.00239 U	0.00835 U	0.00559 U	0.0232 U	0.000588 U	0.0153 U	-0.0199 U	0.0054 U
Tc-99	0.0218 U	-0.0861 U	-0.03 U	0.248 U	0.0145 U	0.238 U	0.104 U	0.0625 U	-0.0278 U	0.162 U

Appendix Table B.2.2
Sediment Sample Results - FSS Data
Sherman Reservoir
YNPS Rowe, MA

Station	OOL-01-05-013-F	OOL-01-05-014-F	OOL-01-05-015-F	OOL-01-05-016-F	OOL-01-05-017-F	OOL-01-05-018-F	OOL-01-05-019-F	OOL-01-05-020-F	OOL-01-06-001-F	OOL-01-06-002-F
gamma-spec (pCi/g)										
Ag-108m	-0.00098503 U	-0.014088 U	-0.014476 U	-0.0075032 U	-0.0014058 U	-0.00019996 U	-0.0096541 U	-0.0087744 U	-0.0061503 U	-0.022016 U
Am-241	0.013243 U	0.068801 U	0.081251 U	-0.39892 U	-0.0044392 U	-0.12582 U	0.033672 U	0.12029 U	-0.16069 U	-0.001178 U
Co-60	0.0096258 U	0.15059	-0.0027688 U	0.0018107 U	0.017873 U	-0.0032588 U	0.032842	-0.00015217 U	0.06697	0.018639 U
Cs-134	-0.026009 U	0.022034 U	-0.015903 U	0.040667	0.023123 U	-0.0020726 U	-0.013633 U	0.00033591 U	0.013913 U	0.017849 U
Cs-137	0.2727	0.61796	0.10747	0.24615	0.32947	0.061491	0.3277	0.13263	0.34653	0.21851
Eu-152	0.033022 U	0.0039489 U	0.075465 U	0.16566 U	-0.04689 U	-0.0021431 U	-0.018161 U	0.083645 U	-0.01233 U	0.056221 U
Eu-154	0.024438 U	-0.016346 U	-0.0050634 U	-0.018805 U	0.025499 U	0.023494 U	-0.0070831 U	0.00060157 U	-0.025816 U	0.028271 U
Eu-155	0.080278 U	0.1722 U	-0.0054117 U	0.07241 U	0.093653 U	-0.021081 U	0.12174	0.095663 U	0.13557 U	0.16599 U
Mn-54	0.0005252 U	-0.0085947 U	-0.00026705 U	0.00079382 U	0.0014478 U	-0.0082831 U	0.0084611 U	-0.00033498 U	-0.0017535 U	0.015464 U
Nb-94	-0.005428 U	0.0026598 U	-0.0039872 U	-0.010092 U	0.0038411 U	0.0043323 U	-0.00022133 U	0.000060486 U	0.0080267 U	0.0049947 U
Sb-125	0.015598 U	0.15277	0.09141 U	0.21553	0.042423 U	0.078362 U	0.03152 U	0.090513 U		0.094645 U
Hard to detect (pCi/g)										
C-14	-0.0443 U	0.0747 U	0.019 U	0.0999 U	-0.0226 U	0.0147 U	0.0577 U	-0.0367 U	0.14 U	0.147 U
Cm-243	-0.00725 U	0.0375 U	0.117 U	0.0308 U	-0.0487 U	-0.012 U	0.0721 U	-0.0384 U		
Fe-55	-4.75 U	-13.8 U	-3.66 U	-4.34 U	-2.61 U	0.855 U	-2.76 U	-5.88 U		
H-3	1.49 U	0.812 U	-0.312 U	-2.04 U	0.727 U	0.635 U	3.14 U	-1.88 U		
Ni-63	-3.67 U	-0.726 U	0.419 U	-3.59 U	-1.25 U	-1.19 U	8.62 U	1.12 U		
Pu-238	-0.0168 U	0.067 U	-0.00968 U	-0.0203 U	0.0306 U	-0.00722 U	0.091 U	-0.0272 U		
Pu-239	-0.0252 U	0.0254 U	-0.0484 U	0.0215 U	0.0697 U	-0.0349 U	0.0765 U	-0.00453 U		
Pu-241	4.33 U	3.35 U	-2.28 U	3.22 U	1.63 U	1.1 U	-4.64 U	-6.69 U		
Sr-90	-0.00184 U	0.00974 U	-0.00574 U	0.0087 U	0.0425 U	0.00913 U	0.016 U	0.00993 U	0.129 U	0.081
Tc-99	-0.071 U	0.189 U	0.0252 U	0.203 U	0.319	0.0681 U	0.0542 U	-0.0901 U		

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-06-003-F	OOL-01-06-004-F	OOL-01-06-005-F	OOL-01-06-006-F	OOL-01-06-007-F	OOL-01-06-008-F	OOL-01-06-009-F
gamma-spec (pCi/g)							
Ag-108m	0.00017578 U	-0.0019399 U	0.045237 U	-0.026375 U	-0.0011832 U	-0.0098888 U	-0.027161 U
Am-241	0.26451 U	-0.15929 U	-0.82251 U	-0.06413 U	-0.074535 U	-0.0021404 U	0.0192 U
Co-60	0.13017	0.72394	0.55755	0.019697 U	0.34656	0.030971 U	0.76493
Cs-134	-0.0050795 U	0.056511 U	0.047023 U	0.017559 U	0.037224 U	-0.0090867 U	0.067067 U
Cs-137	0.48571	0.99552	0.72184	0.092279	0.42083	0.29434	1.1418
Eu-152	0.14321 U	-0.047331 U	-0.011456 U	0.020509 U	-0.0038396 U	0.069946 U	0.059835 U
Eu-154	-0.061913 U	-0.0052207 U	0.01583 U	-0.00031763 U	-0.041564 U	0.00098106 U	0.08185 U
Eu-155	-0.003222 U	0.0037692 U		0.20305	-0.022603 U	0.10041 U	
Mn-54	0.016255 U	-0.023526 U	-0.031888 U	-0.00030724 U	0.034939 U	0.0051365 U	0.0050477 U
Nb-94	0.0090069 U	0.030738 U	0.019165 U	-0.011658 U	-0.011123 U	0.011727 U	-0.00034809 U
Sb-125	0.13028 U	0.26721		0.08391 U	0.1793 U	0.090215 U	
Hard to detect (pCi/g)							
C-14	0.017 U	0.04 U	0.21 U	0.155 U	0.42 U	0.127 U	0.66 U
Cm-243							
Fe-55							
H-3							
Ni-63							
Pu-238							
Pu-239							
Pu-241							
Sr-90	0.245	0.176 U	0.301	0.169 U	0.29	0.134 U	-0.067 U
Tc-99							

Appendix Table B.2.2
 Sediment Sample Results - FSS Data
 Sherman Reservoir
 YNPS Rowe, MA

Station	OOL-01-06-010-F	OOL-01-06-011-F	OOL-01-06-012-F	OOL-01-06-013-F	OOL-01-06-014-F	OOL-01-06-015-F
LTP (pCi/g)						
Ag-108m	-0.002961 U	0.00080631 U	0.029998 U	-0.028425 U	-0.0097159 U	0.0016064 U
Am-241	0.14522 U	0.0053057 U	-0.23424 U	-0.33785 U	0.067284 U	-0.14045 U
Co-60	1.2855	0.1235	0.73851	0.36734	0.049295	0.10361 U
Cs-134	0.13588 U	0.018436 U	0.095732 U	0.070806 U	0.01689 U	0.059302 U
Cs-137	1.3135	0.36833	1.0499	0.52934	0.12474	0.23386
Eu-152	-0.070268 U	-0.022265 U	-0.00188 U	0.2651 U	-0.0019529 U	0.020866 U
Eu-154	-0.022731 U	-0.025072 U	0.070716 U	-0.0013635 U	-0.021746 U	0.0094025 U
Eu-155	0.57177	0.21338	0.15733 U	0.036132 U	0.077196 U	0.03854 U
Mn-54	0.0080192 U	0.011021 U	0.0067474 U	0.035584 U	0.0024438 U	0.0043608 U
Nb-94	0.0088735 U	0.0014745 U	0.037732 U	0.014345 U	0.04168 U	0.0019072 U
Sb-125	0.70661	0.15123	0.68379	0.17059 U	0.11677	0.20085 U
LTP_HTD (pCi/g)						
C-14	0.54 U	0.065 U	-0.005 U	0.3 U	0.183 U	0.21 U
Cm-243				0.026 U		
Fe-55				-1.7 U		
H-3				2 U		
Ni-63				3.1 U		
Pu-238				0.018 U		
Pu-239				0.0127 U		
Pu-241						
Sr-90	0.902	-0.018 U	0.392	0.264	0.092 U	-0.02 U
Tc-99				0.36 U		

Appendix Table B.2.3
Sediment Sample Results
Deerfield River
YNPS Rowe, MA

Station	West Storm Ditch	Sherman Spring			Upstream of WSD								
	SD-304R	SD-220	SD-221	SD-222	SD-223	SD-224	SD-225	SD-226	SD-227	SD-228	SD-229	SD-230	SD-231
Date Sampled	5/24/2006	5/24/2006	5/24/2006	5/24/2006	7/24/2006	7/24/2006	7/24/2006	6/14/2006	6/14/2006	6/14/2006	7/24/2006	6/20/2006	6/20/2006
gamma-spec (pCi/g)													
Ag-108m	-0.00398 U	-0.00669 U	0.0018 U	0.00408 U	-0.016 U	0.0116 U	-0.00956 U	0.00606 U	0.00993 U	-0.0163 U	-0.0109 U	-0.00569 U	0.00652 U
Am-241	0.0401 U	0.00946 U	-0.0232 U	0.0169 U		-0.00193 U		0.0281 U	0.015 U	0 U	-0.16 U	0.0567 U	0.0823 U
Co-60	0.0858	0.0228 U	0.0161 U	0.0123 U	-0.00345 U	0.00872 U	0.00381 U	-0.0119 U	-0.000202 U	0.0144 U	0.0209 U	0.00904 U	0.00653 U
Cs-134	0 U	0.0595 U	0.0662 U	0 U	0 UI	0 UI	0 UI	0.0681 U	0 U	0 U	0.0362 U	0 U	0 U
Cs-137	0.191	0.0673	0.0857	0.0752	0.255	0.175	0.234	0.101	0.412	0.0881	0.252	0.205	0.375
Eu-152	-0.032 U	-0.00428 U	0.0022 U	-0.0352 U	-0.0608 U	-0.0268 U	0.0167 U	-0.03 U	-0.0314 U	-0.0233 U	-0.0266 U	-0.0172 U	-0.045 U
Eu-154	-0.0527 U	0.0433 U	0.0425 U	0.0441 U	0.0495 U	-0.00229 U	-0.0456 U	0.00848 U	-0.0481 U	-0.0534 U	-0.0707 U	0.0117 U	-0.0104 U
Eu-155	0.0772 U	0.0772 U	0.0173 U	0.121 U	-0.0106 U	0 UI	0.0448 U	0.0635 U	0 U	0.0738 U	0.00441 U	0.00197 U	0.0415 U
Mn-54	0.0232 U	0.00926 U	0.00995 U	-0.00726 U	0.0434 U	-0.00322 U	0.0314 U	0.01 U	0 U	0.0182 U	-0.00157 U	0.0196 U	0.0193 U
Nb-94	0.0085 U	-0.00762 U	0.0139 U	0.025 U	0.0045 U	0.00982 U	0.0203 U	0.0369 U	0.0105 U	0.0159 U	-0.00357 U	-0.00417 U	0.0033 U
Sb-125	-0.0341 U	-0.00679 U	-0.00781 U	0.0043 U	0.043 U	0.0268 U	0.0111 U	0.0502 U	0.0868 U	0.0137 U	-0.0131 U	-0.0153 U	0.028 U
Hard to detect (pCi/g)													
C-14	0.00328 U	0.018 U	0.0687 U	0.119 U		-0.187 U		0.134 U	0.0964 U		-0.147 U		
Cm-243/244	-0.00862 U	0.0975	0.0592 U	0.0391 U		0.013 U		0 U	-0.0642 U		-0.0267 U		
Fe-55	0.815 U	4.34 U	3.2 U	6.4 U		-1.89 U		-6.8 U	-4.28 U		1.69 U		
H-3	-1.01 U	3.45 U	1.84 U	0.752 U		1.14 U	1.01 U	1.89 U	-1.18 U		1.99 U		
Ni-63	-1.88 U	-0.361 U	-0.217 U	-1.65 U		-1.29 U		-2.15 U	-2.82 U		4.13 U		
Pu-238	0.3	0.392	0.19 U	0.519		0.0145 U		0 U	-0.007 U		-0.0131 U		
Pu-239/240	0.0113 U	-0.0169 U	0.00296 U	0.29		0 U		-0.0182 U	-0.0874 U		-0.0197 U		
Pu-241	-5.24 U	-1.45 U	1.41 U	-1.97 U		5.57 U		1.42 U	-4.11 U		-10.8 U		
Sr-90	-0.0242 U	0.0114 U	-0.0541 U	-0.00854 U		0.019 U		0.0193 U	0.0417		0.00577 U		
Tc-99	0.0683 U	0.0579 U	0.0411 U	0.14 U		-0.0129 U		0.263 U	0.356		0.112 U		

Appendix Table B.2.3
Sediment Sample Results
Deerfield River
YNPS Rowe, MA

Station	Downstream WSD									
	SD-232 Date Sampled 7/24/2006	SD-232 (dup) 7/24/2006	SD-233 6/19/2006	SD-234 6/19/2006	SD-235 7/24/2006	SD-236 6/15/2006	SD-237 6/19/2006	SD-238 6/19/2006	SD-239 6/15/2006	SD-240 6/15/2006
gamma-spec (pCi/g)										
Ag-108m	-0.00729 U	0.00556 U	0.00163 U	-0.00728 U	0.00382 U	-0.00347 U	-0.00172 U	-0.00328 U	-0.00667 U	-0.00798 U
Am-241	-0.108 U	0.163 U	0.0538 U	-0.0153 U	-0.107 U	-0.00844 U	-0.0219 U	0.0291 U	0.0449 U	-0.0048 U
Co-60	0.0104 U	0.00319 U	0.176	-0.00802 U	0.00518 U	0.00423 U	-0.0102 U	-0.00053 U	0.00115 U	-0.00522 U
Cs-134	0.0729 U	0.0437 U	0 U	0.0479 U	0.0258 U	0 U	0 U	0.0387 U	0 U	0 U
Cs-137	0.456	0.144	0.418	0.307	0.181	0.0678	0.0155 U	0.0989	0.0412	0.153
Eu-152	0.0206 U	0.0534 U	-0.0369 U	-0.045 U	0.071 U	-0.0137 U	0.0254 U	-0.0256 U	-0.0214 U	-0.0651 U
Eu-154	0.0106 U	-0.0329 U	-0.0151 U	-0.0678 U	0.0111 U	-0.0109 U	-0.00551 U	0.0301 U	0.00842 U	-0.0102 U
Eu-155	0.124 U	0.108 U	0.0424 U	0.0031 U	0.0602 U	0 U	0.0344 U	0.0886 U	0 U	0.0365 U
Mn-54	0.00202 U	0.0409 U	-0.00695 U	0.0252 U	0.00111 U	0.0207 U	0.0078 U	0.0353 U	0 U	0.0223 U
Nb-94	-0.0341 U	0.0269 U	-0.00848 U	0.00926 U	0.00338 U	0.0083 U	0.00646 U	-0.0078 U	-0.0106 U	0.0109 U
Sb-125	0.0511 U	-0.000264 U	-0.0231 U	0.0521 U	0.057 U	-0.00185 U	-0.0251 U	-0.0137 U	0.0491 U	0.0389 U
Hard to detect (pCi/g)										
C-14	-0.0395 U	-0.0584 U			-0.0461 U			-0.0571 U		
Cm-243/244	-0.0121 U	0.0307 U			0.0598 U			0 U		
Fe-55	0.933 U	-0.647 U			2.52 U			2.75 U		
H-3	5.66 U	4.38 U			0.89 U			2.88 U		
Ni-63	1.64 U	-2.98 U			-0.465 U			0.565 U		
Pu-238	0.0228 U	-0.00678 U			-0.0142 U			-0.0176 U		
Pu-239/240	-0.0132 U	0.0429 U			0.0675 U			-0.0353 U		
Pu-241	7.76 U	2.21 U			8.28 U			4.06 U		
Sr-90	0.00318 U	-0.0189 U			0.00283 U			0.00433 U		
Tc-99	0.0466 U	-0.141 U			-0.0639 U			0 U		

Station Date Sampled	Monroe Bridge						Bear Swamp					
	SD-241 6/15/2006	SD-242 6/15/2006	SD-243 6/15/2006	SD-244 6/15/2006	SD-245 6/15/2006	SD-246 6/15/2006	SD-247	SD-248	SD-248R 11/7/2006	SD-248R (dup) 11/7/2006	SD-249	SD-249R 11/7/2006
gamma-spec (pCi/g)												
Ag-108m	-0.000982 U	0.00131 U	-0.01 U	0.00355 U	0.0126 U	-0.0141 U	0.00073 U		-0.0112 U	-0.00629 U		-0.00983 U
Am-241	0.00432 U	-0.0148 U	0.00351 U	0.0285 U	-0.0025 U	0.00772 U	-0.0291 U		0.0311 U	0.0292 U		0.0508 U
Co-60	0.0189 U	0.0213 U	0.0173 U	-0.0114 U	-0.00774 U	0.0272 U	-0.0031 U		0.0235 U	-0.00238 U		0.0139 U
Cs-134	0.0307 U	0 U	0 U	0 U	0 U	0.0251 U	0.0398 U		0 UI	0 UI		0 UI
Cs-137	0.0987	0.0732	0.215	0 U	0.0531	0.0692	0.123		0.0828	0.0601		0.0607
Eu-152	-0.0193 U	0.00546 U	-0.00546 U	-0.0321 U	-0.00124 U	-0.0321 U	-0.0591 U		0.00248 U	-0.00865 U		0.0000436 U
Eu-154	0.0221 U	-0.0000754 U	-0.0165 U	0.0000698 U	-0.00899 U	0.0455 U	0.0457 U		-0.0348 U	-0.0751 U		0.0675 U
Eu-155	0.0273 U	0 U	0.0142 U	0.0237 U	0.0314 U	0.0149 U	0 U		0.0957 U	0.0192 U		0.135 U
Mn-54	-0.0172 U	0 U	0.00336 U	-0.00146 U	0.0000592 U	0.0106 U	0.03 U		-0.000528 U	0.0165 U		0.00573 U
Nb-94	0.00545 U	-0.00724 U	-0.000939 U	-0.00233 U	0.0128 U	0 U	0.0127 U		0.00116 U	0.00889 U		0.0142 U
Sb-125	0.00124 U	-0.0056 U	-0.0181 U	0.0451 U	-0.0031 U	0.0168 U	0.006 U		0.0107 U	-0.03 U		0.0396 U
Hard to detect (pCi/g)												
C-14	0 U			-0.0407 U					0.0232 U	-0.0138 U		
Cm-243/244	0 U			0.037 U					0.0156 U	-0.00801 U		
Fe-55	-5.59 U			-9.21 U					15.8 U	-5.08 U		
H-3	4.18 U			-0.467 U			-1.36 U	-2.02 U	-1.97 U	3.31 U	1.12 U	4.58 U
Ni-63	-4.04 U			-2.7 U					4.04 U	-0.527 U		
Pu-238	0.0324 U			0 U					0.00955 U	-0.0125 U		
Pu-239/240	0.0169 U			0.0325 U					0.0177 U	-0.0311 U		
Pu-241	2.23 U			0.639 U					4.69 U	13.1 U		
Sr-90	0.00515 U			0.00829 U					0.0258 U	0.0152 U		
Tc-99	-0.0497 U			-0.00198 U					0.407	0.212 U		

Appendix Table B.2.3
 Sediment Sample Results
 Deerfield River
 YNPS Rowe, MA

Station Date Sampled	No. 4 Dam				
	SD-250	SD-251	SD-251R 11/24/2006	SD-252	SD-252R 11/24/2006
gamma-spec (pCi/g)					
Ag-108m	0.0511 U		0.00548 U		0.00827 U
Am-241	-0.0044 U		-0.0303 U		-0.0131 U
Co-60	-0.0269 U		-0.00567 U		0.000828 U
Cs-134	0.0148 U		0.0305 U		0.0437 U
Cs-137	0.136		0.00222 U		0.205
Eu-152	0.00451 U		-0.00776 U		0.00629 U
Eu-154	-0.0022 U		-0.0239 U		0 UI
Eu-155	0 U		0.0358 U		0.0524 U
Mn-54	0.00913 U		0.00144 U		0 UI
Nb-94	0.0086 U		0.0237 U		-0.0188 U
Sb-125	-0.0044 U		-0.0329 U		0.0285 U
Hard to detect (pCi/g)					
C-14			-0.0227 U		
Cm-243/244			-0.0171 U		
Fe-55			3.41 U		
H-3	3.44 U	-0.168 U	1.65 U	-2.21 U	5.65 U
Ni-63			-4.32 U		
Pu-238			-0.0153 U		
Pu-239/240			-0.0153 U		
Pu-241			3.5 U		
Sr-90			0.022 U		
Tc-99			0.103 U		

Study Area	Background			Sherman Spring			WSD	Upstream of WSD					Monroe Bridge		Bear Swamp	No. 4 Dam	
Station	SW-407	SW-408	SW-409	SW-220	SW-221	SW-222	SW-304	SW-223	SW-226	SW-229	SW-232	SW-235	SW-238	SW-241	SW-244	SW-247	SW-250
Date Sampled	5/17/2006	5/17/2006	5/17/2006	5/19/2006	5/19/2006	5/19/2006	5/18/2006	6/14/2006	6/14/2006	6/19/2006	6/19/2006	6/19/2006	6/15/2006	6/15/2006	6/15/2006		
gamma-spec (pCi/L)																	
Ag-108m	-0.107 U	1.04 U	-1.43 U	0.984 U	-0.116 U	0.196 U	-0.309 U	0.716 U	1.39 U	-0.107 U	-0.367 U	-0.0526 U	0.455 U	-0.198 U	0.0668 U	0.512 U	U
Am-241	2.39 U	3.68 U	0.48 U	1.95 U	-16.2 U	-13.3 U	-3.26 U	7.03 U	4.33 U	2.17 U	5.47 U	-3.73 U	-0.76 U	-23.5 U	3.33 U	4.65 U	-4.09 U
Co-60	0.86 U	-0.954 U	0.515 U	-1.81 U	0.886 U	-0.492 U	-1.82 U	-0.217 U	0.401 U	-0.217 U	1.04 U	0.747 U	0.519 U	-0.0709 U	1.13 U	-0.00489 U	-1.26 U
Cs-134	-0.0955 U	0.614 U	-0.402 U	2.05 U	1.96 U	0.232 U	-0.17 U	1.24 U	-0.223 U	0.735 U	0.48 U	2.47 U	-0.0481 U	-0.0674 U	0.47 U	-0.0343 U	1.05 U
Cs-137	0.139 U	0.397 U	-0.375 U	1.07 U	0.259 U	-1.01 U	0.281 U	1.29 U	0.99 U	0.446 U	-0.107 U	0.203 U	-0.886 U	0.249 U	0.466 U	0.191 U	1.07 U
Eu-152	0 U	5.48 U	-1.13 U	-2.48 U	-0.265 U	3.4 U	5.11 U	0.818 U	0.611 U	3.04 U	2.67 U	2.25 U	-0.0172 U	-0.501 U	-1.22 U	2.45 U	1.2 U
Eu-154	-1.92 U	1.85 U	-7.71 U	2.86 U	-3.81 U	-2.96 U	-2.57 U	-2.11 U	0.000867 U	-1.01 U	-1.13 U	0.673 U	0.489 U	-0.173 U	-0.783 U	-2.47 U	1.76 U
Eu-155	4.95 U	1.1 U	11 U	-10.8 U	0.878 U	3.01 U	-1.77 U	-1.22 U	-0.0557 U	0.432 U	2.37 U	1.72 U	2.09 U	1.32 U	-0.78 U	3.78 U	0.185 U
Mn-54	-1.23 U	0.00949 U	0.733 U	1.54 U	3.48 U	-0.183 U	2.12 U	-0.0785 U	-0.0633 U	-0.471 U	0.236 U	-0.0869 U	-0.233 U	-0.312 U	0.0931 U	0.572 U	0.236 U
Nb-94	-0.176 U	-1.13 U	1.31 U	0.659 U	1.48 U	0.564 U	-1.1 U	0.169 U	-0.0452 U	-0.0946 U	0.347 U	0.152 U	0.924 U	0.484 U	0.419 U	0.563 U	-0.357 U
Sb-125	-0.179 U	5 U	0.106 U	-0.675 U	1.38 U	0.173 U	5.2 U	1.17 U	-0.89 U	2.1 U	2.73 U	-0.147 U	-0.321 U	1.31 U	-0.0587 U	1.83 U	0.506 U
Hard to detect (pCi/L)																	
H-3	-11.7 U	105 U	113 U	3480 U	1470 U	748 U	281 U	-25.5 U	-25.5 U	78.9 U	59.4 U	7.75 U	228 U	242 U	31.8 U	198 U	75.9 U

Study Area	Wheeler Brook					
Station	SW-101	SW-102	SW-103	SW-104	SW-105	SW-106
Date Sampled	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006	5/12/2006
gamma-spec (pCi/L)						
Ag-108m	0.337 U	0.799 U	0.844 U	-0.769 U	-0.126 U	-0.535 U
Am-241	-7.44 U	-2.97 U	-4.61 U	1.14 U	-8.52 U	-10 U
Co-60	0.0438 U	1.11 U	1.16 U	2.19 U	-2.25 U	-0.0765 U
Cs-134	0.213 U	1.36 U	1.07 U	-0.00284 U	0.464 U	-0.4 U
Cs-137	0.858 U	1.24 U	1.52 U	-1.61 U	0.919 U	1.52 U
Eu-152	3.33 U	0.0788 U	-0.799 U	3.63 U	5.45 U	-4 U
Eu-154	2.36 U	-1.13 U	-0.195 U	-1.36 U	0.36 U	2.46 U
Eu-155	1.03 U	-0.503 U	1.09 U	2.92 U	1.96 U	1.35 U
Mn-54	-0.358 U	0.35 U	-0.554 U	-0.0465 U	0.808 U	-0.147 U
Nb-94	-1.67 U	0.67 U	0.0837 U	-0.637 U	0.0715 U	-0.736 U
Sb-125	-9.77 U	3.16 U	2.64 U	2.05 U	-0.571 U	1.44 U
Hard to detect (pCi/L)						
H-3	-65.4 U	-120 U	17.4 U	-16 U	79.1 U	-86.7 U

Study Area	YAEC BUD/TSCA Area													
Station	CB-3R	CB-3R	CB-3R	CB-8	CB-8	MW-100A	MW-100A	MW-100B	MW-100B	MW-101A	MW-101A	MW-101A	MW-101B	MW-101B
Date Sampled	12/5/2006	12/5/2006	Mar-07	12/6/2006	Mar-07	12/6/2006	Mar-07	12/6/2006	Mar-07	12/14/2006	Mar-07	Mar-07	12/6/2006	Mar-07
LTP (pCi/L)														
Ag-108m	1.95 U	-0.691 U								-0.144 U	-0.703 U	0.678 U		
Am-241	0.0475 U	0.376 U								4.78 U	-2.6 U	3.44 U		
Co-60	-0.429 U	25.9								0.77 U	1.88 U	1.13 U		
Cs-134	-1.61 U	1.39 U								-1.03 U	1.26 U	1.16 U		
Cs-137	0.729 U	46.1								-0.0452 U	1.48 U	-0.321 U		
Eu-152	2.35 U	-0.979 U								0.417 U	-5.76 U	-4.81 U		
Eu-154	2.77 U	7.98 U								5.69 U	-1.74 U	-0.85 U		
Eu-155	5.21 U	4.14 U								0.0247 U	0.103 U	-1.15 U		
Mn-54	0.126 U	-0.0562 U								0.575 U	-0.469 U	0.281 U		
Nb-94	-0.241 U	1.28 U								0.508 U	1.95 U	-1.28 U		
Sb-125	-5.72 U	1.09 U								0.572 U	5.43 U	-1.49 U		
LTP_HTD (pCi/L)														
C-14	14.5 U									-2.65 U		-14.7 U		
Cm-243/244	-0.0898 U													
H-3	76.8 U	1870	206 U	-89 U	266 U	90.8 U	255 U	211 U	300 U	3870		3350	-76.1 U	51.2 U
Pu-238	0.00388 U													
Pu-239/240	0.00443 U													
Pu-241	-1.03 U													
Sr-90	-0.324 U									-0.121 U	0.115 U	-0.152 U		
Tc-99	-3 U									6.84 U	2.45 U	-0.705 U		

Study Area	YAEC BUD/TSCA Area														
Station	MW-101C	MW-101C	MW-102A	MW-102A	MW-102A	MW-102A	MW-102B	MW-102B	MW-102C	MW-102C	MW-102D	MW-102D	MW-104A	MW-104A	MW-104A
Date Sampled	12/7/2006	Mar-07	12/12/2006	12/12/2006	Mar-07	Mar-07	12/5/2006	Mar-07	12/12/2006	Mar-07	12/5/2006	Mar-07	12/11/2006	Mar-07	Mar-07
LTP (pCi/L)															
Ag-108m			1.42 U	-0.307 U					0.359 U		-0.863 U	-2.17 U		1.66 U	-0.39 U
Am-241			-0.252 U	-8.58 U					-7.87 U		0.0464 U	2.71 U		4.21 U	8.83 U
Co-60			0.0474 U	-0.0519 U					0.64 U		-0.0725 U	-0.292 U		-0.937 U	-2.13 U
Cs-134			0.6 U	-0.157 U					1.24 U		-1.28 U	-0.114 U		0.522 U	-1.61 U
Cs-137			-0.381 U	-1.52 U					-0.367 U		0.155 U	-0.0386 U		-0.576 U	0.894 U
Eu-152			3.35 U	3.64 U					-0.257 U		-1.05 U	-4.63 U		-1.71 U	0 U
Eu-154			1.21 U	0.556 U					0.274 U		-3.17 U	3.77 U		-3.38 U	-0.87 U
Eu-155			-1.46 U	3.87 U					0.964 U		2.33 U	6.63 U		6.25 U	3.34 U
Mn-54			-0.448 U	-0.671 U					-1.83 U		-1.4 U	-1.54 U		-1.18 U	1.21 U
Nb-94			0.203 U	0.185 U					1.37 U		0.605 U	-0.252 U		-1.1 U	0.357 U
Sb-125			-0.728 U	2.96 U					2.58 U		-2.27 U	-0.408 U		-2.31 U	2.73 U
LTP_HTD (pCi/L)															
C-14			-11.5 U	-7.13 U					-17 U		7.62 U	-1.1 U		-23.8 U	-11.2 U
Cm-243/244											-0.0455 U				
H-3	-59.1 U	51 U	3980	4240	4590	4640	133 U	35.2 U	3520	3610	6530	8580	2850	2930	3100
Pu-238											0.0107 U				
Pu-239/240											-0.00676 U				
Pu-241											2.1 U				
Sr-90			0.232 U	-0.496 U					-0.358 U		-0.574 U	-0.243 U		0.13 U	-0.39 U
Tc-99			5.57 U	0.16 U					3.31 U		-1.32 U	0 U		-4.14 U	-4.42 U

Study Area	YAEC BUD/TSCA Area														
Station	MW-104B	MW-104B	MW-104C	MW-104C	MW-104D	MW-104D	MW-104D	MW-105A	MW-105A	MW-105A	MW-105B	MW-105B	MW-105C	MW-105C	MW-107A
Date Sampled	12/11/2006	Mar-07	12/13/2006	Mar-07	12/12/2006	12/12/2006	Mar-07	12/6/2006	12/6/2006	Mar-07	12/13/2006	Mar-07	12/12/2006	Mar-07	12/11/2006
LTP (pCi/L)															
Ag-108m					-0.346 U	1.1 U					1.15 U		-0.404 U		0.432 U
Am-241					0.0117 U	-0.0076 U					-3.53 U		1.5 U		0.896 U
Co-60					0.224 U	-1.76 U					1.62 U		-0.486 U		0.329 U
Cs-134					0.766 U	1.98 U					1.69 U		0.546 U		1.44 U
Cs-137					0.765 U	-0.8 U					-0.0649 U		1.22 U		1.02 U
Eu-152					0.182 U	6.32 U					1.35 U		0.99 U		3.16 U
Eu-154					-3.27 U	6.69 U					-5.26 U		4.4 U		0.497 U
Eu-155					-0.513 U	5.94 U					3.95 U		2.03 U		-0.321 U
Mn-54					-0.767 U	0.685 U					-1.61 U		-0.632 U		0.0742 U
Nb-94					0.68 U	1.88 U					0 U		-0.0384 U		0.186 U
Sb-125					1.65 U	1.78 U					0.79 U		1.2 U		1.42 U
LTP_HTD (pCi/L)															
C-14					-15.9 U	-17.1 U					-4.46 U		-7.13 U		-8.91 U
Cm-243/244					-0.0454 U	0.00112 U									
H-3	-59.5 U	43.5 U	-104 U	-25.5 U	-293 U	-129 U	36.1 U	140 U	175 U	230 U	2900	3440	2750	2620	4040
Pu-238					-0.00249 U	0.00661 U									
Pu-239/240					-0.00597 U	0.0127 U									
Pu-241					-1.13 U	0.1 U									
Sr-90					-0.102 U	-0.155 U					-0.209 U		-0.274 U		0.0711 U
Tc-99					3.25 U	4.36 U					5 U		3.04 U		9.85 U

Study Area	YAEC BUD/TSCA Area														
Station	MW-107A	MW-107B	MW-107B	MW-107C	MW-107C	MW-107D	MW-107D	MW-107E	MW-107E	MW-107F	MW-107F	MW-109A	MW-109A	MW-109B	MW-109B
Date Sampled	Mar-07	12/5/2006	Mar-07	12/11/2006	Mar-07	12/12/2006	Mar-07	12/5/2006	Mar-07	12/5/2006	Mar-07	12/4/2006	Mar-07	12/5/2006	Mar-07
LTP (pCi/L)															
Ag-108m	1.67 U			0.68 U	-0.0275 U	0.375 U	-0.141 U	-0.0734 U	0.233 U	0.749 U	1.18 U				
Am-241	5.91 U			-0.00592 U	-0.961 U	-0.0616 U	4.68 U	0.00527 U	-20.1 U	-0.0207 U	-6.39 U				
Co-60	-0.646 U			-0.521 U	-2.16 U	-0.373 U	1.25 U	0.156 U	0.865 U	0.154 U	-1.12 U				
Cs-134	0.859 U			-0.727 U	1.96 U	-1.26 U	1.47 U	0.744 U	3.04 U	0.485 U	-0.399 U				
Cs-137	-0.552 U			0.185 U	-1.21 U	0.434 U	-1.5 U	0.328 U	0.469 U	0.672 U	0.812 U				
Eu-152	0 U			-1.01 U	-4.49 U	-5.11 U	8.27 U	-0.441 U	2.44 U	0.118 U	-1.98 U				
Eu-154	3.05 U			-4.19 U	-4.68 U	2.74 U	5.6 U	-0.274 U	10.4 U	1.16 U	-2.28 U				
Eu-155	1.24 U			-2.33 U	-1.02 U	3.03 U	-7.3 U	3.62 U	-3.42 U	-5.24 U	-2.47 U				
Mn-54	-0.411 U			-0.517 U	-3.32 U	-0.855 U	0.825 U	1.03 U	-0.702 U	-0.254 U	-0.133 U				
Nb-94	-0.284 U			0.773 U	-1.53 U	-0.316 U	0.0666 U	-1.04 U	-0.523 U	-0.224 U	-0.411 U				
Sb-125	4.13 U			4.38 U	-6.16 U	-1.94 U	-0.505 U	0.761 U	-0.607 U	-0.731 U	-0.4 U				
LTP_HTD (pCi/L)															
C-14	-7.03 U			-1.79 U	-5 U	-5.31 U	3.86 U	21.1 U	-4.97 U	-3.64 U	1.28 U				
Cm-243/244				0.0247 U		-1.49E-08 U		0.0368 U		0.0834 U					
H-3	4160	-235 U	138 U	29100	30900	9310	9440	5700	6420	9210	9220	231 U	102 U	57.3 U	-7.63 U
Pu-238				0.00773 U		-0.0126 U		0.0161 U		-0.0133 U					
Pu-239/240				-0.00713 U		-0.00944 U		-0.00301 U		0.00444 U					
Pu-241				0.331 U		-1.16 U		-0.36 U		-1.12 U					
Sr-90	0.376 U			0.2 U	0.374 U	0.0291 U	0.25 U	-0.2 U	0.073 U	0.0942 U	0.689 U				
Tc-99	0 U			3.92 U	-7.05 U	7.72 U	-8.26 U	-4.99 U	-8.86 U	-5.33 U	-3.79 U				

Study Area	YAEC BUD/TSCA Area															
Station	MW-109C	MW-109C	MW-109D	MW-109D	MW-110A	MW-110A	MW-110B	MW-110B	MW-110C	MW-110C	MW-110D	MW-110D	MW-111A	MW-111A	MW-111B	MW-111B
Date Sampled	12/5/2006	Mar-07	12/5/2006	Mar-07	12/11/2006	Mar-07	12/7/2006	Mar-07	12/7/2006	Mar-07	12/7/2006	Mar-07	12/5/2006	Mar-07	12/6/2006	Mar-07
LTP (pCi/L)																
Ag-108m																
Am-241																
Co-60																
Cs-134																
Cs-137																
Eu-152																
Eu-154																
Eu-155																
Mn-54																
Nb-94																
Sb-125																
LTP_HTD (pCi/L)																
C-14																
Cm-243/244																
H-3	102 U	102 U	32.6 U	215 U	1660	1350	36.9 U	139 U	2590	2040	-8.89 U	270 U	1680	1630	90.9 U	177 U
Pu-238																
Pu-239/240																
Pu-241																
Sr-90																
Tc-99																

Study Area	YAEC BUD/TSCA Area						YAEC Outside BUD/TSCA Area										
	MW-111C Date Sampled	MW-111C Mar-07	MW-112A 12/6/2006	MW-112A Mar-07	MW-6R 12/5/2006	MW-6R Mar-07	CFW-1 12/12/2006	CFW-1 Mar-07	CFW-5 12/7/2006	CFW-5 Mar-07	CFW-6 12/7/2006	CFW-6 Mar-07	CFW-6 Mar-07	DW-001 12/4/2006	DW-001 Mar-07	MW-103A 12/4/2006	MW-103A Mar-07
LTP (pCi/L)																	
Ag-108m	2 U	-0.785 U															
Am-241	0.000578 U	-11.2 U															
Co-60	0.207 U	-1.74 U															
Cs-134	0.287 U	-1.69 U															
Cs-137	-1.33 U	-0.217 U															
Eu-152	-3.54 U	-0.346 U															
Eu-154	-0.652 U	0.933 U															
Eu-155	-1.99 U	3.05 U															
Mn-54	-1.07 U	0.207 U															
Nb-94	-0.127 U	0.876 U															
Sb-125	1.18 U	-1.17 U															
LTP_HTD (pCi/L)																	
C-14	3.21 U	-2.07 U															
Cm-243/244	-0.00371 U																
H-3	-137 U	2280	415 U	300 U	214 U	146 U	-290 U	316 U	33.5 U	392	581	4210	4000	114 U	61.3 U	142 U	59.9 U
Pu-238	-0.00685 U																
Pu-239/240	0 U																
Pu-241	-1.36 U																
Sr-90	0.148 U	0.0305 U															
Tc-99	-4.21 U	-3.42 U															

Study Area	YAEC Outside BUD/TSCA Area				TransCanada Property											
	MW-103C 12/11/2006	MW-103C Mar-07	MW-103B 12/5/2006	MW-103B Mar-07	CB-4 12/4/2006	CB-4 Mar-07	CB-6 12/11/2006	CB-6 Mar-07	MW-106A 12/13/2006	MW-106A Mar-07	MW-106A Mar-07	MW-106B 12/7/2006	MW-106B Mar-07	MW-106C 12/7/2006	MW-106C Mar-07	MW-106D 12/7/2006
LTP (pCi/L)																
Ag-108m							-1.83 U		0.69 U	0.896 U	-0.504 U					
Am-241							-21.1 U		1.96 U	-4.99 U	-13.8 U					
Co-60							-0.206 U		-0.578 U	-1.06 U	-0.236 U					
Cs-134							0.0985 U		1.92 U	-0.708 U	-2.84 U					
Cs-137							1.65 U		0.621 U	-1.93 U	0.689 U					
Eu-152							-6.74 U		-0.638 U	-3.03 U	2.98 U					
Eu-154							1.36 U		0.654 U	-1.21 U	-5.12 U					
Eu-155							-1.52 U		17.1 U	1.73 U	1.09 U					
Mn-54							0.401 U		-0.739 U	0.889 U	-0.553 U					
Nb-94							0.0312 U		-2.43 U	-0.524 U	0.342 U					
Sb-125							-1.93 U		-0.394 U	-0.0859 U	2.48 U					
LTP_HTD (pCi/L)																
C-14							5.31 U		-11.6 U	-7.09 U	0.856 U					
Cm-243/244																
H-3	-130 U	103 U	184 U	-101 U	189 U	192 U	869	1280	3010	2850	104 U	167 U	-35 U	277 U	180 U	112 U
Pu-238																
Pu-239/240																
Pu-241																
Sr-90							-0.111 U		-0.063 U	-0.112 U	-0.227 U					
Tc-99							4.32 U		2.15 U	-5.14 U	-5.92 U					

Study Area Station Date Sampled	TransCanada Property							TransCanada Inside BUD Area							
	MW-106D Mar-07	MW-113A 12/4/2006	MW-113A Mar-07	MW-113C 12/4/2006	MW-113C Mar-07	Spring 12/4/2006	Spring Mar-07	CW-10 Mar-07	CW-10 12/6/2006	MW-108A 12/14/2006	MW-108A Mar-07	MW-108B 12/6/2006	MW-108B Mar-07	MW-108C 12/6/2006	MW-108C Mar-07
LTP (pCi/L)															
Ag-108m					-1 U		1.45 U								
Am-241					-2.1 U		-5.76 U								
Co-60					0.984 U		1.04 U								
Cs-134					1.67 U		0 U								
Cs-137					-2.43 U		-0.583 U								
Eu-152					-2.13 U		0.883 U								
Eu-154					-0.239 U		-4.83 U								
Eu-155					6.74 U		-1.82 U								
Mn-54					-1.74 U		-0.648 U								
Nb-94					0.248 U		-0.719 U								
Sb-125					-0.709 U		1.17 U								
LTP_HTD (pCi/L)															
C-14					6.74 U		-13.4 U								
Cm-243/244															
H-3	131 U	231 U	69 U	798	870	1100	452	231 U	317 U	131 U	280 U	-98.6 U	281 U	-60.2 U	76.7 U
Pu-238															
Pu-239/240															
Pu-241															
Sr-90					-0.112 U		-0.325 U								
Tc-99					-3.15 U		-4 U								

Appendix C
Toxicity Profiles

C.1: Human Health Toxicity Profiles

APPENDIX B - TOXICITY PROFILES

This appendix contains a Toxicity Profile (or Summary) for each of the substances contained in the *Residential ShortForm*.

The MCP Phase II Risk Characterization Report should contain a Toxicity Profile for each of the chemicals reported at the disposal site. As described in Section 4.4, these Profiles serve several purposes, including educating the public about potential hazards associated with the chemicals and serving as a basis for the quantitative risk characterization.

The Toxicity Profiles contained in this Appendix may be copied and submitted as part of the Phase II Report. These Profiles will be periodically updated, and the risk assessor should insure that the most current version is used.

ACENAPHTHENE

GENERAL BACKGROUND INFORMATION

Acenaphthene is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs are a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The database for acenaphthene is very limited.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of acenaphthene.

HUMAN TOXICOLOGICAL PROFILE

No data were found regarding the human toxicology of acenaphthene.

MAMMALIAN TOXICOLOGICAL PROFILE

Adverse effects on the lungs, glands, and blood were observed in rats following aerosol administration of 12 mg/m³ acenaphthene for 5 months (U.S. EPA, 1981).

GENOTOXICITY

Mutagenicity tests for acenaphthene were negative (U.S. EPA, 1981). Carcinogenicity tests were negative (IARC, 1983).

REFERENCES

International Agency for Research on Cancer (IARC) (1983) *Monograph on the evaluation of carcinogenic risk of chemicals to man: polynuclear aromatic hydrocarbons*. 32:33-43.

U.S. Environmental Protection Agency (U.S. EPA) (1981) An exposure and risk assessment for acenaphthalene. U.S. EPA Contract No. 68-01-6017. Office of Water Regulations and Standards, Washington, D.C.

ACENAPHTHYLENE

GENERAL BACKGROUND INFORMATION

Acenaphthylene is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs are a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The data on acenaphthylene are limited.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of acenaphthylene.

HUMAN TOXICOLOGICAL PROFILE

No data were found regarding the human toxicity of acenaphthylene.

MAMMALIAN TOXICOLOGICAL PROFILE

No data were found regarding the mammalian toxicity of acenaphthylene.

GENOTOXICITY

Data from a single mutagenicity assay using acenaphthylene were positive (U.S. EPA, 1982).

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA) (1982) An exposure and risk assessment for polynuclear aromatic hydrocarbons (acenaphthylene). U.S. EPA Contract 68-01-6017. Office of Water Regulations and Standards. Washington, D.C.

ANTHRACENE

GENERAL BACKGROUND INFORMATION

Anthracene is a polycyclic aromatic hydrocarbon (PAH). PAHs are a class of compounds which are non-polar and contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. As a PAH, anthracene is found in tobacco smoke, certain foods, and the emissions from industrial or natural burning.

PHARMACOKINETICS

Little data were found regarding the pharmacokinetics of anthracene. The intestinal absorption of anthracene is less dependent on the presence of bile in the stomach than is the absorption of larger PAHs such as benzo(a)pyrene (Rahman et al, 1986).

HUMAN TOXICOLOGICAL PROFILE

Anthracene is a skin irritant and allergen (Sax, 1984). Humans exposed to anthracene in an occupational setting may demonstrate skin disorders (Clement, 1985). Anthracene has been associated with gastrointestinal tract toxicity in humans (Badiali et al, 1985). However, the usefulness of this study is limited due to confounding factors. Hematopoietic toxicity has also been observed in cancer patients who have been treated with anthracene-containing chemotherapeutics (Falkson et al, 1985). No control groups and concomitant exposure to other ingredients in the therapeutic agents prevents any definitive conclusions.

MAMMALIAN TOXICOLOGICAL PROFILE

A subchronic study where anthracene was administered to mice by gavage for at least 90 days found no treatment-related effects at doses up to 1000 mg/kg-day (USEPA, 1989).

The data on the carcinogenicity of anthracene are considered inadequate by EPA (IRIS, 1991).

GENOTOXICITY

Tests for DNA damage, mutation, chromosome effects and cell transformation in a variety of eukaryotic cell preparations have shown negative results. The majority of tests using anthracene in prokaryotes are negative, but positive results are reported in one or two tests (ATSDR, 1990; IRIS, 1991).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological summary for polycyclic aromatic hydrocarbons. U.S. Public Health Service.
- Badiali, D. et al. (1985) *Melanosis of the rectum in patients with constant constipation*. *Dis Colon Rectum* 28:241-245.
- Clement (1985) Chemical, physical and biological properties of compounds present at hazardous waste sites.
- Falkson, G. Klein, B., Falkson, H. (1985) *Hematological toxicity: experience with antracyclines and anthracenes*. *Exp. Hematol* 13:64-71.
- Integrated Risk Information System (IRIS) (1991) U.S. Environmental Protection Agency
- International Agency for Research on Cancer (IARC) (1983) *Monograph on the evaluation of carcinogenic risk of chemicals to man, anthracene*. 32:433-440.
- Sax, N.I. (1984) Dangerous Properties of Industrial Materials. 6th edition. Van Nostrand Reinhold Company, N.Y.

ARSENIC

GENERAL BACKGROUND INFORMATION

The toxicity of arsenic depends upon its chemical form along with the route, dose, and duration of exposure. In general, arsenites (As^{+3}) are potentially more toxic than arsenates, soluble arsenic compounds are potentially more toxic than insoluble compounds, and inorganic arsenic compounds are potentially more toxic than organic derivatives (U.S. EPA, 1985).

PHARMACOKINETICS

Absorption from the gastrointestinal tract is dependent upon the solubility of the specific arsenic compound and the dose. Absorption from the respiratory tract is also dependent upon the specific arsenic compound, along with particle size (see section on Relative Absorption Factors).

HUMAN TOXICOLOGICAL PROFILE

Depending upon dose and exposure route, arsenic is an irritant of the skin, mucous membranes, and the gastrointestinal tract. Acute toxicity from the ingestion of higher doses of arsenic may result in vomiting, diarrhea, convulsions, a severe drop in blood pressure, and cardiovascular effects. The lethal dose for humans is reported to be 1.0 to 2.6 mg/kg-bw (Vallee et al., 1960). Acute toxicity from inhalation exposure to arsenic adsorbed to particulate matter may result in conjunctivitis and pharyngitis. Subchronic effects included hyperpigmentation (melanosis), multiple arsenical keratoses, sensory-motor polyneuropathy, persistent chronic headache, lethargy, gastroenteritis, and mild iron deficiency anemia. Inhaled arsenic compounds have been reported to be associated with skin lesions, cardiovascular and respiratory effects, and peripheral neuropathy (Stokinger, 1981; IARC, 1980). Chronic oral exposure of humans to inorganic arsenic compounds has been reported to cause skin lesions, peripheral vascular disease, and peripheral neuropathy (Silver and Wainman, 1952). The incidence of blackfoot disease, a peripheral circulatory disease characterized by gangrene of the extremities, has reportedly been related to the presence of arsenic in the drinking water of residents of the southwest of Taiwan (Tseng, 1977). The symptoms of chronic inhalation exposure to arsenic compounds are similar to those associated with chronic oral toxicity.

MAMMALIAN TOXICOLOGICAL PROFILE

Oral LD₅₀ values for trivalent arsenic vary from 15 to 293 mg/kg in rats and from 10-150 mg/kg in other test species (U.S. EPA, 1984). Chronic toxicity data from arsenic exposure to rats cannot be extrapolated to man as the rat is able to store this compound bound to hemoglobin in red blood cells (Lanz et al., 1950). This binding results in extremely slow excretion by rats compared to other species (Mealey et al., 1959). For this reason, dogs have been used to obtain experimental toxicity information. Studies of the subchronic oral toxicity of diets containing sodium arsenite or sodium arsenate in dogs report that arsenite is potentially more toxic than arsenate. The NOEL (no observed effect level) was reported to be 50 mg/kg-diet for both substances (Byron et al., 1967). Schroeder and Balassa (1967) studied the chronic oral toxicity of arsenic on growth and survival in mice. Ingestion of water containing As⁺³ at 5 mg/L over two years is reported to have resulted in decreased survival and reduced median life span in male and female mice. No information regarding chronic inhalation exposure of experimental animals to arsenic could be located in the available literature. Animal studies to test the teratogenic potential of arsenic have been performed. Matsumoto et al. (1973) reported decreased fetal weight in oral doses of up to 40 mg-arsenate/kg-bw/day administered to pregnant mice for three consecutive days. Diets containing up to 100 mg-arsenite/kg-diet, however, were reported to have had no effect on offspring (Kojima, 1974). No data regarding the teratogenicity of inhaled arsenic could be found in the literature.

GENOTOXICITY

Nearly all results of gene mutation studies for arsenic (III) and arsenic (V) compounds have been negative. Arsenite and arsenate also have been inactive in gene-specific mutation assays in yeast and in cultured mammalian cells. In contrast, arsenic (III), arsenic (V), arsenite and arsenate have been found to result in chromosome aberrations and sister chromatid exchanges in cultured animal and human cells tested in vitro (ATSDR, 1987). There is limited evidence that occupational exposure to arsenic may cause chromosome changes in humans (Beckman et al., 1977). Beckman et al. (1977) reported an increase in gaps, chromatid aberrations and chromosome aberrations from mine workers at a smelter in northern Sweden.

The majority of tests in which experimental animals were exposed orally to a variety of arsenic compounds produced negative results regarding carcinogenicity (Hueper and Payne, 1962; Byron et al., 1967). A few studies have, however, reported tumorigenic effects of arsenic treatment (Schrauzer et al., 1978). Mixed results were reported in arsenic inhalation studies (Ishinishi et al., 1977; Ivankovic et al., 1979). Epidemiological studies conducted in the U.S. have failed to correlate the incidence of skin cancer with arsenic in drinking water (Morton et al., 1976; Goldsmith et al., 1972). A dose-response relationship between the occurrence of skin cancer and arsenic consumption in the drinking water of Taiwanese, however, was reported by Tseng et al. (1977). Arsenic exposure at certain doses may produce a pattern of skin disorders, hyperpigmentation, and keratosis that may develop into basal or squamous cell carcinoma (U.S. EPA, 1985). Several epidemiological studies of workers occupationally exposed to arsenic have reported a correlation between this exposure

and mortality due to respiratory cancer (Higgins et al., 1982; Enterline and Marsh, 1982; Brown and Chu, 1983). Based upon epidemiological data, the EPA has classified arsenic as Group A -Human Carcinogen.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1987) Toxicological profile for arsenic. U.S. Public Health Service.
- Beckman, G. et al., (1977) *Chromosome aberrations in workers exposed to arsenic*. *Environ. Health Perspect.* 19:145.
- Brown, C.C. and Chu, K.C. (1983). *Implications of the multistage theory of carcinogenesis applied to occupational arsenic exposure*. *J. Natl. Cancer Inst.* 70:455-463.
- Byron, W.R., Bierbower, G.W., Brouwer, J.B. and Hansen, W.H. (1967) *Pathological changes in rats and dogs from two-year feeding of sodium arsenite or sodium arsenate*. *Toxicol. Appl. Pharmacol.* 10:132-147.
- Enterline, P.E. and Marsh, G.M. (1982) *Mortality among workers exposed to arsenic and other substances in a copper smelter*. *Am. J. Epidemiol.* 116:895-910.
- Goldsmith, J.R. et al. (1972) *Evaluation of health implications of elevated arsenic in well water*. *Water Res.* 6:1133-1136.
- Higgins, I., Welch, K. and Burchfiel, C. (1982) Mortality of Anaconda smelter workers in relation to arsenic and other exposures. Dept. of Epidemiology, Univ. of Michigan, Ann Arbor, MI.
- Hueper, W.C. and Payne, W.W. (1962) *Experimental studies in metal carcinogenesis. Chromium, nickel, iron, arsenic*. *Arch. Environ. Health* 5:445.
- IARC (International Agency for Research on Cancer). (1980) Arsenic and arsenic compounds. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans. WHO, Lyon, France. 23:39-142.
- Ishinishi, N., et al. (1977). *Preliminary experimental study on carcinogenicity of arsenic trioxide in rat lung*. *Environ. Health Perspect.* 19:191-196.
- Ivankovic, S., Eisenbrand, G. and Pressman, R. (1979) *Lung carcinoma induction in BD rats after single intratracheal instillation of an arsenic containing pesticide mixture formerly used in vineyards*. *Int. J. Cancer* 24:786-788.
- Kojima, H. (1974) *Studies on developmental pharmacology of arsenite. II. Effect of arsenite on pregnancy, nutrition, and hard tissue*. *Fol. Pharmacol. Japon.* 70:149-163.
- Lantz, H., Wallace, P.W. and Hamilton, J.G. (1950) *The metabolism of arsenic in laboratory animals using As⁷⁴ as trace*. *Univ. Calif. Pub. Pharmacol.* 2:263-282.
- Mealey, J., Bronwell, G.L. and Sweet, W.H. (1959) *Radioarsenic in plasma, urine, normal tissues, and intracranial neoplasms*. *Arch. Neurol. Psychiatry* 81:310-320.
- Morton, W., Starr, G., Pohl, D., Stoner, J., Wagner, S. and Weswig, P. (1976) *Skin cancer and water arsenic in Lane County, Oregon*. *Cancer* 37:2523-2532.
- Schrauser, G.N., White, J.E., McGinness, J.E., Schneider, C.J. and Bell, L.J. (1978) *Arsenic and cancer: Effects of joint administration of arsenite and selenite on the genesis of mammary adenocarcinoma in inbred female C3H/ST mice*. *Bioorg. Khim.* 9:245-253.
- Schroeder, H.A. and Balassa, J.J. (1967) *Arsenic, germanium, tin, and vanadium in mice: Effects on growth, survival and tissue levels*. *J. Nutr.* 92:245-252.
- Silver, A.S. and Wainman, P.L. (1952) *Chronic arsenic poisoning following use of an asthma remedy*. *JAMA* 150:584.

Stokinger, H.E. (1981) The Metals: Arsenic. In: Patty's Industrial Hygiene and Toxicology, Vol. II, 3rd ed., C.D. Clayton and F.E. Clayton, Ed.; John Wiley and Sons, Inc., NY. pp. 1517-1531.

Tseng, W.P. (1977) *Effects and dose-response relationships of skin cancer and Blackfoot Disease with arsenic.* **Environ. Health Perspect.** 19:109-119.

U.S. Environmental Protection Agency (EPA) (1985) Health advisories for 52 chemicals which have been detected in drinking water. Office of Drinking Water. NTIS PB860118338.

U.S. Environmental Protection Agency (EPA) (1984) Health effects assessment for arsenic. ECAO-HO20. Prepared for the Office of Emergency and Remedial Response by the Environmental Criteria and Assessment Office.

Vallee, B.L., Ulmer, D.D. and Wacker, W.E.C. (1960) *Arsenic toxicology and chemistry.* **Arch. Ind. Health** 21:132-151.

BENZENE

GENERAL BACKGROUND INFORMATION

Benzene is a clear, volatile, highly flammable, aromatic hydrocarbon which exists naturally and is produced by volcanoes and forest fires. Benzene is also a very common industrial solvent, produced from petroleum. It is used as a solvent for fats, inks, paints, plastics, rubber, in the extraction of oils from seeds and nuts, in photogravure printing, as a chemical intermediate and in the manufacture of detergents, explosives, pharmaceuticals and dyestuffs. It is also a component of gasoline and other petroleum-based fuels. Exposure to benzene can occur via inhalation, ingestion, especially of contaminated drinking water, and dermal contact (as in contact with liquid benzene found in gasoline.) (Sittig, 1981; ATSDR, 1989)

PHARMACOKINETICS

Benzene is readily absorbed through ingestion, moderately absorbed through inhalation and poorly absorbed through intact skin (see section on Relative Absorption Factors). Once in the bloodstream, benzene is distributed throughout the body, with the concentration in any one compartment dependent on the degree of perfusion of tissues by blood. Since benzene is lipid-soluble, it accumulates in fat, but the rate of accumulation is slow since fat is poorly perfused. The metabolites of benzene are responsible for its toxic effects. These include phenol (which is either formed via an unstable benzene oxide precursor or directly from benzene), catechol, hydroquinone and conjugated phenolic compounds. The primary site of benzene metabolism is the liver via the cytochrome P450 mixed function oxidase system. Some benzene metabolism may also occur in the bone marrow via the same enzyme system. Benzene is excreted either unchanged from the lungs or as metabolites in the urine (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Benzene targets its effects on the hemopoietic, immune and nervous systems (ATSDR, 1989). Exposure to benzene has produced irritation of the skin, eyes and upper respiratory tract. Acute exposure has produced central nervous system depression, headache, dizziness, nausea, convulsions, coma and death at extremely high concentrations (Sittig, 1981). Health effects in humans have been reported starting as low as 50 ppm via inhalation. Twenty-five ppm for 6 hrs had no obvious effects though benzene was detected in blood (Sandmeyer, 1981). Early autopsy reports found benzene-induced hemorrhages of the brain, pericardium, urinary tract, mucous membranes and skin (Sittig, 1981). Chronic exposure to benzene produces blood changes involving an initial increase in levels of erythrocytes, leukocytes and thrombocytes, followed by aplastic anemia indicated by anemia, leukopenia and thrombocytopenia (Sittig, 1981).

MAMMALIAN TOXICOLOGICAL PROFILE

The following effects have been produced experimentally in laboratory animals, following exposure to benzene: decreased leukocyte and/or erythrocyte counts, reduction in cellular immunity and bone marrow depression (reduced number of granulopoietic stem cells). Animal studies do not indicate that benzene is teratogenic, but the following fetotoxic effects have been found: reduced fetal weight, altered fetal hematopoiesis, fetal skeletal variations and increased resorptions in pregnant exposed animals. In addition, benzene has produced histopathological changes in ovaries and testes of test animals (ATSDR, 1989).

GENOTOXICITY

Benzene and its metabolites have been shown to be mutagenic in a number of in vitro and in vivo studies. Genotoxic effects produced experimentally include structural and numerical chromosome aberrations in humans, animals and cell cultures, and sister chromatid exchanges and micronuclei in in vivo animal studies. Benzene exposure has been found to produce an increase in the number of chromosome aberrations associated with myelotoxicity (Sittig, 1981). In addition, sperm head abnormalities, inhibition of DNA and RNA synthesis, DNA binding and interference with cell cycle progression have been shown in in vitro studies (ATSDR, 1989). The epidemiologic data indicate that benzene is leukemogenic. The evidence is most convincing for acute myelogenous and acute erythroleukemia, although a correlation has also been found with chronic leukemia. Benzene has been designated a group A human carcinogen (leukemogen) by inhalation. Although data are insufficient to validate the carcinogenicity of benzene via ingestion, it would not be unreasonable that benzene is carcinogenic via this route as well if present in sufficient quantities. The carcinogenicity of benzene via dermal exposure is considered to be lower since benzene is absorbed poorly through the skin (ATSDR, 1989).

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for benzene. U.S. Public Health Service.

Sandmeyer, E.E. (1981) *Aromatic hydrocarbons*. In: *Patty's Industrial Hygiene and Toxicology*, Vol. 2, 3rd ed., Clayton G.D., Clayton F.E., eds. New York. Interscience Publishers. pp. 3253-3283.

Sittig, M. (1981) Handbook of Toxic and Hazardous Chemicals. Noyes Publications.

BENZO[a]ANTHRACENE

GENERAL BACKGROUND INFORMATION

Benzo[a]anthracene (BaA) is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs are a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The overall database for benzo[a]anthracene is limited. Human exposures to BaA can come from the oral, inhalation or dermal routes. BaA is produced when gasoline or other organic material is burned. It is also found in cigarette smoke and cooked food. People most at risk from exposure to BaA are those in the coal tar and asphalt production industries, cooking plants, coal gasification plants, smoke houses and industrial plants that burn wood, trash, coal or oil.

PHARMACOKINETICS

BaA is absorbed by the dermal and oral routes. There is no information on absorption by inhalation. Biotransformation to reactive intermediates is necessary for toxicity (ATSDR, 1990). BaA accumulates in adipose tissue. The metabolism of BaA is similar to the metabolism of benzo[a]pyrene (Cooper et al., 1983). In brief, the aromatic ring is oxidized by arene oxides to form reactive intermediates. The reactive intermediates are subsequently hydrolyzed to diols (Sims and Grover, 1974). The diols are conjugated with glutathione and excreted.

HUMAN TOXICOLOGICAL PROFILE

There are no reports directly correlating human exposure to BaA with the development of excess tumors.

MAMMALIAN TOXICOLOGICAL PROFILE

The only toxicity endpoint that has been adequately studied for BaA is dermal carcinogenicity. There is some evidence that benz[a]anthracene is carcinogenic in laboratory animals by the oral route (Klein, 1963; Bock and King, 1959) and also by subcutaneous injection (IARC, 1973). BaA has been shown to cause skin tumors after dermal application (Bingham and Falk, 1969). Tumorigenicity of the diol epoxide metabolite has been shown (Levin et al., 1978) as well as the mutagenicity of the diol epoxide (Wood et al., 1977).

GENOTOXICITY

The metabolism of BaA is an essential event in producing genotoxic effects in both *in vitro* and *in vivo* biological test systems (ATSDR, 1990). The intermediates formed by BaA metabolism are reactive electrophiles which are capable of interacting with DNA.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological summary for benzo[a]anthracene. U.S. Public Health Service.
- Bingham, E. and Falk, H.L. (1969) *The modifying effect of carcinogens on the threshold response*. **Arch. Environ. Health** 19:779-783.
- Bock, F.G. and King, D.W. (1959) *A study of the sensitivity of the mouse forestomach toward certain polycyclic hydrocarbons*. **J. Natl. Cancer Inst.** 23:833.
- Cooper, C.S. Grover, P.L., and Sims, P. (1983). *The metabolism and activation of benzo(a)pyrene*. In: Bridges, J.W. and L.F. Chase, eds. Progress in Drug Metabolism. Vol. 7. John Wiley and Sons, New York, pp. 295-395.
- Klein, M. (1963) *Susceptibility of strain B6AF/J hybrid infant mice to tumorigenesis with 1,2-benzanthracene, deoxycholic acid, and 3-methylcholanthrene*. **Cancer Res.** 23:1701-1707.
- Levin, W., Thakker, D.R., Wood, A.W. et al. (1978) *Evidence that benzo(a)anthracene 3,4-diol-1,2-epoxide is an ultimate carcinogen on mouse skin*. **Cancer Res.** 38:1705-1710.
- Sanders, C.L., Skinner, C. and Gelman, R.A. (1986) *Percutaneous absorption of 7,10 ¹⁴C-benzo(a)pyrene and 7,12 ¹⁴C-dimethylbenzo(a)pyrene in mice*. **JEPTO** 2:25-34.
- IARC (International Agency for Research on Cancer) (1973) *Certain Polycyclic Aromatic Hydrocarbons and Heterocyclic Compounds*. **IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. Volume 3**. IARC, Lyon, France, pp. 46-68.
- Sims, P. and Grover, P.L. (1974) *Epoxides in polycyclic aromatic hydrocarbon metabolism and carcinogenesis*. **Adv. Cancer Res.** 20:165-274.
- Wood, A.W., Chang, R.L., Levin, W., et al. (1977) *Mutagenicity and cytotoxicity of benz(a)anthracene diol epoxide and tetrahydroepoxides. Exceptional activity of the bay region 1,2-epoxides*. **Proc. Natl. Acad. Sci. USA** 74:2746-2750.

BENZO[a]PYRENE

GENERAL BACKGROUND INFORMATION

Benzo[a]pyrene (BaP) is a member of the class of compounds generally referred to as polyaromatic hydrocarbons (PAH).

PAHs contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. BaP is a component of fossil fuels and is produced from the incomplete combustion of organic compounds. BaP and other PAHs are found in coal tar, creosote oils and pitches formed from the distillation of coal tars (ATSDR, 1990).

PHARMACOKINETICS

BaP is readily absorbed by dermal, inhalation and oral routes (see section on Relative Absorption Factors). Distribution of BaP is rapid among several tissues. Following inhalation exposure to ³H labeled BaP, maximum levels of radioactivity were found in the liver, esophagus, small intestine and blood after 30 minutes. After 12 hours, maximum levels were found in the cecum, stomach and large intestine (Sun et al., 1982). This and other studies provide evidence for the enterohepatic circulation of BaP metabolites.

Mammalian metabolism of BaP follows the mechanism established for smaller aromatic compounds (Williams, 1959). There is an initial oxidation of a double bond on one of the rings to an arene oxide. The oxide is then hydrolyzed to the diol. Oxidations may occur at multiple sites on the BaP molecule. Phase II metabolism is considered the detoxication pathway and involves the conjugation of the activated Phase I metabolites with easily eliminated substrates such as glutathione, glucuronide or sulfate (Cooper et al., 1983). In addition to being conjugated, the diol intermediate can undergo (1) further oxidation to several uncharacterized metabolites via the P-450 monooxygenase system, (2) spontaneous rearrangement to the phenol or (3) hydration to the trans-diols through a reaction catalyzed by epoxide hydrolase (Cooper et al., 1983). BaP 7,8-diol-9,10-epoxide has been established as an ultimate carcinogen (ATSDR, 1990). The primary route of excretion of BaP is through the feces. BaP undergoes first-pass metabolism and is reabsorbed via enterohepatic circulation (Chipman et al., 1982). Rats exposed by gavage to ¹⁴C labeled BaP in peanut oil excreted up to 85% in the feces. Excretion in the urine was 1 to 3% of the administered dose (Hecht et al., 1979).

HUMAN TOXICOLOGICAL PROFILE

The database for the toxicological effects of BaP on humans, separate from PAHs, is limited. Toxic effects attributable to mixtures of PAHs include a variety of skin lesions and non-cancer lung diseases such as bronchitis (IARC, 1973).

MAMMALIAN TOXICOLOGICAL PROFILE

BaP is a moderately potent experimental carcinogen in numerous species by many routes of exposure (IARC, 1983). Mice exposed to doses of BaP ranging from 1.5 to 400 mg/kg/d developed benign and malignant tumors of the forestomach (Hartwell, 1951; Thompson, 1971). Acute intragastric doses of 50 to 67 mg/kg of BaP have been shown to elicit pulmonary adenomas and forestomach papillomas in mice (Sparnins et al., 1986; Wattenberg and Beuding, 1986). Intermittent gavage exposure of mice to 50 to 67 mg/kg BaP resulted in 100% forestomach and pulmonary tumor incidences at 30 weeks of age (Sparnins et al., 1986; Wattenberg and Leong, 1970). Mice fed BaP at concentrations equivalent to 33.3 mg/kg/d exhibited gastric neoplasms following two or more days of consumption. However, lower concentrations of BaP (equivalent to 13.3 mg/kg/d) administered for up to 7 days did not produce any forestomach tumors (Neal and Rigdon, 1967). Hamsters have developed papillomas and carcinomas of the alimentary tract following gavage or dietary exposure to BaP (Chu and Malmgrem, 1965). A single oral dose of 100 mg BaP (200mg/kg) produced mammary tumors in 88% of female Sprague-Dawley rats (Huggins and Yang, 1962). A 77% mammary tumor incidence was observed 90 weeks after a single oral dose of BaP of 50 mg (100mg/kg) was administered to rats (McCormick, 1981).

GENOTOXICITY

There are no studies relating exposure to BaP in humans to genotoxicity. In short-term *in vitro* and *in vivo* genetic toxicology tests, BaP has been shown to be a potent genotoxic agent when metabolically activated. In mice, oral exposure to 10 mg/kg BaP produced gene mutations in the mouse coat color spot test (Davidson and Dawson, 1976,1977). BaP shows positive mutagenic activity, *in vitro*, in several strains of *Salmonella typhimurium* in the presence of either rodent microsomes or hepatocytes for exogenous metabolic activation (ATSDR, 1990). Epidemiological studies have shown increased incidences of lung cancer in humans exposed via inhalation to mixtures of PAHs which include BaP (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for benzo(a)pyrene. U. S. Public Health Service.
- Chipman, J.K., Hiron, P.C., Front, G.S. and Milburn, S. (1982) *Benzo(a)pyrene metabolism and enterohepatic circulation in the rat*. In: Snyder, R. et al. eds. Biological Reactive Intermediates II. Chemical Mechanisms and Biological Effects, Part A. Plenum Press. New York, pps. 761-768.
- Chu, E.W. and Malmgren, R.A. (1965) *An inhibitory effect of vitamin A on the induction of tumors in the forestomach and cervix in the Syrian hamster by carcinogenic polycyclic hydrocarbons*. **Cancer Res.** 25: 884-895.
- Cooper, C.S., Grover, P.L. and Sims, P. (1983) *The metabolism and activation of benzo(a)pyrene*. In: Bridges, J.W., Chase, L.F. eds. Progress in drug metabolism. Vol. 7. John Wiley and Sons, New York. pps. 295-395.
- Davidson, G.E. and Dawson, G.W.P. (1976) *Chemically induced presumed somatic mutations in the mouse*. **Mutat. Res.** 38:151-154.
- Davidson, G.E. and Dawson, G.W.P. (1977) *Induction of somatic mutations in mouse embryos by benzo(a)pyrene*. **Arch. Toxicol.** 38:99-103.
- Hecht, S.S., Grabowski, W. and Groth, K. (1979) *Analysis of faeces for BaP after consumption of charcoal-broiled beef by rats and humans*. **Food Cosmet. Toxicol.** 17:223-227.
- Huggins, C. and Yang, N.C. (1962) *Induction and extinction of mammary cancer*. **Science** 137:257-262.
- International Agency for Research on Cancer (IARC) (1983) IARC monograph on the evaluation of carcinogenic risk of chemicals to man. Vol 32 IARC, Lyon, France.
- Mc Cormick, D. et al. (1981) *Inhibition of benzo(a)pyrene induced mammary carcinogenesis by retinyl acetate*. **J. Natl. Cancer Inst.** 66:559-564.
- Neal, J. and Rigdon, R.H. (1967) *Gastic tumors in mice fed benzo(a)pyrene: A quantitative study*. **Tex. Rep. Biol. Med.** 25:553-557.
- Sanders, C.L., Skinner, C. and Gelman, R.A. (1986) *Percutaneous absorption of 7,10 ¹⁴C-benzo(a)pyrene and 7,12 ¹⁴C-dimethylbenz(a)anthracene in mice*. **JEPTO** 2:25-34.
- Sparnins, V.L., Mott, A.W., Baraney, G. and Wattenberg, G. (1986) *Effects of allyl methyl trisulfide on glutathione-s-transferase activity*. **Nutr. Cancer** 8:211-215.
- Sun, J.D., Wolff, R.K., and Kanapilly, G.M., (1982) *Deposition, retention and biological fate of inhaled pure benzo(a)pyrene adsorbed onto ultrafine particles and as a pure aerosol*. **Toxicol. Appl. Pharmacol.** 65:231-244.
- Wattenberg, L.W. and Bueding, E. (1986) *Inhibitory effects of 5-(2-pyrazonyl)-4-methyl-1,2-dithiol-3-thione (Oltipraz) on carcinogenesis induced by benzo(a)pyrene, diethylnitrosamine, and uracil mustard*. **Carcinogenesis** 7:1379-1381.
- Wattenberg, L.W. and Leong, J.L. (1970) *Inhibition of the carcinogenic action of benzo(a)pyrene by flavones*. **Cancer Res.** 30:1922-1925.
- Williams, R.T. (1959) Detoxication Mechanisms. 2nd ed. Chapman and Hall, London.

BENZO[b]FLUORANTHENE

GENERAL BACKGROUND INFORMATION

Benzo[b]fluoranthene (BbF) is a member of the class of compounds referred to as polycyclic aromatic hydrocarbons (PAHs). PAHs contain two or more aromatic rings. PAHs are ubiquitous in nature and are both naturally occurring and man-made. Exposure to BbF can come from air, water, or soil. As a PAH, BbF is present in the emissions from industrial plants that produce coal tar, cooking plants, asphalt production plants, and home heating with wood and coal. BbF is also present in charcoal-broiled foods and cigarette smoke (ATSDR, 1990).

PHARMACOKINETICS

No data on the absorption, distribution or excretion of BbF were identified. BbF is metabolized under *in vitro* incubation conditions to phenol and dihydrodiol metabolites (Amin et al., 1982). The general metabolic pathways elucidated for benzo(a)pyrene are also active on BbF (Cooper et al., 1983; Levin et al., 1982; Grover et al., 1986). The reactive metabolites associated with the tumorigenic effects of BbF may not be the diol epoxides (Amin et al., 1982; Amin et al., 1985). As for the other PAHs, the material excreted is expected to consist primarily of dihydrodiol and phenol conjugates (Grover et al., 1986).

HUMAN TOXICOLOGICAL PROFILE

The database for human toxicity is very limited. There are no studies correlating exposure to BbF and cancer or systemic toxicity. The only data implicating BbF as a carcinogen come from carcinogenicity studies using a mixture of PAHs.

MAMMALIAN TOXICOLOGICAL PROFILE

The database on the toxicity of BbF is limited. Intratracheal administration of BbF to rats resulted in an increase in respiratory tract tumors (Deutsch-Wenzel et al., 1983). BbF has caused skin tumors in mice following dermal application (Wynder and Hoffman, 1959). The skin tumor initiating ability of BbF has been demonstrated in mice using a standard initiation/promotion protocol with either croton oil or phorbol myristate acetate as a tumor promotor (Amin et al., 1985; LaVoie et al., 1979, 1982).

GENOTOXICITY

The genotoxicity of BbF has been shown equivocally in three *in vitro* studies. BbF has been shown to be mutagenic in *Salmonella typhimurium* in the presence of an exogenous rat-liver preparation (LaVoie et al., 1979). Mutagenic activity has been reported in another similar study (Hermann, 1981). Negative results were reported by Mossanda (1979). The results cannot support an unequivocal determination regarding the genotoxicity of BbF at this time.

REFERENCES

- Agency for Toxic Substance and Disease Registry (ATSDR) (1990) Toxicological profile for benzo(b)fluoranthene. U.S. Public Health Service.
- Amin, S., LaVoie, E.J. and Hecht, S.S. (1982) *Identification of metabolites of benzo(a)fluoranthene*. **Carcinogenesis** 3:171-174.
- Amin, S., Huie, K., Hussaur, N., Geddie, J.E. and Hecht, S.S. (1985) *Mutagenicity and tumor initiating activity of methylated benzo(b)fluoranthenes*. **Carcinogenesis** 6:1023-1025.
- Cooper, C.S., Grover, P.L. and Sims, P. (1983) *The metabolism and activation of benzo(a)pyrene*. In: Bridges, J.W., Chase, L.F. eds. Progress in drug metabolism, Vol. 7. John Wiley and Sons, New York, pps. 295-395.
- Deutsch-Wenzel, R.P., Brune, H., Grimmer, O., Dettbarn, G. and Misfield, J. (1983) *Experimental studies in rat lungs on the carcinogenicity and dose-response relationships of eight frequently occurring environmental polycyclic aromatic hydrocarbons*. **J. Natl. Cancer Inst.** 71:539-544.
- Grover, P.L. (1986) *Pathways involved in the metabolism and activation of polycyclic aromatic hydrocarbons*. **Xenobiotica**. 16:915-931.
- Hermann, M. (1981) *Synergistic effects of individual polycyclic aromatic hydrocarbons and the mutagenicity of their mixtures*. **Mutat. Res.** 90:399-409.
- LaVoie, E.J., Amin, S., Hecht, S.S., Furuya, K. and Hoffmann, D. (1979) *On the metabolic activation of the environmental carcinogens benzo(j)fluoranthene and benzo(b)fluoranthene*. **Proc. Am. Assoc. Ca.** 20:81.
- LaVoie, E.J., Amin, S., Hecht, S.S., Furuya, K. and Hoffmann, D. (1982) *Tumour initiating activity of dihydrodiols of benzo(b)fluoranthene, benzo(j)fluoranthene, and benzo(k)fluoranthene*. **Carcinogenesis** 3:49-52.
- Levin, W., Wood, A., Chang, R.L. et al. (1982) *Oxidative metabolism of polycyclic aromatic hydrocarbons to ultimate carcinogens*. **Drug Metab. Rev.** 13:555-580.
- Mossanda, K., Poncelet, F., Fouassin, A. and Mercier, M. (1979) *Detection of mutagenic polycyclic aromatic hydrocarbons in African smoked fish*. **Food Cosmet. Toxicol.** 17:141-143.
- Wynder, E.L. and Hoffmann, D. (1959) *The carcinogenicity of benzofluoranthenes*. **Cancer** 12:1194-1199.

BENZO[g,h,i]PERYLENE

GENERAL BACKGROUND INFORMATION

Benzo[g,h,i]perylene is a member of the polyaromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The data regarding benzo[g,h,i]perylene are limited. As a PAH, it is found in food (charcoal broiled meats), vegetables, tobacco smoke and soot (U.S. EPA, 1980). Exposure occurs by inhalation, ingestion and by dermal contact.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of benzo[g,h,i]perylene.

HUMAN TOXICOLOGICAL PROFILE

No data were found regarding the human toxicology of benzo[g,h,i]perylene.

MAMMALIAN TOXICOLOGICAL PROFILE

No data were found regarding the mammalian toxicity of benzo[g,h,i]perylene.

GENOTOXICITY

No data were found regarding the genotoxicity of benzo[g,h,i]perylene.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). (1980) An exposure risk assessment of polycyclic aromatic hydrocarbons (benzo[g,h,i]perylene). U.S. EPA Contract 68-01-6017. Office of Water Regulations and Standards. Washington, D.C.

BENZO[k]FLUORANTHENE

GENERAL BACKGROUND INFORMATION

Benzo[k]fluoranthene (BkF) is a member of the class of compounds referred to as polycyclic aromatic hydrocarbons (PAHs). PAHs contain two or more aromatic rings. PAHs are ubiquitous in nature and are both naturally occurring and man-made. Exposure to BkF can come from air, water, or soil. As a PAH, BkF is present in the emissions from industrial plants that produce coal tar, cooking plants, asphalt production plants, and home heating with wood and coal. BkF is also present in charcoal-broiled foods and cigarette smoke (ATSDR, 1990).

PHARMACOKINETICS

No data on the absorption, distribution or excretion of BkF were identified. BkF is believed to be metabolized to phenol and dihydrodiol metabolites (ATSDR, 1990). The general metabolic pathways elucidated for benzo[a]pyrene are believed to be active on BkF. As for the other PAHs, the material excreted is expected to consist primarily of dihydrodiol and phenol conjugates (Levin et al., 1982; Cooper et al., 1983; Grover et al., 1986).

HUMAN TOXICOLOGICAL PROFILE

The database for human toxicity is very limited. There are no studies correlating exposure to BkF and cancer or systemic toxicity. The only data implicating BkF as a carcinogen come from carcinogenicity studies using a mixture of PAHs.

MAMMALIAN TOXICOLOGICAL PROFILE

The database on the toxicity of BkF is limited. The skin tumor initiating ability of BkF has been demonstrated in mice using a standard initiation/promotion protocol with either croton resin or phorbol myristate acetate as tumor promoters (Van Duuren et al., 1966; LaVoie et al., 1982). Chronic dermal application of benzo[k]fluoranthene to mice resulted in no skin tumors, suggesting that BkF alone is not a complete carcinogen (Wynder and Hoffman, 1959).

GENOTOXICITY

The genotoxicity of BkF has not been documented in *in vitro* studies. In vivo, a single topical application of BkF was reported to bind to DNA in CD-1 mouse skin (Weyland et al., 1987). Covalent binding of chemicals to DNA can result in strand breaks and DNA damage, ultimately leading to mutations (ATSDR, 1990).

REFERENCES

Agency for Toxic Substance and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U.S. Public Health Service.

Cooper, C.S., Grover, P.L. and Sims, P. (1983) *The metabolism and activation of benzo(a)pyrene*. In: Bridges, J.W., Chase, L.F. eds. Progress in drug metabolism, Vol.7. John Wiley and Sons, New York, pp. 295-395.

Grover, P.L. (1986) *Pathways involved in the metabolism and activation of polycyclic aromatic hydrocarbons*. **Xenobiotica**. 16:915-931.

LaVoie, E.J., Amin, S. and Hecht, S.S. (1982) *Tumor initiating activity of dihydrodiols of benzo(b)fluoranthene, benzo(j)fluoranthene and benzo(k)fluoranthene*. **Carcinogenesis** 3:49-52.

Levin, W., Wood, A., Chang, R.L. et al. (1982) *Oxidative metabolism of polycyclic aromatic hydrocarbons to ultimate carcinogens*. **Drug Metab. Rev.** 13:555-580.

Van Duuren, B.L., Sivak, A. and Segal, A. (1966) *The tumor producing agents of tobacco leaf and tobacco smoke condensate*. **JNCI** 37:519.

Weyand, E.H., Rice, J.E., and LaVoie, E.J. (1987) *³²P-postlabeling analysis of DNA adducts from non-alterant PAH using thin-layer and high performance liquid chromatography*. **Cancer Lett** 37:257-266.

Wynder, E.L. and Hoffmann, D. (1959) *The carcinogenicity of benzofluoranthenes*. **Cancer** 12:1194-1199.

BIS(2-ETHYLHEXYL)PHTHALATE

GENERAL BACKGROUND INFORMATION

Bis(2-ethylhexyl)phthalate, often referred to as Di(2-ethylhexyl)phthalate (DEHP), exists as a colorless, oily liquid at room temperature. It is used industrially as a plasticizer for resins, to make plastic materials more flexible. DEHP is contained in many plastic products such as imitation leather, rainwear, footwear and toys. It is used in the manufacture of tubing and containers used for blood transfusions and kidney dialysis. DEHP is also used in the manufacture of organic pump fluids in electrical capacitors. DEHP may migrate into the environment under improper use/disposal conditions. As a result, exposure could occur via air, water and food. Patients receiving blood transfusions or kidney dialysis can also be exposed to DEHP (ATSDR, 1989; Sittig, 1981).

PHARMACOKINETICS

DEHP is readily absorbed through ingestion and inhalation and poorly absorbed through the skin (see section on Relative Absorption Factors). DEHP is largely metabolized prior to intestinal absorption, via hydrolysis, to its corresponding monoester metabolite (MEHP), with the release of 2-ethylhexanol. Once absorbed, DEHP and its metabolites are distributed throughout the body, with most of the compounds initially going to the liver. In general, DEHP and its metabolites are converted to more polar derivatives and are then excreted. DEHP is rapidly cleared from the body, with little potential for accumulation. There are differences in the way DEHP is metabolized among species. Although phase I reactions are essentially the same across species except for quantitative differences, phase II reactions differ among species as to the ability to glucuronidate DEHP and its metabolites. The relationship between pharmacokinetics and toxicity is not known due to gaps in knowledge regarding mechanisms of toxic action (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Acute toxicity from DEHP is relatively low by both inhalation and ingestion. A 1-hr exposure to 23,670 mg/m³ DEHP did not result in any deaths. The oral LD₅₀ for DEHP ranges from 26,000 to 49,000 mg/kg (ATSDR, 1989). Exposure to DEHP has produced irritation of the eyes, and mucous membranes, nausea and diarrhea (Sittig, 1981). Liver biopsies from dialysis patients showed liver abnormalities (peroxisome proliferation) (ATSDR, 1989). Most of the toxicity data for DEHP originate from animal studies.

MAMMALIAN TOXICOLOGICAL PROFILE

Laboratory studies indicate that DEHP targets the liver and the testes. DEHP, administered at high levels, has induced morphological and biochemical liver changes in a number of rodent studies. Both DEHP and MEHP, its metabolite, have also been shown to produce reduced organ weight and damage to the seminiferous tubules of the testes. DEHP has also produced developmental and reproductive effects in laboratory rodents. Developmental effects include exencephaly and spina bifida. Reproductive effects include reduced fertility and fewer and smaller litters (ATSDR, 1989).

GENOTOXICITY

There is a large database on the mutagenicity of DEHP involving a large number of tests conducted in bacterial systems as well as in in vivo and in vitro mammalian test systems. In addition, a less extensive database is available on the mutagenicity of the metabolites, MEHP and 2-ethylhexanol. The overall weight of evidence indicates that DEHP is not mutagenic (ATSDR, 1989). A carcinogenic feeding bioassay conducted by the National Toxicology Program (NTP) in B6C3F1 mice and F344 rats found an increased incidence of hepatocellular tumors which increased with increasing dose (NTP, 1982). EPA has designated DEHP as a B2, Probable Human Carcinogen.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for di(2-ethylhexyl)phthalate. U.S. Public Health Service.

NTP (1982) Carcinogenesis bioassay of DEHP (CAS No. 117-81-7) in F344 rats and B6C3F1 mice (feed study). National Toxicology Program, Research Triangle Park, NC. NTP-80-37. NIH Publication 82-1772.

Sittig, M. (1981) Handbook of Toxic and Hazardous Chemicals. Noyes Publications.

CADMIUM

GENERAL BACKGROUND INFORMATION

Cadmium typically exists in the environment as a salt of the +2 valence state or as a metal. It forms no stable organic compounds. Cadmium releases are generally associated with mining, smelting, manufacturing operations, and from the disposal of alkaline batteries containing cadmium (Doull, 1980; U.S. EPA, 1981).

PHARMACOKINETICS

Cadmium is absorbed by all routes of exposure (see section on Relative Absorption Factors). Absorption through the gastrointestinal tract is low, respiratory absorption more efficient and dermal absorption relatively insignificant (ATSDR, 1989). Absorbed cadmium is widely distributed throughout the body, with the major portion of the body burden located in liver and kidney (Sumino et al., 1975). The distribution of cadmium is linked to the distribution of metallothionein, a low-molecular-weight protein, rich in cadmium-binding sites. Cadmium is not known to undergo any direct metabolic conversions in vivo. The principle excretory route for absorbed cadmium is urinary. Excretion is slow, accounting for the long half-life of cadmium in the body (17-38 years) (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Cadmium is a local respiratory tract irritant. Systemic symptoms occur in a few hours after an acute exposure to cadmium dust or fumes. Upper respiratory tract irritation is followed by coughing, chest pain, sweating, and chills. These symptoms resemble nonspecific upper respiratory infection (Sittig, 1985). Within 24 hours severe pulmonary irritation may develop, with progressively increasing pain in the chest, dyspnea, pulmonary edema, cough, and generalized weakness. Chronic exposure to cadmium fumes may result in emphysema-like lung damage (Sittig, 1984). Renal dysfunction may ensue (Friberg, 1950). Bernard and Lauwerys (1984) observed that the gastrointestinal tract is adversely affected by acute oral exposure with such symptoms as nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea. The principal effects of chronic cadmium exposure are osteomalacia and osteoporosis (Itai Itai disease) secondary to glomerular and tubular necrosis in the kidney. The Itai Itai ("ouch-ouch") disease is endemic areas in Japan, which have been contaminated with mining wastes containing cadmium. Victims display the osteomalacia and osteoporosis as primary symptoms, as well as protein, sugar and amino acids not normally found in the urine. Other chronic effects include immunosuppression and decreases in measures of respiratory fitness (ventilation capacity, vital capacity, forced expiratory volume, etc.) (U.S. EPA, 1981).

MAMMALIAN TOXICOLOGICAL PROFILE

Several subchronic and chronic oral toxicity studies have been conducted in animals. Koller et al. (1975) and Fitzhugh and Meiller (1941) conducted feeding studies using

mice and rats, respectively. The first group of researchers reported immunological impact manifested by a decrease in the number of lymphocytes secreting antibodies (to sheep red blood cells) as well as some renal effects. The second set of authors observed hematological symptoms expressed as marked anemia. Yuhas et al. (1979) conducted a drinking water study using Sprague-Dawley male rats. Decreased weight gain was observed at the highest dose level. In addition, the authors identified increases in cadmium content and decreases in the zinc content of the bone. Renal dysfunction or otherwise generalized adverse effects on the kidney have been reported in a number of long-term cadmium ingestion studies (Friberg et al., 1974; Kijikawa et al., 1981; Schroeder et al., 1964; Kanisawa and Schroeder, 1969). In addition, the latter two research groups have observed renal and cardiac arteriosclerosis.

GENOTOXICITY

Results of mutagenicity tests in bacteria and yeasts have been inconclusive. Positive results have been obtained in mutation assays in Chinese hamster cells and in mouse lymphoma cells. Conflicting results have been obtained in assays of chromosomal aberrations in human lymphocytes treated in vitro or obtained from exposed workers. Cadmium treatment in vitro or in vivo appears to result in aneuploidy in germ cells of mice or hamsters (ATSDR, 1989). Reports of elevated prostate cancer in cadmium workers have been evaluated as insufficient evidence of the carcinogenic action of the compound (U.S. EPA, 1985), but the elevated risk of lung cancer observed by Thun et al. (1985) is more convincing. Thus, the carcinogenic potential of inhaled cadmium should be viewed as limited, but suggestive. Although ingestion of cadmium may result in kidney effects, no carcinogenic response has been demonstrated for this route.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for cadmium. U.S. Public Health Service.
- Bernard, A. and Lauwerys, R. (1984) *Cadmium in the human population*. **Experimenti** 40:143-152.
- Doull, J., Klassen, C.D. and Amdur, M.D. (1980) Casarett and Doull's Toxicology, 2nd ed., MacMillan Publishing Co., Inc. New York.
- Fitzhugh, O.G. and Meiller, F.H. (1941) *The chronic toxicity of cadmium*. **J. Pharm. Exp. Ther.** 72:15.
- Friberg, L. (1950) *Health hazards in the manufacture of alkaline accumulators with special reference to chronic cadmium poisoning*. **Acta. Med. Scand.** 138(Suppl. 240): 1-124.
- Friberg, L., Piscator, M., Nordberg, G.F. and Kjellstrom, T. (1974) Cadmium in the Environment, 2nd ed., CRC Press, Boca Raton, FL.
- Kanisawa, M. and Schroeder, H.A. (1969) *Life term studies on the effect of trace elements on spontaneous tumors in mice and rats*. **Cancer Res.** 29:892-895.
- Kijikawa, K., Nakanishi, I. and Kuroda, K. (1981) *Morphological changes of the kidney and bone of rats in chronic cadmium poisoning*. **Exp. Molec. Pathol.** 34:9-24.
- Koller, L.D., Exon, J.H. and Roan, J.G. (1975) *Antibody suppression by cadmium*. **Arch. Environ. Health** 30:598.
- Schroeder, H.A., Balassa, J.J. and Vinton, W.H. (1964) *Chromium, lead, cadmium, nickel, and titanium in mice: Effects on mortality, tumors and tissue levels*. **J. Nutr.** 83:239-250.
- Sittig, M. (1985) Handbook of Toxic and Hazardous Chemicals and Carcinogens. Noyes Publication; Park Ridge, NJ.
- Sumino, K., Hayakawa, K., Shibata, T. and Kitamura, S. (1975) *Heavy metals in normal Japanese tissues*. **Arch. Environ. Health** 30:487-494.
- Thun, M.J., Schnorr, T.M., Smith, A., Halperin, W.E. and Lewen, R.A. (1985) *Mortality among a cohort of U.S. cadmium production workers - an update*. **J. Natl. Cancer Inst.** 74:325-333.
- U.S. Environmental Protection Agency (EPA) (1981) Health assessment document for cadmium. Environmental Criteria and Assessment Office. EPA-600/8-81/023.
- U.S. Environmental Protection Agency (EPA) (1985) Cadmium contamination of the environment: an assessment of nationwide risk. Office of Health and Environmental Assessment. EPA-440/4-85-023.
- Yuhas, E.M., Miya, T.S. and Schnell, R.C. (1979) *Dose-related alterations in growth and mineral deposition by chronic oral cadmium administration in the male rat*. **Toxicology** 12:19-29.

CHLOROFORM

GENERAL BACKGROUND INFORMATION

Chloroform is a clear, colorless, liquid with a characteristic odor, which exists both naturally and as a man-made compound. Chloroform was one of the earliest general anaesthetics but was later banned because of toxic effects. Chloroform is largely used in the production of fluorocarbon 22 (used as a coolant in air conditioners and to make fluoropolymers) (ATSDR, 1989). In addition, chloroform is used as a solvent, in the extraction and purification of pharmaceuticals, in the manufacture of pesticides and dyes and in various products including fire extinguishers, dry cleaning agents, artificial silk, plastics and floor polishes. Chloroform is also widely found in drinking water supplies as a byproduct of chlorination (ATSDR, 1989; Sittig, 1981).

PHARMACOKINETICS

Chloroform is readily absorbed via inhalation and ingestion and poorly absorbed through the skin, unless the dose is occluded, in which case it is very well absorbed (see section on Relative Absorption Factors). Chloroform is lipid-soluble and passes through cell membranes easily. Thus it will reach the central nervous system and cross the placental barrier. It has been found in fresh cow's milk and is thus expected to reach human milk too. Chloroform is metabolized via cytochrome P450 by oxidative dechlorination to form phosgene. The phosgene either reacts with glutathione to form diglutathionyl dithiocarbonate or causes cytotoxicity directly by reacting with other cellular constituents. Inorganic chloride ion and carbon monoxide are minor metabolites of chloroform metabolism. Although there are species differences as to relative amounts metabolized, chloroform is largely excreted unchanged through the lungs. Carbon dioxide is also a major endproduct of chloroform metabolism, most of which is excreted via the lungs but some of which is also incorporated into endogenous metabolites and excreted as bicarbonate, urea, methionine and other amino acids. Carbon monoxide is a minor metabolite also excreted through the lungs. In addition, inorganic chloride ions are excreted via the urine (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Skin contact with chloroform can produce burns. Chloroform is a central nervous system depressant and was used in the past as an anaesthetic until it was determined that it caused liver and kidney toxicity. Specific central nervous system symptoms resulting from acute exposure include fatigue, dizziness, headache, digestive disturbance and mental dullness, as well as coma at high levels. Chronic exposure has produced liver and kidney enlargement and jaundice (Sittig, 1981; ATSDR, 1989).

MAMMALIAN TOXICOLOGICAL PROFILE

Chloroform is acutely toxic via inhalation, with an LC50 of 10,000 ppm for 4 hours in rats (Lundberg et al., 1986). A concentration of 1025 ppm for 1-3 hours was lethal to mice (Derringer et al., 1958). The lowest oral LD50 value reported for rats is 444 mg/kg (Kimura et al., 1971). In a 90 day study, rats exposed to chloroform via the oral route had an increased mortality at 350 mg/kg/day (Chu et al., 1982). Chloroform has been found to target the liver, kidney and central nervous system in animal studies, after inhalation or oral exposure. Central nervous system effects found in animals via inhalation exposure include disturbed equilibrium (cats) at 7,200 ppm, deep narcosis (mice) at 4,000 ppm and slight narcosis (mice) at 2,500 ppm. Liver effects found in lab animals include fatty infiltration, focal necrosis, lobular granular degeneration and increased enzyme levels (SGOT, SGPT). Kidney effects include cloudy swelling, increased weight, tubular necrosis and tubular regeneration. Developmental effects observed after inhalation exposure include increased incidence of missing ribs, imperforate anus, subcutaneous edema and delayed and abnormal ossifications. In a questionable study, pregnant rats treated during gestation via gavage with 126 mg/kg/day were found to produce fetuses with reduced body weight. Reproductive effects found in lab animals include a significant increase in percentage abnormal sperm and gonadal atrophy (ATSDR, 1989).

GENOTOXICITY

The genetic toxicology database for chloroform indicates mixed results in mutagenicity tests. Negative results were obtained in bacteria and gene mutations, as well as chromosome aberrations in mammalian cells. Mixed results were obtained in yeasts. In vivo test results include negative results in *Drosophila* and DNA damage in rats and mice, whereas tests for chromosome aberrations and sperm abnormalities were mixed. Although the available data on genotoxicity suggests that chloroform may be mutagenic, the overall evidence is currently inconclusive (ATSDR, 1989). Carcinogenicity data via the inhalation route are currently not available for chloroform. A number of animal studies have indicated that chloroform is carcinogenic by the oral route. A 1976 NCI gavage study found a dose-related increased incidence of hepatocellular carcinoma in mice (NCI, 1976). A number of studies have found an increased incidence in kidney tumors (Roe et al., 1979; Jorgensen et al., 1985). Based on the above data, the Environmental Protection Agency (EPA) has designated chloroform a B2 carcinogen.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for chloroform. U.S. Public Health Service.
- Chu, I., Villeneuve, D.C., Secours, V.E. and Beckin, G.C. (1982) *Toxicity of trihalomethanes. I. The acute and subacute toxicity of chloroform, bromodichloromethane, chlorodibromomethane and bromoform in rats*. **J. Environ. Sci. Health.** B17:205-224.
- Derringer, M.K., Dunn, T.B. and Heston, W.E. (1953) *Results of exposure of strain C3H mice to chloroform*. **Proc. Soc. Exp. Biol. Med.** 83:474-479.
- Jorgensen, T.A., Meierhenry, E.F. and Rushbrook, C.J. (1985) *Carcinogenicity of chloroform in drinking water to male Osborne-Mendel rats and female B6C3F1 mice*. **Fund. Appl. Toxicol.** 5:760-769.
- Kimura, E.T., Ebert, D.M. and Dodge, B.W. (1971) *Acute toxicity and limits of solvent residue for sixteen organic solvents*. **Toxicol. Appl. Pharmacol.** 19:699-704.
- Lundberg, I., Ekdahl, M., Kronevi, T., Lidums, V. and Lundberg, S. (1986) *Relative hepatotoxicity of some industrial solvents after intraperitoneal injection or inhalation exposure to rats*. **Environ. Res.** 40:411-420.
- NCI (1976) Report on carcinogenesis bioassay of chloroform. NTIS PB-264018.
- Roe, F.J.C., Palmer, A.A.K., Worden, A.N. and Van Abbe, N.J. (1979) *Safety evaluation of toothpaste containing chloroform. I. Long-term studies in mice*. **J. Environ. Toxicol.** 2:799-819.
- Sittig, M. (1981) Handbook of Toxic and Hazardous Chemicals. Noyes Publications.

CHROMIUM

GENERAL BACKGROUND INFORMATION

Chromium is used in plating for corrosion resistance and decorative purposes (appliances, tools, automobiles, etc.), in the manufacture of alloys (including stainless steel and heat resistant alloys), and in printing, dyeing, photography, tanning, and numerous other industrial applications (ATSDR, 1989).

PHARMACOKINETICS

Absorption studies of chromium compounds indicate that it is absorbed by all routes of exposure (see section on Relative Absorption Factors) with chromium (VI) compounds being more readily absorbed than chromium (III) compounds. Once absorbed, chromium is rapidly distributed to all organs, including the developing fetus. Chromium VI is readily reduced to Cr III in vivo. Excretion occurs primarily through the kidneys via urine (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

In humans, the respiratory tract is the primary system of concern for chromium toxicity. Renal damage has also been observed. Hexavalent chromium has been shown to be highly toxic, causing ulceration of nasal mucosa and carcinoma of the lung following long-term occupational exposure. Cases of acute poisoning in man have been reported from the medical use of chromic acid.

Chronic exposures of workers in chromium-related industries have been observed to result in skin and nasopharyngeal irritations. Both Cr(III) and Cr(VI) can cause allergic contact dermatitis and irritation (Samitz and Shrager, 1966). Chromium was shown to be an allergen in recurrent contact dermatitis of the feet (Correia and Brandao, 1986). Hexavalent forms are responsible for effects on the upper respiratory system, including ulceration and perforation of the nasal septum, chronic rhinitis, and pharyngitis. Lindberg and Hedenstierna (1983) reported that subjective and objective evidence of adverse nasal effects were found at exposure levels of 2 to 20 $\mu\text{g Cr(VI)/m}^3$ but not at less than 1 $\mu\text{g/m}^3$. They also reported that workers exposed to 2 to 20 $\mu\text{g Cr(VI)/m}^3$ had slight transient decreases in measures of pulmonary mechanics (e.g., forced vital capacity, FVC) with recovery (no changes) seen by two (non-exposed) days later.

MAMMALIAN TOXICOLOGICAL PROFILE

In laboratory animals, Cr compounds are of low oral acute toxicity. Hexavalent chromium is more acutely toxic than Cr(III), with kidney failure being the primary symptom. The LC_{50} in rats for inhalation of sodium chromate(VI) was reported as 33 $\text{mg Cr/m}^3/4\text{H}$, and the LD_{50} 's for oral and dermal exposures were given as 16.7 mg Cr/kg and 514 mg Cr/kg , respectively (Gad et al., 1986). Chromium was found to localize in the proximal renal tubules when intraperitoneal doses of potassium dichromate were administered to rats 5 times weekly for 8 months (Berry et al., 1978). Low level hexavalent chromium exposure increases respiratory defense mechanisms

while they are inhibited by long-term, high level exposure (Glaser et al., 1985). Chromium salts have been shown to be teratogenic and embryotoxic in mice and hamsters following intravenous or intraperitoneal injection. However, these are unnatural routes of administration for assessing effects of environmental exposures, and further research is needed (U.S. EPA, 1984).

GENOTOXICITY

Both Cr(III) and Cr(VI) have been shown to interact with DNA in bacterial systems. Cr(III) is generally considered to be a relatively inactive genotoxic agent since it is unable to cross cell membranes. It was recently shown, however, to cause chromosomal aberrations in human lymphocytes (Friedman et al., 1987). Hexavalent chromium has consistently caused transformations and mutations in a wide variety of in vitro assays (Bianchi and Lewis, 1985). Chromosomal damage has been observed in lymphocytes cultured from workers exposed to chromium. The epidemiologic studies of respiratory cancer in chromate production workers provide the bulk of the evidence for chromium carcinogenicity. Studies of chromate production facilities in the United States, Great Britain, and Japan have all found an association between occupational exposure to chromium and lung cancer (U.S. EPA, 1984). Workers were exposed to both Cr(VI) and Cr(III), and it is unclear whether Cr(VI) alone is the etiologic agent or whether Cr(III) is implicated as well. The U.S. EPA (1984) concluded that in rats, only calcium chromate had consistently produced lung tumors by several routes of administration, and that other Cr(VI) compounds produced local sarcomas or lung tumors in rats at the site of administration (subcutaneous, intraperitoneal, intermuscular, intrabroncheal, and intratracheal). Trivalent chromium compounds have not been found to be carcinogenic by any route of administration, but these compounds have not been studied as extensively.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for chromium. U.S. Public Health Service.
- Berry, J.P., Houdry, J., Galle P. and Laquie, G. (1978) *Chromium concentration by proximal renal tubule cells: an ultrastructural microanalytical and cytochemical study*. *J. Histochem. Cytochem.* 26:651-657.
- Bianchi, B. and Lewis, A.G. (1985) *Mechanisms of chromium genotoxicity*. In: Merian, E., Fre, R.W., Hardi, W. and Schlatter, C. (eds). Carcinogenic and Mutagenic Metal Compounds: Environmental and Analytical Chemistry, and Biological Effects. Gordon and Breach Science Publishers, London.
- Correia, S., and Brandao, F.M. (1986) *Contact dermatitis of the feet*. *Derm. Beruf. Umwelt.* 34:102-106.
- Friedman, J., Shabtai, F., Levy, L.S. and Djaldetti, M. (1987) *Chromium chloride-induced chromosomal aberrations in human lymphocytes via indirect action*. *Mutat. Res.* 191:207-210.
- Gad, S.C., Powers, W.J., Dunn, B.J., Hoffman, G.M., Siino, K.M. and Walsh, R.D. (1986) *Acute toxicity of four chromate salts*. In: Serrone, D.M., ed. Chromium Symposium 1986: An Update. Pittsburgh, PA: Industrial Health Foundation, Inc., pp. 43-58.
- Glaser, U., Hochrainer, D., Kloppel, H. and Kuhnen, H. (1985) *Low-level chromium (VI) effects on alveolar macrophages and immune functions in Wistar rats*. *Arch. Toxicol.* 57:250-256.
- Lindberg, R.G. and Hedenstierna, L. (1983) *Chrome plating: Symptoms, findings in the upper airways and effects on lung function*. *Arch. Environ. Health* 38:367-374.
- Samitz, M.H. and Shrager, J. (1966) *Patch test reactions to hexavalent and trivalent chromium compounds*. *Arch Dermatol.* 94:304-306.
- U.S. Environmental Protection Agency (U.S. EPA) (1984) Health assessment document for chromium. Final Report EPA-600/8-83-014F. Environ. Criteria and Assessment Office, Res. Triangle Park, N.C.

CHRYSENE

GENERAL BACKGROUND INFORMATION

Chrysene is one of the polycyclic aromatic hydrocarbon (PAH) compounds which are formed during the combustion of organic material. Chrysene often exists in particulate form, adsorbing to existing particulate material in air. Human exposure can occur in the workplace (coal and asphalt production plants, cooking plants, smoke houses) or in the environment due to chrysene contamination of air, food, soil and water (ATSDR, 1990).

PHARMACOKINETICS

Chrysene can be absorbed by all routes of exposure (see section on Relative Absorption Factors). Its absorption is believed to be qualitatively similar to benzo[a]pyrene (ATSDR, 1990). Following absorption, chrysene distributes to all organs, reaching the highest concentration in tissues with large fat content (adipose tissue, mammary tissue, brain) (Modica et al., 1983). Chrysene undergoes metabolic biotransformation mediated by the mixed function oxidase enzyme system to form reactive intermediates hypothesized to be responsible for its toxicity. The major metabolites include trans-dihydrodiols, phenols, diol epoxides and triol epoxides (Thakker et al., 1985). The reactive metabolites are conjugated and excreted primarily in feces (Schlede et al., 1970).

HUMAN TOXICOLOGICAL PROFILE

There is no information available on threshold toxic effects of chrysene in humans. Since it is structurally similar to benzo[a]pyrene, it would be expected to produce effects similar to B[a]P following acute or chronic exposure (see Toxicity Profile on Benzo[a]pyrene).

MAMMALIAN TOXICOLOGICAL PROFILE

There is no information available on threshold toxic effects of chrysene in animals. Since it is structurally similar to benzo[a]pyrene, it would be expected to produce effects similar to B[a]P following acute or chronic exposure (see Toxicity Profile for Benzo[a]pyrene).

GENOTOXICITY

The genotoxicity of chrysene has been evaluated in in vivo and in vitro cytogenetic tests. Chrysene produced weak positive results in bacterial mutation assays, human epithelial mutation studies, cell transformation assays and in vivo cytogenetic studies (Waters et al., 1987). Metabolism of chrysene is essential to produce the observed positive responses. Chrysene is not genotoxic in all test systems, however, it is believed to be a weak mutagen (ATSDR, 1990). The carcinogenicity of chrysene has not been adequately studied. There are no reports directly correlating human chrysene exposure and tumor development. There is limited evidence that chrysene is a skin carcinogen in animals following long-term dermal application (Wynder and Hoffmann, 1959; Hecht et al., 1974).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for chrysene. U.S. Department of Health and Human Services, Public Health Service.
- Hecht, S.S., Bondinell, W.E. and Hoffmann, D. (1974) *Chrysene and methylchrysene: Presence in tobacco smoke and carcinogenicity*. *J. Natl. Cancer Inst.* 53:1121-1133.
- Modica, R., Fiume, M., Guaitani, A. and Bartosek, I. (1983) *Comparative kinetics of benz[a]anthracene, chrysene and triphenylene in rats after oral administration*. *Toxicol. Lett.* 18:103-109.
- Schlede, E., Kuntzman, R., Haber, S. and Conney, A.H. (1970) *Effect of enzyme induction on the metabolism and tissue distribution of benz[a]pyrene*. *Cancer Res.* 30:2898-2904.
- Thakker, D.R., Yagi, H., Levin, W., Wood, A.H., Conney, A.H. and Jerina, D.M. (1985) *Polycyclic aromatic hydrocarbons: Metabolic activation of ultimate carcinogens*. In Anders, M.W., ed. Bioactivation of Foreign Compounds. Academic Press, New York, pps. 178-242.
- Waters, M.D., Stack, H.F., Brady, A.L., Lohman, P.H., Haroun, L. and Vainio, H. (1987) Use of computerized data listings and activity profiles of genetic and related effects in the review of 195 compounds. Genetic Toxicology Division, Health Effects Research Laboratory, EPA, Research Triangle Park, N.C.
- Wynder, E.L. and Hoffmann, D. (1959) *A study of tobacco carcinogenesis. VII. The role of higher polycyclic hydrocarbons*. *Cancer* 12:1079-1086.

DIBENZO[a,h]ANTHRACENE

GENERAL BACKGROUND INFORMATION

Dibenzo[a,h]anthracene is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs are a class of compounds which are non-polar and contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The data regarding dibenzo[a,h]anthracene are very limited. As a PAH, it is found in tobacco smoke, food, and the emissions from industrial or natural burning.

PHARMACOKINETICS

Dibenzo[a,h]anthracene is metabolized similarly to benzo(a)pyrene (ATSDR, 1990). However, while the metabolic profiles of these two compounds (and other alternant PAHs) are qualitatively similar, there are differences in the levels and rates of formation of specific metabolites among tissues and cell preparations used. Sanders et al (1986) applied ¹⁴C - dibenzo[a,h]anthracene to the shaved backs of mice. After 24 hours, the majority of activity was recovered from the application site, with the remainder from body tissues and excreta. In comparison, benzo(a)pyrene similarly applied was found predominantly in the excreta and body tissues, with the remainder at the application site.

HUMAN TOXICOLOGICAL PROFILE

The database for the toxicological effects of dibenzo[a,h]anthracene on humans, separate from other PAHs, is limited. Toxic effects attributable to mixtures of PAHs include a variety of skin lesions and non-cancer lung diseases such as bronchitis (IARC, 1973).

MAMMALIAN TOXICOLOGICAL PROFILE

Dibenzo[a,h]anthracene has been shown to induce skin tumors in lab animals (i.e. it is a complete carcinogen) following dermal exposure (Wyndner and Hoffman, 1959; Van Duuren et al, 1967; and Lijinsky et al, 1965). Dibenzo[a,h]anthracene has also demonstrated tumor initiation activity (Slaga et al. 1980).

Carcinogenic PAHs as a group has immunosuppressive effects, with the degree of immunosuppression correlated with carcinogenic potency (ATSDR, 1990). Dibenzo[a,h]anthracene was also tested for developmental effects via parenteral routes and was found to produce fetolethal effects in rats (Wolfe and Bryan, 1939).

GENOTOXICITY

Dibenzo[a,h]anthracene is mutagenic (Barfknecht et al, 1982; Rocchi et al, 1980) and produces DNA damage (Martin et al, 1978) in cultured human cells. Test results in nonhuman systems were also positive (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.
- Barfknecht, T.R. et al. (1982) *Human cell mutagenicity of polycyclic aromatic hydrocarbons components of diesel emissions*. *Dev. Toxicol. Environ. Sci.* 10:277-294.
- Lijinsky, W.H., Garcia, B., Terracini, B. (1965) *Tumorigenic activity of hydrogenated derivatives of dibenz(ah)anthracene*. *JNCI* 34:1.
- Martin, C.N., McDermid, A.C., Garner, R.C. (1978) *Testing of known carcinogens and noncarcinogens for their ability to induce unscheduled DNA synthesis in HeLa cells*. *Cancer res.* 38:2621-2627.
- Rocchi, P. et al. (1980) *Polycyclic hydrocarbons induction of diphtheria toxin-resistant mutants in human cells*. *Carcinogenesis* 1:765-767.
- Sanders, C.L., Skinner, C., Gelman, R.A. (1986) *Percutaneous absorption of 7,10 ¹⁴C-benzo(a)pyrene and 7,12¹⁴C-dimethylbenz(a)anthracene in mice*. *J. Environmental Pathol Toxicol Oncol* 7:25-34.
- Slaga, T.J., Gleason, G.L., Well, G. (1980) *Comparison of skin tumor-initiating activities in dihydrodiols and dio-epoxide of various polycyclic aromatic hydrocarbons*. *Cancer Res* 40:1981-1984.
- U.S. Environmental Protection Agency (U.S. EPA) (1981) An exposure and risk assessment of polycyclic aromatic hydrocarbons (dibenz(a,h)anthracene). U.S. EPA Contract 68-01-6017. Office of Water Regulations and Standards, Washington, D.C.
- Van Duuren, B.L., Langseth, L. Goldschmidt, B.M. (1967) *Carcinogenicity of epoxides, lactones and peroxy compounds. VI. Structure and carcinogenic activity*. *JNCI* 39:1217-1227.
- Wolfe, J.M. and Bryan, W.R. (1939) *Effects induced in pregnant rats by injection of chemically pure carcinogenic agents*. *Am J Cancer* 36:359-368.
- Wydner, E.L. and Hoffman, D. (1959) *A study of tobacco carcinogenesis. VII. The role of higher polycyclic hydrocarbons*. *Cancer* 12:1079-1086.

1,1-DICHLOROETHANE

GENERAL BACKGROUND INFORMATION

1,1-Dichloroethane (1,1-DCA) is a colorless, oily, lipophilic liquid which evaporates quickly at room temperature and has an ether-like odor. Its liquid and vapor forms ignite easily and may pose a fire hazard when handled improperly. It does not dissolve easily in water. 1,1-DCA is used primarily as an industrial solvent and as a dissolving agent for paint, varnish, finish removers and grease (ATSDR, 1990).

PHARMACOKINETICS

Little information exists quantitating the absorption of 1,1-DCA. However, based on its chemical and physical properties, it would be predicted to be readily absorbed via any route of exposure (ATSDR, 1990). Once absorbed, it should be readily distributed to bodily tissues, with highest concentrations achieved in tissues of greatest lipid content (Sato and Nakajima, 1987). A large percentage of an administered dose is exhaled unchanged (Mitoma et al., 1985). The remainder undergoes biotransformation mediated by the microsomal mixed function oxidase enzyme system to yield reactive acylchloride metabolite(s) which covalently bind to cellular macromolecules (Colacci et al., 1985). An alternative MFO-mediated pathway yields 2,2-dichloroethanol which undergoes subsequent oxidation to dichloroacetaldehyde and dichloroacetic acid (McCall et al., 1983). These metabolites are excreted through urine or further metabolized to CO₂ (Sato and Nakajima, 1987).

HUMAN TOXICOLOGICAL PROFILE

Relatively little information is available on the health effects of 1,1-dichloroethane in humans. It induces central nervous system depression and anesthesia upon inhalation. In fact, it was used as an inhalation anesthetic in the past. The use of 1,1-DCA as an inhalation anesthetic was discontinued when it was discovered that this compound induced cardiac arrhythmias in humans at anesthetic doses ((Reinhardt et al., 1971). No studies were located concerning threshold effects of exposure on any other organ system.

MAMMALIAN TOXICOLOGICAL PROFILE

Limited data indicate that 1,1-dichloroethane is less toxic than its isomer, 1,2-dichloroethane and most other chlorinated aliphatic solvents (Parker et al., 1979). Exposure of animals to 1,1-DCA results in central nervous system depression which may be fatal if exposure levels are high (Plaa and Larson, 1965). Nephrotoxicity has been observed in cats and mice following subchronic exposure. One study (Schwetz et al., 1974) suggests that exposure in utero results in retarded fetal development.

GENOTOXICITY

Results from in vitro genotoxicity test are conflicting. 1,1-DCA tested negative in the Ames assay (Nohmi et al., 1985) and in yeast cells (Bronzetti et al., 1987). However, it did increase the transformation frequency in hamster embryo cells (Hatch et al., 1983). In vivo studies suggest that 1,1-DCA may be genotoxic since it was found to covalently bind to DNA (Colacci et al., 1985). This chemical has been classified as a possible human (C) carcinogen by EPA. This classification is based on conflicting chronic bioassay results in mice (NCI, 1977; Klaunig et al., 1986).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for 1,1-dichloroethane. Agency for Toxic Substances and Disease Registry. U.S. Public Health Service.
- Bronzetti, G., Galli, A. and Vellosi, R. (1987) *Genetic activity of chlorinated ethanes*. *Eur. J. Can. Clin. Oncol.* 23:1737-1738.
- Colacci, A., Arfellini, G. and Mazzullo, M. (1985) *Genotoxicity of 1,1-dichloroethane*. *Res. Comm. Chem. Pathol. Pharmacol.* 49:243-254.
- Hatch, G.G., Mamay, P.D. and Ayer, M.L. (1983) *Chemical enhancement of viral transformation in Syrian hamster embryo cells*. *Can. Res.* 43:1945-1950.
- Klaunig, J.E., Ruch, R.J. and Pereira, M.A. (1986) *Carcinogenicity of chlorinated methane and ethane compounds administered in drinking water to mice*. *Environ. Health. Perspect.* 69:89-95.
- McCall, S.N., Jurgens, P. and Ivanetich, K.M. (1983) *Hepatic microsomal metabolism of the dichloroethanes*. *Biochem. Pharmacol.* 32:207-213.
- Mitoma, C., Steeger, T. and Jackson, S.E. (1985) *Metabolic disposition study of chlorinated hydrocarbons in rats and mice*. *Drug Chem. Toxicol.* 8:183-194.
- NCI (1977) Bioassay of 1,1-dichloroethane for possible carcinogenicity. Bethesda, M.D.: National Cancer Institute. NIH Publication No. 78-1316.
- Nohmi, T., Miyata, R. and Yoshikawa, K. (1985) *Mutagenicity tests on organic chemical contaminants in city water and related compounds: I. Bacterial mutagenicity tests*. *Bull. Nat. Hyg. Sci.* 103:60-64.
- Parker, J.C., Casey, G.E. and Bahlman, L.J. (1979) *Chloroethanes: Review of toxicity*. *Am. Ind. Hyg. Assoc. J.* 40:A46-A57.

Plaa, G.L. and Larson, R.E. (1965) *Relative nephrotoxic properties of chlorinated methane, ethane and ethylene derivatives in mice.* **Toxicol. Appl. Pharmacol.** 7:37-44.

Reinhardt, C.F., Azar, A. and Maxfield, M.E. (1971) *Cardiac arrhythmias and aerosol "sniffing".* **Arch. Environ. Health** 22:265-279.

Sato, A. and Nakajima, T. (1987) *Pharmacokinetics of organic solvent vapors in relation to their toxicity.* **Scand. J. Work Environ. Health** 13:81-93.

Schwetz, B.A., Leong, B.K.J. and Gehring, P.J. (1974) *Embryo- and fetotoxicity of inhaled carbon tetrachloride, 1,1-dichloroethane and methyl ethyl ketone in rats.* **Toxicol. Appl. Pharmacol.** 28:452-464.

ETHYLBENZENE

GENERAL BACKGROUND INFORMATION

Ethylbenzene is a colorless liquid that smells like gasoline. It is volatile and flammable. Ethylbenzene occurs naturally in coal tar and petroleum, and is also manufactured for commercial uses in paints, inks, and insecticides (ATSDR, 1990). The two major uses of ethylbenzene are in the plastic and rubber industry, where it is used in the synthesis of styrene (U.S. EPA, 1980). Gasoline contains about 2% (by weight) ethylbenzene (ATSDR, 1990). Ethylbenzene has a wide environmental distribution due to its widespread use.

PHARMACOKINETICS

Ethylbenzene has been shown to be readily absorbed via inhalation, ingestion, and dermal exposure in humans as well as in laboratory animals (see section on Relative Absorption Factors). Following exposure, ethylbenzene is distributed throughout the body, with the highest levels detected in the kidney, lung, adipose tissue, digestive tract, and liver (Chin et al., 1980). There appears to be quantitative differences in metabolism of the chemical in humans and laboratory animals. However, in all species, ethylbenzene undergoes a variety of microsomal-mediated side-chain hydroxylations to yield the major metabolites, mandelic acid and phenylglyoxylic acid (Engstrom et al., 1984). The oxidation products are conjugated followed by urinary excretion which appears to be complete within 2 days of exposure (ATSDR, 1990).

HUMAN TOXICOLOGICAL PROFILE

Humans exposed to low levels of ethylbenzene in air for short periods of time experience eye and throat irritation. Exposure to higher levels may cause more severe effects such as central nervous system depression, decreased movement and dizziness, and more severe mucous membrane irritation. No studies have reported death in humans following exposure to ethylbenzene. No information was located to indicate that ethylbenzene produces toxicity in other organ systems upon short-term or prolonged exposure (ATSDR, 1990).

MAMMALIAN TOXICOLOGICAL PROFILE

Animal studies indicate that the primary symptoms resulting from acute exposure to ethylbenzene are manifested as neurological and respiratory depression. Other studies suggest that the liver, kidney and hematopoietic system may also be targets of ethylbenzene toxicity (ATSDR, 1990). Studies indicate that ethylbenzene exposure of pregnant rats can produce fetotoxic effects at doses that also induce maternal toxicity (Andrew et al., 1981). Additionally, oral administration resulted in blockage of the estrus cycle in female rats (Ungvary, 1986).

GENOTOXICITY

Results of in vitro genotoxicity test generally indicate that ethylbenzene is not mutagenic in the presence or absence of metabolic activation (ATSDR, 1990). In one in vivo study, there was no dose-dependent increase in the frequency of micronucleated polychromic erythrocytes (Mohtashamipur et al., 1985). Ethylbenzene did cause a mutagenic effect in mouse lymphoma cells and has been shown to induce a marginal yet significant increase in SCE in human lymphocytes. Therefore, ethylbenzene may cause an increased potential for genotoxicity in humans (ATSDR, 1990). No association between increased cancer incidence in humans and exposure to ethylbenzene has been reported. In animal studies, the only chronic bioassay produced inconclusive results of the tumorigenicity of oral ethylbenzene (Maltoni et al., 1985). Ethylbenzene is classified as a Group D agent (not classified as to carcinogenicity) by the EPA.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for ethylbenzene. U.S. Public Health Service.
- Andrew, F.D., Buschbom, R.L. and Cannon, W.C. (1981) Teratologic assessment of ethylbenzene and 2-ethoxyethanol. Richland, WA: Battelle Pacific Northwest Laboratory. PB83-208074.
- Chin, B.J., McKelvey, J.A. and Tyler, T.R. (1980) *Absorption, distribution and excretion of ethylbenzene, ethylcyclohexane and methylethylbenzene isomers in rats*. **Bull. Env. Contam. Toxicol.** 24:477-483.
- Engstrom, K., Riihimaki, V. and Laine, A. (1984) *Urinary disposition of ethylbenzene and m-xylene in man following separate and combined exposure*. **Xenobiotica** 15:281-286.
- Maltoni, C., Conti, B. and Cotti, G. (1985) *Experimental studies on benzene carcinogenicity at the Bologna Institute of Oncology: Current results and ongoing research*. **Am. J. Ind. Med.** 7:415-446.
- Mohtashamipur, E., Norpoth, K. and Woelke, U. (1985) *Effects of ethylbenzene, toluene, and xylene on the induction of micronuclei in bone marrow polychromatic erythrocytes of mice*. **Arch. Toxicol.** 58:106-109.
- Ungvary, G. (1986) *Solvent effects on reproduction*. **Exp. Toxicol.** 220:169-177.
- U.S. Environmental Protection Agency (U.S. EPA) (1980) Ambient water quality criteria for ethylbenzene. Washington, D.C. EPA-440/5-80-048.

FLUORANTHENE

GENERAL BACKGROUND INFORMATION

Fluoranthene is a member of the polyaromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. Fluoranthene has been detected in food, cigarette smoke, and smoke from industrial and natural burning.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of fluoranthene.

HUMAN TOXICOLOGICAL PROFILE

The database for the toxicological effects of fluoranthene on humans, separate from other PAHs, is limited. Toxic effects attributable to mixtures of PAHs include a variety of skin lesions and non-cancer lung diseases such as bronchitis (IARC, 1973).

MAMMALIAN TOXICOLOGICAL PROFILE

The database on the toxicity of fluoranthene is limited. A 13 week subchronic study where CD-1 mice were gavaged with up to 500 mg/kg-day of fluoranthene indicated nephropathy, increased liver weights, hematological alterations and clinical effects (EPA, 1988). A developmental study in which fluoranthene was administered once via intraperitoneal injection to pregnant mice reported only an increased rate of embryo resorption (Irvin and Martin, 1987).

Chronic dermal application of up to 1 percent fluoranthene to the backs of mice did not induce skin tumors following lifetime application (Hoffman et al, 1972; Horton and Christian, 1974; and Wydner and Hoffman, 1959a). Fluoranthene is not a complete carcinogen (ATSDR, 1990) and does not exhibit initiation activity (Hoffman et al, 1972).

GENOTOXICITY

There is some evidence that fluoranthene is genotoxic (ATSDR, 1990). Genotoxic effects have been reported in human cells with exogenous metabolic activation, but negative results were recorded without metabolic activation.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.
- Hoffman, D. et al. (1972) *Fluoranthenes: Quantitative determination in cigarette smoke, formation by pyrolysis and tumor initiating activity*. **JNCI** 49:1165-1175.
- Horton, A.W. and Christian, G.M. (1974) *Cocarcinogenic versus incomplete carcinogenic activity among aromatic hydrocarbons: contrast between chrysenes and benzo(b)triphenylene*. **J Natl Cancer Inst** 53:1017-1020.
- International Agency for Research on Cancer (IARC) (1983) Monograph on the evaluation of chemicals in man, fluoranthene. 32:355-364.
- Irvin, T.R. and martin, J.E. (1987) *In vitro and in vivo embryotoxicity of fluoranthene, a major prenatal toxic component of diesel soot*. **Teratology** 35:65A.
- U.S. Environmental Protection Agency (EPA) (1988) 13-week mouse oral subchronic toxicity study. Prepared by Toxicity Research Laboratories, Ltd. Muskegon, MI for the Office of Solid Waste, Washington, D.C.
- Wydner, E.L. and Hoffman, D. (1959) *A study of tobacco carcinogenesis. VII. The role of higher polycyclic hydrocarbons*. **Cancer** 12:1079-1086.

FLUORENE

GENERAL BACKGROUND INFORMATION

Fluorene is a member of the polyaromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The data on fluorene are very limited. Low levels of (5 to 67 ug/kg) have been detected in smoked meats (U.S. EPA, 1982).

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of fluorene.

HUMAN TOXICOLOGICAL PROFILE

The database for the toxicological effects of fluoranthene on humans, separate from other PAHs, is limited. Toxic effects attributable to mixtures of PAHs include a variety of skin lesions and non-cancer lung diseases such as bronchitis (IARC, 1973).

MAMMALIAN TOXICOLOGICAL PROFILE

Limited information is available on the threshold effects of fluorene. An EPA study (EPA,1989) indicated that CD-1 mice exposed by gavage to up to 500 mg/kg-day of fluorene showed hypoactivity as well as a decrease in red blood cell count and packed cell volume and hemoglobin. Increases in absolute and relative liver, spleen and kidney weights was also observed. Gershbein (1975) reported that partially hepatectomized rats fed a diet of 180 mg/kg-day of fluorene for 10 days showed a statistically significant increase in liver regeneration, which is indicative of the ability to induce a proliferative response.

Fluorene is not reported to be a complete skin carcinogen (ATSDR, 1990). It was inactive as a tumor initiator when an estimated total dose of 1.0 mg was applied prior to the application of tetradecanoyl phorbol acetate (LaVoie et al, 1980).

GENOTOXICITY

There is no evidence that fluorene is genotoxic, but genotoxicity has been studied only in a few in vitro assays (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.
- Gershbein, L.L. (1975) *Liver regeneration as influenced by the structure of aromatic and heterocyclic compounds*. **Res Commun Chem Pathol Pharmacol** 11:445-466.
- International Agency for Research on Cancer (IARC) (1983) *Monograph on the evaluation of carcinogenic risk of chemicals to man, fluorene*. 32: 419-430.
- LaVoie, E.J. (1980) *Identification of mutagenic hydrodiols as metabolites of benzo(j)fluoranthene and benzo(k)fluoranthene*. **Cancer Research** 40:4528-4532.
- U.S. Environmental Protection Agency (U.S. EPA) (1982) An exposure and risk assessment of polycyclic aromatic hydrocarbons (fluorene). U.S. EPA Contract 68-01-6017. Office of Water Regulations and Standards, Washington, D.C.
- U.S. Environmental Protection Agency (EPA) (1989) Mouse oral subchronic toxicity study. Prepared by Toxicity Research Laboratories, Ltd. Muskegon, MI for the Office of Solid Waste, Washington, D.C.

INDENO[1,2,3-cd]PYRENE

GENERAL BACKGROUND INFORMATION

Indeno[1,2,3-cd]pyrene is a member of the polyaromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. Indeno[1,2,3-cd]pyrene is present in cigarette smoke (IARC, 1983) as well as emissions from industrial stacks.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of indeno[1,2,3-cd]pyrene. However, its metabolism should be similar to another non-alternant PAH, benzo(b)fluoranthene (ATSDR, 1990).

HUMAN TOXICOLOGICAL PROFILE

The database for the toxicological effects of indeno[1,2,3-cd]pyrene on humans, separate from other PAHs, is limited. Toxic effects attributable to mixtures of PAHs include a variety of skin lesions and non-cancer lung diseases such as bronchitis (IARC, 1973).

MAMMALIAN TOXICOLOGICAL PROFILE

Studies on laboratory animals have demonstrated that indeno[1,2,3-cd]pyrene can induce skin tumors (i.e. it is a complete carcinogen) following dermal exposure (ATSDR, 1990).

It has tumor initiating activity, but is not as potent as benzo(b)fluoranthene (Rice et al, 1985).

Carcinogenic PAHs as a group are immunosuppressant, with the degree of suppression correlated with the degree of potency (ATSDR, 1990)

GENOTOXICITY

In test systems using non-human cells, indeno[1,2,3-cd]pyrene was found to be genotoxic (ATSDR, 1990).

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.

International Agency for Research on Cancer (IARC) (1983) *Monograph on the evaluation of carcinogenic risk of chemicals to man, Indeno(1,2,3-cd)pyrene*. 32:419-430.

Rice, J.E. et al. (1985) *On the metabolism, mutagenicity and tumor-initiating activity of ideno(123cd)pyrene*. In: Cooke, M. Dennis, A.J. eds. Polynuclear aromatic hydrocarbons: metabolisms, methods and metabolism. Proceedings of the Eighth International Symposium. Columbus, Ohio: Battelle Press, 10970-1109.

MERCURY

GENERAL BACKGROUND INFORMATION

Mercury has been used in the past for medicinal purposes (Gosselin et al., 1984). There are a number of occupations associated with mercury exposure, particularly through inhalation. These include mining, smelting, chloralkali production, and the manufacture of mercury-containing products such as batteries, measuring devices (thermometers) and paints. Mercury has also been used agriculturally as a seed and cereal protectant and as a fungicide.

PHARMACOKINETICS

The pharmacokinetics and pharmacodynamics of mercury depend largely on its chemical form, organic, inorganic or elemental. Absorption efficiencies vary depending on route of exposure and chemical form (see section on Relative Absorption Factors). Distribution, metabolism and excretion depend largely on the lipid solubility, ionization state and molecular size of the specific chemical form (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Exposure to most forms of mercury is associated with a high degree of toxicity. Elemental (metallic) mercury causes behavioral effects and other nervous system damage. Inorganic mercury salts do not generally reach the brain, but will produce kidney damage. Divalent (mercuric) mercury is substantially more toxic in this regard than the monovalent (mercurous) form. Organic mercury compounds are also toxic. Symptoms of chronic mercury poisoning can be both neurological and psychological in nature as the central nervous system is the primary target organ. Hand and finger tremors, slurred or scanning speech patterns, and drunken, stupor-like (ataxic) gait are some motor-control impairments that have been observed in chronic mercurial toxicity. Visual disturbances may also occur, and the peripheral nervous system may be affected. A psychological syndrome known as erethism is known to occur. It is characterized by changes in behavior and personality including depression, fearfulness, restlessness, irritability, irascibility, timidity, indecision, and early embarrassment. Advanced cases may also experience memory loss, hallucination, and mental deterioration.

MAMMALIAN TOXICOLOGICAL PROFILE

In a study by Mitsumori et al. (1981), male and female mice were fed methyl mercury chloride in their diet for up to 78 weeks. Most of the high dose group died from neurotoxicity before the 26th week. Renal tumors developed in 13 of 16 males in the intermediate dosage group by 53 weeks while only 1 male in the control group developed tumors. No renal tumors occurred in exposed or control females. Studies on rats have reported similar effects such as damage to kidneys and the peripheral nervous system (U.S. EPA, 1980). Mice treated with alkyl mercury phosphate were reported to have an increased frequency of offspring with cleft palates (Oharazawa,

1968) while mice treated with methylmercury had offspring with significantly lowered birth weights and possible neurological damage (Fujita, 1969). No adequate epidemiological studies exist on the teratogenic effects of methylmercury on humans (U.S. EPA, 1980).

GENOTOXICITY

Skerfving et al. (1974) reported a statistical relationship between chromosome breaks and concentrations of methyl mercury in the blood of Swedish subjects on fish diets. Concentrations were reported to be from 14-116 ng Hg/ml in the blood of exposed subjects and from 3-18 ng/ml in nonexposed subjects.

REFERENCES

- Agency For Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for mercury. U.S. Public Health Service.
- Fujita, E. (1969) *Experimental studies on organic mercury poisoning: The behavior of Minamata Disease causal agent in maternal bodies and its transfer to their infants via either placenta or breast milk*. *Jour. Kumanoro Med. Soc.* 43:47.
- Gosselin, T.A. et al. (1984) Principles of Clinical Toxicology, Raven Press; New York.
- Mitsumori, K., Maita, K., Saito, T., Tsuda, T. and Shikasu, Y. (1981) *Carcinogenicity of methyl mercury chloride in ICR mice: Preliminary note on renal carcinogens*. *Cancer Lett.* 12:305-310.
- Oharazawa, H. (1968) *Chromosomal abnormalities and teratogenesis induced by ethyl mercuric phosphate in pregnant mice*. *Nippon Sanka-Fujinka Gakk. Zasshi* 20:(1) 479.
- Skerfving, S. et al. (1974) *Methylmercury-induced chromosome damage in man*. *Environ. Res.* 7:83.
- U.S. Environmental Protection Agency (U.S. EPA) (1980) Ambient water quality criteria for mercury. Office of Water Standards and Regulations. EPA 440/5-80-058.

METHYLENE CHLORIDE

GENERAL BACKGROUND INFORMATION

Methylene chloride (also known as DCM or dichloromethane) is a colorless volatile liquid, has a mild sweet odor, and evaporates very quickly. DCM is widely used as an industrial solvent and paint stripper. It is also a component in certain pesticide and aerosol products. DCM is used in photographic film manufacturing. It has a high lipid solubility and modest solubility in water (ATSDR, 1989).

PHARMACOKINETICS

DCM is absorbed by all routes of exposure (see section on Relative Absorption Factors). Once DCM enters the body, absorption is through body membranes into the systemic circulation. In vivo studies have demonstrated two metabolic pathways: 1) an oxidative pathway mediated by the P-450 mixed function oxidase system yielding CO and CO₂, and 2) a glutathione-dependent (GST) pathway that yields CO₂. The GST pathway shows no indication of saturation at inhaled concentrations of up to 10,000 ppm (ATSDR, 1989). DCM is primarily eliminated in expired air as parent compound and the major metabolites CO and CO₂. A small amount of absorbed DCM has been detected in urine and feces (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Levels of >500 ppm of DCM in air can irritate the eyes, nose, and throat. If DCM is topically applied, it may cause only mild skin irritation because it evaporates quickly. CNS effects include lethargy, irritability, nausea, lightheadedness, and headaches. Symptoms usually dissipate quickly after exposure ends. Smokers may experience CNS effects at lower levels of DCM than non-smokers since smoking increases the CO content in blood. Hepatotoxicity is not evident in epidemiological studies. Adverse renal effects such as congestion and tubular changes show that DCM may be contributory, but not significant. Individuals with pre-existing cardiac disease may be more susceptible to DCM levels mediated by CO via CO-Hb (carboxyhemoglobin), depending on the inhaled concentration of DCM (ATSDR, 1989).

MAMMALIAN TOXICOLOGICAL PROFILE

Methylene chloride may cause acute lethality when animals are administered large doses by any route of exposure (ATSDR, 1989). The liver and the central nervous system are the primary targets following DCM exposure. CNS effects include narcosis, reduced REM during sleep and other behavioral manifestations. Liver toxicity, evidenced as histomorphological alterations and alterations in liver cytochromes, was noted in a NCA drinking water bioassay (NCA, 1982) in rats. Limited data show that high concentrations of DCM can cause upper respiratory tract irritation and produce cardiovascular, ocular and renal effects (ATSDR, 1989).

GENOTOXICITY

Methylene chloride reportedly produced a dose related increase in chromosomal aberrations in peripheral lymphocytes of animals. Chromosome damage occurred at all dose levels and the extent of damage was greater in the presence of metabolic activation (Thilagar, 1983). No evidence of abnormalities in bone marrow cells in rats was reported (Burek, 1980). DCM was not found to be mutagenic in bacteria and yeast. Given evidence of in vitro DNA binding studies, the U.S. EPA (1987) concluded that DCM may be a weak mutagen in mammalian systems. Results were generally negative in vivo. Overall, DCM is considered to be a weak mutagen in lower species (ATSDR, 1989). In the NTP (1986) bioassay, significant increases with dose were reported in the incidence of neoplastic mammary tumors in male and female rats and for lung and liver tumors. A U.S. EPA assessment of the data produced by a NCA (1983) study concluded that significant increases in the incidence of hepatocellular adenomas/carcinomas were associated with the ingestion by mice of DCM in drinking water (EPA, 1985a). The U.S. EPA has classified DCM as a Group B2 -- Probable Human Carcinogen (U.S. EPA, 1985b).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for methylene chloride. U.S. Public Health Service.
- Andrae, U. and Wolff, T. (1983) *Dichloromethane is not genotoxic in isolated rat hepatocytes*. *Arch. Toxicol.* 52:287-290.
- Burek, J.D., Nitschke, K.D. and Bell, T.J. (1980) Methylene chloride: A two year inhalation toxicity and oncogenicity study in rats and hamster. Toxicology Research Laboratory, Health and Environmental Sciences. Dow Chemical Company, Midland, MI.
- CEFIC (European Center of Chemical Manufacturer's Federation) (1986) IN: Lefevre, P.A., Ashby, J., eds. Methylene chloride: induction of S-Phase hepatocytes in the mouse after in vivo exposure. ICI Central Toxicology Laboratory Report CTL/R/885.
- National Coffee Association (NCA) (1982) *Twenty-fourth month chronic toxicity and oncogenicity study of methylene chloride in rats*. Unpublished report prepared by Hazelton Laboratories, Inc., Vienna, Virginia.
- National Coffee Association (NCA) (1983) *Twenty-fourth month oncogenicity study of methylene chloride in mice*. Unpublished report prepared by Hazelton Laboratories, Inc., Vienna, Virginia.
- National Toxicology Program (NTP) (1986) NTP technical report on the toxicology and carcinogenesis studies of dichloromethane in F344/N rats and B6C3F1 mice (inhalation studies). NTP TR306.
- Thilagar, A.K. and Kumaroo, V. (1983) *Induction of chromosome damage by methylene chloride in CHO cells*. *Mutat. Res.* 116:361-367.

U.S. Environmental Protection Agency (U.S. EPA) (1985a) Health assessment document for dichloromethane. Office of Health and Environmental Assessment, Washington D.C. EPA/600/8-8200 4F.

U.S. Environmental Protection Agency (U.S. EPA) (1985b) Addendum to the Health Assessment Document for Dichloromethane (methylene chloride). Updated carcinogen assessment of dichloromethane (methylene chloride). Final draft. Office of Research and Development, Washington, D.C. EPA 600/8-82-0044FF.

U.S. Environmental Protection Agency (U.S. EPA) (1987). Update to Health Assessment Document and Addendum for Dichloromethane (Methylene chloride): Pharmacokinetics, mechanism of action and epidemiology. Draft Report. EPA 600/8-87/1030A.

METHYL ETHYL KETONE

GENERAL BACKGROUND INFORMATION

Methyl ethyl ketone (also known as MEK or 2-butanone) is a colorless liquid with an acetone-like odor, moderate water solubility and high volatility. The major uses of MEK are as a solvent for coatings, adhesives and printing inks, as a cleaning/degreasing agent and as a chemical intermediate in the production of synthetic leathers, transparent paper and aluminum foil. MEK is a highly flammable substance and may pose a fire hazard if handled improperly (ATSDR, 1990).

PHARMACOKINETICS

MEK is readily absorbed by all routes of exposure (see section on Relative Absorption Factors). It is readily soluble in blood and appears to distribute uniformly to all organs (Perbellini et al., 1984). MEK is metabolized by both oxidative and reductive pathways (DiVincenzo et al., 1976). It undergoes reduction to 2-butanol and oxidation to 3-hydroxy-2-butanone, which is further reduced to 2,3-butanediol. Small amounts of unmetabolized MEK can be excreted in urine or exhaled air. All metabolites are excreted in the urine as glucuronides or sulfate conjugates.

HUMAN TOXICOLOGICAL PROFILE

MEK can produce irritation to the eyes, respiratory tract and skin following high level exposure. Central nervous system effects have been reported, including headache, dizziness, nausea and fatigue (ATSDR, 1990). No studies were located regarding the possible consequences of exposure on the liver, kidney, reproductive organs or developing fetus. This ketone has been demonstrated to be very hazardous in combination with other solvents by potentiating the neurotoxicity of n-hexane, methyl-n-butyl ketone and ethyl-n-butyl ketone (Altenkirch et al., 1979).

MAMMALIAN TOXICOLOGICAL PROFILE

High level inhalation exposure to MEK results in upper respiratory tract and ocular irritation. Exposure to high level MEK by the inhalation or oral route resulted in liver congestion, increase liver weight and renal tubular necrosis (Patty, 1935; Cavender et al., 1983). Narcosis and incoordination, indicators of central nervous system effects, were also observed, with no signs of peripheral neuropathy. Inhalation exposure during gestation resulted in fetotoxic effects such as reduced fetal weight, skeletal variations and delayed ossification (Deacon et al., 1981; Mast et al., 1989; Schwetz et al., 1974). No studies were located regarding the possible consequences of exposure on the reproductive systems.

GENOTOXICITY

No in vivo studies were located regarding the genotoxicity of MEK. Results of in vitro tests indicate that MEK is nongenotoxic following in vitro exposure (Thorpe, 1982; O'Donoghue et al., 1988).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for 2-butanone. U.S. Public Health Service.
- Altenkirch, H., Stolenburg-Didinger, G., and Wagner, H.M. (1979) *Experimental data on the neurotoxicity of methyl ethyl ketone (MEK)*. **Experientia** 35:503-504.
- Cavender, F., Casey, H. and Salem, H. (1983) *A 90-day vapor inhalation toxicity study of methyl ethyl ketone*. **Fund. Appl. Toxicol.** 3:264-270.
- Deacon, M., Pilny, M. and John, J. (1981) *Embryotoxicity and fetotoxicity of inhaled methylethyl ketone in rats*. **Toxicol. Appl. Pharmacol.** 59:620-622.
- DiVincenzo, G., Kaplan, C. and Dedinas, J. (1976) *Characterization of the metabolites of methyl n-butyl ketone, methyl iso-butyl ketone and methyl ethyl ketone in guinea pig serum and their clearance*. **Toxicol. Appl. Pharmacol.** 36:511-522.
- Mast, T., Dill, J. and Evanoff, J. (1989) Inhalation developmental toxicology studies: teratology study of methyl ethyl ketone in mice. Report of Pacific Northwest Laboratory, Richland, WA to National Institute of Environmental Health Science, National Toxicology Program.
- O'Donoghue, J., Haworth, S. and Curren, R. (1988) *Mutagenicity studies on ketone solvents: Methyl ethyl ketone, methyl isobutyl ketone and isophorone*. **Mutat. Res.** 206:149-161.
- Patty, F., Schrenk, H. and Yant, W. (1935) *Acute response of guinea pigs to vapours of some new commercial organic compounds*. **U.S. Treas. Publ. Hlth. Rep.** 50:1217.
- Perbellini, L., Brugnone, F. and Mozzo, P. (1984) *Methyl ethyl ketone exposure in industrial workers. Uptake and kinetics*. **Int. Arch. Occup. Environ. Health** 54:73-81.
- Schwetz, B., Leong, B. and Gehring, P. (1974) *Embryo and fetotoxicity of inhaled carbon tetrachloride, 1,1-dichloroethane and methyl ethyl ketone in rats*. **Toxicol. Appl. Pharmacol.** 28:452-464.
- Thorpe, E. (1982) Toxicity studies with chemical solvents: short-term in vitro test for genotoxic activity with methyl ethyl ketone. Report to Shell Oil Company, Houston, TX by Sittington Research Centre, Sittington, Kent, U.K.

2-METHYLNAPHTHALENE

GENERAL BACKGROUND INFORMATION

2-Methylnaphthalene is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs are a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. This compound is used in the synthesis of organic chemicals and pesticides. The database for toxicological information is very limited.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of 2-methylnaphthalene.

HUMAN TOXICOLOGICAL PROFILE

No data were found regarding the human toxicity of 2-methylnaphthalene.

MAMMALIAN TOXICOLOGICAL PROFILE

No data were found regarding the mammalian toxicology of 2-methylnaphthalene.

GENOTOXICITY

No data were found regarding the genotoxicity of 2-methylnaphthalene.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicity profile for naphthalene and 2-methylnaphthalene. U.S. Public Health Service.

METHYL TERT BUTYL ETHER

GENERAL BACKGROUND INFORMATION

Methyl tert butyl ether (MTBE) is an volatile organic ether with extensive water solubility and lipophilicity. It is used clinically in the nonsurgical treatment of gallstones (Hofmann, 1990), as an industrial solvent and as a gasoline oxygenated octane enhancer. At normal temperature and pressure, it exists as a clear liquid with a disagreeable odor. MTBE is highly flammable and may pose a fire hazard if improperly handled (U.S. EPA, 1987).

PHARMACOKINETICS

Due to its lipophilicity, MTBE is well absorbed by all routes of exposure. It is readily soluble in blood and rapidly distributes to all organ systems, including fetal tissue, with highest concentrations occurring in organs with high lipid content such as adipose tissue and brain (U.S. EPA, 1987). Most of an administered dose is excreted unchanged in expired air (Biodynamics, 1984). The remainder undergoes oxidative metabolism mediated by the P-450 mixed function oxidase enzyme system to yield either tertiary butanol or formaldehyde which are ultimately eliminated from the body as either exhaled CO₂ or formic acid in urine and feces (Brady et al., 1990; Savolainen et al., 1985).

HUMAN TOXICOLOGICAL PROFILE

The only information concerning the human toxicity of MTBE involves its use as a therapeutic agent to dissolve gallstones. The procedure entails catheterization of the gallbladder through the abdominal cavity and subsequent perfusion with MTBE until the stones are dissolved. More than 400 patients have been treated worldwide with a high degree of success and few complications reported (Hofmann, 1990). Nausea, vomiting, sedation, local pain and mild hemolysis are possible side effects. The only major complication induced by MTBE has been a case of reversible renal failure in a patient during treatment (Ponchon, 1988).

MAMMALIAN TOXICOLOGICAL PROFILE

MTBE is considered to have a relatively low order of acute toxicity, evident from reported LD₅₀ values of 2962-3866 mg/kg and LC₅₀ values of 33,427-39,461 ppm (U.S. EPA, 1987). MTBE, in air, produces local irritation of the upper respiratory tract and mucous membranes. By all routes of exposure, it produces central nervous system depression evidenced as sedation, slowed reflexes, tremors, incoordination and altered behavior. Mild changes in hematological parameters, neurobehavioral indices and organ weights were evident upon prolonged exposure (API, 1985).

Inhalation teratology and reproduction studies have failed to show any treatment related effects (Biodynamics, 1984).

GENOTOXICITY

Limited in vivo and in vitro cytogenetic results are available. In vivo, clastogenic effects were not observed in rats following subchronic exposure to MTBE (Bushy Run, 1989). In vitro tests similarly failed to show any correlation between MTBE exposure and cytogenetic abnormalities. MTBE did yield a dose-related positive response when tested in the mouse lymphoma forward mutation assay in the presence of metabolic activation. Negative results were obtained in the absence of metabolic activation (ARCO, 1987). No information on the carcinogenicity of MTBE was located. However, structure-activity analysis predicts MTBE to be neither a genotoxicant nor a carcinogen (Rosenkranz and Klopman, 1991).

REFERENCES

API (1985) Unpublished information on the production, use, occupational exposure, release and toxicity of MTBE. Submitted by W.F. O'Keefe, American Petroleum Institute.

ARCO (1987) Acute tox study on methyl t-butyl ether. NTIS/OTS0513481.

Biodynamics, Inc. (1984) Methyl t-butyl ether (MTBE) composite report. Final report Vols. I and II. 80-7452: A nine-day inhalation toxicity study of MTBE in the rat; 80-2515: An inhalation teratology study in rats with MTBE; 80-2516: An inhalation teratology study in mice with MTBE; 80-7453: A single generation inhalation reproduction/fertility study in rats with MTBE; 80-089: The metabolic fate of methyl-t-butyl ether (MTBE) following an acute intraperitoneal injection. March 30. Submitted to American Petroleum Institute.

Brady, J.F., Xiao, F., Ning, S.M. and Yang, C.S. (1990) *Metabolism of methyl tertiary-butyl ether by rat hepatic microsomes*. *Arch. Toxicol.* 64:157-160.

Bushy Run Research Center (1989) Methyl tertiary butyl ether repeated exposure vapor inhalation study in rats: In vivo cytogenetic evaluation. Report No. 51-635.

Hofmann, A.F. (1990) *Nonsurgical treatment of gallstone disease*. *Ann. Rev. Med.* 41:401-415.

Ponchon, T., Baroud, J., Pujol, B. Valette, P.J. and Perrot, D. (1988) *Renal failure during dissolution of gallstones by methyl-tert-butyl-ether*. *Lancet* 2:276-77.

Rosenkranz, H.S. and Klopman, G. (1991) *Predictions of the lack of genotoxicity and carcinogenicity in rodents of two gasoline additives: Methyl-tert-butyl and ethyl-tert-butyl ethers*. *In Vitro Toxicol.* 4:49-54.

Savolainen, H., Pfaffli, P. and Elovaara, E. (1985) *Biochemical effects of methyl tertiary-butyl ether in extended vapour exposure of rats*. *Arch. Toxicol.* 57:285-288.

U.S. Environmental Protection Agency (U.S. EPA) (1987) Technical support document - MTBE. Prepared for Test Rules Development Branch, Existing Chemicals Assessment Division, Office of Toxic Substances. Publication SRC TR-86-394.

NAPHTHALENE

GENERAL BACKGROUND INFORMATION

Naphthalene is a white solid substance at room temperature. It has a distinct odor of mothballs or tar. Humidity and sunshine cause evaporation into the air within a few hours. When placed in water or soil, bacteria will destroy naphthalene, or will render it airborne within a few hours (ATSDR, 1990). Tobacco smoke is known to release 3 ug of naphthalene per cigarette (U.S. EPA, 1982). The compound is used in the production of dyes, solvents, lubricants, motor fuels (U.S. EPA, 1980) and is a major component of many moth ball preparations.

PHARMACOKINETICS

Humans can absorb naphthalene by dermal, inhalation and oral routes (see section on Relative Absorption Factors). Metabolism occurs via the P450 mixed function oxidase enzyme system to yield multiple intermediates which are then conjugated. Key metabolites are responsible for each toxicity endpoint following intraperitoneal administration: 2-naphthoquinones --> hemolysis; 1,2-naphthoquinones --> cataracts; 3-GSH adducts --> pulmonary toxicity (Buckpitt et al., 1984). Excretion of metabolites occurs via urine and feces (ATSDR, 1990).

HUMAN TOXICOLOGICAL PROFILE

Adults and children exposed to airborne naphthalene experience vomiting, abdominal pain and anemia (ATSDR, 1990). Most of the data is for inhalation of naphthalene from mothballs. The primary site of toxicity is the erythrocyte resulting in hemolytic crisis (hemolytic anemia). Jaundice is seen upon dermal, inhalation, and oral exposures, as are kidney effects (ATSDR, 1990). Near-blindness resulted in male and female subjects with 5 gram ingestion (ATSDR, 1990).

MAMMALIAN TOXICOLOGY PROFILE

Oral doses in rats have hepatic effects. Dogs (1800 mg/kg) for 5 days of exposure showed signs of lethargy and ataxia, and decreased hemoglobin levels (ATSDR, 1990)

GENOTOXICITY

No studies of genotoxic effects in humans or laboratory animals were located. No human epidemiological evidence for cancer. Inconclusive evidence for cancer in rats and mice were found (ATSDR, 1990).

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for naphthalene 2-methylnaphthalene. U.S. Public Health Service.

Buckpitt, A. and Richieri, P. (1984) Comparative biochemistry and metabolism: Part 2. Naphthalene lung toxicity. Wright-Patterson Air Force Base, OH: Air Force Systems Command,

Aerospace Medical Division. Air Force Aerospace Medical Research Laboratory. AFAMRL-TR-84-058.

U.S. Environmental Protection Agency (U.S. EPA) (1980) Ambient water quality criteria for polycyclic aromatic hydrocarbons. Office of Emergency and Remedial Response. Washington, DC.

MA DEP, ORS & BWSC
Documntation for the Risk Assessment ShortForm Residential Scenario
versions 1.6 a & b - 10/92

B - 97

NICKEL

GENERAL BACKGROUND INFORMATION

Nickel in the ambient atmosphere typically exists as a constituent of suspended particulate matter (U.S. EPA, 1985). The greatest volume of nickel emitted into the atmosphere is the result of fossil fuel combustion. Other sources of nickel emissions are primary production, incinerators, metallurgy, chemical manufacturing, cement manufacturing, coke ovens, nickel recovery, asbestos mining/milling and cooling towers.

PHARMACOKINETICS

Studies of nickel absorption have shown that it is absorbed by all routes of exposure to varying degrees, primarily dependent on the chemical form (see section on Relative Absorption Factors). Absorbed nickel is bound to serum components and distributed to body organs, reaching highest concentrations in kidney and lung tissue (Whanger, 1973). Nickel is not known to be biotransformed. Excretion of absorbed nickel is primarily through urine, with minor excretory routes through hair and sweat (ATSDR, 1988).

HUMAN TOXICOLOGICAL PROFILE

Nickel carbonyl $\text{Ni}(\text{CO})_4$ is a particularly toxic form of nickel upon inhalation and causes chest pain, dry coughing, hyperpnea, cyanosis, occasional gastrointestinal symptoms, sweating, visual disturbances and severe weakness. This is often followed by pulmonary hemorrhage, edema and cellular derangement. Survivors may be left with pulmonary fibrosis. In the workplace, nickel dermatitis may result at high nickel concentrations. At lower concentrations some susceptible individuals develop eczema-like lesions. The threshold for these health effects is much greater than exposures which occur in the ambient environment. The major adverse effects of nickel in man are dermatitis, chemical pneumonitis, and lung and nasal cancers.

MAMMALIAN TOXICOLOGICAL PROFILE

Deaths occurred in rats and mice at concentrations greater than 3.3 and 1.7 mg/m^3 nickel, respectively, upon extended inhalation exposure to NiSO_4 (Dunnick et al., 1987). Mice exposed to Ni_3S_2 died due to necrotizing pneumonia at 7.3 mg/m^3 nickel (Benson et al., 1987). Prolonged exposure of hamsters to nickel oxide at 41.7 mg/m^3 resulted in decreased survival due to emphysema (Wehner et al., 1975). Oral LD_{50} s in rats vary depending upon the nickel-containing compound to which the rats were exposed. These range from 355 mg compound/ kg (118 mg Ni/kg) for nickel acetate (Haro, 1968) to greater than 5000 mg compound/ kg for nickel oxide, nickel sulfide, and nickel subsulfide (Mastromatteo, 1986). Rats fed diets containing nickel sulfate hexahydrate at 0, 250, 500 and 1000 ppm nickel showed no adverse effects over three generations in fertility, gestation, viability or lactation.

GENOTOXICITY

Weak evidence exists for the mutagenicity of nickel in bacterial and mammalian cells. Nickel appears to induce chromosomal aberrations in cultured mammalian cells (Larramendy et al., 1981), but not in vivo (Waksvik and Boysen, 1982). Occupational studies of human exposure indicate that certain nickel compounds appear to be carcinogenic via inhalation. However, there is no evidence of carcinogenicity in mammals through ingestion or dermal exposure (U.S. EPA, 1985). Nickel subsulfide has been found to be carcinogenic via the inhalation route in rats (Ottolenghi et al., 1974). Studies on nickel exposure via the oral route are inadequate to reach conclusions on carcinogenicity (ATSDR, 1988).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1988) Toxicological profile for nickel. U.S. Public Health Service.
- Ambrose, A.M., Larson, P.S., Borzelleca, J.R. and Henningan, G.R. (1976) *Long-term toxicologic assessment of nickel in rats and dogs*. **J. Food Sci. Technol.** 13:181-187.
- Benson, J.M., Burt, D.G. and Carpenter, R.L. (1987) *Comparative inhalation toxicity of nickel sulfate to F344/N rats and B6C3F1 mice exposed for twelve days*. **Fund. Appl. Toxicol.** 10:164-178.
- Dunnick, J.K., Hobbs, C.H. and Benson, J.M. (1987) *Comparative toxicity of nickel oxide, nickel sulfate, and nickel subsulfide in the F344/N rat and B6C3F1 mouse*. **Toxicology** 7:789.
- Haro, R.T., Furst, A. and Falk, H. (1968) *Studies on the acute toxicity of nickelocene*. **Proc. West Pharmacol. Soc.** 11:39-42.
- Larramendy, M.L., Popescu, N.C. and DiPaolo, J.A. (1981) *Induction by inorganic metal salts of sister chromatid exchanges and chromosome aberrations in human and Syrian hamster cell strands*. **Environ. Mutagen.** 3:597-606.
- Mastromatteo, D. (1986) *Lant Memorial Lecture: Nickel*. **Am. Ind. Hyg. Assoc. J.** 47:589-601.
- Ottolenghi, A.D., Haseman, J.K., Payne, W.W., Falk, H.L. and MacFarland, H.N. (1974) *Inhalation studies of nickel sulfide in pulmonary carcinogenesis of rats*. **J. Natl. Cancer Inst.** 54:1165-1172.
- U.S. Environmental Protection Agency (U.S. EPA) (1985) Health effect assessment document for nickel. Office of Research and Development. Office of Emergency and Remedial Response.
- Waksvik, H. and Boysen, V. (1982) *Cytogenic analysis of lymphocytes from workers in a nickel refinery*. **Mutat. Res.** 103:185-190.
- Wehner, A.P., Busch, R.H., Olson, R.J. and Craig, D.K. (1975) *Chronic inhalation of nickel oxide and cigarette smoke by hamsters*. **Am. Ind. Hyg. Assoc. J.** 36:801-809.
- Whanger, P.D. (1973) *Effects of dietary nickel on enzyme activities and mineral content in rats*. **Toxicol. Appl. Pharmacol.** 25:323-331.

PHENANTHRENE

GENERAL BACKGROUND INFORMATION

Phenanthrene is a member of the polyaromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. The database on the potential health effects of phenanthrene is limited.

PHARMACOKINETICS

Little data are available regarding the pharmacokinetics of phenanthrene. The intestinal absorption of phenanthrene is less dependent on the presence of bile in the stomach than is the absorption of the larger PAHs (such as benzo(a)pyrene) (Rahman et al, 1986).

HUMAN TOXICOLOGICAL PROFILE

Phenanthrene has been shown to be a skin photosensitizer in humans (Sax, 1984).

MAMMALIAN TOXICOLOGICAL PROFILE

Phenanthrene has a reported LD 50 of 700 mg/kg in mice (Simmon et al., 1979). Rats injected intraperitoneally evidenced liver effects (Yoshikawa et al, 1987).

There is equivocal evidence for cancer from dermal application of phenanthrene in rats (IARC, 1983). Phenanthrene is not a complete skin carcinogen (ATSDR, 1990). It is neither an initiator (LaVoie et al, 1981; Roe, 1962) nor a promoter (Roe and Grant, 1964). Higgins and Yang (1962) reported no tumor production within two months after the ingestion of 200 mg of phenanthrene by rats.

GENOTOXICITY

There are limited data that suggest that phenanthrene is mutagenic (Wood et al., 1979). However, the majority of tests are negative (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.
- Higgins, L. and Yang, Y. (1962) *Induction and extinction of mammary cancer*. **Science** 137:257-262.
- International Agency for Research on Cancer (IARC) (1983) *Monograph on the evaluation of carcinogenic risk of chemicals to man, Phenanthrene*. 32:419-430.
- LaVoie, K. et al. (1981) *Mutagenicity and tumor initiating activity and metabolism of phenanthrenes*. **Cancer Res.** 41:3441-3447.
- Rahman, A., Barrowman, J.A., Rahimtula, A. (1986) *The influence of bile on the bioavailability of polynuclear aromatic hydrocarbons from the rat intestine*. **Can J Physio Pharmacol** 64:1214-1218.
- Roe, F.J.C. (1962) *Effect of phenanthrene on tumour-initiation by 3,4-benzpyrene*. **Br J Cancer** 16:503-506.
- Sax, N.I. (1984) Dangerous Properties of Industrial Materials. 6th edition. Van Nostrand Reinhold Company. N.Y.
- Simmon, P. et al. (1979) *Mutagenic activity of chemicals carcinogens and related compounds in the intraperitoneal host-mediated assay*. **J. Natl. Cancer Inst.** 62:911-918.
- Wood, R. et al. (1979) *Mutagenicity and tumorigenicity of phenanthrene and chrysene epoxides and diol epoxides*. **Cancer Res.** 39:4069-4077.
- Yoshikawa, T. et al. (1987) *Toxicity of polycyclic aromatic hydrocarbons III. Effects of beta-naphthoflavone pretreatment on hepatotoxicity of compounds produced in the ozonation or NO₂-nitration of phenanthrene and pyrene by rats*. **Vetern Human Toxicol.** 29:113-117.

PYRENE

GENERAL BACKGROUND INFORMATION

Pyrene is a member of the polycyclic aromatic hydrocarbons (PAH). PAHs constitute a class of non-polar compounds that contain two or more aromatic rings. They are ubiquitous in nature and are both naturally occurring and man-made. As with many of the other PAHs, pyrene has been detected in charbroiled meats and shellfish (U.S. EPA, 1982). It is found in tobacco smoke, industrial stack smoke, and smoke from forest fires.

PHARMACOKINETICS

No data were found regarding the pharmacokinetics of pyrene.

HUMAN TOXICOLOGICAL PROFILE

Pyrene is reported to be a skin irritant (Sax, 1984).

MAMMALIAN TOXICOLOGICAL PROFILE

Rats given 150 mg/kg of pyrene had changes in blood chemistry, liver and kidney damage (USEPA, 1982). A 1989 EPA study (EPA, 1989) reported nephropathy and decreased kidney weights in mice exposed to 125 mg/kg-day of pyrene by gavage for 13 weeks.

Mouse skin painting assays indicate that pyrene is neither a complete skin carcinogen, nor an initiating agent (ATSDR, 1990, IRIS, 1991).

GENOTOXICITY

The majority of genotoxic tests of pyrene are negative. Positive results have been recorded in *Salmonella typhimurium* mutagenicity tests and in in vitro mammalian cell systems (ATSDR, 1990).

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for polycyclic aromatic hydrocarbons. U. S. Public Health Service.

Sax, N.I. (1984) Dangerous Properties of Industrial Materials. 6th Edition. Van Nostrand Reinhold Company. N.Y.

U.S. Environmental Protection Agency (U.S. EPA) (1982) An exposure and risk assessment of polycyclic aromatic hydrocarbons (pyrene). USEPA Contract 68-01-6017. Office of Water Regulations and Standards, Washington, D.C.

U.S. Environmental Protection Agency (EPA) (1989) Mouse oral subchronic toxicity study of pyrene. Prepared by Toxicity Research Laboratories, Ltd. Muskegon, MI for the Office of Solid Waste, Washington, D.C.

Integrated Risk Information System (IRIS) (1991) U.S. Environmental Protection Agency.

SILVER

GENERAL BACKGROUND INFORMATION

Silver is used in photographic materials, batteries, paints and jewelry. Silver is used medically in dental amalgam and in medical supplies for burn treatment. Photographic materials are the major source of silver that is released into the environment. Trace amounts of silver are found in water from natural sources and industrial waste.

PHARMACOKINETICS

Studies in humans and animals indicate that silver compounds are absorbed readily by the inhalation and oral routes. Individuals and individual organs absorb silver selectively. The greatest concentrations are found in the reticuloendothelial organs. Silver undergoes oxidation and reduction reactions within the body and is excreted primarily via the fecal route (ATSDR, 1990).

HUMAN TOXICOLOGICAL PROFILE

Blue-gray discoloration of the skin has been observed in many individuals who have ingested metallic silver and silver compounds over periods of months to years. This condition is termed argyria. The pigmentation of the skin is primarily in sun-exposed areas. Silver-containing granules are also observed in the dermis. Gradual accumulation of 1 to 5 grams of silver will lead to generalized argyria. The discoloration is not known to be diagnostic of any other toxic effect (ATSDR, 1990). Occupational exposure to silver dusts can lead to respiratory and gastrointestinal irritation. The average air level was estimated to range from 0.039 to 0.378 mg/m³. Duration of employment ranged from less than one year to greater than ten years. Symptoms included abdominal pain, sneezing, stuffiness, and sore throat. Granular deposits were also observed in the conjunctiva and corneas of the eyes (Rosenman et al., 1979; 1987). Medical case histories indicate that dermal exposure to silver and silver compounds for extended periods of time can lead to local skin discoloration similar in nature to the generalized pigmentation seen after repeated oral exposure. The amount of silver and the duration of exposure necessary to produce this effect have not been established (McMahon and Bergfeld, 1983).

MAMMALIAN TOXICOLOGICAL PROFILE

Oral doses of 1,680 mg/kg silver colloid resulted in the deaths of rats after four days (Dequidt et al., 1974). Ingestion of silver nitrate and silver chloride will also cause deposition of silver granules in the skin of animals (Walker, 1971). Granules were observed in the eyes of rats exposed to silver nitrate in drinking water at doses of 222 mg/kg/day over 37 weeks. These doses also cause general deposition in other tissues (Matuk et al., 1981). Mice given oral doses of 18.1 mg/kg/day silver nitrate for 125 days were observed to have silver deposits in their nervous systems. These animals were less active than unexposed controls (Rungby and Danscher, 1984). Silver has

been found in the brains of neonatal rats whose mothers received silver lactate on days 18 and 19 of gestation (Rungby and Danscher, 1984). No studies were located that examine the reproductive effects of silver in animals or humans.

GENOTOXICITY

Silver is not mutagenic in bacteria but it has been found to cause DNA damage in mammalian cell culture (Robinson et al., 1982). No studies were located regarding cancer in humans or animals following oral, inhalation or dermal exposure to silver or silver compounds (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for silver. U.S. Public Health Service.
- Dequidt, J., Vasseur, P. and Gomez-Potentier, P. (1974) *Experimental toxicological study of some silver derivatives*. *Bulletin de Societe de Pharmacie de Lille* 1:23-35.
- Matuk, Y., Ghosh, M. and McCulloch, C. (1981) *Distribution of silver in the eyes and plasma proteins of the albino rat*. *Can. J. Ophthalmol.* 16:1391-1395.
- McMahon, J.T. and Bergfeld, W.F. (1983) *Metallic cutaneous contaminant mimicking malignant melanoma*. *Cleveland Clinic Quarterly* 50:177-181.
- Robinson, S.H., Cantoni, O. and Costa, M. (1982) *Strand breakage and decreased molecular weight of DNA induced by specific metal compounds*. *Carcinogenesis* 3:657-662.
- Rosenman, K.D., Moss, A. and Kon, S. (1979) *Argyria: Clinical implications of exposure to silver nitrate and silver oxide*. *J. Occup. Med.* 21:430-435.
- Rosenman, K.D., Seixas, N. and Jacobs, I. (1987) *Potential nephrotoxic effects of exposure to silver*. *Br. J. Ind. Med.* 44:267-272.
- Rungby, J. and Danscher, G. (1984) *Hypoactivity in silver exposed mice*. *Acta Pharmacol. Toxicol* 55:398-401.
- Walker, F. (1971) *Experimental argyria: a model for basement membrane studies*. *Br. J. Exp. Pathol.* 52:589-593.

THALLIUM

GENERAL BACKGROUND INFORMATION

Pure thallium is a soft bluish-white metal that is widely distributed in trace amount in the earth's crust. It is used in the manufacture of electronic devices, switches, and closures. It is also used to a limited extent in the manufacture of special glasses and for medical procedures that evaluate heart disease. Up until 1972, thallium was also used as a rat poison (ATSDR, 1991).

PHARMACOKINETICS

Thallium appears to be nearly completely absorbed from the gastrointestinal tract. No information was located on absorption following inhalation or dermal exposure. However, animal studies following intratracheal administration suggested that uptake through respiratory epithelium was rapid and complete. There is little information on the distribution of thallium in humans. Analysis of human tissues indicates that thallium is distributed throughout the body. The highest levels were found in the scalp hair, kidney, heart, bone, and spleen. In animals, the highest levels are found in the kidneys and liver. Excretion of thallium occurs by both the urinary and fecal routes (ATSDR, 1991).

HUMAN TOXICOLOGICAL PROFILE

Thallium is acutely lethal to humans following oral exposure at doses of 54-110 mg thallium/kg of body weight as thallium sulfate (Davis et al., 1981). The estimated lethal dose is approximately 14-15 mg/kg (Gosselin et al., 1984). Thallium compounds can affect the respiratory, cardiovascular, and gastrointestinal systems, the liver, kidneys and the male reproductive system. Alopecia (hair loss) and changes in the nervous system are characteristic of thallium exposure. A retrospective study was conducted which compared the incidence of congenital abnormalities in children born to mothers who had been exposed to thallium during pregnancy (Dolgnier et al., 1983). The number of anomalies in the exposed group did not exceed the number of expected birth defects in the general population.

MAMMALIAN TOXICOLOGICAL PROFILE

In animals, the lowest doses showing lethality for a brief exposure period ranged from 5 to 30 mg/kg body weight for several species (Downs et al., 1960). Exposure to low doses (1.4 mg thallium as thallium sulfate/kg body weight/day) for longer durations (40-240 days) also cause death (Manzo et al., 1983). Electromyographic abnormalities without changes in the myocardium are seen following a single oral dose (56 mg thallium/kg as thallium sulfate) in rabbits (Grunfeld et al., 1963). Parenteral injection in animals has been observed to cause liver effects. Thallium did not cause renal effects in rats following oral exposure, but parenteral exposure studies demonstrated that thallium affects the kidneys following subcutaneous administration. Rats exposed prenatally to 0.08 mg thallium/kg/day or greater during

gestation evidenced impairment of learning. These effects occurred at dose levels below those at which other neurological effects (e.g structural and functional alterations of peripheral nerves) have been observed. Cultured rat embryos exposed to thallium at concentrations of 10, 30, or 100 ug/ml showed dose-related growth retardation at all levels showing embryotoxic effects (Anschutz et al., 1981). Administration by intraperitoneal injection to pregnant rats at a dose of 2.0 mg thallium/kg/day (as thallium sulfate) during gestation days 8-10 resulted in reduced fetal body weights, hydronephrosis, and the absence of vertebral bodies (Gibson and Becker, 1970).

GENOTOXICITY

Animal and bacterial assays suggest that thallium is genotoxic. Thallium-induced dominant lethal mutations in male rats in vivo. The overall embryonic mortality increased at doses of 0.04 ug thallium/kg day or greater as thallium carbonate. In vitro DNA damage tests employing rat embryo cells were positive (Zasukhina et al., 1983). Thallium enhanced viral-induced transformations in Syrian hamster embryo cells (Casto et al., 1979) and was positive in bacterial assays (Kanematsu et al., 1980). No studies are available on the carcinogenic effects of inhalation, oral or dermal exposure to thallium.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1991) Toxicological profile for thallium. U.S. Public Health Service.
- Anschutz, M., Herken, R. and Neubert, D. (1981) *Studies on embryotoxic effects of thallium using the whole embryo culture technique*. In: Neubert D., Merker H.J., eds. Culture Techniques: Applicability for Studies on Prenatal Differentiation and Toxicity: 5th Symposium on Prenatal Development, Berlin, W. Germany. pp. 57-66.
- Casto, B.C., Meyers, J. and DiPaolo, J.A. (1979) *Enhancement of viral transformation for evaluation of the carcinogenic or mutagenic potential of inorganic metal salts*. **Cancer Res.** 39:193-198.
- Davis, L.E., Standefer, J.C., and Kornfeld, M. (1981) *Acute thallium poisoning: Toxicological and morphological studies of the nervous system*. **Ann. Neurol.** 10:38-44.
- Dolgener R., Brockhaus, A. and Ewers, U. (1983) *Repeated surveillance of exposure to thallium in a population living in the vicinity of a cement plant emitting dust containing thallium*. **Int. Arch. Occup. Environ. Health** 52:79-94.
- Downs, W.L., Scott, J.K. and Steadman, L.T. (1960) *Acute and sub-acute toxicity studies of thallium compounds*. **Am. Ind. Hyg. Assoc. J.** 21:399-406.
- Gibson, J.E. and Becker, B.A. (1970) *Placental transfer, embryotoxicity and teratogenicity of thallium sulfate in normal and potassium-deficient rats*. **Toxicol. Appl. Pharmacol.** 16:120-132.
- Gosselin, R.E., Smith, R.P. and Hodge, H.C. (1984) Clinical Toxicology of Commercial Products. 5th ed. Baltimore, MD; Williams and Wilkins, II-139, III-379-383.
- Grunfeld, O., Battilana, G. and Aldana, L. (1963) *Electrocardiographic changes in experimental thallium poisoning*. **Am. J. Vet. Res.** 24:1291-1296.
- Kanematsu, N., Hara, M. and Dada, T. (1980) *Rec assay and mutagenicity studies on metal compounds*. **Mutat. Res.** 77:109-116.
- Manzo, L., Scelsi, R. and Moglia, A. (1983) *Long-term toxicity of thallium in the rat*. In: Chemical Toxicology and Clinical Chemistry of Metals. London, England. Academic Press, pp. 401-405.
- Zasukhina, G.D., Vasilyeva, I.M. and Sdirkova, N.I. (1983) *Mutagenic effect of thallium and mercury salts on rodent cells with different repair activities*. **Mutat. Res.** 124:163-173.

TOLUENE

GENERAL BACKGROUND INFORMATION

Toluene is a clear, colorless organic liquid with a sweet smell and a high degree of lipid solubility. It is used as an industrial solvent/degreaser, as an intermediate in the manufacture of chemicals and pharmaceuticals, and is present as a component of gasoline and other fuels, paints, lacquers, adhesives, rubber and printing ink. Toluene is a volatile molecule with relatively low water solubility. It is flammable and may pose a fire hazard if handled improperly (ATSDR, 1989).

PHARMACOKINETICS

Toluene is readily absorbed by all routes of exposure (see section on Relative Absorption Factors). Once absorbed, it is rapidly distributed to all organ systems, including fetal tissue, with highest concentrations occurring in organs with high lipid content such as adipose tissue, brain and bone marrow. Toluene undergoes primarily oxidative metabolism to benzyl alcohol mediated by the mixed function oxidase enzyme system. Benzyl alcohol is further oxidized by alcohol and aldehyde dehydrogenase to produce benzoic acid which is primarily conjugated with glycine or glucuronic acid and excreted in urine as hippuric acids or benzoyl glucuronide. Toluene may also be excreted unchanged in exhaled air. Metabolism and excretion occurs rapidly, with the major portion occurring within 12 hours of exposure (Fishbein, 1985).

HUMAN TOXICOLOGICAL PROFILE

In humans, the most profound effects of toluene are on the central nervous system. Acute exposure results in reversible depression of the central nervous system, neurological dysfunction, impaired performance and narcosis. Chronic exposure has been reported to result in permanent central nervous system effects such as ataxia, tremors and impaired speech, hearing and vision (ATSDR, 1989). Toluene vapors cause irritation of the upper respiratory tract, mucous membranes and eyes, and may produce cardiac arrhythmias upon chronic exposure (Anderson et al., 1982). Reports of effects on the hematological system, liver, kidney, immune system, reproductive organs and the developing fetus are confounded by exposure to multiple solvents (ATSDR, 1989).

MAMMALIAN TOXICOLOGICAL PROFILE

Toluene has been demonstrated to produce similar effects in humans and animals. The major target organ following acute or chronic exposure is the central nervous system. Signs of central nervous system damage include impaired motor abilities, narcosis, tremors, alterations in EEG activity, changes in the levels of brain neurotransmitters and morphological effects (ATSDR, 1989). High level inhalation exposure resulted in respiratory irritation and inflammation and pulmonary lesions (NTP, 1989). Toluene does not appear to be directly toxic to the cardiovascular system

(Bruckner and Peterson, 1981). Decreased leukocyte counts were observed in dogs following exposure to toluene (Hobara et al., 1984). In addition, exposed mice exhibited increased susceptibility to respiratory infection (Aranyi et al., 1985). Hepatic effects appear to be relatively mild with reported increases in liver weight and minor ultrastructural changes (Ungvary et al., 1982). Renal toxicity has not been observed (NTP, 1989; Bruckner and Peterson, 1981). Studies with animals provide evidence that toluene may be a developmental toxicant. Exposure in utero resulted in skeletal anomalies, retarded skeletal growth and low fetal weights (Ungvary, 1985). No reproductive effects have been reported (API, 1985; NTP, 1989).

GENOTOXICITY

Available in vitro studies suggest that toluene is nongenotoxic (ATSDR, 1989). In vivo studies in animals provide additional supportive evidence (API, 1981). A small number of human studies have reported an increased incidence in chromosomal abnormalities, however, these studies are confounded by possible co-exposure to other chemicals (Schmid et al., 1985; Bauchinger et al., 1982). Other human studies have found no correlation between exposure to toluene and increased frequencies of chromosomal abnormalities (Haglund et al., 1980; Maki-Paakkanen et al., 1980).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for toluene. U.S. Public Health Service.
- Anderson, H.R., Dick, B. and Macnair, R.S. (1982) *An investigation of 140 deaths associated with volatile substance abuse in the United Kingdom*. **Hum. Toxicol.** 1:207-221.
- API. (1981) American petroleum Institute. Mutagenicity evaluation of toluene in the mouse dominant lethal assay. Litton Bionetics, Inc. Proj. No. 21141-05.
- API. (1985) American Petroleum Institute. Two-generation reproduction/fertility study on a petroleum-derived hydrocarbon: Toluene. Volume 1.
- Aranyi, C., O'Shea, W.J. and Sherwood, R.L. (1985) *Effects of toluene inhalation on pulmonary host defenses of mice*. **Toxicol. Lett.** 25:103-110.
- Bauchinger, M., Schmid, E. and Dresch, J. (1982) *Chromosome change in lymphocytes after occupational exposure to toluene*. **Mutat. Res.** 102:439-445.
- Bruckner, J.V. and Peterson, R.G. (1981) *Evaluation of toluene and acetone inhalant abuse. II. Model development and toxicology*. **Toxicol. Appl. Pharmacol.** 61:302-312.
- Fishbein, L. (1985) *An overview of environmental and toxicological aspects of aromatic hydrocarbons. II. Toluene*. **Sci. Total Environ.** 42:267-288.
- Haglund, U., Lundberg, I. and Zech, L. (1980) *Chromosome aberrations and sister chromatid exchanges in Swedish paint industry workers*. **Scan. J. Environ. Health** 6:291-298.
- Hobara, T., Kobayashi, H. and Higashihara, E. (1984) *Acute effects of 1,1,1-trichloroethane, trichloroethylene and toluene on the hematological parameters in dogs*. **Arch. Environ. Contam. Toxicol.** 13:589-593.
- Maki-Paakkanen, J., Husgafvel-Pursiainen, K. and Kalliomaki, P.L. (1980) *Toluene-exposed workers and chromosome aberrations*. **J. Toxicol. Environ. Health** 6:775-781.

NTP. (1989) NTP technical report on the toxicology and carcinogenesis studies of toluene (CAS No. 108-88-3) in F344/N rats and B6C3F₁ mice. NIH Publication No. 89-2826.

Schmid, E., Bauchinger, M. and Hauf, R. (1985) *Chromosome changes with time in lymphocytes after occupational exposure to toluene.* **Mutat. Res.** 142:37-39.

Ungvary, G., Tatrai, E. and Szeberenyi, S. (1982) *Effect of toluene exposure on the liver under different experimental conditions.* **Exp. Mol. Pathol.** 36:347-360.

Ungvary, G. (1985) *The possible contribution of industrial chemicals (organic solvents) to the incidence of congenital defects caused by teratogenic drugs and consumer goods: An experimental study.* In: Marois, M., ed. Prevention of physical and mental congenital defects. Part B: Epidemiology, early detection and therapy, and environmental factors. New York: Alan R. Liss, Inc. pp. 295-300.

XYLENES

GENERAL BACKGROUND INFORMATION

Xylenes are colorless liquid organic molecules with a sweet odor and a high degree of lipid solubility. There are three isomers of xylene: meta- ortho- and para-xylene (m-, o- and p-xylene, respectively). The term "total xylenes" is used to designate a mixture of the three possible isomers, in any proportions. They are commonly used as industrial solvents, as components of paints, varnishes, cleaners, degreasers and gasoline and as chemical intermediates in the manufacture of other chemicals, plastics and synthetic fibers. Xylenes are volatile molecules and therefore, evaporate quickly. They are also flammable and may pose a fire hazard if handled improperly (ATSDR, 1990).

PHARMACOKINETICS

Xylenes are readily absorbed by all routes of exposure (see section on Relative Absorption Factors). Xylenes are very soluble in blood and therefore are absorbed easily into the systemic circulation during exposure (Astrand, 1982). Following absorption, distribution occurs rapidly to all organs, including fetal tissue, with greatest distribution occurring to organs having a high lipid content, such as adipose tissue, bone marrow and brain (Astrand, 1982; Engstrom and Bjurstrom, 1978; Riihimaki et al., 1979). In humans, xylenes are primarily metabolized by the mixed function oxidase enzyme system to methylbenzyl alcohols which are further oxidized by alcohol and aldehyde dehydrogenase to yield methyl benzoic acids. The acids are readily conjugated and excreted in urine (Fishbein, 1985). In addition, a small percentage (3-6%) is exhaled unchanged due to the volatile nature of these compounds.

HUMAN TOXICOLOGICAL PROFILE

Human data suggests that the three xylene isomers all produce qualitatively similar effects, although the individual isomers are not necessarily equal in potency with regard to a given effect (ATSDR, 1990). Exposure, by any route, results in primarily central nervous system effects that may include headaches, nausea, mental confusion, narcosis, impaired learning and memory, dizziness, tremors, unconscienceness and coma, depending on dose and length of exposure. High doses may result in death. The respiratory system may also be a target of xylene toxicity in humans, producing respiratory tract irritation, pulmonary edema and inflammation after inhalation. Ocular irritation may result following exposure to xylene vapors. Skin irritation, dryness and scaling may result following dermal exposure. Limited data are available concerning effects of exposure on the hepatic, renal, cardiovascular, musculoskeletal or hematological system. Insufficient information is available regarding the developmental and reproductive toxicity of xylenes in humans.

MAMMALIAN TOXICOLOGICAL PROFILE

Exposure to xylenes produces similar effects in humans and laboratory animals. The central nervous system is the primary target for both short-term and long-term exposures. Respiratory effects are observed following inhalation exposure. Data from animal studies provide limited evidence that xylene may produce cardiovascular effects (arrhythmias, atrial fibrillation and alterations in blood vessels and blood flow) (Morvai et al., 1976, 1987), hepatic effects (enzyme induction, increased liver weight, ultrastructural alterations) (Condie et al., 1988; Elovaara et al., 1980; Elovaara, 1982) and renal effects (enzyme induction, renal atrophy, tubular alterations) (Condie et al., 1988; Elovaara, 1982; Toftgard and Nilsen, 1982). These results suggest that humans might be at increased risk of developing such effects following exposure. Findings in animal studies suggest that xylenes may produce developmental defects including increased fetal death, decreased fetal weight, delayed skeletal development and gross anomalies (Marks et al., 1982; Ungvary et al., 1980). No animal data exists suggesting effects on reproductive organs, the musculoskeletal system or hematological system.

GENOTOXICITY

Xylenes have been tested for genotoxicity in a variety of in vitro and in vivo assays. Results of the various assays indicate that xylenes are nongenotoxic following in vitro and in vivo exposure (ATSDR, 1990). No evidence of carcinogenicity exists in humans or laboratory animals (ATSDR, 1990).

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1990) Toxicological profile for total xylenes. U.S. Public Health Service.
- Astrand, I. (1982) *Work load and uptake of solvents in tissues of man*. In: Mehlman, M.A., ed. Advances in modern environmental toxicology. Vol. 2, Princeton Junction, N.J.: Senate Press, pp. 141-152.
- Condie, L.W., Hill, J.R. and Borzelleca, J.F. (1988) *Oral toxicology studies with xylene isomers and mixed xylenes*. **Drug Chem. Toxicol.** 11:329-354.
- Elovaara, E. (1982) *Dose-related effects of m-xylene inhalation on the xenobiotic metabolism of the rat*. **Xenobiotica** 12:345-352.
- Elovaara, E., Collan, Y. and Pfaffli, P. (1980) *The combined toxicity of technical grade xylene and ethanol in the rat*. **Xenobiotica** 10:435-445.
- Engstrom, J. and Bjurstrom, R. (1978) *Exposure to xylene and ethylbenzene. II. Concentration in subcutaneous adipose tissue*. **Scand. J. Work Environ. Health** 4:195-203.
- Fishbein, L. (1985) *An overview of the environmental and toxicological aspects of aromatic hydrocarbons: III. Xylene*. **Sci. Total Environ.** 43:165-183.
- Marks, T.A., Ledoux, T.A. and Moore, J.A. (1982) *Teratogenicity of a commercial xylene mixture in the mouse*. **J. Toxicol. Environ. Health** 9:97-105.
- Morvai, V., Hudak, A. and Ungvary, G. (1976) *ECG changes in benzene, toluene and xylene poisoned rats*. **Acta. Med. Acad. Sci. Hung.** 33:275-286.
- Morvai, V., Ungvary, G. and Herrmann, H.J. (1987) *Effects of quantitative undernourishment, ethanol and xylene on coronary microvessels of rats*. **Acta Morphol. Hung.** 35:199-206.
- Riihimaki, V., Pfaffli, P. and Savolainen, K. (1979) *Kinetics of m-xylene in man: General features of absorption, distribution, biotransformation and excretion in repetitive inhalation exposure*. **Scand. J. Work Environ. Health** 5:217-231.
- Toftgard, R. and Nilsen, O.G. (1982) *Effects of xylene and xylene isomers on cytochrome P-450 and in vitro enzymatic activities in rat liver, kidney and lung*. **Toxicology** 23:197-212.
- Ungvary, G., Tatrai, E., Hudak, A. (1980) *Studies on the embryotoxic effects of ortho-, meta- and para-xylene*. **Toxicology** 18:61-74.

ZINC

GENERAL BACKGROUND INFORMATION

Zinc is used most commonly as a protective coating for other metals and in alloys such as bronze and brass. Zinc is emitted to the atmosphere during mining and refining, manufacturing processes, and combustion of zinc-containing materials. Zinc is an essential trace element in nutrition and is found in many foods (ATSDR, 1989).

PHARMACOKINETICS

It has been reported that about 20 to 30 percent of ingested zinc is absorbed and the mechanism may be homeostatically controlled and carrier-mediated. When zinc levels in the body are sufficient to sustain normal physiological functions, zinc absorption decreases. Absorption occurs by the inhalation and dermal routes as well. Once absorbed, zinc is distributed throughout the body where it is used as an essential cofactor in many enzyme systems. Excretion occurs primarily through the feces (ATSDR, 1989).

HUMAN TOXICOLOGICAL PROFILE

Zinc compounds are of relatively low toxicity by ingestion. In humans, exposure to 2 g or more of zinc produces symptoms of fever, nausea, vomiting, stomach cramps, and diarrhea 3-12 hours after ingestion. Zinc chloride is a primary component of smoke bombs, and pathologic changes in humans due to acute inhalation exposure to ZnCl include laryngeal, tracheal, and bronchial mucosal edema and ulceration, interstitial edema, interstitial fibrosis, alveolar obliteration and bronchiolitis obliterans. Severe acute injury is associated with a high mortality (Matarese and Matthews, 1986). Metal fume fever results from occupational inhalation of freshly formed fumes of zinc oxides. It is characterized by transient chills and fever, profuse sweating, and weakness some hours after exposure. The fumes usually consist of extremely fine particles containing other metals in addition to zinc. The very small size (submicronic) of the fume particles with their potential for alveolar deposition is thought to be an important aspect of this phenomenon. It has generally been estimated that fume fever does not occur at zinc oxide levels less than 15 mg/m^3 although some occurrence of fume fever has been reported at levels as low as 5 mg/m^3 . This occupational hazard is not considered to be a general public health problem (U.S. EPA, 1987a; U.S. EPA, 1987b).

Poorly ionized zinc compounds have low dermal toxicity and have been used therapeutically and cosmetically for many years as mild astringents, antiseptics and perspirants (Gilman et al., 1985).

MAMMALIAN TOXICOLOGICAL PROFILE

The highly ionizable zinc salts such as zinc chloride can be acutely toxic. Acute toxicity in laboratory animals was reported to be 250 mg/kg (LD_{LO}) for the guinea pig. A TC_{LO} of 4800 mg/m³ for 30 minutes was calculated for humans (Clayton and Clayton, 1981).

Zinc has a low oral chronic toxicity. In a study involving dogs and cats, 175 to 1000 mg/kg per day of ZnO, administered orally for 3 to 53 weeks, was tolerated. Some of the dogs showed glucosuria and some of the cats showed fibrous degeneration of the pancreas. A number of other animal feeding studies demonstrate the low oral toxicity of zinc (Clayton and Clayton, 1981; U.S. EPA, 1987a).

Generally adverse but minor effects have been demonstrated in guinea pigs inhaling large amounts (1-5 mg/m³) of zinc oxides (Lam et al., 1982,1985; Amdur et al., 1982). Lam et al. (1985) measured pulmonary function in guinea pigs exposed to zinc oxide fume at 5 mg/m³ three hours daily for a period of six days. Vital capacity, functional residual capacity, alveolar volume, and single breath diffusive capacity for carbon monoxide decreased following the final exposure and did not return to normal after 72 hours. Flow resistance increases, and decreases in compliance and total lung capacity returned to normal after this period. Fibroblasts in interstitial infiltrates (including a fibrotic reaction) were observed. It was concluded that pulmonary changes may occur with relatively few exposures at the workplace threshold limit value.

Zinc does not appear to be teratogenic except perhaps at very high doses; intraperitoneal injections of relatively large doses (20 mg/kg) in mice during pregnancy results in some malformations in fetal ossifications (Chang et al., 1977).

GENOTOXICITY

Various studies have indicated that zinc is not mutagenic. In vitro analyses of zinc chloride demonstrated that the fidelity of DNA synthesis was unaffected (Sirover and Loeb, 1976a,b; Miyaki et al., 1977). Zinc industry employees have shown a greater number of chromosomal aberrations in peripheral blood lymphocytes than did controls (Bauchinger et al., 1976). However, these workers were also exposed to other agents known to cause chromosome structural alterations (Leonard, 1985). There is no evidence that the inhalation, ingestion or parenteral administration of zinc induces the formation of tumors.

REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR) (1989) Toxicological profile for zinc. U.S. Public Health Service.
- Amdur, M.O., McCarthy, J.F. and Gill, M.W. (1982) *Respiratory response of guinea pigs to zinc oxide fume*. **Am. Ind. Hyg. Assoc. J.** 43:887-889.
- Bauchinger, M., Schmid, E., Einbrodt, H.J. and Dresch, J. (1976) *Chromosome aberrations in lymphocytes after occupational exposure to lead and chromium*. **Mutat. Res.** 40:57-62.
- Clayton, F.D. and Clayton, F.E. (1981) Patty's Industrial Hygiene and Toxicology. Third Revised Edition, Volume 2A, Toxicology. John Wiley and Sons, New York, NY. pp. 2033-2049.
- Chang, C.H., Mann, D.E. and Gautieri, R.F. (1977) *Teratogenicity of zinc chloride, 1, 10-phenanthroline, and a zinc-1,10-phenanthroline complex in mice*. **J. Pharm. Sci.** 66:1755-1758.
- Gilman, A.G., Goodman, L.S., Rall, T.W. and Murad, F. (1985) The Pharmacological Basis of Therapeutics. 7th Ed. MacMillan Publishing Company. NY, NY.
- Lam, H.F., Persch, R. and Amdur, M.O. (1982) *Changes in lung volume and diffusing capacity in guinea pigs exposed to a combination of sulfur dioxide and submicron zinc oxide mixed in a humidified furnace*. **Toxicol. Appl. Pharmacol.** 66:427-433.
- Lam, H.F., Conner, J.W., Rodgers, A.E., Fitzgerald, S. and Amdur, M.O. (1985) *Functional and morphological changes in the lungs of guinea pigs exposed to freshly-generated ultrafine zinc oxide*. **Toxicol. Appl. Pharmacol.** 78:29-38.
- Leonard, A. (1985) Chromosomal damage in individuals exposed to heavy metals. In: H. Sigel (ed.), Metal Ions in Biological Systems.
- Matarese S.L. and Matthews, J.I. (1986) *Zinc chloride (smoke bomb) inhalation lung injury*. **Chest.** 89:308-9.
- Miyaki, M., Murata, I., Osabe, M. and Ohno, T. (1977) *Effect of metal cations on mis-incorporation by E. Coli DNA polymerases*. **Biochem. Biophys. Res. Commun.** 77:854-860.
- Sirover, M.A. and Loeb, L.A. (1976a) *Metal-induced infidelity during DNA synthesis*. **Proc. Natl. Acad. Sci.** 73:2331-2335.
- Sirover, M.A. and Loeb, L.A. (1976b) *Infidelity of DNA synthesis in vitro: Screening for potential metal mutagens or carcinogens*. **Science** 194:1434-1436.
- U.S. Environmental Protection Agency (U.S. EPA) (1987a) *Summary review of the health effects associated with zinc and zinc oxide*. **Health Issue Assessment**. EPA/600/8-87/022F. Office of Health and Environmental Assessment. Washington, D.C.
- U.S. Environmental Protection Agency (U.S. EPA) (1987b) *Assessment of zinc and zinc oxide as potentially toxic air pollutants*. **Federal Register**

C.2: Ecological Toxicity Profiles

Antimony (Sb)

Antimony is a naturally occurring element, with a concentration range between 0.2 and 0.5 mg/kg in the Earth's crust. It may enter aquatic systems from natural weathering of rocks, from precipitation that travels by overland flow or percolation through soils, and from anthropogenic sources such as mining, manufacturing operations, and municipal and industrial discharges. Environmental concentrations of antimony are reported as 1.1 µg/L in freshwater streams, and in the low mg/kg range for uncontaminated sediments (US EPA, 1980).

The antimony TRV for mammalian receptors was based on a mouse study by Schroeder *et al.* (1968, as cited in Sample *et al.*, 1996). Antimony potassium tartrate administered in the water at a concentration of 5.0 ppm reduced the longevity of female laboratory mice. A 1.25 mg/kg-d dose was considered to be a chronic LOAEL. The chronic NOAEL was estimated by multiplying the chronic NOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.

Little information regarding the toxicity and chronic effects of antimony on birds was available. The antimony TRV for avian receptors was based on a study by Damron and Wilson (1975). They reported a NOAEL for growth endpoints of 840 mg/kg-d for bobwhite quail.

Arsenic (As)

Arsenic is a naturally occurring element in the earth's crust with an average concentration of 2 – 5 mg/kg. Although natural processes (wind-blown dirt and volcanoes) are a source of arsenic, anthropogenic sources (mining, smelting, pesticides, combustion, and waste incineration) contribute a large percent of arsenic found in the environment. Arsenic is widely distributed in surface water with nationwide median arsenic concentrations of 1 µg/L. Arsenic in soil is primarily associated with inorganic arsenic found in igneous and sedimentary rocks. Background arsenic concentrations in soil range from 1 to 40 µg/g, with a mean concentration of 5 µg/g (ATSDR, 2000a).

The arsenic TRV for mammalian receptors was based on a rat study by Schroeder *et al.* (1968, as cited in Sample *et al.*, 1996). Rats were exposed to arsenic in their diet for three generations. Litter size was reduced in each succeeding generation. Rats exposed to arsenic displayed declining litter sizes with each successive generation. The single dose used in the study, 3.2 mg/kg-d, was considered a chronic

LOAEL (Sample *et al.*, 1996). The chronic LOAEL was multiplied by an uncertainty factor of 10 resulting in a chronic NOAEL of 0.32 mg/kg-d (Sample *et al.*, 1996).

The arsenic TRV for avian receptors was based on a mallard duck study by the U.S. FWS (1964, as cited in Sample *et al.*, 1996). Mallard ducks were exposed to sodium arsenite (51.35% arsenic) in their diet at 100, 250, 500, and 1,000 ppm for a period of 128 days. Mallards exposed to the three highest dose levels experienced dose-dependent mortality. Mallards exposed at the 100 ppm dose level did not experience significant increases in mortality when compared to controls. A chronic NOAEL of 5.14 mg/kg-d was derived from the 100 ppm dose level because exposures were over 128 days (assuming sodium arsenite is 51.35% arsenic, a food ingestion rate of 0.1 kg/day, and a body weight of 1 kg).

Barium (Ba)

Barium is naturally occurring commonly found in igneous rocks, sandstone, shale and coal. Both natural and anthropogenic sources release barium into the environment. Barium is found in almost all surface water and drinking water at concentrations ranging from 2 to 380 µg/L. Barium concentrations in soil is found ranging from 15 to 3,000 ppm (ATSDR, 1992).

The barium TRV for mammalian receptors was based on a rat study by Borzelleca *et al.* (1988, as cited in Sample *et al.*, 1996). Rats were exposed to barium in water by oral gavage at four dose levels (66, 96, 138, and 198 mg/kg-d) for 10 days. Exposure at the highest dose level resulted in 30% mortality in female rats. No adverse effects were observed at the other dose levels. The 138 mg/kg-d dose was considered to be a subchronic NOAEL. The subchronic NOAEL was divided by a subchronic to chronic uncertainty factor of 10 resulting in a chronic NOAEL of 13.8 mg/kg-d.

The barium TRV for avian receptors was based on a chick study by Johnson *et al.* (1960, as cited in Sample *et al.*, 1996). Eight groups of day-old chicks were fed barium hydroxide in their diet at eight dose levels (250, 500, 1,000, 2,000, 4,000, 8,000, 16,000, and 32,000 ppm) over a 4 week period. The highest dose level at which no mortality occurred was 2,000 ppm, but that dose level produced a slight depression in growth. The 4,000 ppm dose level caused significant depression of growth. The 2,000 ppm level was used to derive a subchronic NOAEL of 208.26 mg/kg-d (assuming a food-consumption rate of 0.0126 kg/day and a body weight of 0.121 kg; Sample *et al.*, 1996). The subchronic NOAEL was divided by an uncertainty factor of 10 resulting in a chronic NOAEL of 20.8 mg/kg-d.

Beryllium (Be)

Beryllium is the 44th most abundant element in the Earth's crust with an average concentration of 2 – 50 mg/kg. Beryllium is naturally released in the environment by windblown dust and volcanic particles. A larger portion of beryllium found in the atmosphere is from anthropogenic sources (combustion, ore processing, metal fabrication, waste incineration). Beryllium was detected in 5.5% of the 50,000 USGS ambient surface water monitoring stations in 1988 with a mean concentration of 1.9 µg/L. Beryllium concentration in soil depends on the type of soil present. Beryllium occurs in silicate and feldspar minerals resulting in varying concentrations in soil of <1 to 15 mg/kg (ATSDR, 2000b).

The beryllium TRV from mammals was based on a chronic rat study by Schroeder and Mitchner (1975). Rats were exposed to beryllium in drinking water *via* oral gavage for over a year. Because no adverse effects (in terms of lifespan, heart, kidney, liver and spleen), were observed in the beryllium-exposed rats compared to the controls, a chronic NOAEL of 0.55 mg/kg-d was derived from the maximum dose level (Schroeder and Mitchner, 1975).

No information regarding the toxicity and chronic effects of beryllium on birds was available.

Cadmium (Cd)

A small portion of cadmium found in the environment is released from natural weathering of minerals, forest fires, and volcanic emissions. The majority of cadmium released in the environment is from human activities such as mining and smelting operations, fuel combustion, disposal of metal-containing products, fertilizer and sewage sludges. Reported background levels of cadmium in unpolluted waters vary from 0.02 – 3 µg/L. Mean cadmium concentration in the United States topsoil is 0.25 ppm (ATSDR, 1999).

The cadmium TRV for mammalian receptors was based on a rat study by Sutou *et al.* (1980, as cited in Sample *et al.*, 1996). Rats were given cadmium (cadmium chloride) by oral gavage at three dose levels (0.1, 1.0, and 10.0 mg/kg-d) for six weeks through mating and gestation. No adverse effects were observed at the 1.0 mg/kg-d dose level. Fetal implantation and fetal survivorship were reduced and fetal resorption increased among the 10 mg/kg-d dose group. Because the study considered oral exposure during reproduction, the 1.0 mg/kg-d dose level was considered a NOAEL.

The cadmium TRF for avian receptors was based on a mallard duck study by White and Finley (1978, as cited in Sample *et al.*, 1996). Mallard ducks were given cadmium chloride in their diet at three

dose levels (1.6, 15.2, and 210 ppm) over a 90 day period. Mallards at the 210 ppm dose level produced significantly fewer eggs than those at the other dose levels. Because the study considered exposure over 90 days, including a critical life stage (*i.e.*, reproduction), the 15.2 ppm dose level was used to derive a chronic NOAEL of 1.45 mg/kg-d (assuming a food consumption rate of 0.11 kg/d and a body weight of 1.153 kg; White and Finley, 1978, as cited in Sample *et al.*, 1996).

Chromium (Cr)

Chromium is naturally occurring with continental dust contributing a small percentage of chromium present in the environment. Human activities such as combustion processes and ore processing release larger amounts of chromium into the atmosphere. Chromium concentrations in U.S. rivers range from <1 to 30 µg/L. Chromium concentrations in soil depend on the composition of the parent rock. Basalt and serpentine, ultramafic rocks, and phosphorites contain high levels of chromium while granite and sandstone contain lower concentrations. Concentrations of chromium in U.S. soils ranged from 1 – 2000 mg/kg (ATSDR, 2000c).

The chromium TRV for mammalian receptors was based on a rat study by Ivankovik and Preussman (1975, as cited in Sample *et al.*, 1996). Rats were fed chromium oxide (68.42% chromium; as a trivalent form of chromium) at 10,000, 20,000, and 50,000 ppm in their diet for 90 days and 2 years. The study endpoints were reproduction for the 90-day group and cancer and longevity for the 2-year group. Because no adverse effects were observed for any group at any of the dose levels, a chronic NOAEL of 2,737 mg/kg-d was derived from the maximum dose level (based on 68.42% chromium in chromium oxide, a food-consumption rate of 0.028 kg/day, and body weight of 0.35 kg; Sample *et al.*, 1996). The chromium TRV for avian receptors was based on a black duck study by Haseltine *et al.* (1985, unpublished data as cited in Sample *et al.*, 1996). Black ducks were fed a trivalent form of chromium in their diet. Ducks were fed chromium at 10 and 50 ppm in their diet for 10 months, including a critical life stage. No significant differences were observed in duckling survival rates at the 10 ppm level. A chronic NOAEL of 1.0 mg/kg-d was derived from the 10 ppm dose (assuming a food consumption rate of 0.125 kg/day and a body weight of 1.25 kg; Sample *et al.*, 1996).

Copper (Cu)

Copper is a naturally occurring element present in the earth's crust. Natural releases to air and water from windblown dust, volcanic eruptions, *etc.* contribute a small percentage of copper found in the environment. The majority of copper found can be attributed to anthropogenic activities. Copper concentrations in surface waters range from 0.5 – 1,000 µg/L. Copper occurs naturally at levels of

approximately 50 ppm in the earth's crust. Depending on the soil type, copper concentrations can vary between 1 – 300 mg/kg (ATSDR, 2002a).

The copper TRV for mammalian receptors was derived from a mink feeding study by Aulerich *et al.* (1982, as cited in Sample *et al.*, 1996). Mink were fed at 25, 50, 100, and 200 ppm supplemental copper sulfate in their diet plus 60.5 ppm copper in the base feed for 357 days. The three highest dose levels decreased the survival rate of kits; however, the 25 ppm (supplemental, 85.5 total copper) dose level increased survivorship relative to the control group. Because the exposures were approximately one year in duration and included a critical life stage, a chronic NOAEL of 11.7 mg/kg-d was derived from the 25 ppm (supplemental plus the 60.5 ppm copper in base feed, resulting in 85.5 ppm total) dose level (assuming a food consumption rate of 0.137 kg/day and a body weight of 1 kg; Sample *et al.*, 1996).

The copper TRV for avian receptors was based on a chick study by Mehring *et al.* (1960, as cited in Sample *et al.*, 1996). Chicks were fed copper oxide in their diets for 10 weeks at eleven dose levels (36.8, 52, 73.5, 104, 147.1, 208, 294.1, 403, 570, 749, and 1,180 ppm). Chick mortality increased at the two highest dose levels, whereas consumption of copper up to and including the 570 ppm dose level had no effect on chick growth. A chronic NOAEL of 47 mg/kg-d was derived from the 570 ppm dose level (assuming food consumption of 0.044 kg/day and a body weight of 0.534 kg; Sample *et al.*, 1996).

Lead (Pb)

Lead is a naturally occurring element found in the earth's crust. Both natural and anthropogenic processes have released lead into the environment, anthropogenic releases being more predominant. Lead concentrations in surface water depend on pollution, lead content of sediment and characteristics of the water system (pH, temperature, *etc.*). Levels of lead in U.S. surface waters typically range between 5 and 30 µg/L. Sediments contain higher lead concentrations than surface water. Average lead content of river sediments is approximately 20,000 µg/g. The natural content of lead in soil is from the earth's crust (mostly as galena), ranging from <10 to 30 µg/g soil (ATSDR, 1997).

The lead TRV for mammalian receptors was based on a rat study by Azar *et al.* (1973, as cited in Sample *et al.*, 1996). Rats were fed lead acetate in their diets over three generations at five dose levels (10, 50, 100, 1,000, and 2,000 ppm). Of the five doses levels administered, the two highest doses were associated with reduced offspring weights and kidney damage in the young. No adverse effects were observed related to other reproductive indices. A chronic NOAEL of 8 mg/kg-d was derived from the 100 ppm dose level (assuming food consumption of 0.028 kg/day and body weight of 0.35 kg; Sample *et al.*,

1996). This is a conservative NOAEL because lead acetate is generally more readily absorbed than the forms of lead likely to be found at the site.

The lead TRV for avian receptors was based on an American kestrel study by Patee (1984, as cited in Sample *et al.*, 1996). American kestrels were fed metallic lead for 7 months at 10 and 50 ppm dose levels. No significant effects were observed at either dose levels. A NOAEL for kestrels of 3.85 mg/kg-d was derived from the maximum dose of 50 ppm (assuming food consumption rate of 0.01 kg/day and body weight of 0.13 kg; Sample *et al.*, 1996).

Manganese (Mn)

Manganese is ubiquitous in the environment and found in two forms: organic and inorganic. Levels of organic manganese in soil and water and toxicity information on organic manganese is limited. Dissolved manganese concentration in ambient surface waters range from 0.3 to 3,230 µg/L. Manganese comprises of 0.1% of the Earth's crust. Average background manganese concentrations range from 40 to 900 mg/kg (ATSDR, 2000d).

The manganese TRV for mammalian receptors was based on a rat study by Laskey *et al.* (1982, as cited in Sample *et al.*, 1996) in which manganese oxide was added to the food. Three dose levels (350, 1,050, and 3,500 ppm) were administered to rats for 224 days including the gestation period. The percentage of pregnancy and fertility was significantly reduced in the rats consuming the highest dose level. No other effects were noted at the highest dose level and no effects were noted at the other two dose levels. A chronic NOAEL of 88 mg/kg-d was derived from the 1,100 ppm dose level at which there no observed effects (based on a food consumption rate of 0.028 kg/day and a body weight of 0.35 kg; Sample *et al.*, 1996).

The manganese TRV for avian receptors was based on a Japanese quail study by Laskey and Edens (1985, as cited in Sample *et al.*, 1996). Male Japanese quail were fed manganese in their diet for 75 days beginning when they were one day old at a dose level of 5,000 ppm. Reduction in growth and other adverse effects were not observed at the this dose level. The 5,000 ppm dose level was used to derive a chronic NOAEL. Daily manganese intakes were reported to range from 575 mg/kg-d for adults at the end of the study to 977 mg/kg-d for 20 day-old birds. A chronic NOAEL of 776 mg/kg-day was derived based on the average of the daily manganese intakes.

Mercury (Hg)

Mercury is naturally occurring and found in the environment in various inorganic and organic complexes and in metallic form. Ambient concentrations of mercury in surface water were generally less than 5 ng/L. Average mercury soil concentrations in the US ranged from 20 to 625 ng/g (ATSDR, 1994a).

The mercury TRV for mammalian receptors was based on a mouse study by Revis *et al.* (1989, as cited in Sample *et al.*, 1996). Mice were fed mercuric sulfide in their diet at 13 dose levels up to a maximum of 13.2 mg/kg-d for 20 months. No adverse effects were observed at any dose level. Because the study was over one year in duration, the maximum dose of 13.2 mg/kg-d was considered to be a chronic NOAEL.

The mercury TRV for avian receptors was based on a study of Japanese quail by Hill and Schaffner (1976, as cited in Sample *et al.*, 1996). Japanese quail were fed mercuric chloride in their diet at five dose levels (2, 4, 8, 16, and 32 ppm) for a one year period including the reproduction cycle. Although egg production increased with increased dose, fertility and hatchability decreased. The chronic NOAEL of 0.45 mg/kg-d was derived from the 4 ppm dose level at which no adverse effects were evident (assuming food consumption rate of 0.0169 kg/day and body weight of 0.15 kg; Sample *et al.*, 1996).

Nickel (Ni)

Nickel is a naturally occurring element. A fifth of all nickel releases is from natural sources (windblown dust, vegetation, and volcanic eruptions), while the remaining four-fifths is from anthropogenic sources (combustion, metal refining, incineration, steel production, and alloy production). Surface waters contain low nickel levels, typically ranging from 15 – 20 µg/L. Nickel content in soil depends on the geology of the parent rock. Typical nickel levels in soil are reported between 4 and 80 ppm (ATSDR, 2005).

The nickel TRV for mammalian receptors was based on a rat study by Ambrose *et al.* (1976, as cited in Sample *et al.*, 1996). Nickel, as nickel sulfate hexahydrate, was added to the diet of rats for three generations at three dose levels (250, 500, and 1,000 ppm). At the 1,000 ppm dose level, offspring displayed reduced body weights in all generations. A chronic NOAEL of 40 mg/kg-d was derived from the 500 ppm dose level (assuming food consumption rate of 0.028 kg/day and body weight of 0.35; Sample *et al.*, 1996).

The nickel TRV for avian receptors was derived from a mallard duckling study by Cain and Pafford (1981, as cited in Sample *et al.*, 1996). Nickel sulfate was added to the diet of mallard ducklings for a period of 90 days at 176, 774, and 1,069 ppm dose levels. There were no reductions in growth rate, body weight, bill length, or increased mortality at the 774 ppm dose level when compared to controls. Ducklings receiving the highest dose of 1,069 ppm showed reduced growth and a 70% mortality rate. A chronic NOAEL of 77.2 mg/kg-d was derived from the 774 ppm dose level (assuming a food ingestion rate of 0.078 kg/day and a body weight of 0.782 kg; Sample *et al.*, 1996).

Selenium (Se)

Selenium is a naturally occurring element (metal) that is used in the manufacture of glass, photocopying, electronics, pigments, dyes, and insecticides. The solubility of Selenium compounds varies widely, from very high (sodium selenate) to very insoluble (heavy metals selenides). Selenium is adsorbed by iron and manganese hydroxides, iron sulfides, and organic matter (US EPA, 1979). Selenium is generally detected in surface waters at low concentrations. In a study reviewing selenium concentrations from major watersheds, selenium was only detected in 2 of the 535 samples at concentrations greater than 0.010 mg/L. Selenium is also estimated to be the 69th most abundant element in the earth's crust with an average concentration of 0.05 – 0.09 mg/kg. High levels of selenium are found in sulfide mineral galena, chalcopyrite, arsenopyrite, sphalerite, pyrite, marcasite, and pyrrhotite. Selenium concentration of most soils in the US range from 0.01 to 0.2 mg/kg (ATSDR, 2001).

Selenium is an essential element in animal nutrition at low concentrations, but it is extremely toxic at higher concentrations (US EPA, 1979). The acute LC₅₀ (96-hour) values for eight species of freshwater fish ranged from 620 µg/L for fathead minnows (*Pimephales promelas*) to 28,5000 µg/L for bluegill sunfish (*Lepomis macrochirus*) (US EPA, 1987).

Female rats were exposed to 1.5, 2.5 and 7.5 mg of potassium selenate/L in drinking water and observed for reproductive effects (Rosenfield and Beath, 1954, as cited in Sample *et al.*, 1996). No adverse effects on reproduction were observed among rats exposed to 1.5 mg potassium selenate/L in drinking water. However the number of second-generation young were reduced by half among females exposed to 2.5 mg/L. Fertility, juvenile growth and survival were reduced among females exposed to 7.5 mg/L. The study considered exposure over multiple generations. The 1.5 mg/L dose with an exposure rate of 46 mL/day and a body weight of 0.35 kg was used to calculate the NOAEL of 0.20 mg/kg/d. The LOAEL of 0.33 mg/kg/d was calculated using 2.5 mg/L with the same exposure rate and body weight as the NOAEL. Heinz (1986, as cited in Sample *et al.*, 1996) exposed mallard ducks to 1, 5, 10, 25, and 100

ppm of sodium selenite for 78 days to observe reproductive effects. Heinz observed no effect on weight and survival of the mallards exposed to 1,5, or 10 ppm. Mallards exposed to 100 ppm sodium selenite had reduced adult survival and mallards exposed to 25 ppm had reduced duckling survival. Because 5 ppm was the highest dose level that produced no adverse effects, it and the feeding raze of 100g/day with a body weight of 1 kg were used to calculate the NOAEL of 0.5 mg/kg/d. The lowest dose at which adverse effects were observed, 10 ppm, was considered to be a chronic LOAEL.

Silver (Ag)

Silver is a rare, naturally occurring element, released into the environment *via* weathering of rocks and erosions of soil. Anthropogenic releases from ore processing, steel refineries, cement manufacturing, combustion and incineration account for the large percentage of silver found in the environment. Ambient silver concentrations in surface water vary with a mean concentration of 0.2 µg/L. Average ambient silver concentration in soil is measured at 0.3 ppm (ATSDR, 1990a).

The silver TRV for mammalian receptors was based on an albino rat study by Matuk *et al.* (1981). Groups of albino rats were given a 2,500 ppm solution of silver nitrate to drink for six months. Rats drinking the silver nitrate solution gained weight at a slower rate than the control group until about the 23rd week when some of the test animals began to loose weight more rapidly. When the test solution was removed and rats were allowed to drink water, body weights increased and approached that of the control group. A chronic LOAEL of 328.6 mg/kg-d was derived from the 2,500 ppm dose level because of the duration of the study (assuming water consumption rate of 0.046 L/day and body weight of 0.35 kg; Sample *et al.*, 1996). The chronic LOAEL was divided by an uncertainty factor of 10 resulting in a chronic NOAEL of 32.86 mg/kg-d. The silver TRV for avian receptors is based on a study by Peterson and Jensen (1975) in which silver was added to the diet of day-old chicks. A single dose level of 900 ppm was given to chicks over a 28-day period. A significant decrease in growth rate was observed in chicks receiving the silver when compared to controls. Because the addition of silver to the diet significantly decreased the growth rate of young chicks during a critical life stage, the single dose level was used to derive a chronic LOAEL of 62.2 mg/kg-d (assuming a food ingestion rate of 0.0423 kg/day and a body weight of 0.612 kg at 28 days). The chronic LOAEL was divided by an uncertainty factor of 10 resulting in a chronic NOAEL of 6.22 mg/kg-d

Thallium (Tl)

Thallium is a common element with a concentration range between 0.3-0.6 mg/kg in the earth's crust. Compounds are formed from the Tl(I) and Tl(III) oxidation states. Thallium's production and use

in the manufacture of thallaphide cells, atomic beam clocks, photoelectric cells, lamps, thermometers, alloys, semiconductors and scintillation counters may result in its release to the environment through various waste streams. Thallium has been detected in air effluent particulate matter from cement factories, metal smelters and coal burning plants. Particulate-phase thallium is expected to be physically removed from the air by wet and dry deposition. Due to the ionic nature of thallium, volatilization from soil or water surfaces is not expected. Thallium has been detected in fish and plants and monitoring data suggest that it may bioconcentrate in aquatic organisms (HSDB, 2000). Since thallium is naturally occurring, it is present in ambient waters in trace amounts. A survey of tap water from 2,834 homes detected thallium in 0.68% of the samples at an average thallium concentration of 0.89 µg/L. Thallium concentration in the Earth's crust is estimated to range from 0.3 to 0.7 ppm (ATSDR, 1991).

Dietary exposure to 162 mg/Kg of Thallium a day among red-winged blackbirds resulted in a LD₅₀ for mortality (Schafer *et al.*, 1983). Formigli *et al.* (1986, as cited in Sample *et al.*, 1996) exposed male rats to 10 ppm of thallium sulfate for 60 days to determine the effects of male testicular function. Rats exposed to 10 ppm displayed reduced sperm mobility and was used as a basis for the subchronic LOAEL of 0.074 mg/kg/d. The chronic NOAEL was estimated by multiplying the subchronic LOAEL by a subchronic-chronic uncertainty factor of 0.1 and a LOAEL-NOAEL uncertainty factor of 0.1 to produce a dose of 0.0074 mg/kg/d.

Vanadium (V)

Vanadium is a light gray or white lustrous powder or fused lump that is insoluble in water. It is produced primarily from petroleum residues. Vanadium and its compounds are used mainly as alloys for steel and as industrial catalysts. Vanadium itself is nontoxic, but compounds containing this metal, particularly the oxides, may be toxic (Sittig, 1985). In soil, vanadium mobility is expected to be dictated by soil pH; mobility is expected to be lower in acidic soils (HSDB, 2001). The more soluble pentavalent cation may leach. Clay soils studied have more vanadium than other soils. Vanadium concentration in surface water varies based on geographic variations at concentrations from 0.3 to 200 µg/L. Soil vanadium concentrations is dependent on the parent rock type and found at concentrations of 3 – 310 mg/kg (ATSDR, 2002b). A review of available literature yielded little information on the toxicity of this metal.

Domingo *et al.* (1986, as cited in Sample *et al.*, 1996) exposed rats to three dose levels (5, 10, and 20 mg) of sodium metavanadate to rats for 60 days prior to gestation, plus through gestation, delivery and lactation to observed vanadium's effects on reproduction. Significant differences in reproductive

parameters (*i.e.*, number of dead young per litter, size and weight of offspring) were observed at all dose levels. Therefore the lowest dose was considered the chronic LOAEL, resulting in a dose of 2.1 mg/kg/d. The chronic NOAEL of 0.21 mg/kg/d was calculated by multiplying the chronic LOAEL by a LOAEL-NOAEL uncertainty factor of 0.1.

Zinc (Zn)

Zinc is a naturally occurring element found in the earth's crust. Although natural releases of zinc occur, anthropogenic sources contribute a large portion of the zinc released in the environment. Background zinc concentrations in surface water is usually less than 50 µg/L. In general, zinc is more concentrated in sediments of streams and rivers than in the water column. Zinc is found in US soils at concentrations between 10 and 300 mg/kg (ATSDR, 1994b).

The zinc TRV for mammalian receptors was based on a rat study by Schlicker and Cox (1968, as cited in Sample *et al.*, 1996). Female rats were fed zinc oxide in their diet at 2,000 and 4,000 ppm dose levels during day 1 through day 16 of gestation. At the 4,000 ppm dose level, rats exhibited a higher incidence of fetal resorption and reduced fetal growth rates. At the 2,000 ppm dose level, female rats did not give birth to offspring external anatomical malformations in the fetuses. A chronic NOAEL of 160 mg/kg-d was derived from the 2,000 ppm dose level because the study investigated zinc exposures during a critical life stage (assuming a food consumption of 0.028 kg/day and a body weight of 0.35 kg; Sample *et al.*, 1996).

The zinc TRV for avian receptors was based on a white leghorn hen study by Stahl *et al.* (1990, as cited in Sample *et al.*, 1996). White Leghorn hens were given zinc sulfate in their diet at 48, 228, and 2,028 ppm dose levels for 44 weeks. Hatchability of eggs laid by hens exposed to the 2,028 ppm dose level was less than 20% of controls. No adverse effects were seen among hens at the 48 and 228 ppm dose level. A chronic NOAEL of 14.5 mg/kg-d was derived from the 228 ppm dose (assuming food consumption of 0.123 kg/day and body weight of 1.935 kg; Stahl *et al.*, 1990, as cited in Sample *et al.*, 1996).

Acetone

The acetone TRV for mammalian receptors was based on a rat study by the EPA (1986, as cited in Sample *et al.*, 1996). Rats were exposed to acetone *via* oral intubation for 90 days at 100, 500, and 2,500 mg/kg-d, assuming a body weight of 0.35 kg. Significant kidney damage was observed at the two highest dose levels and liver weights increased at the highest dose level. No significant differences were

observed at the 100 mg/kg-d dose level. This dose level was considered to be a subchronic NOAEL because the exposure duration was 90 days, and it did not include a critical life stage. The subchronic NOAEL was divided by an uncertainty factor of 10 resulting in a chronic NOAEL of 10 mg/kg-d. No suitable studies were available to estimate the acetone TRV for avian receptors. A chronic NOAEL of 1.0 mg/kg-d was derived by dividing the chronic NOAEL for rats by an uncertainty factor of 10.

Benzo(a)pyrene

Because there is a paucity of suitable studies assessing the toxicity of individual polycyclic aromatic hydrocarbons (PAHs), toxicity information for benzo(a)pyrene was used to derive TRV for acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, chrysene, dibenzo(ah)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3,cd)pyrene, naphthalene, 2-methylnaphthalene, phenanthrene, and pyrene. Benzo(a)pyrene, often considered the most toxic PAH, is never found by itself in the environment. It is always a component of a complex mixture of compounds. Many of these compounds evoke similar biological responses to a lesser degree. This fact forms the basis for toxicity equivalency factors (TEFs). There are three possible approaches to assess the toxicity of a mixture of related compounds when definitive toxicity information is available for only one component of the mixture: 1) evaluating the toxicity of the mixture based on the single component alone while ignoring the other components; 2) treating all components as if they were equally toxic; or 3) developing some relative potency ranking approach in which the toxicity of the other components are indexed to that of the most potent compound using a weighing factor called the toxicity equivalence factor (TEF) (Birnbaum, 1999). Only the last approach is scientifically defensible, although there is uncertainty in the approach. Clearly, additional studies are needed to more precisely understand the limitations of the TEF approach. Current documentation in fish and other wildlife species indicates that the uncertainties associated with not using such an approach are greater than the uncertainties of using it (Tillitt, 1992).

Relative potential potencies have been developed for polycyclic aromatic hydrocarbons (PAHs) for which there are inadequate data to develop compound-specific toxicity factors. These relative potential potencies, also referred to as toxicity equivalency factors (TEFs), are multiplied by benzo(a)pyrene NOAEL to estimate the TRVs for the other PAHs. The relative potential potencies used in this risk assessment were obtained from MADEP (1995). For those compounds where relative potential potencies are not available (*i.e.*, acenaphthene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene), relative potential potencies were taken from Nisbet and LaGoy (1992). The relative potential potency for dibenzofuran has been found to be similar to anthracene

based on related chemical structure (HSDB, 2004). Benzo(a)pyrene toxicity criteria were multiplied by the potential potencies listed below to derive TRVs for the other PAHs.

PAHs Potential	Potencies	Source
Dibenzo(a,h)anthracene	1.0	a
Benzo(a)pyrene	1.0	a
Benzo(a)anthracene	0.1	a
Benzo(b)fluoranthene	0.1	a
Indeno (1,2,3-cd)pyrene	0.1	a
Anthracene	0.01	b
Benzo(g,h,i)perlyene	0.01	b
Benzo(k)fluoranthene	0.01	a
Chrysene	0.01	a
Dibenzofuran	0.01	c
Acenaphthene	0.001	b
2-Methylnaphthalene	0.001	b
Fluoranthene	0.001	b
Fluorene	0.001	b
Naphthalene	0.001	b
Phenanthrene	0.001	b
Pyrene	0.001	b

a MADEP, 1995

b Nisbet and LaGoy, 1992

c HSDB, 2004

The benzo(a)pyrene TRV for mammalian receptors was based on a mouse study by Mackenzie and Angevine (1981). Mice were fed benzo(a)pyrene by oral intubation from day 7 to day 16 of gestation at 10, 40, and 160 mg/kg-d. The weights of offspring were reduced in each of the three dose levels tested, and other adverse effects were also noted in the two highest dose groups (*i.e.*, sterility and fertility problems in the offspring, and reduced percentage of viable births in the dams). The lowest dose level was considered a chronic LOAEL. The chronic LOAEL was divided by an uncertainty factor of 10, resulting in a chronic NOAEL of 1.0 mg/kg-d (assuming a body weight of 0.03 kg).

The benzo(a)pyrene TRV for avian receptors was based on a pigeon study by Hough *et al.* (1993). Benzo(a)pyrene was given intramuscularly at one dose level (10 mg/kg body weight) once a week to pigeons over a five-month period. The number and size of arterial lesions in the brachiocephalic arteries were enhanced after long-term dosing. In addition, chronic administration of benzo(a)pyrene resulted in decreased fertility in female birds. A chronic LOAEL of 1.43 mg/kg-d was derived from the weekly dose. The chronic LOAEL was divided by uncertainty factor of 10, resulting in a chronic NOAEL of 0.143 mg/kg-d.

In the absence of available and appropriate toxicity data for other PAH compounds, toxicity information for benzo(a)pyrene was used to derive mammalian and avian TRVs for the remaining PAHs

using the mammalian relative potency values described above. Evidence reported by Sanderson and Van den Berg (1999) show statistically highly significant correlations when using mammalian potential potencies for avian species (*e.g.*, great blue herons, double-crested cormorants, and great cormorants). Although a certain level of uncertainty is associated with this approach, in the absence of any defensible approach, the relative potential potencies used to derive mammalian TRVs are also applied for avian TRVs.

Polychlorinated Biphenyls (PCBs)

Aroclor 1254 was conservatively chosen as a TRV for total PCBs because it is generally the most toxic PCB formulation that is widely studied (*e.g.*, Tables 5-2 and 5-3) (Aulerich and Ringer, 1977; McLane and Hughes, 1980; Ringer, 1983).

The PCB TRVs for mammalian receptors were based on a recent mink study by Bursian *et al.* (2002, as cited in US EPA, 2003). Bursian and co-workers fed fish caught from the Housatonic River to mink. Five treatment diets containing target concentrations of 0.055 mg/kg PCBs (control), 0.34 mg/kg, 0.56 mg/kg, 0.90 mg/kg, 1.6 mg/kg, and 3.7 mg/kg. The diets were fed to captive adult female mink for approximately 160 days. The exposure period for adult females began approximately 2 months prior to mating, and continued through mating and whelping of the kits. Some kits were exposed for an additional 6 months following whelping. Effect on breeding success (number of females bred/total number of females) or whelping success (number of females whelping/number of females bred) of female mink and gestation length was not significantly altered by exposure treatments. Average litter size and kit survival at birth and 3 weeks of age were also not affected by the exposure treatments. The decrease in percent survival of kits in the 3.7 mg/kg PCB treatment group at 6 weeks of age was lower when compared to kits in the control and 1.6 mg/kg PCB treatment groups. There were no significant differences between treatments for adult female body weights at the beginning of the study, during the pre-breeding period, and at 3 and 6 weeks post whelping. However, there was a significant treatment interaction for kit body weights from birth to 6 weeks of age. Kits in the 3.7 mg/kg PCB treatment group had significantly lower body weights when compared to kits in the other groups. At 6 weeks of age, however, mean kit body weight in the 3.7 mg/kg PCB treatment group was only slightly lower than mean kit body weights observed in the control treatment (251 ± 16.2 g *versus* 293 ± 11.3 g, respectively). From 10 to 30 weeks of age, differences in kit body weights between treatments were minor and did not have a dose-dependent relationship with PCBs.

The 1.6 and 3.7 mg/kg treatment diets represent the NOAEL (0.17 mg/kg-day) and LOAEL (0.41 mg/kg-day), respectively (US EPA, 2003). Aroclor 1260 was the predominant Aroclor present in the PCBs in the Bursian study and is generally considered less toxic than Aroclor 1254, the predominant Aroclor present at the YNPS site. Therefore, the NOAEL and LOAEL derived from the Bursian *et al.* study were adjusted using the toxicity equivalency factor (TEF) scheme proposed by the World Health Organization (WHO) in 1997 (Van den Berg *et al.*, 1998). This adjustment yields the TRVs shown in the table below. Comparison of congeners present in Aroclor 1260 vs. 1254 yields a TEF adjustment factor of 0.51 for Aroclor 1254 from 1260. Note that the TEF adjustment factor of 0.51 for Aroclor 1254 vs. 1260 is consistent with an adjustment factor of 0.5 (extrapolated visually) from Figure 3 from the Tillitt *et al.* (1992) paper, which showed the relative potency of Aroclor 1260 compared to Aroclor 1254 in the H4IIE rat hepatoma cell bioassay.

	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)
Bursian <i>et al.</i> , study (Aroclor 1260)	0.17	0.41
Modified Bursian TRV (Aroclor 1254)	0.09	0.21

The avian TRV was interpolated from the results of chicken studies as reported by US EPA (Lillie *et al.*, 1974; Lillie *et al.*, 1975; Scott, 1977; as cited in US EPA, 2003). Dose-response relationships were observed for hatchability and chick bodyweight. For avian receptors, the proposed NOAEL is 0.4 mg/kg-day and the LOAEL is 0.5 mg/kg-d for Aroclor 1248 (US EPA, 2003).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1990a. "Toxicological Profile for Silver (Draft)." National Technical Information Service (NTIS). 143p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1990b. "Toxicological Profile for Vanadium (Draft)." National Technical Information Service (NTIS). 129p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1991. "Toxicological Profile for Thallium (Draft)." National Technical Information Service (NTIS). 115p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. "Toxicological Profile for Barium and Compounds." National Technical Information Service (NTIS). NTIS PB93-110658 ; ATSDR/TP-91/03. 137p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1994a. "Toxicological Profile for Mercury (Update)." National Technical Information Service (NTIS). NTIS PB95-100194. 357p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1994b. "Toxicological Profile for Zinc (Update)." National Technical Information Service (NTIS). 239p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. "Toxicological profile for lead (Update - Draft for public comment)." National Technical Information Service (NTIS). 483p.

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. "Toxicological profile for cadmium (update)." National Technical Information Service (NTIS). NTIS PB99-166621. 397p.

Agency for Toxic Substances and Disease Registry (ATSDR). 2000a. "Toxicological profile for arsenic (Update)." National Technical Information Service (NTIS). NTIS PB2000-108021. 446p, September.

Agency of Toxic Substance and Disease Registry (ATSDR). 2000b. Toxicological Profile for Beryllium. (Draft). National Technical Information Service (NTIS). 255p.

Agency of Toxic Substance and Disease Registry (ATSDR). 2000c. Toxicological Profile for Chromium. (Draft). National Technical Information Service (NTIS). NTIS PB2000-108022. 436p.

Agency for Toxic Substances and Disease Registry (ATSDR). 2000d. "Toxicological profile for manganese." National Technical Information Service (NTIS). NTIS PB2000-108022. 461p.

Agency of Toxic Substance and Disease Registry (ATSDR). 2001. "Toxicological profile for selenium (Update - Draft for public comment)." National Technical Information Service (NTIS). 406p.

Agency of Toxic Substance and Disease Registry (ATSDR). 2002a. "Toxicological Profile for Copper. (Draft)." National Technical Information Service (NTIS). 275p.

Agency of Toxic Substance and Disease Registry (ATSDR). 2002b. "Toxicological Profile for Vanadium. (Draft)." National Technical Information Service (NTIS). 130p.

Agency of Toxic Substance and Disease Registry (ATSDR). 2005. "Toxicological Profile for Copper. (Draft)." National Technical Information Service (NTIS). 397p.

Aulerich, R; Ringer, RK. 1977. "Current status of PCB toxicity, including reproduction in mink." *Arch. Environ. Contam. Toxicol.* 6:279-292.

Birnbaum, LS. 1999. "TEFs: A practical approach to a real-world problem." *Human and Ecol. Risk Assess.* 5(1):13-24.

Damron, BL; Wilson, HR. 1975. "Lead toxicity of Bobwhite quail." *Bull. Environ. Contam. Res.* 14(4):489-496.

Hazardous Substance Data Bank (HSDB). 2000, 2001, 2004. National Library of Medicine (On-line). Downloaded from <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>.

Hough, JL; Baird, MB; Sfeir, GT; Pacini, CS; Darrow, D; Wheelock, C. 1993. "Benzo(a)pyrene enhances atherosclerosis in white carneau and show racer pigeons." *Arteriosclerosis and Thrombosis* 13(12):1721-1727.

Mackenzie, KM; Angevine, DM. 1981. "Infertility in mice exposed in utero to benzo(a)pyrene." *Biological Reproduction* 24:183-191.

Massachusetts Department of Environmental Protection (MADEP). 1995. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim final policy)." Bureau of Waste Site Cleanup and Office of Research and Standards, Boston, MA, BWSC/ORS-95-141, July.

Matuk, Y; Ghosh, M; McCulloch, C. 1981. "Distribution of silver in the eyes and plasma proteins of the albino rat." *Can. J. Ophthalmol.* 16:145-150.

McLane, A; Hughes, D. 1980. "Reproductive success of screech owls fed Aroclor 1248." *Arch Environ. Contam. Toxicol.* 9:661-665.

Nisbet, IC; LaGoy, PK. 1992. "Toxic equivalency factors (TEFs) for polycyclic aromatic hydrocarbons (PAHs)." *Reg. Toxicol. and Pharmacol.* 16:290-300.

Peterson, RP; Jensen, LS. 1975. "Interrelationship of dietary silver with copper in the chick." *Poultry Sci.* 54(3):771-775.

Ringer, R. 1983. "Chapter 17: Toxicology of PCBs in mink and ferrets." In *PCBs: Human and Environmental Hazard, Papers from the International Symposium on PCBs in the Great Lakes, 1982.* p227-240.

Sample, BE; Opresko, DM; Suter, II, GW. 1996. "Toxicological Benchmarks for Wildlife: 1996 Revision." Prepared for the U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN, ES/ER/TM-86/R3, June.

Sanderson, JT; Van den Berg, M. 1999. "Toxic equivalency factors (TEFs) and their use in ecological risk assessment: A successful method when used appropriately." *Human and Ecological Risk Assessment* 5(1):43-52.

Schafer, EW, Bowles, WA; Hurlbut, J. 1983. "The Acute Oral Toxicity, Repellency, and Hazard Potential of 998 Chemicals to One or More Species of Wild and Domestic Birds." *Arch. Environ. Contam. Toxicol.* 12:355-382.

Schroeder, HA; Mitchener, M. 1975. "Life-term studies in rats: Effects of aluminum, barium, beryllium, and tungsten." *J. Nutr.* 105(4):421-427.

Sittig, M. 1985. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*. Noyes Data Corporation, Park Ridge, NJ.

Tillitt, D; Ankley, G; Geisy, J; Ludwig, J; Kurita-Matsuba, H; Weseloh, D; Ross, P; Bishop, C; Sileo, L; Stromborg, K; Larson, J; Kubiak, T. 1992. "Polychlorinated biphenyl residues and egg mortality in doublecrested cormorants from the Great Lakes." *Environ. Toxicol. Chem.* 11:1281-1288.

US EPA. 1979. "Water-Related Fate of 129 Priority Pollutants. Vol. I." EPA 440/4-79-029.

US EPA. 1980. "Ambient Water Quality Criteria for Antimony." Report to US EPA, Office of Water Regulations and Standards, Washington, DC. US EPA, Environmental Criteria and Assessment Office, EPA-440/5-80-20, NTIS PB81-117319, 103p., October.

US EPA. 1987. "Quality Criteria for Water." Office of Water, Washington, D.C. EPA-440/5-86-001.

US EPA. 2003. "Ecological Risk Assessment for General Electric (GE)/Housatonic River site: Rest of the River." New England Region, Boston, MA.

Van den Berg, M; Birnbaum, L; Bosveld, ATC; Brunstrom B; Cook, P; Feeley, M; Giesy, JP; Hanberg, A; Hasegawa, R; Kennedy, SW; Kubiak, T; Larsen, JC; van Leeuwen, FX; Liem, AK; Nolt, C; Peterson, RE; Poellinger, L; Safe, S; Schrenk, D; Tillitt, D; Tysklind, M; Younes, M; Waern, F; Zacharewski, T. 1998. "Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife." *Environ. Health Perspect.* 106(12):775-792.

Appendix D
Exposure Equations

D.1: Chemical Exposure Equations

Exposure to COPCs in an environmental medium depends on both chemical-specific and receptor-specific factors. This section presents the equations and receptor-specific exposure parameters used to estimate the average daily dose (ADD) from exposures to impacted soils and groundwater at the Site. The equations used to quantify exposure associated with each of these media, by exposure route, are presented below.

Dermal Contact with Soil or Sediment

Exposure associated with dermal contact with soils was quantified in accordance with MADEP (1995) guidance, using the following equation:

$$ADD_{dermal} = \frac{EPC \cdot SA \cdot AF \cdot RAF \cdot EF \cdot ED \cdot EP \cdot CF}{BW \cdot AP} \quad (D.1-1)$$

where:

ADD _{dermal}	=	Average Daily Dose (mg/kg day),
EPC	=	Exposure Point Concentration (mg/kg soil or sediment),
SA	=	Skin Surface Area in contact with soil/sediment (cm ² /day),
AF	=	Mass of soil/sediment adhered to the unit surface area of exposed skin (mg/cm ²),
ED	=	Exposure Duration (day/event),
RAF	=	Relative Absorption Factor (unitless),
EF	=	Exposure Frequency (events/year),
EP	=	Exposure Period (years),
BW	=	Body Weight (kg),
AP	=	Averaging Period (days),
CF	=	Conversion Factor (kg/mg).

Incidental Ingestion of Soil or Sediment

Exposure from incidental ingestion of soil was quantified, per MADEP (1995) guidance, using the following equation:

$$ADD_{ingestion} = \frac{EPC \cdot IR \cdot RAF \cdot EF \cdot ED \cdot EP \cdot CF}{BW \cdot AP} \quad (D.1-2)$$

where:

ADD _{ingestion}	=	Average Daily Dose (mg/kg-day),
EPC	=	Exposure Point Concentration (mg/kg soil or sediment),
IR	=	Daily Soil/Sediment Ingestion Rate (mg/day),
RAF	=	Relative Absorption Factor (unitless),
EF	=	Exposure Frequency (events/year),

ED	=	Exposure Duration (day/event),
EP	=	Exposure Period, (years),
BW	=	Body Weight (kg),
AP	=	Averaging Period (days),
CF	=	Conversion Factor (kg/mg).

Dermal Contact with Surface Water

Exposure from dermal contact with surface water while wading is quantified using the following equation (MADEP, 1995):

$$ADD_{dermal} = \frac{EPC \cdot SA \cdot Kp \cdot RAF \cdot EF \cdot ED \cdot EP \cdot C}{BW \cdot AP} \quad (D.1-3)$$

where:

ADD _{dermal}	=	Average Daily Dose (mg/kg-day),
EPC	=	Exposure Point Concentration, (mg/L surface water),
SA	=	Skin surface area in contact with surface water(cm ² /day),
Kp	=	Skin Permeability Constant (cm/hr),
RAF	=	Relative Absorption Factor (unitless),
EF	=	Exposure Frequency (events/year),
ED	=	Exposure Duration (in this case, ED always equals 1 day/event),
EP	=	Exposure Period (years),
BW	=	Body Weight (kg),
AP	=	Averaging Period (days),
C	=	Conversion Factor (L/cm ³)

Skin permeability coefficients (K_p) were obtained from the USEPA (2004) Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Assessment). In accordance to MADEP (1995), a K_p value of 10⁻³ was used for inorganic chemicals with no measured values. In cases where an organic K_p was not available for some COPCs (e.g., methyl-tert-butyl ether) it was calculated using the following equation (USEPA, 2004).

$$\log K_p = -2.80 + 0.66 \log K_{ow} - 0.0056 MW \quad (D.1-4)$$

where:

K _{ow}	=	Octanol/water partition coefficient (unitless)
MW	=	Molecular Weight (g/mole).

Ingestion of Groundwater or Incidental Ingestion of Surface Water

Exposure from ingestion of groundwater and incidental ingestion of surface water while wading was quantified, per MADEP (1995) guidance, using the following equation:

$$ADD_{\text{ingestion}} = \frac{EPC \cdot IR \cdot RAF \cdot EF \cdot ED \cdot EP \cdot CF}{BW \cdot AP} \quad (\text{D.1-5})$$

where:

ADD _{ingestion}	=	Average Daily Dose (mg/kg-day),
EPC	=	Exposure Point Concentration (mg/L groundwater or surface water),
IR	=	Daily Groundwater/Surface water Ingestion Rate (mL/day),
RAF	=	Relative Absorption Factor (unitless),
EF	=	Exposure Frequency (day/year),
ED	=	Exposure Duration (hour/day),
EP	=	Exposure Period, (years),
BW	=	Body Weight (kg),
AP	=	Averaging Period (days),
CF	=	Conversion Factor (L/mL, day/hour).

Inhalation of Fugitive Dust

For exposure from inhalation of fugitive dust, the risk characterization is based on comparing the ambient concentration to a concentration-based toxicity benchmark (either a non-cancer "reference concentration," or a cancer "unit risk factor"). Consequently, instead of an average daily dose, it is necessary to calculate an effective average COPC concentration in air. The effective average COPC concentration accounts for the amount of time an individual is exposed to COPCs in a particular exposure setting. The effective average COPC concentration in air is given by (MADEP, 1995):

$$ADE_{\text{inhalation}} = \frac{EPC \cdot EF \cdot ED \cdot EP \cdot CF}{AP} \quad (\text{D.1-6})$$

where:

ADE _{inhalation}	=	Average Daily Exposure (mg/m ³)
EPC	=	Exposure Point Concentration (mg/m ³ dust)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (hours/event)
EP	=	Exposure Period (years)
AP	=	Averaging Period (days)
CF	=	Conversion Factor(day/hour)

Averaging Period (AP)

The averaging period for cancer risk assessment is a lifetime, whereas the averaging period for non-cancer hazard evaluations is over the exposure period (MADEP, 1995):

$$\begin{aligned} AP_{\text{cancer}} &= 70 \text{ years} \times 365 \text{ days/year} \\ AP_{\text{non-cancer}} &= EF \times ED \times EP \times 365 \text{ days/year} \end{aligned}$$

D.2: Activity and Dose Units of Measure

Measure	International Units	Conventional Units	Unit Conversion
Activity	Becquerel (Bq)	Curie (Ci)	1 Bq = 2.7×10^{-11} Ci
	1 nuclear disintegration /sec	3.7×10^{10} disintegrations/sec	1 Ci = 3.7×10^{10} Bq
Absorbed Dose	Gray (Gy) = 1 Joule/kg	1 rad = 0.01 Joule/kg	1 Gy = 100 rad
		1 rad = 100 erg/g tissue	1 rad = 0.01 Gy
Effective Dose Equivalent	Sievert (Sv) = Gy \times QF (QF = quality factors)	Radiation Equivalent Man (rem)	1 rem = 0.01 Gy \times QF
			1 rem = 1 rad \times QF

The energy of radioactive decay is sometimes given in units of million electron volts (MeV) per disintegration. Conversions for energy units are:

$$1 \text{ erg} = 10^{-7} \text{ Joule}$$

$$1 \text{ erg} = 6.24145 \times 10^5 \text{ MeV}$$

Absorbed Dose (rad) vs. Effective Dose Equivalent (rem)

The conversion from rad (radiation absorbed dose) to rem ("radiation equivalent man" dose) is given by:

$$\text{rem} = \text{rad} \times \text{QF} \quad (\times \text{ organ-specific absorption -- sometimes})$$

where QF represents a "quality factor" that increases for high energy radiation. Generally, for high energy (>10 MeV) emissions such as alpha emissions, QF = 20. For lower energy emissions, such as gamma, beta, and x-rays, the QF value is typically 1, although radionuclide-specific QF values can vary somewhat and are tabulated in reference documents. In addition to adjusting for radiation quality factors, the conversion from rad to rem is sometimes adjusted based on organ or tissue-specific absorption.

Conversion of Mass Units to Activity Units

$$\frac{\text{pCi}}{\text{g}} = \frac{\text{mg}}{\text{kg}} \times 10^{-6} \frac{\text{kg}}{\text{mg}} \times \left[\text{AvNo} \left(\frac{6.02 \times 10^{23} \text{ atoms}}{\text{mole}} \right) / \text{MW} \left(\frac{\text{g}}{\text{mole}} \right) \right] \\ \times \left(\frac{\text{LN}(2)}{t_{1/2}} \right) \times \frac{1 \text{ yr}}{31,536,000 \text{ sec}} \times \frac{1 \text{ pCi}}{0.037 \text{ atom disint/sec}}$$

$$\frac{\text{pCi}}{\text{g}} = \frac{\text{mg}}{\text{kg}} \times \left[3.576 \times 10^{11} / (\text{MW} \times t_{1/2}) \right]$$

$$\frac{\text{mg}}{\text{kg}} = \frac{\text{pCi}}{\text{g}} \times 2.796 \times 10^{-12} \times \text{MW} \times t_{1/2}$$

For Aqueous conversion from pCi/L to mg/L, a similar conversion applies:

$$\frac{\text{mg}}{\text{L}} = \frac{\text{pCi}}{\text{L}} \times 2.796 \times 10^{-15} \times \text{MW} \times t_{1/2}$$

where

AvNo = Avogadro's Number (6.02×10^{23} atoms/mole)

MW = Atomic Weight (g/mole)

$t_{1/2}$ = half-life (yrs)

D.3: Equations for Radiation Exposure Dose

The NRC and MADPH have established radioactive dose-based criteria for radionuclides. These dose-based criteria can be related to the cancer risk calculations using a so-called "dose conversion factor," or DCF. The DCF represents the radiation dose per unit of radiation activity for a particular exposure pathway (radionuclide-specific). The relationships between cancer risk and radiation dose are summarized below by exposure pathway.

Ingestion Pathway

Combing Equations (5-10) and (6-5) in the report, the cancer risk for the oral (ingestion) pathway is given by:

$$\text{Risk}_{\text{oral}} = \overline{\text{EPC}} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{rCSF}_{\text{oral}} \quad (\text{D.3-1})$$

where:

$\overline{\text{EPC}}$	=	Average exposure point concentration over duration of exposure (<i>e.g.</i> , pCi/g, pCi/L)
IR	=	Media intake rate (<i>e.g.</i> , g/day, L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
$\text{rCSF}_{\text{oral}}$	=	Radionuclide oral ingestion cancer slope factor (Risk/pCi)

The radiation dose for ingestion exposures is given by an analogous equation:

$$\text{Dose}_{\text{oral}} = \text{EPC}_o \times \text{IR} \times \text{EF} \times \text{DCF}_{\text{oral}} \quad (\text{D.3-2})$$

where

EPC_o	=	Concentration of radionuclide at time of license termination (<i>e.g.</i> , concentration at time $t=0$; pCi/g)
$\text{Dose}_{\text{oral}}$	=	Oral radiation dose (mrem/yr)
DCF_{oral}	=	Oral dose conversion factor (mrem/pCi)

An inspection of Equation (D.3-1) and Equation (D.3-2) reveals similarities and an important difference. Because risks are calculated over a "lifetime," the concentration term in Equation (6-8) of the report is an average over the exposure duration. In contrast, the NRC 25 mrem/year maximum dose in a single year must be demonstrated at the time of license termination (*e.g.*, not an average over a lifetime) – the DPH dose-based requirement for 10 mrem/yr would be met at the time of property transfer.

Therefore, the concentration value used in Equation (D.3-2) is not an average over the exposure duration, but rather the "initial" concentration (EPC_0) at the time of license termination or property transfer. For long-lived radionuclides, this distinction is not important because the average concentration over the time period to be considered for cancer risk (30 years) will be essentially equivalent to the initial concentration. However, for those radionuclides with relatively short half-lives, such as Cobalt-60 with an approximate half-life of 5.3 years, the average concentration over a 30-year period is 4-fold lower than the initial concentration in year "0".

If Equations (D.3-1) and (D.3-2) are combined, substituting the relationship for the average concentration given by Equation (5-12) from the report, the relationship between the radiation dose and cancer risk is given by:

$$\text{Risk}_{\text{oral}} = \text{Dose}_{\text{oral}} \times \text{ED} \times \frac{(1 - e^{-\lambda T})}{T\lambda} \times \left(\frac{\text{rCSF}_{\text{oral}}}{\text{DCF}_{\text{oral}}} \right) \quad (\text{D.3-3a})$$

Note that $T = \text{ED}$ in Equation D.3-3a.

For long-lived radionuclides, this relationship is simply:

$$\text{Risk}_{\text{oral}} = \text{Dose}_{\text{oral}} \times \text{ED} \times \left(\frac{\text{rCSF}_{\text{oral}}}{\text{DCF}_{\text{oral}}} \right) \quad (\text{D.3-3b})$$

In other words, the cancer risk associated with a given radiation dose for an individual radionuclide is proportional to the ratio of the cancer slope factor and the dose conversion factor, times the exposure duration. This relationship is radionuclide- and pathway-specific.

In a similar manner, the corresponding equations for the inhalation and external radiation pathways are given below.

Inhalation:

$$\text{Risk}_i = \text{Dose}_i \times \text{ED} \times \frac{(1 - e^{-\lambda T})}{T\lambda} \times \left(\frac{\text{rCSF}_i}{\text{DCF}_i} \right) \quad (\text{D.3-4})$$

where

- Dose_i = Inhalation radiation dose (mrem/yr)
- DCF_i = Inhalation dose conversion factor (mrem/pCi)

External Radiation:

$$\text{Risk}_{\text{ext}} = \text{Dose}_{\text{ext}} \times \text{ED} \times \frac{(1 - e^{-\lambda T})}{T\lambda} \times \left(\frac{\text{rCSF}_{\text{ext}}}{\text{DCF}_{\text{ext}}} \right) \quad (\text{D.3-5})$$

where

Dose_{ext} = External radiation dose (mrem/yr)
 CSF_{ext} = External radiation cancer slope factor (risk per pCi/g)
 DCF_{ext} = External radiation dose conversion factor (mrem/yr per pCi/g)

Values for the radionuclide cancer slope factors are compiled by US EPA based on updates to the HEAST tables.¹ Values for pathway-specific DCF factors are found in RESRAD (ANL, 2001); the DCF values in RESRAD are obtained from Federal Guidance Reports 11 and 12.²

¹ Values of cancer slope factors for radionuclides are given at: <http://www.epa.gov/radiation/heat/index.html>.

² Available at: <http://www.epa.gov/radiation/federal/techdocs.htm>.

References

Argonne National Laboratory (ANL). 2001. "User's Manual for RESRAD Version 6." Prepared for US Department of Energy (US DOE). July.

Massachusetts Department of Environmental Protection (MADEP). 1995. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim final policy)." Bureau of Waste Site Cleanup and Office of Research and Standards, Boston, MA, BWSC/ORS-95-141, July.

US EPA. 2004. "Risk assessment guidance for Superfund (RAGS). Volume I: Human health evaluation manual (Part E, Supplemental guidance for dermal risk assessment) (Final)." Office of Superfund Remediation and Technology Innovation (Washington, DC). EPA/540/R/99/005; OSWER 9285.7-02EP; PB99-963312.

Appendix E

Human Health Chemical Risk Tables

List of Tables

Table E.1.1	Duplicate Analysis
Table E.2.1	Chemicals in Groundwater - Summary Statistics 2000 - 2006 versus 2006 only
Table E.2.2	Summary Statistics Comparison of Surface Soil (0-3 ft bgs), Surface and Subsurface Soils (0-15 ft bgs) and Surface Soils (0-0.5 feet bgs)
Table E.3.1	Detailed Risk Tables for Current Recreators Use
Table E.4.1	Detailed Risk Tables for Future Recreators Use
Table E.5.1	Detailed Risk Tables for Future Commercial Use – TransCanada
Table E.6.1	Detailed Risk Tables for Future Commercial Use – YAEC Non-RUA
Table E.7.1	Detailed Risk Tables for Future Commercial Use – YAEC Inside RUA
Table E.8.1	Detailed Risk Tables for Subchronic Future Recreational Use – TransCanada
Table E.9.1	Detailed Risk Tables for Subchronic Future Recreational Use – YAEC Non-RUA
Table E.10.1	Detailed Risk Tables for Subchronic Future Recreational Use – YAEC Inside RUA
Table E.11.1	Detailed Risk Tables for Current Recreators Use Exposed to Background Media
Table E.12.1	Detailed Risk Tables for Future Recreators Use Exposed to Background Media
Table E.13.1	Detailed Risk Tables for Future Commercial Use Exposed to Background Media

Appendix Table E.1.1
Duplicate Analysis
Yankee Nuclear Power Station, Rowe, MA

Average with Parent and Duplicate Samples¹

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Average with Parent and Duplicate Samples ¹				
				Detected	Sampled	Minimum	Mean	Maximum
Background	Dioxin/Furan	1,2,3,4,5,6,7,8-OCDD	pg/g	1	2	21	11.68	21
Background	Dioxin/Furan	1,2,3,4,5,6,7,8-OCDF	pg/g	1	2	1.7	0.93	1.7
Background	Dioxin/Furan	1,2,3,4,6,7,8-HpCDD	pg/g	1	2	3.8	2.38	3.8
Background	Dioxin/Furan	1,2,3,4,6,7,8-HpCDF	pg/g	2	2	0.3	0.70	1.1
Background	Dioxin/Furan	1,2,3,4,7,8-HxCDD	pg/g	1	2	0.23	0.16	0.23
Background	Dioxin/Furan	1,2,3,4,7,8-HxCDF	pg/g	2	2	0.29	0.43	0.57
Background	Dioxin/Furan	1,2,3,6,7,8-HxCDD	pg/g	1	2	0.3	0.20	0.3
Background	Dioxin/Furan	1,2,3,6,7,8-HxCDF	pg/g	1	2	0.21	0.12	0.21
Background	Dioxin/Furan	1,2,3,7,8,9-HxCDD	pg/g	1	2	0.35	0.22	0.35
Background	Dioxin/Furan	1,2,3,7,8-PeCDF	pg/g	1	2	0.22	0.15	0.22
Background	Dioxin/Furan	2,3,4,6,7,8-HxCDF	pg/g	1	2	0.28	0.16	0.28
Background	Dioxin/Furan	2,3,4,7,8-PeCDF	pg/g	2	2	0.14	0.26	0.38
Background	EPH	Acenaphthylene	mg/Kg	1	8	0.136	0.16	0.136
Background	EPH	Benzo(b)fluoranthene	mg/Kg	2	8	0.0298	0.14	0.0339
Background	EPH	Chrysene	mg/Kg	3	8	0.0255	0.12	0.0461
Background	EPH	Fluoranthene	mg/Kg	6	8	0.0302	0.10	0.0823
Background	Inorganics	Antimony	mg/Kg	7	8	1.62	2.62	4.75
Background	Inorganics	Arsenic	mg/Kg	30	31	0.7	2.35	5.61
Background	Inorganics	Beryllium	mg/Kg	7	31	0.194	0.50	0.482
Background	Inorganics	Boron	mg/Kg	2	2	18	18.50	19
Background	Inorganics	Cadmium	mg/Kg	8	31	0.245	0.52	0.79
Background	Inorganics	Chromium	mg/Kg	31	31	1.94	14.94	34
Background	Inorganics	Copper	mg/Kg	24	31	2.3	6.86	19
Background	Inorganics	Lead	mg/Kg	30	30	0.97	16.33	101
Background	Inorganics	Lithium	mg/Kg	2	2	23	24.50	26
Background	Inorganics	Mercury	mg/Kg	8	31	0.0581	0.34	0.318
Background	Inorganics	Nickel	mg/Kg	31	31	3.8	10.59	29
Background	Inorganics	Selenium	mg/Kg	4	31	1.41	1.63	2.45
Background	Inorganics	Silver	mg/Kg	4	31	1.36	0.55	3.22
Background	Inorganics	Thallium	mg/Kg	3	31	0.411	0.65	0.73
Background	Inorganics	Zinc	mg/Kg	31	31	30.8	53.80	77
Background	SVOC	Acenaphthylene	µg/Kg	1	15	96.5	192.97	96.5
Background	SVOC	Anthracene	µg/Kg	1	15	48	189.73	48
Background	SVOC	Benzo(a)anthracene	µg/Kg	1	15	232	202.00	232
Background	SVOC	Benzo(a)pyrene	µg/Kg	2	15	132	195.63	219
Background	SVOC	Benzo(b)fluoranthene	µg/Kg	2	15	384	233.37	533
Background	SVOC	Benzo(g,h,i)perylene	µg/Kg	2	15	71.8	184.02	105
Background	SVOC	Benzo(k)fluoranthene	µg/Kg	2	15	133	195.57	217
Background	SVOC	Benzoic acid	µg/Kg	2	15	2290	908.20	3500
Background	SVOC	Chrysene	µg/Kg	3	15	76.9	199.43	337
Background	SVOC	Fluoranthene	µg/Kg	6	15	47.8	222.02	552
Background	SVOC	Indeno(1,2,3-cd)pyrene	µg/Kg	1	15	119	194.47	119
Background	SVOC	Phenanthrene	µg/Kg	4	15	74.2	216.85	357
Background	SVOC	Pyrene	µg/Kg	4	15	64.8	252.61	773
Background	TPH	TPH-DRO	mg/Kg	1	1	4.4	4.40	4.4
Background	VPH	C5-C8 Aliphatics	mg/Kg	8	8	1.81	2.89	4.95
Background	VPH	C9-C10 Aromatics	mg/Kg	8	8	0.66	16.45	89
Background	VPH	C9-C12 Aliphatics	mg/Kg	8	8	1.02	24.17	124
Background	VPH	Toluene	mg/Kg	1	8	0.839	0.23	0.839
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,5,6,7,8-OCDD	pg/g	7	17	31	38.07	240
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,5,6,7,8-OCDF	pg/g	2	17	4.4	3.46	7.6
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,6,7,8-HpCDD	pg/g	8	17	5.8	5.90	27

Average with Parent Samples Only²

Detected	Sampled	Minimum	Mean	Maximum
1	2	1.7	0.93	1.7
1	2	3.8	2.38	3.8
2	2	0.3	0.70	1.1
1	2	0.23	0.16	0.23
2	2	0.29	0.43	0.57
1	2	0.3	0.20	0.3
1	2	0.21	0.12	0.21
1	2	0.35	0.22	0.35
1	2	0.22	0.15	0.22
1	2	0.28	0.16	0.28
2	2	0.14	0.26	0.38
1	8	0.136	0.16	0.136
2	8	0.0298	0.14	0.0339
3	8	0.0255	0.12	0.0461
6	8	0.0302	0.10	0.0823
7	8	1.62	2.62	4.75
27	28	0.7	2.39	5.61
7	28	0.194	0.49	0.482
2	2	18	18.50	19
8	28	0.245	0.52	0.79
28	28	1.94	14.90	34
22	28	2.3	6.76	18.7
27	27	0.97	17.76	101
2	2	23	24.50	26
8	28	0.0581	0.34	0.318
28	28	3.8	10.42	29
4	28	1.41	1.62	2.45
4	28	1.36	0.59	3.22
3	28	0.411	0.68	0.73
28	28	30.8	52.85	75.8
1	14	96.5	190.32	96.5
1	14	48	186.86	48
1	14	232	200.00	232
2	14	132	193.18	219
2	14	384	233.61	533
2	14	71.8	180.74	105
2	14	133	193.11	217
2	14	2290	894.50	3500
3	14	76.9	197.24	337
6	14	47.8	221.45	552
1	14	119	191.93	119
4	14	74.2	215.91	357
4	14	64.8	254.22	773
8	8	1.81	2.89	4.95
8	8	0.66	16.45	89
8	8	1.02	24.17	124
1	8	0.839	0.23	0.839
7	15	31	42.79	240
2	15	4.4	3.85	7.6
8	15	5.8	6.63	27

Average with Average of Parent and Duplicate Samples³

Detected	Sampled	Minimum	Mean	Maximum
1	2	1.7	0.93	1.7
1	2	3.8	2.38	3.8
2	2	0.3	0.70	1.1
1	2	0.23	0.16	0.23
2	2	0.29	0.43	0.57
1	2	0.3	0.20	0.3
1	2	0.21	0.12	0.21
1	2	0.35	0.22	0.35
1	2	0.22	0.15	0.22
1	2	0.28	0.16	0.28
2	2	0.14	0.26	0.38
1	8	0.136	0.16	0.136
2	8	0.0298	0.14	0.0339
3	8	0.0255	0.12	0.0461
6	8	0.0302	0.10	0.0823
7	8	1.62	2.62	4.75
24	25	0.7	2.44	5.61
7	25	0.194	0.48	0.482
2	2	18	18.50	19
8	25	0.245	0.51	0.79
25	25	1.94	14.73	34
20	25	2.3	7.04	18.7
26	26	0.97	18.33	101
2	2	23	24.50	26
8	25	0.0581	0.33	0.318
25	25	3.8	10.49	29
4	25	1.41	1.61	2.45
4	25	1.36	0.64	3.22
3	25	0.411	0.72	0.73
25	25	30.8	52.39	75.8
1	13	96.5	187.27	96.5
1	13	48	183.54	48
1	13	232	197.69	232
2	13	132	190.35	219
2	13	384	233.88	533
2	13	71.8	176.95	105
2	13	133	190.27	217
2	13	2290	878.69	3500
3	13	76.9	194.72	337
6	13	47.8	220.79	552
1	13	119	189.00	119
4	13	74.2	214.83	357
4	13	64.8	256.08	773
1	1	4.4	4.40	4.4
8	8	1.81	2.89	4.95
8	8	0.66	16.45	89
8	8	1.02	24.17	124
1	8	0.839	0.23	0.839
7	13	31	48.76	240
2	13	4.4	4.34	7.6
8	13	5.8	7.55	27

Average with Parent and Duplicate Samples¹

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Detected	Sampled	Minimum	Mean	Maximum
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,6,7,8-HpCDF	pg/g	8	17	0.09	2.95	10
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,7,8,9-HpCDF	pg/g	3	17	0.28	0.31	1.3
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,7,8-HxCDD	pg/g	1	17	0.24	0.12	0.24
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,4,7,8-HxCDF	pg/g	4	17	0.2	0.64	3.5
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,6,7,8-HxCDD	pg/g	1	17	0.71	0.21	0.71
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,6,7,8-HxCDF	pg/g	3	17	0.17	0.27	0.79
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,7,8,9-HxCDD	pg/g	2	17	0.45	0.25	0.55
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,7,8,9-HxCDF	pg/g	1	17	0.14	0.07	0.14
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,7,8-PeCDD	pg/g	1	17	0.34	0.10	0.34
YAEC Non-BUD/TSCA	Dioxin/Furan	1,2,3,7,8-PeCDF	pg/g	2	17	0.55	0.19	0.55
YAEC Non-BUD/TSCA	Dioxin/Furan	2,3,4,6,7,8-HxCDF	pg/g	2	17	0.6	0.22	0.75
YAEC Non-BUD/TSCA	Dioxin/Furan	2,3,4,7,8-PeCDF	pg/g	2	17	0.57	0.22	0.71
YAEC Non-BUD/TSCA	Dioxin/Furan	2,3,7,8-TCDD	pg/g	4	17	0.32	0.47	4.2
YAEC Non-BUD/TSCA	Dioxin/Furan	2,3,7,8-TCDF	pg/g	8	17	0.27	0.54	3.1
YAEC Non-BUD/TSCA	EPH	2-Methylnaphthalene	mg/Kg	4	45	0.0214	0.21	3.01
YAEC Non-BUD/TSCA	EPH	Acenaphthene	mg/Kg	3	45	0.155	0.24	3.85
YAEC Non-BUD/TSCA	EPH	Acenaphthylene	mg/Kg	1	45	0.0281	0.15	0.0281
YAEC Non-BUD/TSCA	EPH	Adjusted TPH	mg/Kg	6	27	32.7	46.10	638
YAEC Non-BUD/TSCA	EPH	Anthracene	mg/Kg	6	45	0.0344	0.24	3.67
YAEC Non-BUD/TSCA	EPH	Benzo(a)anthracene	mg/Kg	6	45	0.136	0.62	17.3
YAEC Non-BUD/TSCA	EPH	Benzo(a)pyrene	mg/Kg	7	45	0.0718	0.46	11.2
YAEC Non-BUD/TSCA	EPH	Benzo(b)fluoranthene	mg/Kg	7	45	0.0529	0.89	30
YAEC Non-BUD/TSCA	EPH	Benzo(g,h,i)perylene	mg/Kg	6	45	0.104	0.33	6.8
YAEC Non-BUD/TSCA	EPH	Benzo(k)fluoranthene	mg/Kg	7	45	0.11	0.46	11.6
YAEC Non-BUD/TSCA	EPH	C11-C22 Aromatics	mg/Kg	16	78	5.5	29.23	647
YAEC Non-BUD/TSCA	EPH	C19-C36 Aliphatics	mg/Kg	10	78	7.5	15.35	163
YAEC Non-BUD/TSCA	EPH	C9-C18 Aliphatics	mg/Kg	4	78	9.98	11.78	180
YAEC Non-BUD/TSCA	EPH	Chrysene	mg/Kg	8	45	0.117	0.78	23.7
YAEC Non-BUD/TSCA	EPH	Dibenz(a,h)anthracene	mg/Kg	1	45	0.292	0.16	0.292
YAEC Non-BUD/TSCA	EPH	Fluoranthene	mg/Kg	10	45	0.021	1.15	34.9
YAEC Non-BUD/TSCA	EPH	Fluorene	mg/Kg	5	45	0.022	0.23	3.77
YAEC Non-BUD/TSCA	EPH	Indeno(1,2,3-cd)Pyrene	mg/Kg	6	45	0.0976	0.34	7.46
YAEC Non-BUD/TSCA	EPH	Naphthalene	mg/Kg	2	45	0.652	0.38	9.85
YAEC Non-BUD/TSCA	EPH	Phenanthrene	mg/Kg	10	45	0.0443	0.56	14.5
YAEC Non-BUD/TSCA	EPH	Pyrene	mg/Kg	7	45	0.284	0.78	20.1
YAEC Non-BUD/TSCA	EPH	Total EPH	mg/Kg	2	7	6.5	4.06	13
YAEC Non-BUD/TSCA	EPH	Unadjusted TPH	mg/Kg	7	27	32.2	55.29	842
YAEC Non-BUD/TSCA	Inorganics	Antimony	mg/Kg	5	35	0.56	2.15	24
YAEC Non-BUD/TSCA	Inorganics	Arsenic	mg/Kg	166	179	0.66	2.22	12
YAEC Non-BUD/TSCA	Inorganics	Barium	mg/Kg	1	1	67.7	67.70	67.7
YAEC Non-BUD/TSCA	Inorganics	Beryllium	mg/Kg	1	191	1	0.38	1
YAEC Non-BUD/TSCA	Inorganics	Cadmium	mg/Kg	4	181	0.938	0.86	7.2
YAEC Non-BUD/TSCA	Inorganics	Chromium	mg/Kg	178	181	3.2	12.86	28
YAEC Non-BUD/TSCA	Inorganics	Copper	mg/Kg	142	180	1.8	13.58	330
YAEC Non-BUD/TSCA	Inorganics	Lead	mg/Kg	229	237	0.43	21.68	2000
YAEC Non-BUD/TSCA	Inorganics	Mercury	mg/Kg	11	181	0.007	0.29	2
YAEC Non-BUD/TSCA	Inorganics	Nickel	mg/Kg	156	180	3.5	11.86	98
YAEC Non-BUD/TSCA	Inorganics	Selenium	mg/Kg	38	181	5.5	3.62	16
YAEC Non-BUD/TSCA	Inorganics	Silver	mg/Kg	1	181	0.81	0.21	0.81
YAEC Non-BUD/TSCA	Inorganics	Thallium	mg/Kg	2	173	0.6	0.68	0.82
YAEC Non-BUD/TSCA	Inorganics	Zinc	mg/Kg	142	180	20	68.09	750
YAEC Non-BUD/TSCA	PCBs	Aroclor-1248	µg/Kg	2	567	60.8	15.28	440
YAEC Non-BUD/TSCA	PCBs	Aroclor-1254	µg/Kg	350	567	4.85	215.66	2800
YAEC Non-BUD/TSCA	PCBs	Aroclor-1260	µg/Kg	246	567	3.01	54.49	1330
YAEC Non-BUD/TSCA	SVOC	1-Methylnaphthalene	µg/Kg	2	14	171	217.86	1580
YAEC Non-BUD/TSCA	SVOC	2,4-Dimethylphenol	µg/Kg	1	108	160	212.41	160

Average with Parent Samples Only²

Detected	Sampled	Minimum	Mean	Maximum
7	15	0.38	3.31	10
3	15	0.28	0.34	1.3
1	15	0.24	0.13	0.24
4	15	0.2	0.72	3.5
1	15	0.71	0.24	0.71
3	15	0.17	0.30	0.79
2	15	0.45	0.27	0.55
1	15	0.14	0.08	0.14
1	15	0.34	0.11	0.34
2	15	0.55	0.21	0.55
2	15	0.6	0.25	0.75
2	15	0.57	0.24	0.71
4	15	0.32	0.52	4.2
8	15	0.27	0.60	3.1
4	42	0.0214	0.22	3.01
3	42	0.155	0.24	3.85
1	42	0.0281	0.15	0.0281
6	26	32.7	47.27	638
5	42	0.0344	0.25	3.67
5	42	0.136	0.65	17.3
6	42	0.0718	0.48	11.2
6	42	0.0529	0.94	30
5	42	0.104	0.34	6.8
6	42	0.11	0.48	11.6
16	72	5.5	31.23	647
10	72	7.5	16.19	163
4	72	9.98	12.32	180
7	42	0.117	0.82	23.7
1	42	0.292	0.16	0.292
9	42	0.021	1.21	34.9
4	42	0.0225	0.24	3.77
5	42	0.1074	0.36	7.46
2	42	0.652	0.39	9.85
9	42	0.0443	0.59	14.5
6	42	0.284	0.82	20.1
2	6	6.5	4.43	13
7	26	32.2	56.81	842
3	31	0.77	2.22	24
159	170	0.66	2.23	12
1	1	67.7	67.70	67.7
1	181	1	0.38	1
3	172	0.938	0.84	6.2
169	172	3.2	12.99	28
135	171	1.8	13.81	330
218	226	0.43	22.54	2000
11	172	0.007	0.30	2
149	171	3.5	12.00	98
37	172	5.5	3.63	16
1	172	0.81	0.21	0.81
2	164	0.6	0.66	0.82
136	171	20	68.69	750
2	537	60.8	15.43	440
331	537	4.85	214.09	2800
232	537	3.01	54.40	1330
2	13	171	228.35	1580
1	102	160	214.17	160

Average with Average of Parent and Duplicate Samples³

Detected	Sampled	Minimum	Mean	Maximum
6	13	5.2	3.75	10
2	13	0.49	0.36	1.3
1	13	0.24	0.14	0.24
3	13	1.5	0.81	3.5
1	13	0.71	0.26	0.71
2	13	0.51	0.33	0.79
2	13	0.45	0.30	0.55
1	13	0.34	0.11	0.34
2	13	0.55	0.24	0.55
2	13	0.6	0.28	0.75
2	13	0.57	0.27	0.71
4	13	0.32	0.58	4.2
8	13	0.27	0.68	3.1
4	41	0.0214	0.22	3.01
3	41	0.155	0.25	3.85
1	41	0.0281	0.15	0.0281
6	25	32.7	48.52	638
4	41	0.0344	0.25	3.67
4	41	0.345	0.67	17.3
5	41	0.0718	0.49	11.2
5	41	0.0529	0.96	30
4	41	0.219	0.35	6.8
5	41	0.11	0.49	11.6
15	67	5.5	27.47	647
10	67	7.5	16.73	163
4	67	9.98	12.57	180
6	41	0.117	0.83	23.7
1	41	0.292	0.16	0.292
8	41	0.021	1.23	34.9
3	41	0.133	0.24	3.77
4	41	0.228	0.36	7.46
2	41	0.652	0.40	9.85
8	41	0.0443	0.60	14.5
5	41	0.973	0.84	20.1
2	5	6.5	4.96	13
7	25	32.2	58.44	842
5	31	0.56	2.10	24
151	161	0.66	2.24	12
1	1	67.7	67.70	67.7
1	171	1	0.38	1
3	163	0.938	0.84	6.2
160	163	3.2	13.14	28
128	162	1.8	14.05	330
208	215	0.43	23.30	2000
11	163	0.007	0.30	2
141	162	3.5	11.69	98
37	163	5.5	3.69	16
1	163	0.81	0.21	0.81
2	157	0.6	0.66	0.82
130	162	20	69.31	750
2	509	60.8	15.62	440
315	509	4.85	214.79	2800
219	509	3.01	54.80	1330
2	12	171	240.21	1580
1	96	160	216.04	160

Average with Parent and Duplicate Samples¹

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Detected	Sampled	Minimum	Mean	Maximum
YAEC Non-BUD/TSCA	SVOC	2-Methylnaphthalene	µg/Kg	9	128	100	430.48	10000
YAEC Non-BUD/TSCA	SVOC	3+4-Methylphenol	µg/Kg	3	108	81	212.31	340
YAEC Non-BUD/TSCA	SVOC	Acenaphthene	µg/Kg	11	128	240	531.66	13000
YAEC Non-BUD/TSCA	SVOC	Acenaphthylene	µg/Kg	29	128	78.7	388.90	5100
YAEC Non-BUD/TSCA	SVOC	Anthracene	µg/Kg	33	128	68.3	1138.99	25000
YAEC Non-BUD/TSCA	SVOC	Benzo(a)anthracene	µg/Kg	39	128	76	1313.96	29000
YAEC Non-BUD/TSCA	SVOC	Benzo(a)pyrene	µg/Kg	37	128	95.7	835.18	16000
YAEC Non-BUD/TSCA	SVOC	Benzo(b)fluoranthene	µg/Kg	36	128	92.6	1070.44	16000
YAEC Non-BUD/TSCA	SVOC	Benzo(g,h,i)perylene	µg/Kg	36	128	66.9	468.33	5200
YAEC Non-BUD/TSCA	SVOC	Benzo(k)fluoranthene	µg/Kg	35	128	100	979.63	19000
YAEC Non-BUD/TSCA	SVOC	Benzoic acid	µg/Kg	1	108	150	1025.46	150
YAEC Non-BUD/TSCA	SVOC	Butyl benzyl phthalate	µg/Kg	1	108	500	215.69	500
YAEC Non-BUD/TSCA	SVOC	Carbazole	µg/Kg	13	114	87	370.02	5100
YAEC Non-BUD/TSCA	SVOC	Chrysene	µg/Kg	39	128	85	1570.52	30000
YAEC Non-BUD/TSCA	SVOC	Dibenzo(a,h)anthracene	µg/Kg	18	128	66.2	311.26	3800
YAEC Non-BUD/TSCA	SVOC	Dibenzofuran	µg/Kg	3	108	85	314.44	11000
YAEC Non-BUD/TSCA	SVOC	Di-n-butyl phthalate	µg/Kg	3	108	74	209.97	84
YAEC Non-BUD/TSCA	SVOC	Fluoranthene	µg/Kg	50	128	72	3542.81	94000
YAEC Non-BUD/TSCA	SVOC	Fluorene	µg/Kg	14	128	83	627.35	16000
YAEC Non-BUD/TSCA	SVOC	Indeno(1,2,3-cd)pyrene	µg/Kg	28	128	76.6	556.28	8900
YAEC Non-BUD/TSCA	SVOC	Naphthalene	µg/Kg	9	128	220	548.47	17000
YAEC Non-BUD/TSCA	SVOC	N-Nitrosodimethylamin	µg/Kg	1	108	72	423.40	72
YAEC Non-BUD/TSCA	SVOC	Phenanthrene	µg/Kg	35	128	33.4	1972.33	75000
YAEC Non-BUD/TSCA	SVOC	Pyrene	µg/Kg	45	128	70	2455.44	56000
YAEC Non-BUD/TSCA	TPH	TPH-DRO	mg/Kg	113	147	2.2	25.50	320
YAEC Non-BUD/TSCA	TPH	TPH-GRO	mg/Kg	1	49	4.6	1.39	4.6
YAEC Non-BUD/TSCA	VOC	2-Butanone	µg/Kg	7	26	1.4	82.43	130
YAEC Non-BUD/TSCA	VOC	4-Isopropyltoluene	µg/Kg	2	25	12	12.27	73
YAEC Non-BUD/TSCA	VOC	Acetone	µg/Kg	12	26	14	216.63	730
YAEC Non-BUD/TSCA	VOC	Carbon Disulfide	µg/Kg	5	26	1.2	39.08	23
YAEC Non-BUD/TSCA	VOC	Diethyl Ether	µg/Kg	1	26	1.3	12.81	1.3
YAEC Non-BUD/TSCA	VOC	m+p-Xylenes	µg/Kg	1	26	2.7	17.08	2.7
YAEC Non-BUD/TSCA	VOC	Naphthalene	µg/Kg	1	4	489	162.63	489
YAEC Non-BUD/TSCA	VOC	Toluene	µg/Kg	13	26	0.49	31.05	230
YAEC Non-BUD/TSCA	VPH	C5-C8 Aliphatics	mg/Kg	16	43	0.417	4.34	28
YAEC Non-BUD/TSCA	VPH	C9-C10 Aromatics	mg/Kg	15	43	0.0507	4.02	23
YAEC Non-BUD/TSCA	VPH	C9-C12 Aliphatics	mg/Kg	15	43	0.127	4.78	43
YAEC Non-BUD/TSCA	VPH	m+p-Xylenes	mg/Kg	2	31	0.0251	0.19	0.059
YAEC Non-BUD/TSCA	VPH	Naphthalene	mg/Kg	4	31	0.0759	0.55	0.55
YAEC Non-BUD/TSCA	VPH	o-Xylene	mg/Kg	3	31	0.0264	0.19	0.385
YAEC Non-BUD/TSCA	VPH	Toluene	mg/Kg	8	31	0.0193	0.66	12
YAEC Non-BUD/TSCA	VPH	Total VPH	mg/Kg	2	7	16	12.06	43
YAEC SCFA/TSCA	EPH	Adjusted TPH	mg/Kg	4	5	29.5	32.58	52.2
YAEC SCFA/TSCA	EPH	Anthracene	mg/Kg	2	5	0.0289	0.16	0.519
YAEC SCFA/TSCA	EPH	Benzo(a)anthracene	mg/Kg	4	5	0.0606	0.13	0.358
YAEC SCFA/TSCA	EPH	Benzo(a)pyrene	mg/Kg	1	5	0.0578	0.07	0.0578
YAEC SCFA/TSCA	EPH	Benzo(b)fluoranthene	mg/Kg	4	5	0.0316	0.15	0.366
YAEC SCFA/TSCA	EPH	Benzo(g,h,i)perylene	mg/Kg	2	5	0.0414	0.07	0.0718
YAEC SCFA/TSCA	EPH	Benzo(k)fluoranthene	mg/Kg	3	5	0.0414	0.08	0.145
YAEC SCFA/TSCA	EPH	C11-C22 Aromatics	mg/Kg	13	37	9.72	23.33	208
YAEC SCFA/TSCA	EPH	C19-C36 Aliphatics	mg/Kg	9	37	13.5	26.10	369
YAEC SCFA/TSCA	EPH	C9-C18 Aliphatics	mg/Kg	2	37	10.6	6.19	21.6
YAEC SCFA/TSCA	EPH	Chrysene	mg/Kg	3	5	0.0548	0.21	0.769
YAEC SCFA/TSCA	EPH	Fluoranthene	mg/Kg	5	5	0.111	0.49	1.35
YAEC SCFA/TSCA	EPH	Indeno(1,2,3-cd)pyrene	mg/Kg	2	5	0.0398	0.07	0.0791
YAEC SCFA/TSCA	EPH	Phenanthrene	mg/Kg	4	5	0.059	0.23	0.803

Average with Parent Samples Only²

Detected	Sampled	Minimum	Mean	Maximum
7	119	100	293.48	4500
3	102	81	214.06	340
9	119	240	393.91	13000
26	119	78.7	359.82	5100
30	119	68.3	895.71	25000
36	119	76	1148.94	29000
34	119	95.7	752.39	16000
33	119	92.6	992.21	16000
33	119	66.9	435.73	5200
32	119	100	920.92	19000
1	102	150	1033.33	150
1	102	500	217.65	500
11	106	87	299.88	5100
36	119	85	1399.48	30000
16	119	66.2	296.35	3800
3	102	85	322.21	11000
3	102	74	211.59	84
45	119	72	3175.03	94000
12	119	83	438.02	16000
26	119	76.6	523.76	8900
7	119	220	319.56	4080
1	102	72	426.78	72
32	119	33.4	1363.85	75000
41	119	70	2091.13	56000
109	141	2.2	24.27	320
1	46	4.6	1.40	4.6
7	23	1.4	92.42	130
2	22	12	13.55	73
10	23	22	240.80	730
5	23	1.2	43.79	23
1	23	1.3	13.72	1.3
1	23	2.7	18.92	2.7
1	4	489	162.63	489
12	23	0.49	34.76	230
16	40	0.417	4.36	28
15	40	0.0507	4.01	23
15	40	0.127	4.84	43
2	29	0.0251	0.19	0.059
4	29	0.0759	0.53	0.55
3	29	0.0264	0.18	0.385
8	29	0.0193	0.68	12
2	6	16	13.25	43
4	5	29.5	32.58	52.2
2	5	0.0289	0.16	0.519
4	5	0.0606	0.13	0.358
1	5	0.0578	0.07	0.0578
4	5	0.0316	0.15	0.366
2	5	0.0414	0.07	0.0718
3	5	0.0414	0.08	0.145
12	35	9.72	23.65	208
8	35	13.5	26.83	369
2	35	10.6	6.33	21.6
3	5	0.0548	0.21	0.769
5	5	0.111	0.49	1.35
2	5	0.0398	0.07	0.0791
4	5	0.059	0.23	0.803

Average with Average of Parent and Duplicate Samples³

Detected	Sampled	Minimum	Mean	Maximum
6	111	100	362.91	9000
3	96	81	215.93	340
8	111	240	465.45	13000
24	111	78.7	389.85	5100
28	111	68.3	1031.99	25000
34	111	76	1324.14	29000
32	111	95.7	847.47	16000
31	111	92.6	1103.40	16000
31	111	66.9	474.92	5200
30	111	100	1011.27	19000
1	96	150	1041.67	150
1	96	500	219.74	500
10	99	87	342.95	5100
34	111	85	1606.73	30000
15	111	73	321.66	3800
3	96	85	330.83	11000
3	96	74	213.30	84
41	111	72	3497.40	94000
11	111	83	518.59	16000
24	111	76.6	577.26	8900
6	111	220	458.17	17000
1	96	72	430.28	72
30	111	33.4	1589.42	75000
37	111	76	2367.13	56000
104	135	2.2	23.68	320
1	43	4.6	1.40	4.6
7	20	1.4	105.46	130
1	19	73	14.75	73
8	20	35	265.53	730
5	20	1.2	49.95	23
1	20	1.3	14.95	1.3
1	20	2.7	21.35	2.7
1	4	489	162.63	489
11	20	0.49	39.36	230
16	39	0.417	4.32	28
15	39	0.0507	3.96	23
15	39	0.127	4.81	43
2	29	0.0251	0.17	0.059
4	29	0.0759	0.51	0.55
3	29	0.0264	0.16	0.385
8	29	0.0193	0.66	12
2	5	16	14.60	43
4	5	29.5	32.58	52.2
2	5	0.0289	0.16	0.519
4	5	0.0606	0.13	0.358
1	5	0.0578	0.07	0.0578
4	5	0.0316	0.15	0.366
2	5	0.0414	0.07	0.0718
3	5	0.0414	0.08	0.145
11	35	9.72	23.33	208
7	35	15.6	26.56	369
2	35	10.6	6.34	21.6
3	5	0.0548	0.21	0.769
5	5	0.111	0.49	1.35
2	5	0.0398	0.07	0.0791
4	5	0.059	0.23	0.803

Average with Parent and Duplicate Samples¹

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Average with Parent and Duplicate Samples ¹				
				Detected	Sampled	Minimum	Mean	Maximum
YAEC SCFA/TSCA	EPH	Pyrene	mg/Kg	5	5	0.111	0.38	0.958
YAEC SCFA/TSCA	EPH	Unadjusted TPH	mg/Kg	4	5	30.3	33.92	57.3
YAEC SCFA/TSCA	Inorganics	Arsenic	mg/Kg	42	42	0.88	3.19	6.6
YAEC SCFA/TSCA	Inorganics	Barium	mg/Kg	32	32	67	96.69	410
YAEC SCFA/TSCA	Inorganics	Chromium	mg/Kg	42	42	12	15.90	31
YAEC SCFA/TSCA	Inorganics	Copper	mg/Kg	10	10	5	11.50	18
YAEC SCFA/TSCA	Inorganics	Lead	mg/Kg	42	42	0.98	9.51	63
YAEC SCFA/TSCA	Inorganics	Mercury	mg/Kg	1	42	0.53	0.28	0.53
YAEC SCFA/TSCA	Inorganics	Nickel	mg/Kg	10	10	9.7	12.47	15
YAEC SCFA/TSCA	Inorganics	Zinc	mg/Kg	10	10	49	66.00	100
YAEC SCFA/TSCA	PCBs	2,4,5,6-TC-M-Xylene (	µg/Kg	4	4	9.82	9.92	10
YAEC SCFA/TSCA	PCBs	Aroclor-1248	µg/Kg	13	499	12.4	20.52	71.3
YAEC SCFA/TSCA	PCBs	Aroclor-1254	µg/Kg	290	499	5.7	554.89	30000
YAEC SCFA/TSCA	PCBs	Aroclor-1260	µg/Kg	210	499	5.48	198.62	3730
YAEC SCFA/TSCA	SVOC	Acenaphthene	mg/Kg	1	50	0.12	0.19	0.12
YAEC SCFA/TSCA	SVOC	Anthracene	mg/Kg	1	50	0.36	0.20	0.36
YAEC SCFA/TSCA	SVOC	Benzo(a)anthracene	mg/Kg	3	50	0.17	0.21	1.2
YAEC SCFA/TSCA	SVOC	Benzo(a)pyrene	mg/Kg	4	50	0.09	0.21	1.1
YAEC SCFA/TSCA	SVOC	Benzo(b)fluoranthene	mg/Kg	3	50	0.18	0.21	1
YAEC SCFA/TSCA	SVOC	Benzo(g,h,i)perylene	mg/Kg	3	50	0.11	0.20	0.57
YAEC SCFA/TSCA	SVOC	Benzo(k)fluoranthene	mg/Kg	3	50	0.15	0.21	0.96
YAEC SCFA/TSCA	SVOC	Carbazole	mg/Kg	1	50	0.16	0.19	0.16
YAEC SCFA/TSCA	SVOC	Chrysene	mg/Kg	3	50	0.17	0.21	1.2
YAEC SCFA/TSCA	SVOC	Dibenzo(a,h)anthracene	mg/Kg	2	50	0.1	0.19	0.3
YAEC SCFA/TSCA	SVOC	Fluoranthene	mg/Kg	5	50	0.09	0.23	1.9
YAEC SCFA/TSCA	SVOC	Fluorene	mg/Kg	1	50	0.11	0.19	0.11
YAEC SCFA/TSCA	SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	3	50	0.1	0.20	0.49
YAEC SCFA/TSCA	SVOC	Phenanthrene	mg/Kg	2	50	0.13	0.21	0.88
YAEC SCFA/TSCA	SVOC	Pyrene	mg/Kg	5	50	0.08	0.22	1.6
YAEC SCFA/TSCA	TPH	TPH-DRO	mg/Kg	10	10	3.8	10.21	23
YAEC SCFA/TSCA	VOC	1,2,4-Trimethylbenzene	µg/Kg	3	37	30.5	8.51	61.8
YAEC SCFA/TSCA	VOC	1,3,5-Trimethylbenzene	µg/Kg	1	37	30.9	7.45	30.9
YAEC SCFA/TSCA	VOC	2-Butanone	µg/Kg	13	37	2.1	51.89	17
YAEC SCFA/TSCA	VOC	4-Isopropyltoluene	µg/Kg	1	37	3.1	7.35	3.1
YAEC SCFA/TSCA	VOC	Acetone	µg/Kg	18	37	4.8	114.22	120
YAEC SCFA/TSCA	VOC	Bromomethane	µg/Kg	3	37	30.3	16.15	49.5
YAEC SCFA/TSCA	VOC	Carbon Disulfide	µg/Kg	6	37	2.7	22.48	26.7
YAEC SCFA/TSCA	VOC	Diethyl Ether	µg/Kg	8	37	3.2	19.83	79
YAEC SCFA/TSCA	VOC	Ethylbenzene	µg/Kg	1	37	4.4	7.39	4.4
YAEC SCFA/TSCA	VOC	Methylene Chloride	µg/Kg	8	37	26.6	54.41	97
YAEC SCFA/TSCA	VOC	Naphthalene	µg/Kg	2	6	54.6	73.70	275
YAEC SCFA/TSCA	VOC	Toluene	µg/Kg	19	37	2	9.15	30.4

Note

- 1 - Parent and duplicate samples were considered as two separated samples in the summary statistics.
- 2 - Duplicate samples were not included in the summary statistics.
- 3 - Parent and duplicate samples were averaged together before averaging to all other samples in the summary statistics.

Average with Parent Samples Only²

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Average with Parent Samples Only ²				
				Detected	Sampled	Minimum	Mean	Maximum
YAEC SCFA/TSCA	EPH	Pyrene	mg/Kg	5	5	0.111	0.38	0.958
YAEC SCFA/TSCA	EPH	Unadjusted TPH	mg/Kg	4	5	30.3	33.92	57.3
YAEC SCFA/TSCA	Inorganics	Arsenic	mg/Kg	40	40	0.88	3.15	6.6
YAEC SCFA/TSCA	Inorganics	Barium	mg/Kg	30	30	67	96.40	410
YAEC SCFA/TSCA	Inorganics	Chromium	mg/Kg	40	40	12	15.93	31
YAEC SCFA/TSCA	Inorganics	Copper	mg/Kg	10	10	5	11.50	18
YAEC SCFA/TSCA	Inorganics	Lead	mg/Kg	40	40	0.98	9.70	63
YAEC SCFA/TSCA	Inorganics	Mercury	mg/Kg	1	40	0.53	0.28	0.53
YAEC SCFA/TSCA	Inorganics	Nickel	mg/Kg	10	10	9.7	12.47	15
YAEC SCFA/TSCA	Inorganics	Zinc	mg/Kg	10	10	49	66.00	100
YAEC SCFA/TSCA	PCBs	2,4,5,6-TC-M-Xylene (	µg/Kg	4	4	9.82	9.92	10
YAEC SCFA/TSCA	PCBs	Aroclor-1248	µg/Kg	12	459	12.4	19.75	71.3
YAEC SCFA/TSCA	PCBs	Aroclor-1254	µg/Kg	269	459	6.5	554.26	30000
YAEC SCFA/TSCA	PCBs	Aroclor-1260	µg/Kg	200	459	5.48	195.80	3590
YAEC SCFA/TSCA	SVOC	Acenaphthene	mg/Kg	1	46	0.12	0.19	0.12
YAEC SCFA/TSCA	SVOC	Anthracene	mg/Kg	1	46	0.36	0.20	0.36
YAEC SCFA/TSCA	SVOC	Benzo(a)anthracene	mg/Kg	3	46	0.17	0.21	1.2
YAEC SCFA/TSCA	SVOC	Benzo(a)pyrene	mg/Kg	3	46	0.19	0.22	1.1
YAEC SCFA/TSCA	SVOC	Benzo(b)fluoranthene	mg/Kg	3	46	0.18	0.21	1
YAEC SCFA/TSCA	SVOC	Benzo(g,h,i)perylene	mg/Kg	3	46	0.11	0.20	0.57
YAEC SCFA/TSCA	SVOC	Benzo(k)fluoranthene	mg/Kg	3	46	0.15	0.21	0.96
YAEC SCFA/TSCA	SVOC	Carbazole	mg/Kg	1	46	0.16	0.19	0.16
YAEC SCFA/TSCA	SVOC	Chrysene	mg/Kg	3	46	0.17	0.22	1.2
YAEC SCFA/TSCA	SVOC	Dibenzo(a,h)anthracene	mg/Kg	2	46	0.1	0.19	0.3
YAEC SCFA/TSCA	SVOC	Fluoranthene	mg/Kg	4	46	0.09	0.23	1.9
YAEC SCFA/TSCA	SVOC	Fluorene	mg/Kg	1	46	0.11	0.19	0.11
YAEC SCFA/TSCA	SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	3	46	0.1	0.20	0.49
YAEC SCFA/TSCA	SVOC	Phenanthrene	mg/Kg	2	46	0.13	0.21	0.88
YAEC SCFA/TSCA	SVOC	Pyrene	mg/Kg	4	46	0.08	0.22	1.6
YAEC SCFA/TSCA	TPH	TPH-DRO	mg/Kg	10	10	3.8	10.21	23
YAEC SCFA/TSCA	VOC	1,2,4-Trimethylbenzene	µg/Kg	3	35	30.5	8.10	61.8
YAEC SCFA/TSCA	VOC	1,3,5-Trimethylbenzene	µg/Kg	1	35	30.9	6.99	30.9
YAEC SCFA/TSCA	VOC	2-Butanone	µg/Kg	13	35	2.1	46.58	17
YAEC SCFA/TSCA	VOC	4-Isopropyltoluene	µg/Kg	1	35	3.1	6.88	3.1
YAEC SCFA/TSCA	VOC	Acetone	µg/Kg	17	35	4.8	101.89	120
YAEC SCFA/TSCA	VOC	Bromomethane	µg/Kg	2	35	30.3	15.84	49.5
YAEC SCFA/TSCA	VOC	Carbon Disulfide	µg/Kg	6	35	2.7	19.63	26.7
YAEC SCFA/TSCA	VOC	Diethyl Ether	µg/Kg	8	35	3.2	19.99	79
YAEC SCFA/TSCA	VOC	Ethylbenzene	µg/Kg	1	35	4.4	6.92	4.4
YAEC SCFA/TSCA	VOC	Methylene Chloride	µg/Kg	8	35	26.6	49.17	97
YAEC SCFA/TSCA	VOC	Naphthalene	µg/Kg	2	5	54.6	82.76	275
YAEC SCFA/TSCA	VOC	Toluene	µg/Kg	18	35	2	8.78	30.4

Average with Average of Parent and Duplicate Samples³

Study Area	Chemical Group	Oil or Hazardous Materials	Units	Average with Average of Parent and Duplicate Samples ³				
				Detected	Sampled	Minimum	Mean	Maximum
YAEC SCFA/TSCA	EPH	Pyrene	mg/Kg	5	5	0.111	0.38	0.958
YAEC SCFA/TSCA	EPH	Unadjusted TPH	mg/Kg	4	5	30.3	33.92	57.3
YAEC SCFA/TSCA	Inorganics	Arsenic	mg/Kg	40	40	0.88	3.12	6.6
YAEC SCFA/TSCA	Inorganics	Barium	mg/Kg	30	30	67	96.53	410
YAEC SCFA/TSCA	Inorganics	Chromium	mg/Kg	40	40	12	15.95	31
YAEC SCFA/TSCA	Inorganics	Copper	mg/Kg	10	10	5	11.50	18
YAEC SCFA/TSCA	Inorganics	Lead	mg/Kg	40	40	0.98	9.66	63
YAEC SCFA/TSCA	Inorganics	Mercury	mg/Kg	1	40	0.53	0.28	0.53
YAEC SCFA/TSCA	Inorganics	Nickel	mg/Kg	10	10	9.7	12.47	15
YAEC SCFA/TSCA	Inorganics	Zinc	mg/Kg	10	10	49	66.00	100
YAEC SCFA/TSCA	PCBs	2,4,5,6-TC-M-Xylene (	µg/Kg	4	4	9.82	9.92	10
YAEC SCFA/TSCA	PCBs	Aroclor-1248	µg/Kg	11	428	12.4	19.95	71.3
YAEC SCFA/TSCA	PCBs	Aroclor-1254	µg/Kg	255	428	7.49	585.23	30000
YAEC SCFA/TSCA	PCBs	Aroclor-1260	µg/Kg	191	428	5.48	205.63	3730
YAEC SCFA/TSCA	SVOC	Acenaphthene	mg/Kg	1	44	120	192.16	120
YAEC SCFA/TSCA	SVOC	Anthracene	mg/Kg	1	44	360	197.61	360
YAEC SCFA/TSCA	SVOC	Benzo(a)anthracene	mg/Kg	3	44	170	215.80	1200
YAEC SCFA/TSCA	SVOC	Benzo(a)pyrene	mg/Kg	3	44	190	216.93	1100
YAEC SCFA/TSCA	SVOC	Benzo(b)fluoranthene	mg/Kg	3	44	180	212.39	1000
YAEC SCFA/TSCA	SVOC	Benzo(g,h,i)perylene	mg/Kg	3	44	110	201.48	570
YAEC SCFA/TSCA	SVOC	Benzo(k)fluoranthene	mg/Kg	3	44	150	211.93	960
YAEC SCFA/TSCA	SVOC	Carbazole	mg/Kg	1	44	160	193.07	160
YAEC SCFA/TSCA	SVOC	Chrysene	mg/Kg	3	44	170	216.25	1200
YAEC SCFA/TSCA	SVOC	Dibenzo(a,h)anthracene	mg/Kg	2	44	100	194.32	300
YAEC SCFA/TSCA	SVOC	Fluoranthene	mg/Kg	4	44	90	231.48	1900
YAEC SCFA/TSCA	SVOC	Fluorene	mg/Kg	1	44	110	191.93	110
YAEC SCFA/TSCA	SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	3	44	100	198.75	490
YAEC SCFA/TSCA	SVOC	Phenanthrene	mg/Kg	2	44	130	207.95	880
YAEC SCFA/TSCA	SVOC	Pyrene	mg/Kg	4	44	80	223.30	1600
YAEC SCFA/TSCA	TPH	TPH-DRO	mg/Kg	10	10	3.8	10.21	23
YAEC SCFA/TSCA	VOC	1,2,4-Trimethylbenzene	µg/Kg	3	33	30.5	7.60	61.8
YAEC SCFA/TSCA	VOC	1,3,5-Trimethylbenzene	µg/Kg	1	33	30.9	6.41	30.9
YAEC SCFA/TSCA	VOC	2-Butanone	µg/Kg	13	33	2.1	40.06	17
YAEC SCFA/TSCA	VOC	4-Isopropyltoluene	µg/Kg	1	33	3.1	6.30	3.1
YAEC SCFA/TSCA	VOC	Acetone	µg/Kg	16	33	4.8	89.56	120
YAEC SCFA/TSCA	VOC	Bromomethane	µg/Kg	2	33	30.3	14.74	49.5
YAEC SCFA/TSCA	VOC	Carbon Disulfide	µg/Kg	6	33	2.7	16.15	26.7
YAEC SCFA/TSCA	VOC	Diethyl Ether	µg/Kg	7	33	3.2	19.07	79
YAEC SCFA/TSCA	VOC	Ethylbenzene	µg/Kg	1	33	4.4	6.34	4.4
YAEC SCFA/TSCA	VOC	Methylene Chloride	µg/Kg	7	33	26.6	42.14	97
YAEC SCFA/TSCA	VOC	Naphthalene	µg/Kg	2	4	54.6	95.86	275
YAEC SCFA/TSCA	VOC	Toluene	µg/Kg	18	33	2	8.32	30.4

Appendix Table E.2.1

Chemicals in Groundwater - Summary Statistics 2000 - 2006 versus 2006 only
Yankee Nuclear Power Station, Rowe, MA

All GW Data 2000 - 2006

Chemical of Concern (COC)	GW-1	Number Detected	Number Sampled	Percent Detected	Minimum	Average	Maximum	Cancer Risk	Hazard Index
Inorganics									
Antimony	0.006	17	124	14%	0.0008	0.003	0.0063		0.25
Arsenic	0.01	14	124	11%	0.004	0.005	0.068	1.37E-04	3.55
Boron	NA	110	223	49%	0.0012	0.101	1.9		0.15
Chromium	0.1	20	124	16%	0.002	0.007	0.088		0.46
Selenium	0.05	7	123	6%	0.005	0.018	0.05		0.16
Polychlorinated Biphenyls									
Aroclor-1254	0.3	16	116	14%	0.38	0.461	5.5	1.48E-05	4.31
Semivolatile Organic Compounds									
Benzidine	NA	3	86	3%	2.1	8.053	3.7	1.14E-03	0.02
Benzo(a)pyrene	0.2	1	90	1%	0.13	0.373	0.13	1.16E-06	0.00
Volatile Organic Compounds									
1,1-Dichloroethane	70	28	149	19%	0.45	2.379	8		0.00
1,4-Dioxane	NA	7	57	12%	8.4	161.304	36.6	5.40E-07	0.06
Acetone	3000	53	146	36%	2.4	354.653	14000		0.24
Tetrahydrofuran	NA	34	117	29%	1.2	111.709	4470	4.56E-05	0.33
Totals								1.8E-04	5.20

Cancer Risk and Hazard Index based on Max Detect

2006 GW Samples Only

Number Detected	Number Sampled	Percent Detected	Minimum	Average	Maximum	Cancer Risk	Hazard Index
16	45	36%	0.0008	0.004	0.0062		0.24
11	45	24%	0.004	0.004	0.0161	3.24E-05	0.84
31	34	91%	0.0012	0.056	0.214		0.02
10	45	22%	0.002	0.003	0.0082		0.04
6	45	13%	0.005	0.007	0.0091		0.03
0	13	0%					
0	17	0%					
0	17	0%					
9	54	17%	0.6	1.583	2.7		0.00
7	54	13%	8.4	29.061	36.6	5.40E-07	0.06
30	54	56%	2.6	251.081	4890		0.09
34	54	63%	1.2	229.628	456	1.00E-05	0.02
						4.3E-05	1.33

Tetrahydrofuran: Last sample in MW107D 4/2006 = 456 µg/L

Exceed GW-1

Acetone: Exceeds GW-1 in MW-101C (4890 and 3570 reanalysis, 12/2006)

Antimony: Exceeds GW-1 in CB-3 (5/2006)

Arsenic: MW-101A, MW-107A consistently > GW-1

Appendix Table E.2.2
Summary Statistics Comparison of Surface Soil (0-3 ft bgs), Surface and Subsurface Soils (0-15 ft bgs) and Surface Soils (0-0.5 feet bgs)
Yankee Nuclear Power Station, Rowe, MA

Study Area and Analyte	Surface soils 0-3 ft bgs						Surface and Subsurface soils 0-15 ft bgs						Surface soils 0-0.5 feet bgs					
	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹
TransCanada Property																		
Extractable Petroleum Hydrocarbons (mg/kg)																		
2-Methylnaphthalene - EPH	2	3	67%	0.22	0.15	0.441	2	3	67%	0.19	0.18	0.441	2	3	67%	0.22	0.15	0.441
Adjusted C11-C22 Aromatics	2	3	67%	74.78	92.50	117	2	3	67%	74.78	92.50	117	2	3	67%	74.78	92.50	117
Adjusted TPH	2	3	67%	256.62	318.00	437	2	3	67%	256.62	318.00	437	2	3	67%	256.62	318.00	437
Anthracene - EPH	1	3	33%	0.06	0.07	0.0218	1	9	11%	0.14	0.18	0.0218	1	3	33%	0.06	0.07	0.0218
Phenanthrene - EPH	2	3	67%	0.08	0.08	0.101	2	9	22%	0.15	0.18	0.101	2	3	67%	0.08	0.08	0.101
Unadjusted C11-C22 Aromatics	3	5	60%	54.07	25.80	117	5	13	38%	22.84	5.50	117	3	5	60%	54.07	25.80	117
Unadjusted C19-C36 Aliphatics	2	5	40%	44.47	20.10	98.8	3	13	23%	18.94	3.79	98.8	2	5	40%	44.47	20.10	98.8
Unadjusted C9-C18 Aliphatics	2	5	40%	81.05	20.10	221	2	13	15%	32.57	3.67	221	2	5	40%	81.05	20.10	221
Unadjusted TPH	2	3	67%	256.62	318.00	437	2	3	67%	256.62	318.00	437	2	3	67%	256.62	318.00	437
Volatile Petroleum Hydrocarbons (mg/kg)																		
Adjusted C9-C10 Aromatics	2	5	40%	2.12	0.27	7.12	3	11	27%	5.32	4.45	23	2	5	40%	2.12	0.27	7.12
Adjusted C9-C12 Aliphatics	3	5	60%	2.32	0.48	7.7	3	5	60%	2.32	0.48	7.7	3	5	60%	2.32	0.48	7.7
Ethylbenzene - VPH	2	5	40%	0.02	0.02	0.0358	2	11	18%	0.30	0.39	0.0358	2	5	40%	0.02	0.02	0.0358
m+p-Xylenes - VPH	2	5	40%	0.06	0.05	0.14	2	11	18%	0.31	0.39	0.14	2	5	40%	0.06	0.05	0.14
Naphthalene - VPH	2	5	40%	0.11	0.02	0.318	2	11	18%	0.63	0.80	0.318	2	5	40%	0.11	0.02	0.318
o-Xylene - VPH	2	5	40%	0.03	0.02	0.0663	2	11	18%	0.30	0.39	0.0663	2	5	40%	0.03	0.02	0.0663
Toluene - VPH	2	5	40%	0.03	0.02	0.0481	4	11	36%	1.57	0.39	12	2	5	40%	0.03	0.02	0.0481
Unadjusted C5-C8 Aliphatics	5	7	71%	2.56	0.97	1.92	7	15	47%	6.30	4.72	28	5	7	71%	2.56	0.97	1.92
Unadjusted C9-C12 Aliphatics	5	7	71%	5.09	4.72	14.8	6	15	40%	7.70	5.35	43	5	7	71%	5.09	4.72	14.8
Total Petroleum Hydrocarbons (mg/kg)																		
TPH-DRO	25	30	83%	7.52	6.20	22	26	34	76%	7.76	5.95	35	14	15	93%	9.60	8.80	22
Inorganics (mg/Kg)																		
Arsenic	30	30	100%	2.37	2.05	4.6	39	42	93%	2.17	1.95	4.6	16	16	100%	3.00	3.15	4.6
Cadmium	1	30	3%	0.61	0.38	6.2	1	42	2%	0.71	0.39	6.2	1	16	6%	0.81	0.39	6.2
Chromium	29	30	97%	14.02	12.00	28	39	42	93%	12.56	12.00	28	15	16	94%	11.08	12.00	16
Copper	30	30	100%	16.90	15.50	33	41	42	98%	16.04	14.50	53	16	16	100%	15.51	14.00	28
Lead	36	36	100%	10.17	2.55	230	72	80	90%	6.66	3.20	230	14	14	100%	20.86	2.50	230
Mercury	1	30	3%	0.31	0.29	0.73	3	42	7%	0.35	0.29	2	0	16	0%	ND		
Nickel	30	30	100%	17.82	13.00	98	36	42	86%	15.17	12.00	98	16	16	100%	18.36	12.00	98
Selenium	8	30	27%	3.70	1.20	13	11	42	26%	4.44	3.18	16	2	16	13%	2.43	1.20	8.9
Silver	1	30	3%	0.17	0.12	0.81	1	42	2%	0.23	0.12	0.81	0	16	0%	ND		
Thallium	1	30	3%	0.45	0.28	0.82	2	42	5%	0.83	0.29	0.82	0	16	0%	ND		
Zinc	29	30	97%	62.53	56.00	250	33	42	79%	64.81	60.00	250	15	16	94%	64.44	53.50	250
Polychlorinated Biphenyls (ug/kg)																		
Aroclor-1248	1	71	1%	9.13	5.05	9.36	1	114	1%	11.94	16.50	9.36	1	58	2%	7.35	4.98	9.36
Aroclor-1254	36	71	51%	28.81	18.00	120	37	114	32%	25.10	16.50	120	35	58	60%	29.68	18.85	103
Aroclor-1260	19	71	27%	11.89	12.60	30.3	19	114	17%	13.66	16.50	30.3	19	58	33%	10.73	5.60	30.3
Semivolatile Organic Compounds (ug/kg)																		
Acenaphthene	2	19	11%	169.53	180.00	359	2	31	6%	173.26	180.00	359	2	12	17%	180.13	180.00	359
Acenaphthylene	6	19	32%	192.89	180.00	356	6	31	19%	187.58	180.00	356	5	12	42%	207.29	190.00	356
Anthracene	6	19	32%	212.11	180.00	791	6	31	19%	199.35	180.00	791	5	12	42%	247.60	180.00	791
Benzo(a)anthracene	8	19	42%	438.74	180.00	2,790	8	31	26%	338.26	180.00	2,790	6	12	50%	602.71	197.50	2,790
Benzo(a)pyrene	7	19	37%	348.79	180.00	2,570	7	31	23%	283.13	180.00	2,570	6	12	50%	460.29	187.50	2,570
Benzo(b)fluoranthene	7	19	37%	391.84	180.00	2,370	7	31	23%	309.52	180.00	2,370	6	12	50%	525.71	194.50	2,370
Benzo(g,h,i)perylene	6	19	32%	262.91	180.00	1,230	6	31	19%	230.49	180.00	1,230	5	12	42%	328.15	182.50	1,230
Benzo(k)fluoranthene	7	19	37%	356.63	180.00	2,430	7	31	23%	287.94	180.00	2,430	6	12	50%	470.13	187.50	2,430
Benzoic acid	1	12	8%	883.33	900.00	150	1	24	4%	877.08	900.00	150	1	7	14%	871.43	900.00	150
Butyl benzyl phthalate	1	12	8%	219.58	182.50	500	1	24	4%	199.38	180.00	500	1	7	14%	247.14	195.00	500
Carbazole	1	12	8%	197.92	180.00	350	1	24	4%	188.54	180.00	350	1	7	14%	210.00	185.00	350
Chrysene	8	19	42%	444.32	180.00	2,850	8	31	26%	341.68	180.00	2,850	6	12	50%	610.21	197.50	2,850
Dibenzo(a,h)anthracene	2	19	11%	175.33	180.00	400	2	31	6%	176.81	180.00	400	2	12	17%	189.31	180.00	400
Fluoranthene	9	19	47%	764.21	185.00	5,860	9	31	29%	537.74	180.00	5,860	6	12	50%	1102.54	230.00	5,860
Fluorene	1	19	5%	163.21	180.00	150	1	31	3%	169.39	180.00	150	1	12	8%	170.13	180.00	150
Indeno(1,2,3-cd)pyrene	5	19	26%	267.14	180.00	1,440	5	31	16%	233.08	180.00	1,440	4	12	33%	334.04	182.50	1,440
Phenanthrene	7	19	37%	343.56	180.00	2,430	7	31	23%	279.93	180.00	2,430	6	12	50%	458.65	180.00	2,430
Pyrene	9	19	47%	677.79	185.00	5,200	9	31	29%	484.77	180.00	5,200	6	12	50%	985.71	200.00	5,200

Appendix Table E.2.2
Summary Statistics Comparison of Surface Soil (0-3 ft bgs), Surface and Subsurface Soils (0-15 ft bgs) and Surface Soils (0-0.5 feet bgs)
Yankee Nuclear Power Station, Rowe, MA

Study Area and Analyte	Surface soils 0-3 ft bgs						Surface and Subsurface soils 0-15 ft bgs						Surface soils 0-0.5 feet bgs					
	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹
Volatile Organic Compounds (ug/kg)																		
2-Butanone	0	2	0%	ND			4	10	40%	5.33	6.00	3.6	0	2	0%	ND		
Acetone	0	2	0%	ND			5	10	50%	31.15	22.00	100	0	2	0%	ND		
Carbon Disulfide	0	2	0%	ND			5	10	50%	4.87	3.00	23	0	2	0%	ND		
Diethyl Ether	0	2	0%	ND			1	10	10%	6.13	6.00	1.3	0	2	0%	ND		
Toluene	1	2	50%	31.00	31.00	46	9	10	90%	56.99	34.00	230	1	2	50%	31.00	31.00	46
YAEC Non-BUD/TSCA																		
Extractable Petroleum Hydrocarbons (mg/Kg)																		
Unadjusted C11-C22 Aromatics	5	17	29%	32.99	4.28	226	5	17	29%	32.99	4.28	226	4	8	50%	57.59	29.20	226
Unadjusted C19-C36 Aliphatics	5	17	29%	31.66	4.28	163	5	17	29%	31.66	4.28	163	4	8	50%	49.78	36.40	163
Volatile Petroleum Hydrocarbons (mg/Kg)																		
Adjusted C9-C12 Aliphatics	2	3	67%	0.15	0.13	0.209	2	3	67%	0.15	0.13	0.209	0	1	0%	ND		
m+p-Xylenes - VPH	1	3	33%	0.053	0.06	0.0275	1	3	33%	0.053	0.06	0.0275	1	1	100%	0.028	0.03	0.0275
Toluene - VPH	1	3	33%	0.051	0.04	0.0871	1	3	33%	0.051	0.04	0.0871	1	1	100%	0.087	0.09	0.0871
Unadjusted C5-C8 Aliphatics	3	7	43%	3.46	3.57	0.34	3	7	43%	3.46	3.57	0.34	1	3	33%	5.56	4.43	0.34
Unadjusted C9-C12 Aliphatics	3	7	43%	3.47	3.57	0.311	3	7	43%	3.47	3.57	0.311	1	3	33%	5.52	4.43	0.24
Total Petroleum Hydrocarbons (mg/Kg)																		
TPH-DRO	42	49	86%	31.13	7.90	320	46	54	85%	28.87	7.45	320	20	22	91%	43.97	7.70	320
TPH-GRO	1	13	8%	1.63	1.25	4.6	1	16	6%	1.56	1.25	4.6	0	5	0%	ND		
Inorganics (mg/Kg)																		
Antimony	2	8	25%	1.52	1.67	0.83	2	8	25%	1.52	1.67	0.83	1	4	25%	1.52	1.67	0.83
Arsenic	58	61	95%	2.56	1.70	12	63	66	95%	2.49	1.70	12	27	27	100%	2.82	2.50	5.9
Beryllium	1	73	1%	0.39	0.40	1	1	78	1%	0.39	0.40	1	0	33	0%	ND		
Chromium	63	63	100%	13.52	13.00	28	68	68	100%	13.61	13.00	28	28	28	100%	12.53	12.00	24
Copper	42	63	67%	9.38	9.50	25	47	68	69%	9.67	9.80	25	19	28	68%	9.34	8.65	22
Lead	78	78	100%	16.99	4.50	160	83	83	100%	16.34	4.70	160	42	42	100%	20.44	5.20	150
Mercury	2	63	3%	0.29	0.30	0.008	2	68	3%	0.29	0.30	0.008	1	28	4%	0.29	0.30	0.008
Nickel	53	63	84%	11.88	11.00	78	58	68	85%	11.88	11.00	78	23	28	82%	10.49	11.00	22
Selenium	10	63	16%	3.38	1.45	12	11	68	16%	3.33	1.45	12	5	28	18%	3.53	1.83	9.2
Zinc	46	63	73%	64.80	56.00	520	51	68	75%	63.60	55.50	520	19	28	68%	72.23	58.00	520
Polychlorinated Biphenyls (µg/Kg)																		
Aroclor-1016	14	241	6%	14.09	5.50	83.8	14	248	6%	14.12	5.50	83.8	14	219	6%	13.99	5.35	83.8
Aroclor-1248	15	241	6%	18.87	5.50	440	15	248	6%	18.77	5.50	440	15	219	7%	19.25	5.35	440
Aroclor-1254	201	241	83%	132.36	87.00	826	204	248	82%	129.65	82.60	826	188	219	86%	137.52	92.20	826
Aroclor-1260	175	241	73%	53.51	24.70	617	176	248	71%	52.67	23.30	617	169	219	77%	56.11	28.00	617
Dioxin/Furans (pg/g)																		
Dioxin/Furan TEQ	2	2	100%	0.53	0.53	0.798	2	2	100%	0.53	0.53	0.7975	1	1	100%	0.80	0.80	0.798
Semivolatile Organic Compounds (µg/Kg)																		
Fluoranthene	1	17	6%	265.88	200.00	400	1	20	5%	253.50	200.00	400	1	7	14%	333.57	215.00	400
Pyrene	1	17	6%	265.88	200.00	400	1	20	5%	253.50	200.00	400	1	7	14%	333.57	215.00	400

Appendix Table E.2.2

Summary Statistics Comparison of Surface Soil (0-3 ft bgs), Surface and Subsurface Soils (0-15 ft bgs) and Surface Soils (0-0.5 feet bgs)

Yankee Nuclear Power Station, Rowe, MA

Study Area and Analyte	Surface soils 0-3 ft bgs						Surface and Subsurface soils 0-15 ft bgs						Surface soils 0-0.5 feet bgs					
	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹
YAEC BUD/TSCA																		
Extractable Petroleum Hydrocarbons (mg/Kg)																		
2-Methylnaphthalene - EPH	4	48	8%	0.081	0.07	0.13	4	52	8%	0.080	0.07	0.13	3	41	7%	0.075	0.07	0.13
Acenaphthene - EPH	7	48	15%	0.097	0.07	0.52	7	52	13%	0.095	0.07	0.52	6	41	15%	0.094	0.07	0.52
Acenaphthylene - EPH	1	48	2%	0.082	0.07	0.0613	1	52	2%	0.081	0.07	0.0613	1	41	2%	0.075	0.07	0.0613
Adjusted C11-C22 Aromatics	6	26	23%	37.95	15.18	389	6	28	21%	36.21	15.10	389	6	24	25%	39.93	15.25	389
Adjusted TPH	17	48	35%	75.06	15.45	1080	18	52	35%	71.09	15.33	1080	16	41	39%	84.86	15.95	1080
Anthracene - EPH	13	48	27%	0.12	0.07	0.924	13	52	25%	0.11	0.07	0.924	12	41	29%	0.12	0.07	0.924
Benzo(a)anthracene - EPH	9	48	19%	0.19	0.08	3.21	10	52	19%	0.18	0.07	3.21	7	41	17%	0.21	0.08	3.21
Benzo(a)pyrene - EPH	13	48	27%	0.16	0.07	2.04	14	52	27%	0.15	0.07	2.04	10	41	24%	0.17	0.07	2.04
Benzo(b)fluoranthene - EPH	15	48	31%	0.13	0.07	1.69	17	52	33%	0.12	0.07	1.69	12	41	29%	0.13	0.07	1.69
Benzo(g,h,i)perylene - EPH	10	48	21%	0.11	0.07	0.753	10	52	19%	0.11	0.07	0.753	8	41	20%	0.11	0.07	0.753
Benzo(k)fluoranthene - EPH	14	48	29%	0.16	0.07	2.23	15	52	29%	0.16	0.07	2.23	11	41	27%	0.17	0.07	2.23
Chrysene - EPH	16	48	33%	0.20	0.07	3.18	17	52	33%	0.19	0.07	3.18	13	41	32%	0.21	0.07	3.18
Dibenzo(a,h)anthracene - EPH	3	48	6%	0.087	0.07	0.292	3	52	6%	0.086	0.07	0.292	3	41	7%	0.081	0.07	0.292
Fluoranthene - EPH	22	48	46%	0.32	0.08	5.31	25	52	48%	0.30	0.08	5.31	19	41	46%	0.35	0.07	5.31
Fluorene - EPH	7	48	15%	0.096	0.07	0.539	7	52	13%	0.094	0.07	0.539	6	41	15%	0.093	0.07	0.539
Indeno(1,2,3-cd)pyrene - EPH	6	48	13%	0.11	0.07	0.821	6	52	12%	0.11	0.07	0.821	6	41	15%	0.11	0.08	0.821
Naphthalene - EPH	1	48	2%	0.083	0.07	0.0945	1	52	2%	0.082	0.07	0.0945	1	41	2%	0.076	0.07	0.0945
Phenanthrene - EPH	15	48	31%	0.21	0.08	2.39	15	52	29%	0.20	0.08	2.39	12	41	29%	0.23	0.08	2.39
Pyrene - EPH	19	48	40%	0.28	0.08	4.34	22	52	42%	0.27	0.08	4.34	16	41	39%	0.31	0.08	4.34
Unadjusted C11-C22 Aromatics	44	141	31%	38.61	13.00	788	55	192	29%	31.91	4.33	788	28	84	33%	45.16	14.58	788
Unadjusted C19-C36 Aliphatics	47	141	33%	37.80	14.10	1,010	54	192	28%	32.02	8.66	1010	34	84	40%	44.22	15.00	1010
Unadjusted C9-C18 Aliphatics	15	141	11%	22.31	3.88	562	17	192	9%	18.82	3.83	562	12	84	14%	26.68	14.18	562
Unadjusted TPH	18	48	38%	76.23	15.73	1,080	19	52	37%	72.17	15.43	1080	17	41	41%	86.23	16.25	1080
Volatile Petroleum Hydrocarbons (mg/kg)																		
Adjusted C9-C10 Aromatics	5	22	23%	3.36	0.13	42.5	5	24	21%	3.09	0.13	42.5	5	17	29%	4.28	0.13	42.5
Adjusted C9-C12 Aliphatics	6	13	46%	0.96	0.10	10.3	6	13	46%	0.96	0.10	10.3	6	13	46%	0.96	0.10	10.3
m+p-Xylenes - VPH	2	22	9%	2.82	0.05	0.0841	2	24	8%	2.59	0.05	0.0841	2	17	12%	3.63	0.05	0.0841
Naphthalene - VPH	3	22	14%	1.49	0.03	0.987	3	24	13%	1.37	0.03	0.987	3	17	18%	1.91	0.03	0.987
o-Xylene - VPH	1	22	5%	1.41	0.03	0.0461	1	24	4%	1.29	0.03	0.0461	1	17	6%	1.81	0.03	0.0461
Toluene - VPH	4	22	18%	1.64	0.03	4.84	4	24	17%	1.51	0.03	4.84	2	17	12%	1.83	0.03	0.221
Unadjusted C5-C8 Aliphatics	17	50	34%	2.94	2.71	19.3	17	62	27%	3.02	2.95	19.3	16	34	47%	2.76	2.23	19.3
Unadjusted C9-C12 Aliphatics	16	50	32%	5.12	2.78	94.9	16	62	26%	4.77	3.06	94.9	16	34	47%	6.30	2.78	94.9
Total Petroleum Hydrocarbons (mg/kg)																		
TPH-DRO	27	33	82%	14.47	7.40	60	27	37	73%	13.02	6.50	60	14	16	88%	18.73	12.00	59
TPH-GRO	1	10	10%	16.15	1.25	150	1	12	8%	13.67	1.25	150	0	5	0%	ND		
Inorganics (mg/kg)																		
Arsenic	83	94	88%	3.11	2.50	27	109	123	89%	2.95	2.40	27	41	45	91%	3.72	3.10	27
Boron	0	2	0%	ND			7	7	100%	87.71	88.00	110	0	1	0%	5.00	5.00	
Beryllium	2	107	2%	0.30	0.25	0.609	3	134	2%	0.30	0.25	0.609	1	51	2%	0.30	0.25	0.343
Cadmium	2	107	2%	1.05	1.25	2.5	2	141	1%	1.07	1.25	2.5	2	51	4%	1.08	1.25	2.5
Chromium	97	101	96%	13.11	12.00	49	127	132	96%	13.16	12.00	49	45	48	94%	12.18	12.00	32
Copper	78	107	73%	13.39	11.00	94	102	134	76%	13.81	12.00	94	37	51	73%	14.43	11.00	93
Lead	118	122	97%	11.56	5.70	120	143	149	96%	10.20	5.10	120	66	68	97%	12.07	6.43	120
Lithium	2	2	100%	15.5	15.50	18	3	3	100%	16	17.00	18	1	1	100%	13	13.00	13
Mercury	9	107	8%	0.24	0.25	0.5	14	141	10%	0.24	0.25	0.53	4	51	8%	0.24	0.25	0.019
Nickel	67	101	66%	12.50	10.00	110	85	125	68%	12.37	11.00	110	30	48	63%	10.60	10.00	28
Selenium	5	107	5%	4.22	5.00	10	10	141	7%	4.57	5.00	13	2	51	4%	4.16	5.00	10
Zinc	37	98	38%	88.68	75.00	750	41	117	35%	86.19	75.00	750	17	46	37%	89.40	75.00	750
Polychlorinated Biphenyls (µg/kg)																		
Aroclor-1248	6	820	1%	10.5	5.15	71.2	6	954	1%	10.96	5.53	71.2	6	641	1%	9.74	5.00	71.2
Aroclor-1254	649	820	79%	392.2	153	5,400	697	954	73%	348.64	119.50	5,400	553	641	86%	459.95	200.00	5,400
Aroclor-1260	553	820	67%	184.0	54.7	3,590	578	954	61%	162.56	37.60	3,590	501	641	78%	221.52	82.20	3,590
Dioxin/Furans (pg/g)																		
Dioxin/Furan TEQ	12	12	100%	1.19	0.50	7.38	27	27	100%	1.12	0.39	7.376	19	19	100%	1.51	0.56	7.376

Appendix Table E.2.2
Summary Statistics Comparison of Surface Soil (0-3 ft bgs), Surface and Subsurface Soils (0-15 ft bgs) and Surface Soils (0-0.5 feet bgs)
Yankee Nuclear Power Station, Rowe, MA

Study Area and Analyte	Surface soils 0-3 ft bgs						Surface and Subsurface soils 0-15 ft bgs						Surface soils 0-0.5 feet bgs					
	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹	Det	N	Detected Frequency	Average	Median	Maximum ¹
Semivolatile Organic Compounds (µg/kg)																		
1-Methylnaphthalene	1	12	8%	117.9	120.3	185	1	12	8%	117.88	120.25	185	1	9	11%	125.33	130.00	185
2-Methylnaphthalene	2	63	3%	193.9	180.0	348	2	79	3%	191.82	180.00	348	2	40	5%	202.93	180.00	348
Acenaphthene	8	63	13%	196.4	175.0	530	8	79	10%	193.81	180.00	530	8	40	20%	206.86	175.00	530
Acenaphthylene	10	63	16%	221.7	180.0	822	10	79	13%	213.93	180.00	822	9	40	23%	248.22	180.00	822
Anthracene	17	63	27%	246.9	180.0	1,500	17	79	22%	234.07	180.00	1,500	15	40	38%	288.43	180.00	1,500
Benzidine	2	41	5%	1494.2	1750.0	234	2	44	5%	1516.16	1750.00	234	2	27	7%	1447.20	1750.00	234
Benzo(a)anthracene	28	63	44%	379.2	180.0	2,210	26	79	33%	341.65	180.00	2,210	22	40	55%	489.12	185.00	2,210
Benzo(a)pyrene	26	63	41%	348.5	180.0	2,830	24	79	30%	317.35	180.00	2,830	20	40	50%	449.21	185.00	2,830
Benzo(b)fluoranthene	24	63	38%	385.4	180.0	3,210	22	79	28%	346.80	180.00	3,210	19	40	48%	506.00	185.00	3,210
Benzo(g,h,i)perylene	17	63	27%	243.8	180.0	837	17	79	22%	231.55	180.00	837	15	40	38%	282.58	182.50	837
Benzo(k)fluoranthene	23	63	37%	367.7	180.0	2,850	22	79	28%	331.39	180.00	2,850	19	40	48%	473.15	185.00	2,850
Bis(2-ethylhexyl)phthalate	1	63	2%	196.6	180.0	448	1	73	1%	198.88	180.00	448	1	40	3%	207.04	180.00	448
Carbazole	6	63	10%	199.6	180.0	810	6	79	8%	196.36	180.00	810	6	40	15%	211.90	175.00	810
Chrysene	27	63	43%	427.3	180.0	2,840	25	79	32%	379.74	180.00	2,840	21	40	53%	562.35	185.00	2,840
Dibenzo(a,h)anthracene	7	63	11%	187.4	180.0	210	7	79	9%	186.60	180.00	210	6	40	15%	194.62	177.50	210
Dibenzofuran	3	63	5%	199.5	180.0	450	3	73	4%	196.77	180.00	450	3	40	8%	211.70	180.00	450
Fluoranthene	35	63	56%	668.4	185.0	4,090	34	79	43%	568.86	180.00	4,090	24	40	60%	909.29	202.50	4,090
Fluorene	5	63	8%	202.2	180.0	750	5	79	6%	198.42	180.00	750	5	40	13%	215.97	175.00	750
Indeno(1,2,3-cd)pyrene	15	63	24%	242.7	180.0	892	15	79	19%	230.69	180.00	892	13	40	33%	280.45	181.50	892
Isophorone	1	63	2%	191.2	180.0	135	1	73	1%	189.59	180.00	135	1	40	3%	198.59	180.00	135
Naphthalene	4	63	6%	193.9	180.0	420	4	79	5%	191.79	180.00	420	3	40	8%	205.38	180.00	420
Phenanthrene	20	62	32%	380.5	182.5	4,000	19	78	24%	340.92	182.50	4,000	15	39	38%	494.37	185.00	4,000
Pyrene	33	63	52%	604.8	180.0	4,990	32	79	41%	518.61	180.00	4,990	23	40	58%	827.57	192.50	4,990
Volatile Organic Compounds (µg/kg)																		
1,2,4-Trimethylbenzene							1	74	1%	11.252027	2.50	5.1	0	32	0%	ND		
1,2-Dichloroethane	1	48	2%	15.56	2.50	9.3	1	74	1%	11.31	2.50	9.3	0	32	0%	ND		
1,3,5-Trimethylbenzene	0	46	0%	ND			1	74	1%	11.24	2.50	4.5	0	32	0%	ND		
2-Butanone	14	46	30%	143.12	5.50	24	20	72	28%	94.66	5.50	15	11	30	37%	165.66	5.00	6
2-Hexanone	1	48	2%	135.46	2.75	1	1	74	1%	89.65	2.50	1	1	32	3%	154.68	2.75	1
4-Isopropyltoluene	0	46	0%	ND			2	74	3%	11.27	2.50	5.8	0	32	0%	ND		
4-Methyl-2-Pentanone	4	48	8%	136.33	3.00	10	3	74	4%	90.12	2.65	9	3	32	9%	155.75	3.00	9
Acetone	12	47	26%	82.60	6.00	86	23	73	32%	65.24	6.30	200	8	31	26%	20.30	6.00	77
Carbon Disulfide	1	48	2%	68.75	2.75	0.5	8	74	11%	46.12	2.60	13.5	1	32	3%	78.36	2.75	0.5
Dichlorodifluoromethane	3	48	6%	28.92	2.75	6.7	2	74	3%	19.99	2.50	6.7	1	32	3%	32.72	2.85	6.7
Diethyl Ether	0	46	0%	ND			5	74	7%	17.92	5.00	79	0	32	0%	ND		
Ethylbenzene	0	46	0%	ND			1	74	1%	11.24	2.50	4.4	0	32	0%	ND		
Isopropylbenzene	0	46	0%	ND			1	74	1%	11.18	2.50	1	0	32	0%	ND		
m+p-Xylenes	1	48	2%	28.77	2.75	1.8	1	74	1%	19.94	2.50	1.8	1	32	3%	32.58	2.85	1.8
Methylene Chloride	0	46	0%	ND			5	74	7%	99.44	8.50	97	0	32	0%	ND		
n-Butylbenzene	1	48	2%	16.10	2.50	35	1	74	1%	11.66	2.50	35	0	32	0%	17.28	2.50	
n-Propylbenzene	0	46	0%	ND			1	74	1%	11.20	2.50	1.4	0	32	0%	ND		
o-Xylene	1	48	2%	15.40	2.50	1.8	1	74	1%	11.21	2.50	1.8	1	32	3%	17.26	2.50	1.8
sec-Butylbenzene	0	46	0%	ND			1	74	1%	11.23	2.50	3.2	0	32	0%	ND		
Tetrachloroethene	0	46	0%	ND			2	74	3%	11.17	2.50	0.8	0	32	0%	ND		
Toluene	17	48	35%	143.24	2.68	5740	26	74	35%	94.66	2.75	5740	11	32	34%	23.39	2.50	98
Trichlorofluoromethane	4	48	8%	15.42	2.50	5.2	7	74	9%	11.24	2.50	5.6	4	32	13%	17.26	2.50	5.2

Notes:

Only analytes detected in at least one sample from these Study Areas are presented.

Samples with no sample depth information assumed to be surface grab samples and included in all statistics.

¹ - In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits

Appendix Table E.3.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Current Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) from Trans Canada Shoreline, Groundwater from Trans Canada, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator						
Dermal Contact with Soil	1.7E-08	8.3%	Aroclor-1254 (70%)	7.2E-03	11.2%	Aroclor-1254 (47%)
Incidental Ingestion of Soil	1.0E-08			5.2E-03		
Inhalation of Fugitive Dust	7.9E-10	<1%	Nickel (99%)	1.2E-07	<1%	Zinc (63%)
Dermal Contact with Sediment	1.4E-07	67.9%	Aroclor-1254 (65%)	4.7E-02	72.4%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08	23.4%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	1.0E-02	16.2%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.0E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.1E-05	<1%	Cadmium (65%)
Total Risks*:	2.0E-07			6.5E-02		
Future Adolescent Recreator						
Dermal Contact with Soil	9.7E-09	4.0%	Aroclor-1254 (70%)	2.3E-03	5.2%	Aroclor-1254 (47%)
Incidental Ingestion of Soil	3.5E-09			9.5E-04		
Inhalation of Fugitive Dust	1.4E-09	<1%	Nickel (99%)	1.2E-07	<1%	Zinc (63%)
Dermal Contact with Sediment	2.1E-07	88.8%	Aroclor-1254 (65%)	4.0E-02	90.3%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.6E-08	6.6%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	1.9E-03	4.3%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	9.0E-05	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	4.1E-06	<1%	Cadmium (65%)
Total Risks*:	2.4E-07			4.4E-02		
Future Adult Recreator						
Dermal Contact with Soil	7.7E-09	4.0%	Aroclor-1254 (70%)	1.7E-03	5.2%	Aroclor-1254 (47%)
Incidental Ingestion of Soil	2.8E-09			6.9E-04		
Inhalation of Fugitive Dust	1.6E-09	<1%	Nickel (99%)	1.2E-07	<1%	Zinc (63%)
Dermal Contact with Sediment	1.7E-07	88.6%	Aroclor-1254 (65%)	2.9E-02	90.3%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.3E-08	6.6%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	1.4E-03	4.3%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	6.6E-05	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.0E-06	<1%	Cadmium (65%)
Total Risks*:	1.9E-07			3.2E-02		
Child + Adolescent + Adult	6.3E-07					

* Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways. Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.3.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		2.87E-04	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		1.31E-04	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		2.08E-04	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		1.70E-03	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		5.22E-06	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		3.54E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	1.16E-08	69.6%	3.38E-03	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	5.07E-09	30.4%	1.48E-03	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		1.08E-09	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		2.51E-08	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		7.47E-09	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		1.31E-08	<1%

Total Cancer Risk: 1.67E-08 **Hazard Index:** 7.23E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.95E-07 (cancer)	4.61E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		1.21E-04	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		5.14E-04	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		4.08E-04	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		5.70E-04	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		3.06E-04	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		2.08E-04	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	7.23E-09	69.6%	2.11E-03	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	3.16E-09	30.4%	9.22E-04	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		1.26E-09	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		2.95E-08	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		7.30E-09	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		1.28E-08	<1%
Total Cancer Risk:					1.04E-08		Hazard Index:	5.16E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.64E-08 (cancer)	5.41E-07 (non-cancer)
	IR	Ingestion Rate (mg/day)		100
	EF	Exposure Frequency (ev/yr)		31
	ED	Exposure Duration (day/ev)		1
	EP	Exposure Period (yr)		6
	CF	Conversion Factor (kg/mg)		0.000001
	BW	Body Weight (kg)		15.7
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.3

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RFC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		3.38E-10	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		8.61E-09	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		9.10E-09	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	7.85E-10	99.9%	1.91E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		8.54E-10	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		7.46E-08	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	7.12E-13	<1%	4.15E-09	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	3.11E-13	<1%	1.82E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		2.54E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		5.55E-14	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		2.45E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		3.44E-16	<1%
Total Cancer Risk:					7.86E-10	Hazard Index:		1.19E-07

Notes

Intake Factor (IF) = $\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	2.43E-03 (cancer)	2.83E-02 (non-cancer)
EF	Exposure Frequency (ev/yr)	31	
ED	Exposure Duration (hr/ev)	8	
EP	Exposure Period (yr)	6	
CF	Conversion factor (d/hr)	0.042	
AP	Averaging Period - Cancer (d)	25,550	
	Averaging Period - Non-Cancer (d)	2,190	
PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP N/A - Not available)

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table E.3.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		1.40E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		1.35E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		8.88E-06	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		2.28E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		4.57E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		5.29E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		7.60E-03	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		3.64E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		9.64E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	8.82E-08	64.9%	2.57E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		3.34E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		3.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.05E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	4.12E-09	3.0%	2.20E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	4.14E-08	30.4%	2.21E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		5.27E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	4.42E-11	<1%	1.84E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	4.08E-10	<1%	2.18E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		7.90E-04	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		3.49E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		5.93E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	1.81E-09	1.3%	9.66E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		7.94E-07	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		2.77E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		6.57E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		4.61E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		4.47E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		2.93E-07	<1%
Total Cancer Risk:					1.36E-07		Hazard Index:	4.69E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.13E-06 (cancer)	1.32E-05 (non-cancer)
----------------------	---	---	-------------------	-----------------------

SA	Surface Area Exposed to Soil (cm ² /day)	2434
AF	Soil Skin Adherence Factor (mg/cm ²)	1
EF	Exposure Frequency (ev/yr)	31
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	6
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		5.75E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.85E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		1.22E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		6.70E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		2.08E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		3.62E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		3.12E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		4.27E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.98E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	5.62E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		4.95E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		5.19E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		1.56E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.37E-09	5.1%	1.26E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.38E-08	50.9%	1.27E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		7.79E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.09E-11	<1%	3.79E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	1.25E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		3.25E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.43E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		8.76E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.04E-09	2.2%	5.55E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		3.26E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		1.14E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		2.70E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.89E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.84E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		1.00E-07	<1%

Total Cancer Risk: 4.68E-08 **Hazard Index:** 1.05E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.64E-08 (cancer)	5.41E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		1.10E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.00E-04	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		3.46E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:		1.05E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.51E-03 (cancer)	5.27E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			2,434	
EF	Exposure Frequency (ev/yr)			31	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			6	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			15.7	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			2,190	

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.13E-06	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.21E-06	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		2.73E-06	24.6%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 1.11E-05

Notes

Intake Factor (IF) = $\frac{IR \times FR \times EF \times ED \times EP}{BW \times AP}$		=	4.64E-06 (cancer)	5.41E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
FR	Fraction from Contaminated Source			1
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		9.13E-05	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		4.18E-05	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		6.63E-05	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		5.41E-04	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		1.66E-06	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		1.13E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	6.76E-09	69.6%	1.08E-03	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	2.96E-09	30.4%	4.70E-04	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		3.42E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		7.98E-09	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		2.38E-09	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		4.18E-09	<1%

Total Cancer Risk: 9.72E-09 **Hazard Index:** 2.30E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	2.30E-07 (cancer)	1.47E-06 (non-cancer)
	SA	Surface Area Exposed to Soil (cm ² /day)	5,657	
	AF	Soil Skin Adherence Factor (mg/cm ²)	0.13	
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (day/ev)	1	
	EP	Exposure Period (yr)	11	
	CF	Conversion Factor (kg/mg)	0.000001	
	BW	Body Weight (kg)	42.6	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		2.23E-05	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		9.47E-05	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		7.51E-05	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		1.05E-04	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		5.64E-05	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		3.83E-05	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	2.44E-09	69.6%	3.88E-04	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	1.07E-09	30.4%	1.70E-04	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		2.33E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		5.43E-09	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		1.35E-09	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		2.37E-09	<1%
Total Cancer Risk:					3.51E-09		Hazard Index:	9.50E-04

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.57E-08 (cancer)	9.97E-08 (non-cancer)
	IR Ingestion Rate (mg/day)			50
	EF Exposure Frequency (ev/yr)			31
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			11
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		3.38E-10	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		8.61E-09	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		9.10E-09	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	1.44E-09	99.9%	1.91E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		8.54E-10	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		7.46E-08	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	1.31E-12	<1%	4.15E-09	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	5.71E-13	<1%	1.82E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		2.54E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		5.55E-14	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		2.45E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		3.44E-16	<1%
Total Cancer Risk:					1.44E-09	Hazard Index:		1.19E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	4.45E-03 (cancer)	2.83E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	11	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	4,015	
	PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995).
 N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

Appendix Table E.3.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		1.20E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		1.16E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		7.60E-06	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		1.95E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		3.91E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		4.53E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		6.51E-03	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		3.11E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		8.26E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	1.39E-07	64.9%	2.20E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		2.86E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		3.01E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		9.02E-07	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	6.47E-09	3.0%	1.88E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	6.50E-08	30.4%	1.89E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		4.51E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	6.95E-11	<1%	1.58E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	6.41E-10	<1%	1.86E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		6.77E-04	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		2.99E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		5.08E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	2.85E-09	1.3%	8.27E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		6.80E-07	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		2.38E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		5.63E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		3.95E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		3.83E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		2.51E-07	<1%
Total Cancer Risk:					2.14E-07		Hazard Index:	4.01E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.77E-06 (cancer)	1.13E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.06E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		3.40E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		2.24E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.23E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		3.84E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		6.67E-05	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		5.75E-05	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		7.87E-05	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		3.65E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	6.51E-09	41.1%	1.04E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		9.12E-07	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		9.57E-08	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		2.87E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	8.01E-10	5.1%	2.33E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	8.05E-09	50.9%	2.34E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		1.44E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	3.07E-11	<1%	6.98E-07	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	7.93E-11	<1%	2.31E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		5.98E-06	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		2.64E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		1.61E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.52E-10	2.2%	1.02E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		6.01E-09	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		2.10E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		4.97E-09	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		3.49E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		3.38E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		1.85E-08	<1%

Total Cancer Risk: 1.58E-08 **Hazard Index:** 1.93E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.57E-08 (cancer)	9.97E-08 (non-cancer)
	IR	Ingestion Rate (mg/day)	50	
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (day/ev)	1	
	EP	Exposure Period (yr)	11	
	CF	Conversion Factor (kg/mg)	0.000001	
	BW	Body Weight (kg)	42.6	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		9.40E-07	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		8.59E-05	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		2.97E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	8.98E-05	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	7.09E-03 (cancer)	4.51E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)		5,657	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (hr/ev)		4	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (L/cm ³)		0.001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.14

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		4.15E-07	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.66E-06	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		1.00E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	4.08E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	3.13E-06 (cancer)	1.99E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.15
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		6.66E-05	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		3.05E-05	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		4.83E-05	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		3.94E-04	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		1.21E-06	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		8.22E-06	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	5.38E-09	69.6%	7.85E-04	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	2.35E-09	30.4%	3.43E-04	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		2.50E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		5.82E-09	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		1.73E-09	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		3.05E-09	<1%

Total Cancer Risk: 7.73E-09 **Hazard Index:** 1.68E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.83E-07 (cancer)	1.07E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		1.63E-05	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		6.91E-05	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		5.48E-05	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		7.66E-05	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		4.11E-05	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		2.79E-05	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	1.94E-09	69.6%	2.83E-04	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	8.50E-10	30.4%	1.24E-04	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		1.70E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		3.96E-09	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		9.82E-10	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		1.73E-09	<1%
Total Cancer Risk:					2.79E-09	Hazard Index:	6.93E-04	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.25E-08 (cancer)	7.27E-08 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.17

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		3.38E-10	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		8.61E-09	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		9.10E-09	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	1.57E-09	99.9%	1.91E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		8.54E-10	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		7.46E-08	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	1.42E-12	<1%	4.15E-09	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	6.23E-13	<1%	1.82E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		2.54E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		5.55E-14	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		2.45E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		3.44E-16	<1%
Total Cancer Risk:					1.57E-09	Hazard Index:		1.19E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	4.85E-03 (cancer)	2.83E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	12	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	4,380	
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.3.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		8.74E-04	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		8.43E-05	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		5.55E-06	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		1.43E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		2.85E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		3.31E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		4.75E-03	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		2.27E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		6.03E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	1.10E-07	64.9%	1.61E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		2.09E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		2.19E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		6.58E-07	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	5.15E-09	3.0%	1.37E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	5.17E-08	30.4%	1.38E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		3.29E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	5.53E-11	<1%	1.15E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	5.10E-10	<1%	1.36E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		4.94E-04	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		2.18E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		3.70E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	2.27E-09	1.3%	6.03E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		4.96E-07	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		1.73E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		4.10E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		2.88E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		2.79E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		1.83E-07	<1%
Total Cancer Risk:					1.70E-07		Hazard Index:	2.93E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.41E-06 (cancer)	8.23E-06 (non-cancer)
	SA Surface Area Exposed to Soil (cm ² /day)		5657	
	AF Soil Skin Adherence Factor (mg/cm ²)		1	
	EF Exposure Frequency (ev/yr)		31	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		12	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		58.4	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		7.73E-05	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		2.48E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		1.63E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		9.00E-05	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		2.80E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		4.87E-05	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		4.20E-05	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		5.74E-05	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		2.66E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.18E-09	41.1%	7.55E-04	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		6.65E-07	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		6.98E-08	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		2.09E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	6.38E-10	5.1%	1.70E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	6.40E-09	50.9%	1.71E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		1.05E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.44E-11	<1%	5.09E-07	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.31E-11	<1%	1.68E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		4.36E-06	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.93E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		1.18E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	2.80E-10	2.2%	7.47E-08	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		4.38E-09	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		1.53E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		3.63E-09	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		2.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		2.47E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		1.35E-08	<1%
Total Cancer Risk:					1.26E-08	Hazard Index:	1.41E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.25E-08 (cancer)	7.27E-08 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		6.86E-07	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		6.27E-05	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		2.16E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	6.55E-05	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.64E-03 (cancer)	3.29E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			31	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.3.1.21

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.03E-07	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		1.94E-06	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		7.33E-07	24.6%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 2.97E-06

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	2.49E-06 (cancer)	1.45E-05 (non-cancer)
	IR Ingestion Rate (L/d)		0.01	
	EF Exposure Frequency (ev/yr)		31	
	ED Exposure Duration (d/ev)		1	
	EP Exposure Period (yr)		12	
	BW Body Weight (kg)		58.4	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) from Trans Canada Shoreline, Groundwater from Trans Canada, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway		Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	
Future Child Recreator								
Dermal Contact with Soil	4.9E-08	8.3%	Aroclor-1254 (70%)		2.1E-02	10.7%	Aroclor-1254 (47%)	
Incidental Ingestion of Soil	3.1E-08				1.5E-02			
Inhalation of Fugitive Dust	2.3E-09	<1%	Nickel (100%)		3.5E-07	<1%	Zinc (63%)	
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected		8.2E-03	4.1%	C9-C10 Aromatic (48%)	
Dermal Contact with Sediment	4.0E-07	67.9%	Aroclor-1254 (65%)		1.4E-01	69.5%	Aroclor-1254 (55%)	
Incidental Ingestion of Sediment	1.4E-07	23.4%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)		3.1E-02	15.6%	Aroclor-1254 (54%)	
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected		3.2E-04	<1%	Cadmium (94%)	
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected		3.6E-05	<1%	Cadmium (59%)	
Total Risks*:	5.9E-07				2.0E-01			
Future Adolescent Recreator								
Dermal Contact with Soil	2.9E-08	4.0%	Aroclor-1254 (70%)		6.8E-03	4.9%	Aroclor-1254 (47%)	
Incidental Ingestion of Soil	1.0E-08				2.8E-03			
Inhalation of Fugitive Dust	4.3E-09	<1%	Nickel (100%)		3.5E-07	<1%	Zinc (63%)	
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected		6.0E-03	4.4%	C9-C10 Aromatic (48%)	
Dermal Contact with Sediment	6.3E-07	88.8%	Aroclor-1254 (65%)		1.2E-01	86.3%	Aroclor-1254 (55%)	
Incidental Ingestion of Sediment	4.7E-08	6.6%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)		5.7E-03	4.2%	Aroclor-1254 (54%)	
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected		2.7E-04	<1%	Cadmium (94%)	
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected		1.3E-05	<1%	Cadmium (59%)	
Total Risks*:	7.1E-07				1.4E-01			
Future Adult Recreator								
Dermal Contact with Soil	2.3E-08	4.0%	Aroclor-1254 (70%)		5.0E-03	4.9%	Aroclor-1254 (47%)	
Incidental Ingestion of Soil	8.3E-09				2.1E-03			
Inhalation of Fugitive Dust	4.7E-09	<1%	Nickel (100%)		3.5E-07	<1%	Zinc (63%)	
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected		4.4E-03	4.4%	C9-C10 Aromatic (48%)	
Dermal Contact with Sediment	5.0E-07	88.6%	Aroclor-1254 (65%)		8.7E-02	86.3%	Aroclor-1254 (55%)	
Incidental Ingestion of Sediment	3.7E-08	6.6%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)		4.2E-03	4.2%	Aroclor-1254 (54%)	
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected		2.0E-04	<1%	Cadmium (94%)	
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected		9.8E-06	<1%	Cadmium (59%)	
Total Risks*:	5.7E-07				1.0E-01			
Child + Adolescent + Adult	1.9E-06							

* Total risks are calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways. Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.4.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		8.52E-04	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		3.90E-04	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		6.18E-04	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		5.04E-03	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		1.55E-05	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		1.05E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	3.44E-08	69.6%	1.00E-02	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	1.50E-08	30.4%	4.39E-03	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		3.19E-09	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		7.45E-08	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		2.22E-08	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		3.90E-08	<1%
Total Cancer Risk:					4.94E-08	Hazard Index:	2.14E-02	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$ =		1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)	2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)	0.35	
EF	Exposure Frequency (ev/yr)	92	
ED	Exposure Duration (day/ev)	1	
EP	Exposure Period (yr)	6	
CF	Conversion Factor (kg/mg)	0.000001	
BW	Body Weight (kg)	15.7	
AP	Averaging Period - Cancer (d)	25,550	
	Averaging Period - Non- Cancer (d)	2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		3.60E-04	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		1.53E-03	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		1.21E-03	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		1.69E-03	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		9.08E-04	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		6.17E-04	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	2.15E-08	69.6%	6.26E-03	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	9.38E-09	30.4%	2.74E-03	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		3.75E-09	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		8.74E-08	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		2.17E-08	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		3.81E-08	<1%
Total Cancer Risk:					3.08E-08		Hazard Index:	1.53E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table E.4.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		1.00E-09	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		2.55E-08	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		2.70E-08	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	2.33E-09	99.9%	5.67E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		2.54E-09	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		2.21E-07	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	2.11E-12	<1%	1.23E-08	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	9.24E-13	<1%	5.39E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		7.53E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		1.65E-13	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		7.26E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		1.02E-15	<1%
Total Cancer Risk:					2.33E-09	Hazard Index:		3.52E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (hr/ev)			8
	EP Exposure Period (yr)			6
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

**Appendix Table E.4.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		3.13E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		7.22E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		6.26E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.40E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		1.22E-03	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		3.87E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.78E-03	21.9%
Total Cancer Risk:					0.00E+00	Hazard Index:		8.15E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table E.4.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.63E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		2.71E-04	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		1.24E-04	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		1.97E-04	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		1.60E-03	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		4.92E-06	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		3.34E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	2.01E-08	69.6%	3.19E-03	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	8.78E-09	30.4%	1.40E-03	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		1.02E-09	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		2.37E-08	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		7.05E-09	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		1.24E-08	<1%

Total Cancer Risk: 2.88E-08 **Hazard Index:** 6.82E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
	SA Surface Area Exposed to Soil (cm ² /day)		5,657	
	AF Soil Skin Adherence Factor (mg/cm ²)		0.13	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		11	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		42.6	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		6.63E-05	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		2.81E-04	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		2.23E-04	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		3.12E-04	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		1.67E-04	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		1.14E-04	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	7.25E-09	69.6%	1.15E-03	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	3.17E-09	30.4%	5.04E-04	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		6.90E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		1.61E-08	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		3.99E-09	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		7.03E-09	<1%
Total Cancer Risk:					1.04E-08		Hazard Index:	2.82E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		1.00E-09	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		2.55E-08	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		2.70E-08	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	4.27E-09	99.9%	5.67E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		2.54E-09	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		2.21E-07	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	3.87E-12	<1%	1.23E-08	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	1.69E-12	<1%	5.39E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		7.53E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		1.65E-13	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		7.26E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		1.02E-15	<1%
Total Cancer Risk:					4.28E-09	Hazard Index:		3.52E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table E.4.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		2.31E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		5.33E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		4.62E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		2.66E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		9.02E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.85E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.31E-03	21.9%
Total Cancer Risk:					0.00E+00	Hazard Index:		6.01E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07	Hazard Index:	1.19E-01	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.14

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index: 5.74E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		5,657	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		11	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		42.6	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	1.00E-01	N/A	3.00E-02	N/A		1.98E-04	4.0%
Inorganics								
Boron	1.90E+02	3.00E-02	N/A	2.00E-01	N/A		9.05E-05	1.8%
Copper	3.01E+01	6.00E-02	N/A	4.00E-02	N/A		1.43E-04	2.9%
Nickel	2.11E+01	3.50E-01	N/A	2.00E-02	N/A		1.17E-03	23.5%
Selenium	2.83E+00	2.00E-03	N/A	5.00E-03	N/A		3.59E-06	<1%
Zinc	1.15E+02	2.00E-02	N/A	3.00E-01	N/A		2.44E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	1.60E-01	2.00E+00	2.00E-05	1.60E-08	69.6%	2.33E-03	46.8%
Aroclor-1260	4.01E-02	1.60E-01	2.00E+00	2.00E-05	6.98E-09	30.4%	1.02E-03	20.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E-01	N/A	6.00E-01	N/A		7.41E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E-01	N/A	9.00E-01	N/A		1.73E-08	<1%
m+p-Xylenes	2.70E-03	1.20E-01	N/A	2.00E-01	N/A		5.14E-09	<1%
Toluene	1.90E-03	1.20E-01	N/A	8.00E-02	N/A		9.05E-09	<1%

Total Cancer Risk: 2.30E-08 **Hazard Index:** 4.98E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	3.60E-01	N/A	3.00E-02	N/A		4.84E-05	2.4%
Inorganics								
Boron	1.90E+02	1.00E+00	N/A	2.00E-01	N/A		2.05E-04	10.0%
Copper	3.01E+01	1.00E+00	N/A	4.00E-02	N/A		1.63E-04	7.9%
Nickel	2.11E+01	1.00E+00	N/A	2.00E-02	N/A		2.27E-04	11.1%
Selenium	2.83E+00	1.00E+00	N/A	5.00E-03	N/A		1.22E-04	5.9%
Zinc	1.15E+02	1.00E+00	N/A	3.00E-01	N/A		8.29E-05	4.0%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	8.50E-01	2.00E+00	2.00E-05	5.77E-09	69.6%	8.41E-04	40.9%
Aroclor-1260	4.01E-02	8.50E-01	2.00E+00	2.00E-05	2.52E-09	30.4%	3.68E-04	17.9%
Volatile Organic Compounds								
2-Butanone	1.40E-03	1.00E+00	N/A	6.00E-01	N/A		5.04E-10	<1%
4-Isopropyltoluene	7.30E-02	1.00E+00	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.00E+00	N/A	9.00E-01	N/A		1.17E-08	<1%
m+p-Xylenes	2.70E-03	1.00E+00	N/A	2.00E-01	N/A		2.91E-09	<1%
Toluene	1.90E-03	1.00E+00	N/A	8.00E-02	N/A		5.13E-09	<1%
Total Cancer Risk:					8.29E-09		Hazard Index:	2.06E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Trans Canada Shoreline

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE \div RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	1.87E+01	5.98E-04	N/A	5.00E+04	N/A		1.00E-09	<1%
Inorganics								
Boron	1.90E+02	6.08E-03	N/A	2.00E+04	N/A		2.55E-08	7.3%
Copper	3.01E+01	9.64E-04	N/A	3.00E+03	N/A		2.70E-08	7.7%
Nickel	2.11E+01	6.74E-04	4.80E-04	1.00E+03	4.66E-09	99.9%	5.67E-08	16.1%
Selenium	2.83E+00	9.05E-05	N/A	3.00E+03	N/A		2.54E-09	<1%
Zinc	1.15E+02	3.69E-03	N/A	1.40E+03	N/A		2.21E-07	62.9%
Polychlorinated Biphenyls								
Aroclor-1254	9.17E-02	2.93E-06	1.00E-04	2.00E+01	4.23E-12	<1%	1.23E-08	3.5%
Aroclor-1260	4.01E-02	1.28E-06	1.00E-04	2.00E+01	1.85E-12	<1%	5.39E-09	1.5%
Volatile Organic Compounds								
2-Butanone	1.40E-03	4.48E-08	N/A	5.00E+06	N/A		7.53E-16	<1%
4-Isopropyltoluene	7.30E-02	2.34E-06	N/A	N/A	N/A		N/A	
Acetone	4.90E-02	1.57E-06	N/A	8.00E+05	N/A		1.65E-13	<1%
m+p-Xylenes	2.70E-03	8.64E-08	N/A	1.00E+05	N/A		7.26E-14	<1%
Toluene	1.90E-03	6.08E-08	N/A	5.00E+06	N/A		1.02E-15	<1%
Total Cancer Risk:					4.67E-09	Hazard Index:		3.52E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table E.4.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		1.68E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		3.88E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		3.37E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		1.94E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-05	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		6.58E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.08E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		9.58E-04	21.9%
Total Cancer Risk:					0.00E+00		Hazard Index:	4.38E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
--	---	-------------------	-----------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 12
- BW Body Weight (kg) 58.4
- AP Averaging Period - Cancer (d) 25,550
- Averaging Period - Non- Cancer (d) 4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
	SA Surface Area Exposed to Soil (cm ² /day)		5657	
	AF Soil Skin Adherence Factor (mg/cm ²)		1	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		12	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		58.4	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%

Total Cancer Risk: 3.73E-08 **Hazard Index:** 4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.4.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00	Hazard Index:		9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.5.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Commercial Use
Yankee Nuclear Power Station, Rowe, MA**

Receptor/Exposure Pathway	Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Trans Canada			Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Trans Canada		
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Commercial Use						
Dermal Contact with Soil	4.0E-08	13.1%	Benzo(a)pyrene (46%)	9.5E-04	7.1%	Nickel (34%)
Incidental Ingestion of Soil	2.4E-07	78.5%	Benzo(a)pyrene (52%)	2.4E-03	18.2%	Aroclor-1254 (25%)
Inhalation of Fugitive Dust	2.6E-08	8.4%	Nickel (86%)	5.3E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	9.9E-03	74.7%	C9-C10 Aromatic (48%)
Total Risks: 3.1E-07				1.3E-02		

Appendix Table E.5.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		2.54E-04	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		2.59E-05	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		3.18E-04	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		1.51E-06	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		4.25E-06	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	3.36E-09	8.3%	2.35E-04	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	1.39E-09	3.4%	9.71E-05	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		2.88E-07	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		6.56E-07	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		7.22E-08	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	2.33E-09	5.8%	2.99E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	46.0%	2.37E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	2.09E-09	5.2%	2.67E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		8.94E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-10	<1%	2.43E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		1.12E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	1.44E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	2.36E-10	<1%	3.02E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	9.33E-09	23.1%	1.19E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		1.95E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		3.83E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	1.42E-09	3.5%	1.82E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		1.17E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		4.75E-08	<1%
Total Cancer Risk:					4.04E-08	Hazard Index:	9.47E-04	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		3,477	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.03	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.5.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		4.39E-04	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		2.07E-04	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		4.36E-04	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		3.62E-04	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		1.02E-04	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	8.56E-09	3.5%	5.99E-04	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	3.53E-09	1.5%	2.47E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		4.98E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		1.13E-06	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		1.25E-07	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	1.57E-08	6.5%	2.00E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	1.25E-07	51.5%	1.59E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	1.40E-08	5.8%	1.79E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		1.54E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	1.27E-09	<1%	1.63E-06	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		5.37E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	6.92E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	1.59E-09	<1%	2.03E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	6.26E-08	25.9%	8.01E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		3.36E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		6.60E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	9.54E-09	3.9%	1.22E-06	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		2.02E-06	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		3.98E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		1.90E-07	<1%

Total Cancer Risk: 2.42E-07 **Hazard Index:** 2.42E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		250	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		25	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		70	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.5.1.3

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RFC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RFC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		1.09E-08	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		4.12E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	2.23E-08	86.4%	1.30E-07	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		9.00E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		3.26E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	7.52E-12	<1%	1.05E-08	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	3.10E-12	<1%	4.34E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		2.48E-11	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		2.82E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		3.10E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	2.39E-10	<1%	6.41E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	1.90E-09	7.3%	5.10E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	2.13E-10	<1%	5.73E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		3.84E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	1.94E-11	<1%	5.21E-11	<1%
Butyl benzyl phthalate	2.20E-01	7.03E-06	N/A	N/A	N/A		N/A	
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	2.42E-11	<1%	6.49E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	9.54E-10	3.7%	2.56E-11	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		1.12E-10	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		2.19E-11	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	1.45E-10	<1%	3.90E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		5.02E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		9.90E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		4.53E-14	<1%
Total Cancer Risk:					2.58E-08		Hazard Index:	5.33E-07

Notes

Intake Factor (IF) = $\frac{EF \times ED \times EP \times CF}{AP}$		=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
EF	Exposure Frequency (ev/yr)			250
ED	Exposure Duration (hr/ev)			8
EP	Exposure Period (yr)			25
CF	Conversion factor (d/hr)			0.042
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			9,125
PM ₁₀	Respirable particulate concentration in air (ug/m ³)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.5.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		3.82E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		8.81E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		7.63E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		4.40E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.71E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		1.49E-03	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		4.72E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		2.17E-03	21.9%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 9.94E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times EP \times ED}{BW \times AP}$	=	3.49E-03 (cancer)	9.78E-03 (non-cancer)
--	---	-------------------	-----------------------

	IR-G	Groundwater Ingestion Rate (L/day)	1
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	250
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
	EP	Exposure Period (yr)	25
N/A - Not available	BW	Body Weight (kg)	70
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non- Cancer (d)	9,125

Appendix Table E.6.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Commercial Use
Yankee Nuclear Power Station, Rowe, MA**

Receptor/Exposure Pathway	Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC Non-BUD/TSCA			Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC Non-BUD/TSCA		
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Commercial Use						
Dermal Contact with Soil	5.5E-08	36.8%	Dioxin/Furan (53%)	1.9E-03	4.0%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	7.9E-08	53.2%	Aroclor-1254 (50%)	5.2E-03	10.7%	Aroclor-1254 (53%)
Inhalation of Fugitive Dust	1.5E-08	10.1%	Nickel (100%)	5.4E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	4.1E-02	85.3%	Cadmium (24%), Barium (21%)
Total Risks: 1.5E-07				4.9E-02		

Appendix Table E.6.1.1

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	2.90E-08	53.2%	N/A	
Inorganics								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		1.44E-05	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		2.12E-04	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		1.38E-06	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		4.41E-06	<1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	1.64E-09	3.0%	3.29E-05	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	2.20E-09	4.0%	1.54E-04	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	1.54E-08	28.3%	1.08E-03	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	6.24E-09	11.4%	4.37E-04	22.6%
Total Cancer Risk:					5.45E-08	Hazard Index:	1.94E-03	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
	SA	Surface Area Exposed to Soil (cm ² /day)	3,477	
	AF	Soil Skin Adherence Factor (mg/cm ²)	0.03	
	EF	Exposure Frequency (ev/yr)	250	
	ED	Exposure Duration (day/ev)	1	
	EP	Exposure Period (yr)	25	
	CF	Conversion Factor (kg/mg)	0.000001	
	BW	Body Weight (kg)	70	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.6.1.2

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA**

Commercial Worker Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	1.39E-08	17.6%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		1.15E-04	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		2.91E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		3.31E-04	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		1.06E-04	2.0%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	4.18E-09	5.3%	8.37E-05	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	5.61E-09	7.1%	3.92E-04	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	3.93E-08	49.8%	2.75E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	1.59E-08	20.1%	1.11E-03	21.5%
Total Cancer Risk:					7.89E-08	Hazard Index:	5.18E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		250	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		25	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		70	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.6.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	4.57E-20	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		2.28E-08	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	1.49E-08	99.6%	8.68E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		8.23E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		3.38E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	3.68E-12	<1%	5.15E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	4.92E-12	<1%	6.89E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	3.45E-11	<1%	4.84E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	1.40E-11	<1%	1.95E-08	3.6%
Total Cancer Risk:					1.49E-08	Hazard Index:		5.36E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
	EF Exposure Frequency (ev/yr)		250	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		25	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table E.6.1.4

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA**

Commercial Worker Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		8.55E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		3.16E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		9.78E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		7.18E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		6.36E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		1.96E-03	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		6.31E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		2.54E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		4.11E-04	<1%
<i>Volatile Organic Compounds</i>								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		8.13E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		5.87E-05	<1%
Total Cancer Risk:					0.00E+00	Hazard Index:		4.14E-02

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times EP \times ED}{BW \times AP}$	=	3.49E-03 (cancer)	9.78E-03 (non-cancer)
--	---	----------------------	--------------------------

	IR-G	Groundwater Ingestion Rate (L/day)	1
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	250
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
	EP	Exposure Period (yr)	25
N/A - Not available	BW	Body Weight (kg)	70
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non- Cancer (d)	9,125

Appendix Table E.7.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Commercial Use
Yankee Nuclear Power Station, Rowe, MA**

Receptor/Exposure Pathway	Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC BUD/TSCA			Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway			
Future Commercial Use						
Dermal Contact with Soil	1.7E-07	6.1%	Dioxin/Furan (39%), Aroclor-1254 (27%)	5.1E-03	2.1%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	4.3E-07	15.7%	Benzo(a)pyrene (29%), Aroclor-1254 (27%)	1.3E-02	5.5%	Aroclor-1254 (62%)
Inhalation of Fugitive Dust	1.9E-08	<1%	Nickel (81%)	8.1E-07	<1%	Zinc (57%)
Ingestion of Groundwater	2.1E-06	77.6%	Tetrahydrofuran (77%)	2.2E-01	92.4%	Thallium (22%), Acetone (14%)
Total Risks:	2.8E-06			2.4E-01		

Appendix Table E.7.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	6.51E-08	38.7%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	1.00E-01	N/A	3.00E-02	N/A		1.29E-04	2.5%
Inorganics								
Copper	1.34E+01	6.00E-02	N/A	4.00E-02	N/A		2.05E-05	<1%
Mercury	2.40E-01	5.00E-02	N/A	3.00E-04	N/A		4.08E-05	<1%
Nickel	1.25E+01	3.50E-01	N/A	2.00E-02	N/A		2.23E-04	4.3%
Zinc	8.87E+01	2.00E-02	N/A	3.00E-01	N/A		6.03E-06	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	4.57E-08	27.2%	3.20E-03	62.3%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	2.15E-08	12.8%	1.50E-03	29.2%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		3.01E-06	<1%
Acenaphthene	1.96E-01	1.00E-01	N/A	6.00E-02	N/A		3.34E-07	<1%
Acenaphthylene	2.22E-01	1.00E-01	N/A	3.00E-02	N/A		7.54E-07	<1%
Anthracene	2.47E-01	1.00E-01	N/A	3.00E-01	N/A		8.40E-08	<1%
Benzo(a)anthracene	3.79E-01	2.00E-02	7.30E-01	3.00E-02	2.02E-09	1.2%	2.58E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	1.85E-08	11.0%	2.37E-07	<1%
Benzo(b)fluoranthene	3.85E-01	2.00E-02	7.30E-01	3.00E-02	2.05E-09	1.2%	2.62E-07	<1%
Benzo(g,h,i)perylene	2.44E-01	1.00E-01	N/A	3.00E-02	N/A		8.29E-07	<1%
Benzo(k)fluoranthene	3.68E-01	2.00E-02	7.30E-02	3.00E-02	1.96E-10	<1%	2.50E-07	<1%
Carbazole	2.00E-01	1.00E+00	2.00E-02	N/A	1.46E-09	<1%	N/A	
Chrysene	4.27E-01	2.00E-02	7.30E-02	3.00E-02	2.27E-10	<1%	2.91E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	9.97E-09	5.9%	1.28E-07	<1%
Fluoranthene	6.68E-01	1.00E-01	N/A	4.00E-02	N/A		1.71E-06	<1%
Fluorene	2.02E-01	1.00E-01	N/A	4.00E-02	N/A		5.16E-07	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	2.00E-02	7.30E-01	3.00E-02	1.29E-09	<1%	1.65E-07	<1%
Naphthalene	1.94E-01	1.00E-01	N/A	2.00E-02	N/A		9.90E-07	<1%
Phenanthrene	3.81E-01	1.00E-01	N/A	3.00E-02	N/A		1.29E-06	<1%
Pyrene	6.05E-01	1.00E-01	N/A	3.00E-02	N/A		2.06E-06	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	1.00E-01	N/A	6.00E-01	N/A		4.08E-09	<1%
4-Methyl-2-Pentanone	1.00E-02	1.00E-01	N/A	8.00E-02	N/A		1.28E-08	<1%
Acetone	8.26E-02	1.00E-01	N/A	9.00E-01	N/A		9.37E-09	<1%
Dichlorodifluoromethane	6.70E-03	1.00E+00	N/A	2.00E-01	N/A		3.42E-08	<1%
Trichlorofluoromethane	5.20E-03	1.00E+00	N/A	3.00E-01	N/A		1.77E-08	<1%
Toluene	1.43E-01	1.20E-01	N/A	8.00E-02	N/A		2.19E-07	<1%
Total Cancer Risk:					1.68E-07	Hazard Index:	5.14E-03	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		3,477	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.03	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.7.1.2

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	3.12E-08	7.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	3.60E-01	N/A	3.00E-02	N/A		2.23E-04	1.7%
Inorganics								
Copper	1.34E+01	1.00E+00	N/A	4.00E-02	N/A		1.64E-04	1.2%
Mercury	2.40E-01	1.00E+00	N/A	3.00E-04	N/A		3.91E-04	3.0%
Nickel	1.25E+01	1.00E+00	N/A	2.00E-02	N/A		3.06E-04	2.3%
Zinc	8.87E+01	1.00E+00	N/A	3.00E-01	N/A		1.45E-04	1.1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	1.16E-07	26.9%	8.15E-03	61.6%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	5.47E-08	12.6%	3.83E-03	28.9%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		5.19E-06	<1%
Acenaphthene	1.96E-01	3.60E-01	N/A	6.00E-02	N/A		5.77E-07	<1%
Acenaphthylene	2.22E-01	3.60E-01	N/A	3.00E-02	N/A		1.30E-06	<1%
Anthracene	2.47E-01	3.60E-01	N/A	3.00E-01	N/A		1.45E-07	<1%
Benzo(a)anthracene	3.79E-01	2.80E-01	7.30E-01	3.00E-02	1.35E-08	3.1%	1.73E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	1.24E-07	28.7%	1.59E-06	<1%
Benzo(b)fluoranthene	3.85E-01	2.80E-01	7.30E-01	3.00E-02	1.38E-08	3.2%	1.76E-06	<1%
Benzo(g,h,i)perylene	2.44E-01	3.60E-01	N/A	3.00E-02	N/A		1.43E-06	<1%
Benzo(k)fluoranthene	3.68E-01	2.80E-01	7.30E-02	3.00E-02	1.31E-09	<1%	1.68E-06	<1%
Carbazole	2.00E-01	1.00E+00	2.00E-02	N/A	6.98E-10	<1%	N/A	
Chrysene	4.27E-01	2.80E-01	7.30E-02	3.00E-02	1.53E-09	<1%	1.95E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	6.69E-08	15.4%	8.56E-07	<1%
Fluoranthene	6.68E-01	3.60E-01	N/A	4.00E-02	N/A		2.94E-06	<1%
Fluorene	2.02E-01	3.60E-01	N/A	4.00E-02	N/A		8.90E-07	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	2.80E-01	7.30E-01	3.00E-02	8.67E-09	2.0%	1.11E-06	<1%
Naphthalene	1.94E-01	3.60E-01	N/A	2.00E-02	N/A		1.71E-06	<1%
Phenanthrene	3.81E-01	3.60E-01	N/A	3.00E-02	N/A		2.23E-06	<1%
Pyrene	6.05E-01	3.60E-01	N/A	3.00E-02	N/A		3.55E-06	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	1.00E+00	N/A	6.00E-01	N/A		1.96E-08	<1%
4-Methyl-2-Pentanone	1.00E-02	1.00E+00	N/A	8.00E-02	N/A		6.12E-08	<1%
Acetone	8.26E-02	1.00E+00	N/A	9.00E-01	N/A		4.49E-08	<1%
Dichlorodifluoromethane	6.70E-03	1.00E+00	N/A	2.00E-01	N/A		1.64E-08	<1%
Trichlorofluoromethane	5.20E-03	1.00E+00	N/A	3.00E-01	N/A		8.48E-09	<1%
Toluene	1.43E-01	1.00E+00	N/A	8.00E-02	N/A		8.76E-07	<1%
Total Cancer Risk:					4.33E-07	Hazard Index:	1.32E-02	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		250	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		25	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		70	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.7.1.3

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RFC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.02E-19	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	1.21E-03	N/A	5.00E+04	N/A		5.54E-09	<1%
Inorganics								
Copper	1.34E+01	4.29E-04	N/A	3.00E+03	N/A		3.26E-08	4.0%
Mercury	2.40E-01	7.68E-06	N/A	3.00E+02	N/A		5.84E-09	<1%
Nickel	1.25E+01	4.00E-04	4.80E-04	1.00E+03	1.56E-08	81.1%	9.13E-08	11.3%
Zinc	8.87E+01	2.84E-03	N/A	1.40E+03	N/A		4.63E-07	57.1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.02E-10	<1%	1.43E-07	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.80E-11	<1%	6.72E-08	8.3%
Semivolatile Organic Compound								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		1.72E-11	<1%
Acenaphthene	1.96E-01	6.29E-06	N/A	5.00E+04	N/A		2.87E-11	<1%
Acenaphthylene	2.22E-01	7.09E-06	N/A	5.00E+04	N/A		3.24E-11	<1%
Anthracene	2.47E-01	7.90E-06	N/A	5.00E+04	N/A		3.61E-11	<1%
Benzo(a)anthracene	3.79E-01	1.21E-05	2.09E-04	5.00E+04	2.06E-10	1.1%	5.54E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	1.90E-09	9.8%	5.09E-11	<1%
Benzo(b)fluoranthene	3.85E-01	1.23E-05	2.09E-04	5.00E+04	2.10E-10	1.1%	5.63E-11	<1%
Benzo(g,h,i)perylene	2.44E-01	7.80E-06	N/A	5.00E+04	N/A		3.56E-11	<1%
Benzo(k)fluoranthene	3.68E-01	1.18E-05	2.09E-05	5.00E+04	2.00E-11	<1%	5.37E-11	<1%
Carbazole	2.00E-01	6.39E-06	N/A	N/A	N/A		N/A	
Chrysene	4.27E-01	1.37E-05	2.09E-05	5.00E+04	2.33E-11	<1%	6.24E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	6.00E-06	2.09E-03	5.00E+04	1.02E-09	5.3%	2.74E-11	<1%
Fluoranthene	6.68E-01	2.14E-05	N/A	5.00E+04	N/A		9.77E-11	<1%
Fluorene	2.02E-01	6.47E-06	N/A	5.00E+04	N/A		2.95E-11	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	7.77E-06	2.09E-04	5.00E+04	1.32E-10	<1%	3.55E-11	<1%
Naphthalene	1.94E-01	6.21E-06	N/A	3.00E+03	N/A		4.72E-10	<1%
Phenanthrene	3.81E-01	1.22E-05	N/A	5.00E+04	N/A		5.56E-11	<1%
Pyrene	6.05E-01	1.94E-05	N/A	5.00E+04	N/A		8.84E-11	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	7.68E-07	N/A	5.00E+06	N/A		3.51E-14	<1%
4-Methyl-2-Pentanone	1.00E-02	3.20E-07	N/A	3.00E+06	N/A		2.44E-14	<1%
Acetone	8.26E-02	2.64E-06	N/A	8.00E+05	N/A		7.54E-13	<1%
Dichlorodifluoromethane	6.70E-03	2.14E-07	N/A	2.00E+05	N/A		2.45E-13	<1%
Trichlorofluoromethane	5.20E-03	1.66E-07	N/A	7.00E+05	N/A		5.43E-14	<1%
Toluene	1.43E-01	4.58E-06	N/A	5.00E+06	N/A		2.09E-13	<1%

Total Cancer Risk: 1.93E-08 Hazard Index: 8.10E-07

Notes

Intake Factor (IF) = $\frac{EF \times ED \times EP \times CF}{AP}$	=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
EF	Exposure Frequency (ev/yr)	250	
ED	Exposure Duration (hr/ev)	8	
EP	Exposure Period (yr)	25	
CF	Conversion factor (d/hr)	0.042	
AP	Averaging Period - Cancer (d)	25,550	
	Averaging Period - Non- Cancer (d)	9,125	
PM ₁₀	Respirable particulate concentration in air (ug/m ³)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.7.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		2.20E-02	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		9.78E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		1.05E-02	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		7.83E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		2.67E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		2.27E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		4.89E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		1.37E-02	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		9.78E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.96E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		4.89E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.87E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	3.41E-08	1.6%	4.36E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		5.47E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		2.35E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	4.42E-07	20.6%	1.13E-02	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		3.14E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	1.07E-08	<1%	1.66E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	1.66E-06	77.3%	2.91E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		4.35E-03	1.9%
Adjusted C9-C10 Aromatics								
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		5.37E-04	<1%
Total Cancer Risk:					2.15E-06	Hazard Index:	2.23E-01	

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times EP \times ED}{BW \times AP}$	=	3.49E-03 (cancer)	9.78E-03 (non-cancer)
--	---	----------------------	--------------------------

	IR-G	Groundwater Ingestion Rate (L/day)	1
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	250
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
	EP	Exposure Period (yr)	25
N/A - Not available	BW	Body Weight (kg)	70
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non-Cancer (d)	9,125

Appendix Table E.8.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Subchronic Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Trans Canada, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator (1-2 years)						
Dermal Contact with Soil	1.3E-08	16.0%	Benzo(a)pyrene (46%)	1.2E-02	10.2%	Nickel (47%)
Incidental Ingestion of Soil	2.7E-08	34.1%	Benzo(a)pyrene (52%)	7.2E-03		
Inhalation of Fugitive Dust	2.2E-10	<1%	Nickel (86%)	1.9E-07	<1%	Zinc (62%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	5.2E-03	4.3%	Copper (41%)
Dermal Contact with Sediment	4.0E-08	49.6%	Aroclor-1254 (65%)	8.1E-02	67.5%	Aroclor-1254 (38%), Copper (32%)
Incidental Ingestion of Sediment	2.0E-08			2.1E-02	17.7%	Aroclor-1254 (46%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	5.3E-05	<1%	Cadmium (59%)
Total Risks*:	8.0E-08			1.2E-01		

* Total risks are calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.
Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.8.1.1

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-01	N/A		3.43E-04	2.8%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		5.82E-03	47.1%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		4.29E-03	34.8%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		2.04E-05	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		5.74E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	5.00E-05	1.06E-09	8.3%	1.27E-03	10.3%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	5.00E-05	4.37E-10	3.4%	5.24E-04	4.2%
Semivolatile Organic Compound								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-01	N/A		3.89E-07	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-01	N/A		8.85E-07	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E+00	N/A		9.73E-08	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-01	7.35E-10	5.8%	4.03E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-01	5.84E-09	46.0%	3.20E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-01	6.56E-10	5.2%	3.60E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-01	N/A		1.21E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-01	5.97E-11	<1%	3.27E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E+00	N/A		1.51E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	4.54E-10	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-01	7.44E-11	<1%	4.08E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-01	2.94E-09	23.1%	1.61E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-01	N/A		2.63E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-01	N/A		5.16E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-01	4.48E-10	3.5%	2.45E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-01	N/A		1.58E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-01	N/A		3.11E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-01	N/A		6.40E-08	<1%

Total Cancer Risk: 1.27E-08 **Hazard Index:** 1.23E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.15E-07 (cancer)	1.38E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		1,670	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		0.58	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		10.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.2

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-01	N/A		2.11E-04	2.9%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		9.95E-04	13.9%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		2.10E-03	29.2%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		1.74E-03	24.3%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		4.91E-04	6.8%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	5.00E-05	9.61E-10	3.5%	1.15E-03	16.1%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	5.00E-05	3.97E-10	1.5%	4.76E-04	6.6%
Semivolatile Organic Compound								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-01	N/A		2.40E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-01	N/A		5.45E-07	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E+00	N/A		6.00E-08	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-01	1.76E-09	6.5%	9.65E-07	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-01	1.40E-08	51.5%	7.67E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-01	1.57E-09	5.8%	8.62E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-01	N/A		7.43E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-01	1.43E-10	<1%	7.84E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E+00	N/A		2.59E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	7.77E-11	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-01	1.78E-10	<1%	9.77E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-01	7.03E-09	25.9%	3.85E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-01	N/A		1.62E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-01	N/A		3.18E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-01	1.07E-09	3.9%	5.87E-07	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-01	N/A		9.71E-07	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-01	N/A		1.92E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-01	N/A		9.13E-08	<1%
Total Cancer Risk:					2.72E-08	Hazard Index:	7.18E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
	IR Ingestion Rate (mg/day)		100	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		0.58	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.3

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+05	N/A		4.02E-10	<1%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.9%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	1.92E-10	86.4%	4.79E-08	24.9%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	62.4%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	6.45E-14	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	2.66E-14	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+05	N/A		9.12E-13	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+05	N/A		1.04E-12	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+05	N/A		1.14E-12	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+05	2.05E-12	<1%	2.36E-12	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+05	1.63E-11	7.3%	1.88E-12	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+05	1.83E-12	<1%	2.11E-12	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+05	N/A		1.41E-12	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+05	1.67E-13	<1%	1.92E-12	<1%
Butyl benzyl phthalate	2.20E-01	7.03E-06	N/A	N/A	N/A		N/A	
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+05	2.08E-13	<1%	2.39E-12	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+05	8.19E-12	3.7%	9.43E-13	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+05	N/A		4.11E-12	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+05	N/A		8.07E-13	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+05	1.25E-12	<1%	1.44E-12	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+05	N/A		1.85E-12	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+05	N/A		3.64E-12	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%
Total Cancer Risk:					2.22E-10	Hazard Index:	1.92E-07	

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	7.00E-04 (cancer)	8.40E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (hr/ev)		8
	EP	Exposure Period (yr)		0.58
	CF	Conversion factor (d/hr)		0.042
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		213
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)		3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} \times PM_{10} \times 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} \times IF$

Appendix Table E.8.1.4

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		9.19E-04	17.6%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		2.12E-03	40.6%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E+00	N/A		1.84E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		1.06E-04	2.0%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-01	N/A		4.12E-05	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-01	N/A		3.59E-04	6.9%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-01	N/A		1.14E-03	21.8%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E+00	N/A		5.23E-04	10.0%
Total Cancer Risk:					0.00E+00	Hazard Index:	5.22E-03	

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-04 (cancer)	2.36E-02 (non-cancer)
----------------------	---	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	0.58
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.5

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.18E-03	5.1%
Beryllium	6.83E-01	3.00E-02	N/A	5.00E-03	N/A		1.61E-04	<1%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		8.84E-04	1.1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.82E-03	8.4%
Chromium	1.16E+01	4.00E-02	N/A	2.00E-02	N/A		9.09E-04	1.1%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		2.63E-02	32.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.09E-02	13.4%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.88E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	5.00E-05	2.56E-08	64.9%	3.08E-02	37.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.30E-01	N/A	1.00E-02	N/A		1.30E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-01	N/A		1.05E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E+00	N/A		3.15E-07	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-01	1.20E-09	3.0%	6.56E-07	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-01	1.20E-08	30.4%	6.59E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-01	N/A		1.57E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.29E-11	<1%	5.51E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-01	1.19E-10	<1%	6.50E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-01	N/A		1.77E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-01	5.26E-10	1.3%	2.88E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.29E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.96E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-01	N/A		1.38E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-01	N/A		8.74E-08	<1%

Total Cancer Risk: 3.95E-08 **Hazard Index:** 8.12E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.28E-07 (cancer)	3.93E-05 (non-cancer)
----------------------	---	---	-------------------	-----------------------

SA	Surface Area Exposed to Soil (cm ² /day)	1670
AF	Soil Skin Adherence Factor (mg/cm ²)	1
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	0.58
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.50E-03	11.8%
Beryllium	6.83E-01	1.00E+00	N/A	5.00E-03	N/A		3.22E-04	1.5%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		5.29E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.92E-03	13.7%
Chromium	1.16E+01	1.00E+00	N/A	2.00E-02	N/A		1.36E-03	6.4%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.58E-03	7.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.86E-03	8.7%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		8.63E-04	4.1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	5.00E-05	8.15E-09	41.1%	9.78E-03	46.0%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E+00	N/A	1.00E-02	N/A		5.98E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-01	N/A		2.26E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E+00	N/A		6.78E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-01	1.00E-09	5.1%	5.50E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-01	1.01E-08	50.9%	5.52E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-01	N/A		3.39E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	3.85E-11	<1%	1.65E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-01	9.94E-11	<1%	5.45E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-01	N/A		3.82E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-01	4.41E-10	2.2%	2.42E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.96E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.18E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-01	N/A		8.24E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.99E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-01	N/A		4.36E-08	<1%

Total Cancer Risk: 1.98E-08 **Hazard Index:** 2.13E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
	IR Ingestion Rate (mg/day)		100	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		0.58	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.28E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.43E+01	1.43E+01	N/A	5.00E-04	N/A		3.00E-04	94.3%
Zinc	2.15E-02	6.00E-04	2.17E+00	2.17E+00	N/A	3.00E-01	N/A		1.47E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	3.18E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.31E-03 (cancer)	1.57E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			1,670	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			0.58	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			10.7	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.8.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		4.91E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		3.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.69E-05	31.8%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 5.32E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-06 (cancer)	2.36E-04 (non-cancer)
	IR Ingestion Rate (L/d)		0.01	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (d/ev)		1	
	EP Exposure Period (yr)		0.58	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1

Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Subchronic Recreational Use
Yankee Nuclear Power Station, Rowe, MA

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC Non-BUD/TSCA, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator (1-2 years)						
Dermal Contact with Soil	1.7E-08	22.4%	Dioxin/Furan (53%)	1.5E-02	7.5%	Aroclor-1254 (38%)
Incidental Ingestion of Soil	8.9E-09			1.2E-02		
Inhalation of Fugitive Dust	1.3E-10	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	8.4E-02	41.5%	Cadmium (28%), Barium (25%)
Dermal Contact with Sediment	4.0E-08	51.6%	Aroclor-1254 (65%)	8.1E-02	40.3%	Aroclor-1254 (38%), Copper (32%)
Incidental Ingestion of Sediment	2.0E-08	25.9%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	2.1E-02	10.5%	Aroclor-1254 (46%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	5.3E-05	<1%	Cadmium (59%)
Total Risks*:	7.7E-08			2.0E-01		

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.9.1.1

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	9.14E-09	53.2%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		3.23E-03	21.3%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		2.86E-03	18.9%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		1.86E-05	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		5.95E-05	<1%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	N/A	5.17E-10	3.0%	N/A	
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	5.00E-05	6.93E-10	4.0%	8.32E-04	5.5%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	5.00E-05	4.86E-09	28.3%	5.83E-03	38.4%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	5.00E-05	1.96E-09	11.4%	2.36E-03	15.5%
Total Cancer Risk:					1.72E-08		Hazard Index:	1.52E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.15E-07 (cancer)	1.38E-05 (non-cancer)
	SA	Surface Area Exposed to Soil (cm ² /day)		1,670	
	AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (day/ev)		1	
	EP	Exposure Period (yr)		0.58	
	CF	Conversion Factor (kg/mg)		0.000001	
	BW	Body Weight (kg)		10.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		213	

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.2

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	1.56E-09	17.6%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		5.52E-04	4.5%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		1.40E-03	11.4%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		1.59E-03	13.0%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		5.09E-04	4.2%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	N/A	4.70E-10	5.3%	N/A	
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	5.00E-05	6.30E-10	7.1%	7.56E-04	6.2%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	5.00E-05	4.42E-09	49.8%	5.30E-03	43.3%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	5.00E-05	1.79E-09	20.1%	2.14E-03	17.5%
Total Cancer Risk:					8.87E-09	Hazard Index:	1.23E-02	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
	IR Ingestion Rate (mg/day)		100	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		0.58	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.3

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	3.92E-22	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	1.28E-10	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	3.16E-14	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	4.23E-14	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	2.97E-13	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	1.20E-13	<1%	7.19E-09	3.6%
Total Cancer Risk:					1.28E-10	Hazard Index:		1.97E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	7.00E-04 (cancer)	8.40E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (hr/ev)		8
	EP	Exposure Period (yr)		0.58
	CF	Conversion factor (d/hr)		0.042
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		213
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)		3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

Appendix Table E.9.1.4

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		2.06E-02	24.6%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		7.61E-03	9.1%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		2.36E-02	28.1%
Chromium	2.20E-03	1.00E+00	N/A	2.00E-02	N/A		2.59E-03	3.1%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		1.53E-03	1.8%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		4.71E-03	5.6%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		1.52E-02	18.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		6.12E-03	7.3%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		9.89E-04	1.2%
<i>Volatile Organic Compounds</i>								
Acetone	7.48E-02	1.00E+00	N/A	2.70E+00	N/A		6.53E-04	<1%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		1.41E-04	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	8.37E-02

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-04 (cancer)	2.36E-02 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	0.58
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.5

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.18E-03	5.1%
Beryllium	6.83E-01	3.00E-02	N/A	5.00E-03	N/A		1.61E-04	<1%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		8.84E-04	1.1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.82E-03	8.4%
Chromium	1.16E+01	4.00E-02	N/A	2.00E-02	N/A		9.09E-04	1.1%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		2.63E-02	32.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.09E-02	13.4%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.88E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	5.00E-05	2.56E-08	64.9%	3.08E-02	37.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.30E-01	N/A	1.00E-02	N/A		1.30E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-01	N/A		1.05E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E+00	N/A		3.15E-07	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-01	1.20E-09	3.0%	6.56E-07	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-01	1.20E-08	30.4%	6.59E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-01	N/A		1.57E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.29E-11	<1%	5.51E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-01	1.19E-10	<1%	6.50E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-01	N/A		1.77E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-01	5.26E-10	1.3%	2.88E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.29E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.96E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-01	N/A		1.38E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-01	N/A		8.74E-08	<1%

Total Cancer Risk: 3.95E-08 **Hazard Index:** 8.12E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.28E-07 (cancer)	3.93E-05 (non-cancer)
----------------------	---	---	----------------------	--------------------------

SA	Surface Area Exposed to Soil (cm ² /day)	1670
AF	Soil Skin Adherence Factor (mg/cm ²)	1
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	0.58
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.50E-03	11.8%
Beryllium	6.83E-01	1.00E+00	N/A	5.00E-03	N/A		3.22E-04	1.5%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		5.29E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.92E-03	13.7%
Chromium	1.16E+01	1.00E+00	N/A	2.00E-02	N/A		1.36E-03	6.4%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.58E-03	7.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.86E-03	8.7%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		8.63E-04	4.1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	5.00E-05	8.15E-09	41.1%	9.78E-03	46.0%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E+00	N/A	1.00E-02	N/A		5.98E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-01	N/A		2.26E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E+00	N/A		6.78E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-01	1.00E-09	5.1%	5.50E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-01	1.01E-08	50.9%	5.52E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-01	N/A		3.39E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	3.85E-11	<1%	1.65E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-01	9.94E-11	<1%	5.45E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-01	N/A		3.82E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-01	4.41E-10	2.2%	2.42E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.96E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.18E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-01	N/A		8.24E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.99E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-01	N/A		4.36E-08	<1%

Total Cancer Risk: 1.98E-08 **Hazard Index:** 2.13E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		0.58	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		10.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.28E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.43E+01	1.43E+01	N/A	5.00E-04	N/A		3.00E-04	94.3%
Zinc	2.15E-02	6.00E-04	2.17E+00	2.17E+00	N/A	3.00E-01	N/A		1.47E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	3.18E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.31E-03 (cancer)	1.57E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)			1,670
	EF	Exposure Frequency (ev/yr)			92
	ED	Exposure Duration (hr/ev)			4
	EP	Exposure Period (yr)			0.58
	CF	Conversion Factor (L/cm ³)			0.001
	BW	Body Weight (kg)			10.7
	AP	Averaging Period - Cancer (d)			25,550
		Averaging Period - Non- Cancer (d)			213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.9.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		4.91E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		3.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.69E-05	31.8%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 5.32E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-06 (cancer)	2.36E-04 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			0.58
BW	Body Weight (kg)			10.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Subchronic Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC BUD/TSCA , Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator (1-2 years)						
Dermal Contact with Soil	5.3E-08	20.2%	Dioxin/Furan (39%), Aroclor-1254 (27%)	3.4E-02	8.0%	Aroclor-1254 (51%)
Incidental Ingestion of Soil	4.9E-08	18.6%	Benzo(a)pyrene (29%), Aroclor-1254 (27%)	2.8E-02	6.6%	Aroclor-1254 (56%)
Inhalation of Fugitive Dust	1.7E-10	<1%	Nickel (81%)	3.0E-07	<1%	Zinc (58%)
Ingestion of Groundwater	1.2E-07	46.1%	Tetrahydrofuran (77%)	2.8E-01	66.2%	Copper (20%), Antimony (19%)
Dermal Contact with Sediment	4.0E-08	15.1%	Aroclor-1254 (65%)	8.1E-02	19.1%	Aroclor-1254 (38%), Copper (32%)
Incidental Ingestion of Sediment	2.0E-08			2.1E-02		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	5.3E-05	<1%	Cadmium (59%)
Total Risks*:	2.6E-07			4.3E-01		

* Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.
Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.10.1.1

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.05E-08	38.7%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	1.00E-01	N/A	3.00E-01	N/A		1.74E-04	<1%
Inorganics								
Copper	1.34E+01	1.00E+00	N/A	4.00E-02	N/A		4.61E-03	13.6%
Mercury	2.40E-01	5.00E-02	N/A	3.00E-04	N/A		5.51E-04	1.6%
Nickel	1.25E+01	3.50E-01	N/A	2.00E-02	N/A		3.01E-03	8.9%
Zinc	8.87E+01	2.00E-02	N/A	3.00E-01	N/A		8.14E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	5.00E-05	1.44E-08	27.2%	1.73E-02	51.1%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	5.00E-05	6.76E-09	12.8%	8.11E-03	24.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-02	N/A		4.06E-06	<1%
Acenaphthene	1.96E-01	1.00E-01	N/A	6.00E-01	N/A		4.51E-07	<1%
Acenaphthylene	2.22E-01	1.00E-01	N/A	3.00E-01	N/A		1.02E-06	<1%
Anthracene	2.47E-01	1.00E-01	N/A	3.00E+00	N/A		1.13E-07	<1%
Benzo(a)anthracene	3.79E-01	2.00E-02	7.30E-01	3.00E-01	6.35E-10	1.2%	3.48E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-01	5.84E-09	11.0%	3.20E-07	<1%
Benzo(b)fluoranthene	3.85E-01	2.00E-02	7.30E-01	3.00E-01	6.46E-10	1.2%	3.54E-07	<1%
Benzo(g,h,i)perylene	2.44E-01	1.00E-01	N/A	3.00E-01	N/A		1.12E-06	<1%
Benzo(k)fluoranthene	3.68E-01	2.00E-02	7.30E-02	3.00E-01	6.16E-11	<1%	3.38E-07	<1%
Carbazole	2.00E-01	1.00E+00	2.00E-02	N/A	4.58E-10	<1%	N/A	
Chrysene	4.27E-01	2.00E-02	7.30E-02	3.00E-01	7.16E-11	<1%	3.92E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-01	3.14E-09	5.9%	1.72E-07	<1%
Fluoranthene	6.68E-01	1.00E-01	N/A	4.00E-01	N/A		2.30E-06	<1%
Fluorene	2.02E-01	1.00E-01	N/A	4.00E-01	N/A		6.96E-07	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	2.00E-02	7.30E-01	3.00E-01	4.07E-10	<1%	2.23E-07	<1%
Naphthalene	1.94E-01	1.00E-01	N/A	2.00E-01	N/A		1.33E-06	<1%
Phenanthrene	3.81E-01	1.00E-01	N/A	3.00E-01	N/A		1.75E-06	<1%
Pyrene	6.05E-01	1.00E-01	N/A	3.00E-01	N/A		2.78E-06	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	1.00E-01	N/A	6.00E-01	N/A		5.51E-08	<1%
4-Methyl-2-Pentanone	1.00E-02	1.00E-01	N/A	8.00E-01	N/A		1.72E-08	<1%
Acetone	8.26E-02	1.00E-01	N/A	2.70E+00	N/A		4.21E-08	<1%
Dichlorodifluoromethane	6.70E-03	1.00E+00	N/A	N/A	N/A		N/A	
Trichlorofluoromethane	5.20E-03	1.00E+00	N/A	7.00E-01	N/A		1.02E-07	<1%
Toluene	1.43E-01	1.20E-01	N/A	8.00E-01	N/A		2.96E-07	<1%
Total Cancer Risk:					5.29E-08	Hazard Index:	3.38E-02	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.15E-07 (cancer)	1.38E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		1,670	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		0.58	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		10.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.2

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	3.50E-09	7.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	3.60E-01	N/A	3.00E-01	N/A		1.07E-04	<1%
Inorganics								
Copper	1.34E+01	1.00E+00	N/A	4.00E-02	N/A		7.89E-04	2.8%
Mercury	2.40E-01	1.00E+00	N/A	3.00E-04	N/A		1.88E-03	6.7%
Nickel	1.25E+01	1.00E+00	N/A	2.00E-02	N/A		1.47E-03	5.2%
Zinc	8.87E+01	1.00E+00	N/A	3.00E-01	N/A		6.96E-04	2.5%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	5.00E-05	1.31E-08	26.9%	1.57E-02	56.0%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	5.00E-05	6.14E-09	12.6%	7.37E-03	26.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-02	N/A		2.50E-06	<1%
Acenaphthene	1.96E-01	3.60E-01	N/A	6.00E-01	N/A		2.78E-07	<1%
Acenaphthylene	2.22E-01	3.60E-01	N/A	3.00E-01	N/A		6.27E-07	<1%
Anthracene	2.47E-01	3.60E-01	N/A	3.00E+00	N/A		6.98E-08	<1%
Benzo(a)anthracene	3.79E-01	2.80E-01	7.30E-01	3.00E-01	1.52E-09	3.1%	8.34E-07	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-01	1.40E-08	28.7%	7.66E-07	<1%
Benzo(b)fluoranthene	3.85E-01	2.80E-01	7.30E-01	3.00E-01	1.55E-09	3.2%	8.47E-07	<1%
Benzo(g,h,i)perylene	2.44E-01	3.60E-01	N/A	3.00E-01	N/A		6.89E-07	<1%
Benzo(k)fluoranthene	3.68E-01	2.80E-01	7.30E-02	3.00E-01	1.48E-10	<1%	8.08E-07	<1%
Carbazole	2.00E-01	1.00E+00	2.00E-02	N/A	7.84E-11	<1%	N/A	
Chrysene	4.27E-01	2.80E-01	7.30E-02	3.00E-01	1.71E-10	<1%	9.39E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-01	7.52E-09	15.4%	4.12E-07	<1%
Fluoranthene	6.68E-01	3.60E-01	N/A	4.00E-01	N/A		1.42E-06	<1%
Fluorene	2.02E-01	3.60E-01	N/A	4.00E-01	N/A		4.29E-07	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	2.80E-01	7.30E-01	3.00E-01	9.74E-10	2.0%	5.34E-07	<1%
Naphthalene	1.94E-01	3.60E-01	N/A	2.00E-01	N/A		8.22E-07	<1%
Phenanthrene	3.81E-01	3.60E-01	N/A	3.00E-01	N/A		1.08E-06	<1%
Pyrene	6.05E-01	3.60E-01	N/A	3.00E-01	N/A		1.71E-06	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	1.00E+00	N/A	6.00E-01	N/A		9.42E-08	<1%
4-Methyl-2-Pentanone	1.00E-02	1.00E+00	N/A	8.00E-01	N/A		2.94E-08	<1%
Acetone	8.26E-02	1.00E+00	N/A	2.70E+00	N/A		7.21E-08	<1%
Dichlorodifluoromethane	6.70E-03	1.00E+00	N/A	N/A	N/A		N/A	
Trichlorofluoromethane	5.20E-03	1.00E+00	N/A	7.00E-01	N/A		1.75E-08	<1%
Toluene	1.43E-01	1.00E+00	N/A	8.00E-01	N/A		4.22E-07	<1%
Total Cancer Risk:					4.87E-08	Hazard Index:	2.80E-02	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
	IR Ingestion Rate (mg/day)		100	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		0.58	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.3

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	8.80E-22	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.79E+01	1.21E-03	N/A	5.00E+05	N/A		2.04E-10	<1%
Inorganics								
Copper	1.34E+01	4.29E-04	N/A	3.00E+03	N/A		1.20E-08	4.1%
Mercury	2.40E-01	7.68E-06	N/A	3.00E+02	N/A		2.15E-09	<1%
Nickel	1.25E+01	4.00E-04	4.80E-04	1.00E+03	1.34E-10	81.1%	3.36E-08	11.4%
Zinc	8.87E+01	2.84E-03	N/A	1.40E+03	N/A		1.70E-07	57.6%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	8.79E-13	<1%	5.27E-08	17.8%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.12E-13	<1%	2.47E-08	8.4%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+05	N/A		6.34E-13	<1%
Acenaphthene	1.96E-01	6.29E-06	N/A	5.00E+05	N/A		1.06E-12	<1%
Acenaphthylene	2.22E-01	7.09E-06	N/A	5.00E+05	N/A		1.19E-12	<1%
Anthracene	2.47E-01	7.90E-06	N/A	5.00E+05	N/A		1.33E-12	<1%
Benzo(a)anthracene	3.79E-01	1.21E-05	2.09E-04	5.00E+05	1.77E-12	1.1%	2.04E-12	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+05	1.63E-11	9.8%	1.87E-12	<1%
Benzo(b)fluoranthene	3.85E-01	1.23E-05	2.09E-04	5.00E+05	1.80E-12	1.1%	2.07E-12	<1%
Benzo(g,h,i)perylene	2.44E-01	7.80E-06	N/A	5.00E+05	N/A		1.31E-12	<1%
Benzo(k)fluoranthene	3.68E-01	1.18E-05	2.09E-05	5.00E+05	1.72E-13	<1%	1.98E-12	<1%
Carbazole	2.00E-01	6.39E-06	N/A	N/A	N/A		N/A	
Chrysene	4.27E-01	1.37E-05	2.09E-05	5.00E+05	2.00E-13	<1%	2.30E-12	<1%
Dibenzo(a,h)anthracene	1.87E-01	6.00E-06	2.09E-03	5.00E+05	8.76E-12	5.3%	1.01E-12	<1%
Fluoranthene	6.68E-01	2.14E-05	N/A	5.00E+05	N/A		3.59E-12	<1%
Fluorene	2.02E-01	6.47E-06	N/A	5.00E+05	N/A		1.09E-12	<1%
Indeno(1,2,3-cd)pyrene	2.43E-01	7.77E-06	2.09E-04	5.00E+05	1.13E-12	<1%	1.30E-12	<1%
Naphthalene	1.94E-01	6.21E-06	N/A	3.00E+03	N/A		1.74E-10	<1%
Phenanthrene	3.81E-01	1.22E-05	N/A	5.00E+05	N/A		2.05E-12	<1%
Pyrene	6.05E-01	1.94E-05	N/A	5.00E+05	N/A		3.25E-12	<1%
Volatile Organic Compounds								
2-Butanone	2.40E-02	7.68E-07	N/A	5.00E+06	N/A		1.29E-14	<1%
4-Methyl-2-Pentanone	1.00E-02	3.20E-07	N/A	3.00E+06	N/A		8.96E-15	<1%
Acetone	8.26E-02	2.64E-06	N/A	8.00E+05	N/A		2.78E-13	<1%
Dichlorodifluoromethane	6.70E-03	2.14E-07	N/A	2.00E+06	N/A		9.01E-15	<1%
Trichlorofluoromethane	5.20E-03	1.66E-07	N/A	7.00E+06	N/A		2.00E-15	<1%
Toluene	1.43E-01	4.58E-06	N/A	5.00E+06	N/A		7.70E-14	<1%

Total Cancer Risk: 1.66E-10 **Hazard Index:** 2.96E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	7.00E-04 (cancer)	8.40E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (hr/ev)		8
	EP	Exposure Period (yr)		0.58
	CF	Conversion factor (d/hr)		0.042
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non-Cancer (d)		213
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)		3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.10.1.4

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		5.30E-02	18.8%
Beryllium	2.00E-04	1.00E+00	N/A	5.00E-03	N/A		9.42E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		2.52E-02	9.0%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		1.88E-02	6.7%
Chromium	8.20E-03	1.00E+00	N/A	2.00E-02	N/A		9.66E-03	3.4%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		5.48E-02	19.5%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		1.18E-02	4.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		3.30E-02	11.7%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		2.36E-02	8.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		4.71E-03	1.7%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-04	N/A		1.18E-02	4.2%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		4.49E-03	1.6%
<i>Semivolatile Organic Compounds</i>								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-01	1.92E-09	1.6%	1.05E-05	<1%
<i>Volatile Organic Compounds</i>								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E+00	N/A		1.32E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		5.65E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-01	2.48E-08	20.6%	2.71E-03	<1%
Acetone	2.89E+00	1.00E+00	N/A	2.70E+00	N/A		2.52E-02	9.0%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E+00	6.01E-10	<1%	4.00E-05	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	N/A	9.32E-08	77.3%	N/A	
<i>Volatile Petroleum Hydrocarbons</i>								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-01	N/A		1.05E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E+00	N/A		1.29E-04	<1%
Total Cancer Risk:					1.21E-07	Hazard Index:	2.82E-01	

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-04 (cancer)	2.36E-02 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	0.58
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.5

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.18E-03	5.1%
Beryllium	6.83E-01	3.00E-02	N/A	5.00E-03	N/A		1.61E-04	<1%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		8.84E-04	1.1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.82E-03	8.4%
Chromium	1.16E+01	4.00E-02	N/A	2.00E-02	N/A		9.09E-04	1.1%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		2.63E-02	32.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.09E-02	13.4%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.88E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	5.00E-05	2.56E-08	64.9%	3.08E-02	37.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.30E-01	N/A	1.00E-02	N/A		1.30E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-01	N/A		1.05E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E+00	N/A		3.15E-07	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-01	1.20E-09	3.0%	6.56E-07	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-01	1.20E-08	30.4%	6.59E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-01	N/A		1.57E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.29E-11	<1%	5.51E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-01	1.19E-10	<1%	6.50E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-01	N/A		1.77E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-01	5.26E-10	1.3%	2.88E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.29E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.96E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-01	N/A		1.38E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-01	N/A		8.74E-08	<1%

Total Cancer Risk: 3.95E-08 **Hazard Index:** 8.12E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.28E-07 (cancer)	3.93E-05 (non-cancer)
----------------------	---	---	----------------------	--------------------------

SA	Surface Area Exposed to Soil (cm ² /day)	1670
AF	Soil Skin Adherence Factor (mg/cm ²)	1
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	0.58
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	10.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	213

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.50E-03	11.8%
Beryllium	6.83E-01	1.00E+00	N/A	5.00E-03	N/A		3.22E-04	1.5%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		5.29E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.92E-03	13.7%
Chromium	1.16E+01	1.00E+00	N/A	2.00E-02	N/A		1.36E-03	6.4%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.58E-03	7.4%
Lithium	1.15E+01	1.00E+00	N/A	N/A	N/A		N/A	
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.86E-03	8.7%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		8.63E-04	4.1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	5.00E-05	8.15E-09	41.1%	9.78E-03	46.0%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E+00	N/A	1.00E-02	N/A		5.98E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-01	N/A		2.26E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E+00	N/A		6.78E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-01	1.00E-09	5.1%	5.50E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-01	1.01E-08	50.9%	5.52E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-01	N/A		3.39E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	3.85E-11	<1%	1.65E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-01	9.94E-11	<1%	5.45E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	N/A	N/A		N/A	
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	N/A	N/A		N/A	
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-01	N/A		3.82E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-01	4.41E-10	2.2%	2.42E-07	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	N/A	N/A		N/A	
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.96E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.18E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-01	N/A		8.24E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.99E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-01	N/A		4.36E-08	<1%

Total Cancer Risk: 1.98E-08 **Hazard Index:** 2.13E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.96E-08 (cancer)	2.36E-06 (non-cancer)
	IR Ingestion Rate (mg/day)		100	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		0.58	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		10.7	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.28E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.43E+01	1.43E+01	N/A	5.00E-04	N/A		3.00E-04	94.3%
Zinc	2.15E-02	6.00E-04	2.17E+00	2.17E+00	N/A	3.00E-01	N/A		1.47E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	3.18E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.31E-03 (cancer)	1.57E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			1,670	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			0.58	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			10.7	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.10.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Subchronic Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		4.91E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		3.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.69E-05	31.8%

Total Cancer Risk: 0.00E+00 **Hazard Index:** 5.32E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.96E-06 (cancer)	2.36E-04 (non-cancer)
IR	Ingestion Rate (L/d)		0.01	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (d/ev)		1	
EP	Exposure Period (yr)		0.58	
BW	Body Weight (kg)		10.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		213	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1

Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Current Recreational Use
Yankee Nuclear Power Station, Rowe, MA

Exposed to Media from Background

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	1.4E-08	18.8%	Benzo(a)pyrene (76%)	9.3E-04	5.1%	Nickel (91%)
Incidental Ingestion of Soil	2.3E-08	30.9%	Benzo(a)pyrene (76%)	6.6E-04		
Inhalation of Fugitive Dust	4.3E-10	<1%	Nickel (91%)	4.7E-08	<1%	Zinc (74%)
Dermal Contact with Sediment	3.7E-08	49.7%	Benzo(a)pyrene (87%)	1.4E-02	75.7%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	2.1E-08			3.4E-03	18.8%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	6.4E-05	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	5.5E-06	<1%	Cadmium (82%)
Total Risks*:	7.5E-08			1.8E-02		
Future Adolescent Recreator						
Dermal Contact with Soil	8.2E-09	10.9%	Benzo(a)pyrene (76%)	3.0E-04	2.3%	Nickel (91%)
Incidental Ingestion of Soil	7.8E-09	10.4%	Benzo(a)pyrene (76%)	1.2E-04		
Inhalation of Fugitive Dust	7.9E-10	1.1%	Nickel (91%)	4.7E-08	<1%	Zinc (74%)
Dermal Contact with Sediment	5.8E-08	77.7%	Benzo(a)pyrene (87%)	1.2E-02	92.3%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	7.2E-09			6.3E-04	4.9%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	5.5E-05	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-06	<1%	Cadmium (82%)
Total Risks*:	7.5E-08			1.3E-02		
Future Adult Recreator						
Dermal Contact with Soil	6.5E-09	10.9%	Benzo(a)pyrene (76%)	2.2E-04	2.3%	Nickel (91%)
Incidental Ingestion of Soil	6.2E-09	10.3%	Benzo(a)pyrene (76%)	8.9E-05		
Inhalation of Fugitive Dust	8.7E-10	1.4%	Nickel (91%)	4.7E-08	<1%	Zinc (74%)
Dermal Contact with Sediment	4.7E-08	77.4%	Benzo(a)pyrene (87%)	8.7E-03	92.3%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	5.8E-09			4.6E-04	4.9%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	4.0E-05	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.5E-06	<1%	Cadmium (82%)
Total Risks*:	6.0E-08			9.4E-03		
Child + Adolescent + Adult	2.1E-07					

* Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.
Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.11.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		4.82E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		8.52E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		2.96E-06	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		1.64E-05	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		1.48E-06	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		7.37E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	1.11E-09	7.9%	5.94E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	1.07E-08	76.2%	5.71E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	1.32E-09	9.4%	7.05E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		1.61E-06	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	1.07E-10	<1%	5.71E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	1.10E-10	<1%	5.85E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		6.31E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	6.86E-10	4.9%	3.66E-07	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		3.23E-06	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		3.87E-06	<1%

Total Cancer Risk: 1.41E-08 **Hazard Index:** 9.33E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.95E-07 (cancer)	4.61E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			2,434
AF	Soil Skin Adherence Factor (mg/cm ²)			0.35
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		9.42E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		2.86E-04	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		1.74E-04	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		9.64E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		6.26E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		3.12E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	1.83E-09	7.9%	9.76E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	1.76E-08	76.2%	9.39E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	2.17E-09	9.4%	1.16E-06	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		6.82E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	1.76E-10	<1%	9.38E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	1.80E-10	<1%	9.61E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		2.67E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	1.13E-09	4.9%	6.01E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		1.37E-06	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		1.63E-06	<1%
Total Cancer Risk:					2.31E-08		Hazard Index:	6.60E-04

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.64E-08 (cancer)	5.41E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		2.10E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	3.94E-10	90.9%	9.57E-09	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		4.85E-10	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		3.46E-08	73.9%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		1.75E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		8.70E-13	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	3.13E-12	<1%	3.50E-12	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	3.01E-11	6.9%	3.37E-12	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	3.72E-12	<1%	4.16E-12	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		1.90E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	3.01E-13	<1%	3.37E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	3.08E-13	<1%	3.45E-12	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		9.93E-16	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	1.93E-12	<1%	2.16E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		3.81E-12	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		4.56E-12	<1%
Total Cancer Risk:					4.33E-10	Hazard Index:	4.68E-08	

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	2.43E-03 (cancer)	2.83E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)		31
	ED	Exposure Duration (hr/ev)		8
	EP	Exposure Period (yr)		6
	CF	Conversion factor (d/hr)		0.042
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non-Cancer (d)		2,190
	PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP)

N/A - Not available

Blank - Not a COPC for this Study Area

$$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$$

$$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$$

Appendix Table E.11.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		7.07E-05	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		5.89E-06	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		1.89E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		3.93E-03	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		3.79E-04	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		4.42E-03	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		2.80E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		9.51E-05	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		4.72E-07	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		5.44E-07	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	2.81E-09	7.6%	1.50E-06	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	3.24E-08	87.0%	1.73E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		4.43E-06	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	2.77E-10	<1%	1.48E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		2.39E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		4.92E-06	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		1.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	1.75E-09	4.7%	9.30E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		3.82E-07	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		8.27E-08	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		3.19E-07	<1%
Total Cancer Risk:					3.72E-08		Hazard Index:	1.39E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.13E-06 (cancer)	1.32E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		9.68E-05	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		8.06E-06	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		5.56E-04	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		1.79E-03	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		2.59E-04	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		1.82E-04	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		3.28E-04	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		1.95E-04	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		6.98E-08	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		8.05E-08	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	1.62E-09	7.6%	8.62E-07	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	1.86E-08	87.0%	9.93E-07	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		6.56E-07	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	1.59E-10	<1%	8.49E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		9.82E-06	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		2.02E-07	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		2.37E-07	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	1.00E-09	4.7%	5.35E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		1.57E-07	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		3.40E-08	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		1.09E-07	<1%
Total Cancer Risk:					2.14E-08		Hazard Index: 3.43E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.64E-08 (cancer)	5.41E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		9.92E-07	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		6.27E-05	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	6.37E-05	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.51E-03 (cancer)	5.27E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			2,434	
EF	Exposure Frequency (ev/yr)			31	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			6	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			15.7	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			2,190	

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.7
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		1.02E-06	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		4.51E-06	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	5.53E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	4.64E-06 (cancer)	5.41E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.53E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		2.71E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		9.42E-07	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		5.23E-06	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		4.72E-07	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		2.35E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	6.50E-10	7.9%	1.89E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	6.25E-09	76.2%	1.82E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	7.72E-10	9.4%	2.24E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		5.13E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	6.25E-11	<1%	1.82E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	6.40E-11	<1%	1.86E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		2.01E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	4.00E-10	4.9%	1.16E-07	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		1.03E-06	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		1.23E-06	<1%
Total Cancer Risk:					8.20E-09		Hazard Index:	2.97E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.30E-07 (cancer)	1.47E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		1.74E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		5.27E-05	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		3.20E-05	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		1.78E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		1.15E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		5.74E-09	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	6.19E-10	7.9%	1.80E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	5.95E-09	76.2%	1.73E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	7.35E-10	9.4%	2.13E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		1.26E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	5.95E-11	<1%	1.73E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	6.09E-11	<1%	1.77E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		4.92E-11	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	3.81E-10	4.9%	1.11E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		2.52E-07	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		3.01E-07	<1%
Total Cancer Risk:					7.81E-09		Hazard Index:	1.22E-04

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.57E-08 (cancer)	9.97E-08 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RFC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		2.10E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	7.22E-10	90.9%	9.57E-09	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		4.85E-10	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		3.46E-08	73.9%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		1.75E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		8.70E-13	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	5.74E-12	<1%	3.50E-12	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	5.52E-11	6.9%	3.37E-12	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	6.81E-12	<1%	4.16E-12	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		1.90E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	5.52E-13	<1%	3.37E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	5.65E-13	<1%	3.45E-12	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		9.93E-16	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	3.53E-12	<1%	2.16E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		3.81E-12	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		4.56E-12	<1%
Total Cancer Risk:					7.94E-10	Hazard Index:	4.68E-08	

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	4.45E-03 (cancer)	2.83E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	11	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	4,015	
	PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP N/A - Not available)

Blank - Not a COPC for this Study Area

$$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$$

$$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$$

Appendix Table E.11.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		6.06E-05	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		5.04E-06	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		1.62E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		3.37E-03	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		3.24E-04	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		3.79E-03	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		2.40E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		8.15E-05	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		4.04E-07	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		4.66E-07	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	4.42E-09	7.6%	1.28E-06	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	5.09E-08	87.0%	1.48E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		3.80E-06	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	4.35E-10	<1%	1.26E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		2.05E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		4.22E-06	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		1.37E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	2.74E-09	4.7%	7.97E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		3.27E-07	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		7.08E-08	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		2.73E-07	<1%
Total Cancer Risk:					5.85E-08		Hazard Index:	1.19E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.77E-06 (cancer)	1.13E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		1.49E-06	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		1.02E-04	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		3.31E-04	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		4.78E-05	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		3.35E-05	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		6.05E-05	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		3.60E-05	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		1.29E-08	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		1.48E-08	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	5.47E-10	7.6%	1.59E-07	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	6.30E-09	87.0%	1.83E-07	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		1.21E-07	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	5.39E-11	<1%	1.56E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		1.81E-06	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		3.73E-08	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		4.36E-08	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	3.39E-10	4.7%	9.86E-08	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		2.89E-08	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		6.26E-09	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		2.01E-08	<1%
Total Cancer Risk:					7.24E-09		Hazard Index: 6.33E-04	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.57E-08 (cancer)	9.97E-08 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		8.50E-07	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		5.37E-05	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	5.46E-05	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	7.09E-03 (cancer)	4.51E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (hr/ev)			4
EP	Exposure Period (yr)			11
CF	Conversion Factor (L/cm ³)			0.001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		3.75E-07	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		1.66E-06	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	2.04E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	3.13E-06 (cancer)	1.99E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.15
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.12E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		1.98E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		6.87E-07	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		3.81E-06	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		3.44E-07	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		1.71E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	5.17E-10	7.9%	1.38E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	4.98E-09	76.2%	1.33E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	6.14E-10	9.4%	1.64E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		3.74E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	4.97E-11	<1%	1.33E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	5.09E-11	<1%	1.36E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		1.46E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	3.19E-10	4.9%	8.48E-08	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		7.50E-07	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		8.97E-07	<1%
Total Cancer Risk:					6.53E-09		Hazard Index:	2.17E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.83E-07 (cancer)	1.07E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		1.27E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		3.84E-05	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		2.34E-05	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		1.30E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		8.42E-08	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		4.19E-09	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	4.92E-10	7.9%	1.31E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	4.74E-09	76.2%	1.26E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	5.85E-10	9.4%	1.56E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		9.16E-08	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	4.74E-11	<1%	1.26E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	4.85E-11	<1%	1.29E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		3.59E-11	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	3.03E-10	4.9%	8.08E-08	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		1.84E-07	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		2.20E-07	<1%
Total Cancer Risk:					6.21E-09		Hazard Index:	8.87E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.25E-08 (cancer)	7.27E-08 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.17

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RFC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		2.10E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	7.88E-10	90.9%	9.57E-09	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		4.85E-10	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		3.46E-08	73.9%
<i>Semivolatile Organic Compounds</i>								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		1.75E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		8.70E-13	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	6.26E-12	<1%	3.50E-12	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	6.02E-11	6.9%	3.37E-12	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	7.43E-12	<1%	4.16E-12	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		1.90E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	6.02E-13	<1%	3.37E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	6.16E-13	<1%	3.45E-12	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		9.93E-16	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	3.85E-12	<1%	2.16E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		3.81E-12	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		4.56E-12	<1%

Total Cancer Risk: 8.67E-10 Hazard Index: 4.68E-08

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	4.85E-03 (cancer)	2.83E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	31	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	12	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	4,380	
	PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADE N/A - Not available)

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table E.11.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		4.42E-05	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		3.68E-06	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		1.18E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		2.46E-03	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		2.37E-04	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		2.76E-03	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		1.75E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		5.94E-05	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		2.95E-07	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		3.40E-07	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	3.52E-09	7.6%	9.36E-07	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	4.05E-08	87.0%	1.08E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		2.77E-06	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	3.46E-10	<1%	9.22E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		1.49E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		3.08E-06	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		1.00E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	2.18E-09	4.7%	5.81E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		2.39E-07	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		5.17E-08	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		1.99E-07	<1%
Total Cancer Risk:					4.65E-08		Hazard Index:	8.66E-03

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.41E-06 (cancer)	8.23E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)	5657	
AF	Soil Skin Adherence Factor (mg/cm ²)	1	
EF	Exposure Frequency (ev/yr)	31	
ED	Exposure Duration (day/ev)	1	
EP	Exposure Period (yr)	12	
CF	Conversion Factor (kg/mg)	0.000001	
BW	Body Weight (kg)	58.4	
AP	Averaging Period - Cancer (d)	25,550	
	Averaging Period - Non-Cancer (d)	4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		1.30E-05	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		1.08E-06	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		7.47E-05	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		2.41E-04	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		3.49E-05	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		2.44E-05	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		4.42E-05	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		2.63E-05	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		9.38E-09	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		1.08E-08	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	4.35E-10	7.6%	1.16E-07	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	5.01E-09	87.0%	1.33E-07	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		8.81E-08	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	4.29E-11	<1%	1.14E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		1.32E-06	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		2.72E-08	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		3.18E-08	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	2.70E-10	4.7%	7.19E-08	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		2.11E-08	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		4.57E-09	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		1.47E-08	<1%
Total Cancer Risk:					5.76E-09		Hazard Index: 4.62E-04	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.25E-08 (cancer)	7.27E-08 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		6.20E-07	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		3.92E-05	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	3.98E-05	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.64E-03 (cancer)	3.29E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)		5,657	
EF	Exposure Frequency (ev/yr)		31	
ED	Exposure Duration (hr/ev)		4	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (L/cm ³)		0.001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.11.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Current Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		2.74E-07	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		1.21E-06	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.49E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	2.49E-06 (cancer)	1.45E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			31
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Media from Background

Receptor/Exposure Pathway	Cancer Risks			Non Cancer Risks		
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator						
Dermal Contact with Soil	4.2E-08	18.8%	Benzo(a)pyrene (76%)	2.8E-03	5.1%	Nickel (91%)
Incidental Ingestion of Soil	6.9E-08	30.9%	Benzo(a)pyrene (76%)	2.0E-03		
Inhalation of Fugitive Dust	1.3E-09	<1%	Nickel (91%)	1.4E-07	<1%	Zinc (74%)
Ingestion of Groundwater	0.0E+00		No COCs in groundwater	0.0E+00		No COCs in groundwater
Dermal Contact with Sediment	1.1E-07	49.7%	Benzo(a)pyrene (87%)	4.1E-02	75.7%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	6.4E-08			1.0E-02	18.8%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.9E-04	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.6E-05	<1%	Cadmium (82%)
Total Risks*:	2.2E-07			5.4E-02		
Future Adolescent Recreator						
Dermal Contact with Soil	2.4E-08	10.9%	Benzo(a)pyrene (76%)	8.8E-04	2.3%	Nickel (91%)
Incidental Ingestion of Soil	2.3E-08	10.4%	Benzo(a)pyrene (76%)	3.6E-04		
Inhalation of Fugitive Dust	2.4E-09	1.1%	Nickel (91%)	1.4E-07	<1%	Zinc (74%)
Ingestion of Groundwater	0.0E+00		No COCs in groundwater	0.0E+00		No COCs in groundwater
Dermal Contact with Sediment	1.7E-07	77.7%	Benzo(a)pyrene (87%)	3.5E-02	92.3%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	2.1E-08			1.9E-03	4.9%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.6E-04	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	6.0E-06	<1%	Cadmium (82%)
Total Risks*:	2.2E-07			3.8E-02		
Future Adult Recreator						
Dermal Contact with Soil	1.9E-08	10.9%	Benzo(a)pyrene (76%)	6.4E-04	2.3%	Nickel (91%)
Incidental Ingestion of Soil	1.8E-08	10.3%	Benzo(a)pyrene (76%)	2.6E-04		
Inhalation of Fugitive Dust	2.6E-09	1.4%	Nickel (91%)	1.4E-07	<1%	Zinc (74%)
Ingestion of Groundwater	0.0E+00		No COCs in groundwater	0.0E+00		No COCs in groundwater
Dermal Contact with Sediment	1.4E-07	77.4%	Benzo(a)pyrene (87%)	2.6E-02	92.3%	Lithium (32%), Chromium (28%)
Incidental Ingestion of Sediment	1.7E-08			1.4E-03	4.9%	Chromium (52%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.2E-04	<1%	Cadmium (98%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	4.4E-06	<1%	Cadmium (82%)
Total Risks*:	1.8E-07			2.8E-02		
Child + Adolescent + Adult	6.2E-07					

* Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.
Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table E.12.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.43E-04	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		2.53E-03	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		8.79E-06	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		4.88E-05	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		4.40E-06	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		2.19E-07	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	3.31E-09	7.9%	1.76E-06	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	3.18E-08	76.2%	1.70E-06	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	3.93E-09	9.4%	2.09E-06	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		4.79E-06	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	3.18E-10	<1%	1.69E-06	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	3.26E-10	<1%	1.74E-06	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		1.87E-09	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	2.04E-09	4.9%	1.09E-06	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		9.59E-06	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		1.15E-05	<1%

Total Cancer Risk: 4.17E-08 **Hazard Index:** 2.77E-03

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			2,434
AF	Soil Skin Adherence Factor (mg/cm ²)			0.35
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		2.80E-04	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		8.48E-04	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		5.16E-04	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		2.86E-04	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		1.86E-06	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		9.25E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	5.44E-09	7.9%	2.90E-06	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	5.23E-08	76.2%	2.79E-06	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	6.45E-09	9.4%	3.44E-06	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		2.02E-06	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	5.23E-10	<1%	2.78E-06	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	5.35E-10	<1%	2.85E-06	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		7.92E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	3.35E-09	4.9%	1.78E-06	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		4.05E-06	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		4.85E-06	<1%
Total Cancer Risk:					6.86E-08		Hazard Index:	1.96E-03

Notes

Intake Factor (IF) = $\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
FR	Fraction from Contaminated Source			1
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		6.24E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	1.17E-09	90.9%	2.84E-08	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		1.44E-09	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		1.03E-07	73.9%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		5.19E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		2.58E-12	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	9.29E-12	<1%	1.04E-11	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	8.94E-11	6.9%	1.00E-11	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	1.10E-11	<1%	1.23E-11	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		5.65E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	8.93E-13	<1%	9.99E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	9.15E-13	<1%	1.02E-11	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		2.95E-15	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	5.72E-12	<1%	6.40E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		1.13E-11	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		1.35E-11	<1%
Total Cancer Risk:					1.29E-09	Hazard Index:	1.39E-07	

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	92	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	6	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	2,190	
	PM ₁₀	Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP)

N/A - Not available

Blank - Not a COPC for this Study Area

$$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$$

$$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$$

Appendix Table E.12.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		2.10E-04	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		1.75E-05	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		5.62E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		1.17E-02	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		1.12E-03	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		1.31E-02	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		8.30E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		2.82E-04	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		1.40E-06	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		1.62E-06	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	8.35E-09	7.6%	4.45E-06	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	9.61E-08	87.0%	5.12E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		1.32E-05	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	8.22E-10	<1%	4.38E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		7.09E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		1.46E-05	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		4.75E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	5.18E-09	4.7%	2.76E-06	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		1.13E-06	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		2.45E-07	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		9.46E-07	<1%
Total Cancer Risk:					1.11E-07		Hazard Index:	4.11E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		2.87E-04	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		2.39E-05	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		1.65E-03	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		5.33E-03	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		7.70E-04	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		5.39E-04	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		9.75E-04	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		5.80E-04	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		2.39E-07	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	4.80E-09	7.6%	2.56E-06	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	5.53E-08	87.0%	2.95E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		1.95E-06	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	4.73E-10	<1%	2.52E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		2.91E-05	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		6.00E-07	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		7.02E-07	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	2.98E-09	4.7%	1.59E-06	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		4.66E-07	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		1.01E-07	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		3.24E-07	<1%
Total Cancer Risk:					6.36E-08		Hazard Index: 1.02E-02	

Notes

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
FR	Fraction from Contaminated Source		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.94E-06	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.89E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			2,434	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			6	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			15.7	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			2,190	

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.7
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		3.02E-06	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		1.34E-05	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.64E-05

Notes

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
	IR	Ingestion Rate (L/d)		0.01
	FR	Fraction from Contaminated Source		1
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (d/ev)		1
	EP	Exposure Period (yr)		6
	BW	Body Weight (kg)		15.7
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		4.55E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		8.05E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		2.80E-06	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		1.55E-05	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		1.40E-06	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		6.96E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	1.93E-09	7.9%	5.61E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	76.2%	5.39E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	2.29E-09	9.4%	6.66E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		1.52E-06	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	1.86E-10	<1%	5.39E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-10	<1%	5.52E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		5.96E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	1.19E-09	4.9%	3.45E-07	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		3.05E-06	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		3.65E-06	<1%
Total Cancer Risk:					2.43E-08		Hazard Index:	8.81E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table E.12.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		5.15E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		1.56E-04	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		9.51E-05	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		5.27E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		3.43E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		1.70E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	1.84E-09	7.9%	5.34E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	1.77E-08	76.2%	5.13E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	2.18E-09	9.4%	6.34E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		3.73E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	1.77E-10	<1%	5.13E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	1.81E-10	<1%	5.25E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		1.46E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	1.13E-09	4.9%	3.29E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		7.47E-07	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		8.93E-07	<1%
Total Cancer Risk:					2.32E-08		Hazard Index:	3.61E-04

Notes

Intake Factor (IF) = $\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
FR	Fraction from Contaminated Source			1
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.10

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RFC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		6.24E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	2.14E-09	90.9%	2.84E-08	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		1.44E-09	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		1.03E-07	73.9%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		5.19E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		2.58E-12	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	1.70E-11	<1%	1.04E-11	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	1.64E-10	6.9%	1.00E-11	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	2.02E-11	<1%	1.23E-11	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		5.65E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	1.64E-12	<1%	9.99E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	1.68E-12	<1%	1.02E-11	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		2.95E-15	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	1.05E-11	<1%	6.40E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		1.13E-11	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		1.35E-11	<1%
Total Cancer Risk:					2.36E-09		Hazard Index:	1.39E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF	Exposure Frequency (ev/yr)	92	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	11	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non-Cancer (d)	4,015	
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP N/A - Not available)

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.12.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		1.80E-04	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		1.50E-05	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		4.81E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		9.99E-03	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		9.63E-04	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		7.11E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		2.42E-04	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		1.20E-06	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		1.38E-06	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	1.31E-08	7.6%	3.81E-06	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	1.51E-07	87.0%	4.39E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		1.13E-05	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	1.29E-09	<1%	3.75E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		6.08E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		1.25E-05	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		4.07E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	8.14E-09	4.7%	2.37E-06	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		9.71E-07	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		2.10E-07	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		8.10E-07	<1%
Total Cancer Risk:					1.74E-07		Hazard Index:	3.52E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		5.30E-05	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		4.41E-06	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		3.04E-04	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		9.81E-04	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		1.42E-04	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		9.94E-05	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		1.80E-04	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		1.07E-04	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		3.82E-08	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		4.40E-08	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	1.62E-09	7.6%	4.71E-07	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	1.87E-08	87.0%	5.43E-07	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		3.59E-07	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	1.60E-10	<1%	4.64E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		5.37E-06	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		1.11E-07	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		1.29E-07	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	1.01E-09	4.7%	2.93E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		8.58E-08	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		1.86E-08	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		5.97E-08	<1%
Total Cancer Risk:					2.15E-08		Hazard Index: 1.88E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
	IR	Ingestion Rate (mg/day)		50
	FR	Fraction from Contaminated Source		1
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (day/ev)		1
	EP	Exposure Period (yr)		11
	CF	Conversion Factor (kg/mg)		0.000001
	BW	Body Weight (kg)		42.6
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.52E-06	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.59E-04	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.62E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$					=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)						5,657	
EF	Exposure Frequency (ev/yr)						92	
ED	Exposure Duration (hr/ev)						4	
EP	Exposure Period (yr)						11	
CF	Conversion Factor (L/cm ³)						0.001	
BW	Body Weight (kg)						42.6	
AP	Averaging Period - Cancer (d)						25,550	
	Averaging Period - Non- Cancer (d)						4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		1.11E-06	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		4.93E-06	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	6.04E-06

Notes

Intake Factor (IF) = $\frac{IR \times FR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
FR	Fraction from Contaminated Source			1
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.15
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		3.32E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		5.87E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		2.04E-06	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		1.13E-05	1.8%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		1.02E-06	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		5.08E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	1.54E-09	7.9%	4.09E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	1.48E-08	76.2%	3.93E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	1.82E-09	9.4%	4.86E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		1.11E-06	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	1.48E-10	<1%	3.93E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-10	<1%	4.03E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		4.35E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	9.45E-10	4.9%	2.52E-07	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		2.23E-06	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		2.66E-06	<1%
Total Cancer Risk:					1.94E-08		Hazard Index:	6.43E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		3.76E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		1.14E-04	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		6.93E-05	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		3.85E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		2.50E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		1.24E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	1.46E-09	7.9%	3.89E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	1.41E-08	76.2%	3.74E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	1.74E-09	9.4%	4.62E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		2.72E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	1.41E-10	<1%	3.74E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	1.44E-10	<1%	3.83E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		1.06E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	9.00E-10	4.9%	2.40E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		5.45E-07	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		6.52E-07	<1%
Total Cancer Risk:					1.84E-08		Hazard Index:	2.63E-04

Notes

Intake Factor (IF) = $\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
FR	Fraction from Contaminated Source		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.17

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Background

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		6.24E-09	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	2.34E-09	90.9%	2.84E-08	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		1.44E-09	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		1.03E-07	73.9%
<i>Semivolatile Organic Compounds</i>								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		5.19E-12	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		2.58E-12	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	1.86E-11	<1%	1.04E-11	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	1.79E-10	6.9%	1.00E-11	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	2.21E-11	<1%	1.23E-11	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		5.65E-12	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	1.79E-12	<1%	9.99E-12	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	1.83E-12	<1%	1.02E-11	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		2.95E-15	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	1.14E-11	<1%	6.40E-12	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		1.13E-11	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		1.35E-11	<1%
Total Cancer Risk:					2.57E-09		Hazard Index:	1.39E-07

Notes

Intake Factor (IF) = $\frac{EF \times ED \times EP \times CF}{AP}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
--	---	-------------------	-----------------------

EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (hr/ev)	8
EP	Exposure Period (yr)	12
CF	Conversion factor (d/hr)	0.042
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non-Cancer (d)	4,380
PM ₁₀	Respirable particulate concentration in air (ug/m ³)	3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADI)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table E.12.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	3.00E-02	N/A	2.00E-03	N/A		1.31E-04	<1%
Boron	2.98E+00	3.00E-02	N/A	2.00E-01	N/A		1.09E-05	<1%
Cadmium	5.14E-01	1.40E-01	N/A	5.00E-04	N/A		3.51E-03	13.7%
Chromium	9.95E+00	9.00E-02	N/A	3.00E-03	N/A		7.29E-03	28.4%
Copper	1.92E+01	6.00E-02	N/A	4.00E-02	N/A		7.02E-04	2.7%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		8.20E-03	31.9%
Nickel	1.21E+01	3.50E-01	N/A	2.00E-02	N/A		5.19E-03	20.2%
Zinc	1.08E+02	2.00E-02	N/A	3.00E-01	N/A		1.76E-04	<1%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	1.00E-01	N/A	6.00E-02	N/A		8.75E-07	<1%
Anthracene	1.24E-01	1.00E-01	N/A	3.00E-01	N/A		1.01E-06	<1%
Benzo(a)anthracene	1.71E-01	2.00E-02	7.30E-01	3.00E-02	1.04E-08	7.6%	2.78E-06	<1%
Benzo(a)pyrene	1.97E-01	2.00E-02	7.30E+00	3.00E-02	1.20E-07	87.0%	3.20E-06	<1%
Benzo(g,h,i)perylene	1.01E-01	1.00E-01	N/A	3.00E-02	N/A		8.22E-06	<1%
Chrysene	1.68E-01	2.00E-02	7.30E-02	3.00E-02	1.03E-09	<1%	2.74E-06	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		4.43E-04	1.7%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		9.13E-06	<1%
Fluorene	4.86E-02	1.00E-01	N/A	4.00E-02	N/A		2.97E-06	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.00E-02	7.30E-01	3.00E-02	6.48E-09	4.7%	1.73E-06	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E-01	N/A	5.00E-02	N/A		7.08E-07	<1%
2-Butanone	3.77E-02	1.00E-01	N/A	6.00E-01	N/A		1.53E-07	<1%
Toluene	1.61E-02	1.20E-01	N/A	8.00E-02	N/A		5.91E-07	<1%
Total Cancer Risk:					1.38E-07		Hazard Index:	2.57E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Background

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Beryllium	3.58E-01	1.00E+00	N/A	2.00E-03	N/A		3.86E-05	2.8%
Boron	2.98E+00	1.00E+00	N/A	2.00E-01	N/A		3.22E-06	<1%
Cadmium	5.14E-01	1.00E+00	N/A	5.00E-04	N/A		2.22E-04	16.2%
Chromium	9.95E+00	1.00E+00	N/A	3.00E-03	N/A		7.16E-04	52.2%
Copper	1.92E+01	1.00E+00	N/A	4.00E-02	N/A		1.03E-04	7.6%
Lithium	6.72E+00	1.00E+00	N/A	2.00E-02	N/A		7.25E-05	5.3%
Nickel	1.21E+01	1.00E+00	N/A	2.00E-02	N/A		1.31E-04	9.6%
Zinc	1.08E+02	1.00E+00	N/A	3.00E-01	N/A		7.80E-05	5.7%
Semivolatile Organic Compounds								
Acenaphthene	2.15E-02	3.60E-01	N/A	6.00E-02	N/A		2.78E-08	<1%
Anthracene	1.24E-01	3.60E-01	N/A	3.00E-01	N/A		3.21E-08	<1%
Benzo(a)anthracene	1.71E-01	2.80E-01	7.30E-01	3.00E-02	1.29E-09	7.6%	3.44E-07	<1%
Benzo(a)pyrene	1.97E-01	2.80E-01	7.30E+00	3.00E-02	1.49E-08	87.0%	3.96E-07	<1%
Benzo(g,h,i)perylene	1.01E-01	3.60E-01	N/A	3.00E-02	N/A		2.62E-07	<1%
Chrysene	1.68E-01	2.80E-01	7.30E-02	3.00E-02	1.27E-10	<1%	3.39E-07	<1%
Dibenzofuran	3.63E-02	1.00E+00	N/A	2.00E-03	N/A		3.92E-06	<1%
Di-n-octyl phthalate	3.74E-02	1.00E+00	N/A	1.00E-01	N/A		8.07E-08	<1%
Fluorene	4.86E-02	3.60E-01	N/A	4.00E-02	N/A		9.44E-08	<1%
Indeno(1,2,3-cd)pyrene	1.06E-01	2.80E-01	7.30E-01	3.00E-02	8.02E-10	4.7%	2.13E-07	<1%
Volatile Organic Compounds								
1,1-Dichloroethene	1.45E-02	1.00E+00	N/A	5.00E-02	N/A		6.26E-08	<1%
2-Butanone	3.77E-02	1.00E+00	N/A	6.00E-01	N/A		1.36E-08	<1%
Toluene	1.61E-02	1.00E+00	N/A	8.00E-02	N/A		4.35E-08	<1%
Total Cancer Risk:					1.71E-08		Hazard Index: 1.37E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
FR	Fraction from Contaminated Source		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	3.77E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		1.84E-06	1.6%
Cadmium	4.17E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.16E-04	98.4%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.18E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.12.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Background

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	3.77E-03	1.00E+00	N/A	2.00E-01	N/A		8.13E-07	18.4%
Cadmium	4.17E-05	1.00E+00	N/A	5.00E-04	N/A		3.60E-06	81.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	4.41E-06

Notes

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
	IR	Ingestion Rate (L/d)		0.01
	FR	Fraction from Contaminated Source		1
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (d/ev)		1
	EP	Exposure Period (yr)		12
	BW	Body Weight (kg)		58.4
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table E.13.1

Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Commercial Use
Yankee Nuclear Power Station, Rowe, MA

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Background (Trans Canada COPCs)

Receptor/Exposure Pathway	COPC Contributing			COPC Contributing		
	Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks	Non Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks
Future Commercial Use						
Dermal Contact with Soil	1.3E-08	11.3%	Benzo(a)pyrene (76%)	2.1E-04	25.7%	Nickel (91%)
Incidental Ingestion of Soil	8.7E-08	76.0%	Benzo(a)pyrene (76%)	6.0E-04	74.2%	Nickel (43%)
Inhalation of Fugitive Dust	1.5E-08	12.7%	Nickel (91%)	3.8E-07	<1%	Zinc (74%)
Ingestion of Groundwater	0.0E+00		No COCs detected	0.0E+00		No COCs detected
Total Risks: 1.1E-07				8.0E-04		

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Background (YAEC Non-BUD/TSCA COPCs)

Receptor/Exposure Pathway	COPC Contributing			COPC Contributing		
	Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks	Non Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks
Future Commercial Use						
Dermal Contact with Soil	2.0E-08	46.6%	Dioxin/Furan (100%)	2.0E-04	25.7%	Nickel (93%)
Incidental Ingestion of Soil	9.5E-09	22.4%	Dioxin/Furan (100%)	5.9E-04	74.2%	Nickel (44%)
Inhalation of Fugitive Dust	1.3E-08	31.0%	Nickel (100%)	3.8E-07	<1%	Zinc (74%)
Ingestion of Groundwater	0.0E+00		No COCs detected	0.0E+00		No COCs detected
Total Risks: 4.3E-08				7.9E-04		

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from Background (YAEC BUD/TSCA COPCs)

Receptor/Exposure Pathway	COPC Contributing			COPC Contributing		
	Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks	Non Cancer Risks	Percent Contribution by Receptor & Pathway	Majority of Risks
Future Commercial Use						
Dermal Contact with Soil	3.3E-08	22.8%	Dioxin/Furan (61%)	2.6E-04	21.3%	Nickel (73%)
Incidental Ingestion of Soil	9.7E-08	67.1%	Benzo(a)pyrene (69%)	9.6E-04	78.6%	Mercury (54%)
Inhalation of Fugitive Dust	1.5E-08	10.1%	Nickel (91%)	3.8E-07	<1%	Zinc (73%)
Ingestion of Groundwater	0.0E+00		No COCs detected	0.0E+00		No COCs detected
Total Risks: 1.4E-07				1.2E-03		

Appendix Table E.13.1.1

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA**

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.07E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		1.89E-04	91.3%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		6.56E-07	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		3.64E-06	1.8%
<i>Semivolatile Organic Compounds</i>								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		3.28E-07	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		1.63E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	1.03E-09	7.9%	7.32E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	9.89E-09	76.2%	1.27E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-09	9.4%	1.56E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		3.57E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	9.89E-11	<1%	1.26E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	1.01E-10	<1%	1.29E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		1.40E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	6.33E-10	4.9%	8.10E-08	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		7.16E-07	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		8.56E-07	<1%
Total Cancer Risk:					1.30E-08		Hazard Index:	2.07E-04

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		3,477	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.03	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only TransCanada COPCs were evaluated.

Appendix Table E.13.1.2

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA**

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD/RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		8.52E-05	14.3%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		2.58E-04	43.3%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		1.57E-04	26.3%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		8.72E-05	14.6%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		5.67E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		2.82E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	6.90E-09	7.9%	8.83E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	6.64E-08	76.2%	8.49E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	8.20E-09	9.4%	1.05E-06	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		6.16E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	6.64E-10	<1%	8.49E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	6.80E-10	<1%	8.69E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		2.41E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	4.25E-09	4.9%	5.43E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		1.24E-06	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		1.48E-06	<1%
Total Cancer Risk:					8.71E-08		Hazard Index:	5.97E-04

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only TransCanada COPCs were evaluated.

Appendix Table E.13.1.3

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m³)	Unit Risk (m³/µg)	Reference Concentration (RFC) (µg/m³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		1.70E-08	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	1.32E-08	90.9%	7.72E-08	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		3.91E-09	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		2.79E-07	73.9%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		7.01E-12	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	1.05E-10	<1%	2.82E-11	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	1.01E-09	6.9%	2.72E-11	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	1.25E-10	<1%	3.35E-11	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		1.53E-11	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	1.01E-11	<1%	2.72E-11	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	1.04E-11	<1%	2.78E-11	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		8.01E-15	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	6.48E-11	<1%	1.74E-11	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		3.07E-11	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		3.68E-11	<1%
Total Cancer Risk:					1.46E-08		Hazard Index: 3.77E-07	

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
	EF	Exposure Frequency (ev/yr)	250	
	ED	Exposure Duration (hr/ev)	8	
	EP	Exposure Period (yr)	25	
	CF	Conversion factor (d/hr)	0.042	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	9,125	
	PM ₁₀	Respirable particulate concentration in air (ug/m³)	3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

* Only TransCanada COPCs were evaluated.

Appendix Table E.13.1.4

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA**

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	3.64E-07	1.00E+00	1.50E+05	N/A	1.99E-08	100.0%	N/A	
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.07E-05	5.2%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		1.89E-04	92.7%
Selenium	1.61E+00	2.00E-03	N/A	5.00E-03	N/A		6.56E-07	<1%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		3.64E-06	1.8%
Total Cancer Risk:					1.99E-08		Hazard Index:	2.04E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$			=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
	SA	Surface Area Exposed to Soil (cm ² /day)			3,477	
	AF	Soil Skin Adherence Factor (mg/cm ²)			0.03	
	EF	Exposure Frequency (ev/yr)			250	
	ED	Exposure Duration (day/ev)			1	
	EP	Exposure Period (yr)			25	
	CF	Conversion Factor (kg/mg)			0.000001	
	BW	Body Weight (kg)			70	
	AP	Averaging Period - Cancer (d)			25,550	
		Averaging Period - Non- Cancer (d)			9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only YAEC Non-BUD/TSCA COPCs were evaluated.

Appendix Table E.13.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	3.64E-07	1.00E+00	1.50E+05	N/A	9.54E-09	100.0%	N/A	
<i>Inorganics</i>								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		8.52E-05	14.5%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		2.58E-04	43.9%
Selenium	1.61E+00	1.00E+00	N/A	5.00E-03	N/A		1.57E-04	26.7%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		8.72E-05	14.8%
Total Cancer Risk:					9.54E-09	Hazard Index:		5.88E-04

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
	IR	Ingestion Rate (mg/day)		50	
	EF	Exposure Frequency (ev/yr)		250	
	ED	Exposure Duration (day/ev)		1	
	EP	Exposure Period (yr)		25	
	CF	Conversion Factor (kg/mg)		0.000001	
	BW	Body Weight (kg)		70	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only YAEC Non-BUD/TSCA COPCs were evaluated.

Appendix Table E.13.1.6

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	3.64E-07	1.16E-11	3.30E-08	N/A	3.13E-20	<1%	N/A	
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		1.70E-08	4.5%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	1.32E-08	100.0%	7.72E-08	20.5%
Selenium	1.61E+00	5.14E-05	N/A	3.00E+03	N/A		3.91E-09	1.0%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		2.79E-07	74.0%
Total Cancer Risk:					1.32E-08		Hazard Index:	3.77E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
	EF	Exposure Frequency (ev/yr)		250
	ED	Exposure Duration (hr/ev)		8
	EP	Exposure Period (yr)		25
	CF	Conversion factor (d/hr)		0.042
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		9,125
	PM ₁₀	Respirable particulate concentration in air (ug/m ³)		3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

* Only YAEC Non-BUD/TSCA COPCs were evaluated.

Appendix Table E.13.1.7

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	3.64E-07	1.00E+00	1.50E+05	N/A	1.99E-08	60.5%	N/A	
Inorganics								
Copper	6.97E+00	6.00E-02	N/A	4.00E-02	N/A		1.07E-05	4.1%
Mercury	3.18E-01	5.00E-02	N/A	3.00E-04	N/A		5.41E-05	20.8%
Nickel	1.06E+01	3.50E-01	N/A	2.00E-02	N/A		1.89E-04	72.5%
Zinc	5.35E+01	2.00E-02	N/A	3.00E-01	N/A		3.64E-06	1.4%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	1.00E-01	N/A	3.00E-02	N/A		3.28E-07	<1%
Anthracene	4.80E-02	1.00E-01	N/A	3.00E-01	N/A		1.63E-08	<1%
Benzo(a)anthracene	1.93E-01	2.00E-02	7.30E-01	3.00E-02	1.03E-09	3.1%	1.32E-07	<1%
Benzo(a)pyrene	1.86E-01	2.00E-02	7.30E+00	3.00E-02	9.89E-09	30.1%	1.27E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-09	3.7%	1.56E-07	<1%
Benzo(g,h,i)perylene	1.05E-01	1.00E-01	N/A	3.00E-02	N/A		3.57E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.00E-02	7.30E-02	3.00E-02	9.89E-11	<1%	1.26E-07	<1%
Chrysene	1.90E-01	2.00E-02	7.30E-02	3.00E-02	1.01E-10	<1%	1.29E-07	<1%
Fluoranthene	5.48E-05	1.00E-01	N/A	4.00E-02	N/A		1.40E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.00E-02	7.30E-01	3.00E-02	6.33E-10	1.9%	8.10E-08	<1%
Phenanthrene	2.10E-01	1.00E-01	N/A	3.00E-02	N/A		7.16E-07	<1%
Pyrene	2.52E-01	1.00E-01	N/A	3.00E-02	N/A		8.56E-07	<1%
Total Cancer Risk:					3.29E-08	Hazard Index:	2.60E-04	

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.65E-07 (cancer)	1.02E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		3,477	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.03	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only YAEC BUD/TSCA COPCs were evaluated.

Appendix Table E.13.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	3.64E-07	1.00E+00	1.50E+05	N/A	9.54E-09	9.9%	N/A	
Inorganics								
Copper	6.97E+00	1.00E+00	N/A	4.00E-02	N/A		8.52E-05	8.9%
Mercury	3.18E-01	1.00E+00	N/A	3.00E-04	N/A		5.19E-04	54.1%
Nickel	1.06E+01	1.00E+00	N/A	2.00E-02	N/A		2.58E-04	27.0%
Zinc	5.35E+01	1.00E+00	N/A	3.00E-01	N/A		8.72E-05	9.1%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.60E-01	N/A	3.00E-02	N/A		5.67E-07	<1%
Anthracene	4.80E-02	3.60E-01	N/A	3.00E-01	N/A		2.82E-08	<1%
Benzo(a)anthracene	1.93E-01	2.80E-01	7.30E-01	3.00E-02	6.90E-09	7.1%	8.83E-07	<1%
Benzo(a)pyrene	1.86E-01	2.80E-01	7.30E+00	3.00E-02	6.64E-08	68.7%	8.49E-07	<1%
Benzo(b)fluoranthene	2.29E-01	2.80E-01	7.30E-01	3.00E-02	8.20E-09	8.5%	1.05E-06	<1%
Benzo(g,h,i)perylene	1.05E-01	3.60E-01	N/A	3.00E-02	N/A		6.16E-07	<1%
Benzo(k)fluoranthene	1.86E-01	2.80E-01	7.30E-02	3.00E-02	6.64E-10	<1%	8.49E-07	<1%
Chrysene	1.90E-01	2.80E-01	7.30E-02	3.00E-02	6.80E-10	<1%	8.69E-07	<1%
Fluoranthene	5.48E-05	3.60E-01	N/A	4.00E-02	N/A		2.41E-10	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	2.80E-01	7.30E-01	3.00E-02	4.25E-09	4.4%	5.43E-07	<1%
Phenanthrene	2.10E-01	3.60E-01	N/A	3.00E-02	N/A		1.24E-06	<1%
Pyrene	2.52E-01	3.60E-01	N/A	3.00E-02	N/A		1.48E-06	<1%
Total Cancer Risk:					9.66E-08	Hazard Index:	9.58E-04	

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.75E-07 (cancer)	4.89E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		250	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		25	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		70	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		9,125	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

* Only YAEC BUD/TSCA COPCs were evaluated.

Appendix Table E.13.1.9

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Commercial Worker
Yankee Nuclear Power Station, Rowe, MA

Commercial Worker Dermal Contact with Soil (0-3 ft bgs) from Background*

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m³)	Unit Risk (m³/µg)	Reference Concentration (RFC) (µg/m³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RFC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	3.64E-07	1.16E-11	3.30E-08	N/A	3.13E-20	<1%	N/A	
Inorganics								
Copper	6.97E+00	2.23E-04	N/A	3.00E+03	N/A		1.70E-08	4.5%
Mercury	3.18E-01	1.02E-05	N/A	3.00E+02	N/A		7.74E-09	2.0%
Nickel	1.06E+01	3.38E-04	4.80E-04	1.00E+03	1.32E-08	90.9%	7.72E-08	20.2%
Zinc	5.35E+01	1.71E-03	N/A	1.40E+03	N/A		2.79E-07	73.2%
Semivolatile Organic Compounds								
Acenaphthylene	9.65E-02	3.09E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Anthracene	4.80E-02	1.54E-06	N/A	5.00E+04	N/A		7.01E-12	<1%
Benzo(a)anthracene	1.93E-01	6.18E-06	2.09E-04	5.00E+04	1.05E-10	<1%	2.82E-11	<1%
Benzo(a)pyrene	1.86E-01	5.95E-06	2.09E-03	5.00E+04	1.01E-09	6.9%	2.72E-11	<1%
Benzo(b)fluoranthene	2.29E-01	7.34E-06	2.09E-04	5.00E+04	1.25E-10	<1%	3.35E-11	<1%
Benzo(g,h,i)perylene	1.05E-01	3.36E-06	N/A	5.00E+04	N/A		1.53E-11	<1%
Benzo(k)fluoranthene	1.86E-01	5.95E-06	2.09E-05	5.00E+04	1.01E-11	<1%	2.72E-11	<1%
Chrysene	1.90E-01	6.09E-06	2.09E-05	5.00E+04	1.04E-11	<1%	2.78E-11	<1%
Fluoranthene	5.48E-05	1.75E-09	N/A	5.00E+04	N/A		8.01E-15	<1%
Indeno(1,2,3-cd)pyrene	1.19E-01	3.81E-06	2.09E-04	5.00E+04	6.48E-11	<1%	1.74E-11	<1%
Phenanthrene	2.10E-01	6.73E-06	N/A	5.00E+04	N/A		3.07E-11	<1%
Pyrene	2.52E-01	8.05E-06	N/A	5.00E+04	N/A		3.68E-11	<1%
Total Cancer Risk:					1.46E-08	Hazard Index:	3.81E-07	

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	8.15E-02 (cancer)	2.28E-01 (non-cancer)
	EF Exposure Frequency (ev/yr)			250
	ED Exposure Duration (hr/ev)			8
	EP Exposure Period (yr)			25
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			9,125
	PM ₁₀ Respirable particulate concentration in air (ug/m³)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, PM₁₀ concentration for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

* Only YAEC BUD/TSCA COPCs were evaluated.

Appendix F
Human Health Radionuclide Risk Tables

**Table F.1
Human Health Radiological Risks
Current Use -- Walk Through Recreational
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	9%	0.065	1.88E-08	4.62E-11	7.82E-12	
Cs-137+D	55%	0.296	5.10E-08	5.31E-10	4.30E-10	
Ag-108m+D	6%	0.008	4.96E-09	7.84E-12		
H-3						
C-14						
Fe-55						
Ni-63						
Sr-90	29%	0.049	6.4E-11	2.9E-10	3.31E-10	
Nb-94						
Tc-99	20%	0.165	1.3E-12	6.9E-11		
Sb-125	17%	0.049	1.2E-09	7.4E-12	7.29E-12	
Cs-134						
Eu-152						
Eu-154						
Eu-155					3.12E-12	
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243	10%	0.052	1.4E-09	4.3E-10		
Totals:			7.7E-08	1.1E-09	3.5E-10	N/A
Overall:			7.9E-08			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Sr-90 (soil) and Cs-137 (sediment) included as COPCs for information only -- both are respectively within background.

**Table F.1-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor		Current Use
	Adult	Child	Walk Through Recreational
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.50	50% of daily drinking water (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.042	0.042	1 hr/day walk through recreator
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	30	30	assume April - October, 1 day/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.1-2
External Radiation Risk
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 0 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.065	5.3	0.065	0.016	1.24E-05	1.62E+01	1.88E-08	8.2E-04	3.3E-03
Cs-137+D	0.296	30.0	0.296	0.214	2.55E-06	3.41E+00	5.10E-08	2.3E-03	3.2E-03
Ag-108m+D	0.0	127.0	0.008	0.007	7.18E-06	9.65E+00	5.0E-09	2.2E-04	2.4E-04
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.049	29.0	0.049	0.035	1.96E-08	2.46E-02	6.4E-11	2.7E-06	3.8E-06
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.2	210000.0	0.165	0.165	8.14E-11	1.26E-04	1.3E-12	6.5E-08	6.5E-08
Sb-125	0.0	3.0	0.049	0.007	1.81E-06	2.45E+00	1.2E-09	5.4E-05	3.7E-04
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.1	28.0	0.052	0.037	4.19E-07	5.83E-01	1.4E-09	6.7E-05	9.5E-05
Total:							6.98E-08	3.1E-03	6.4E-03

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	9.37E-02
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.12E-03

where:

EF	=	Exposure Frequency (d/yr)	30	Implicit
ED	=	Adult + Child Exposure Duration(yr)	30	MADEP (1995)
ACF	=	Area Correction Factor	0.9	0.5 acre (EPA, 2000)
ET _{out}	=	Exposure time outside (fraction of day)	0.042	1 hr/day walk through recreator
ET _{in}	=	Exposure time inside (fraction of day)	0	No structures at site
GSF	=	gamma shielding factor	0.40	(EPA, 2000)
		ACF x (ET _{out} +(ET _{in} x GSF)) =	3.75E-02	
		Exposure time at site (hr/day)	1.0	
		Away from site (hr/day)	23.0	

**Table F.1-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.065	5.3	0.065	0.04	0.009	4.03E-11	2.69E-05	4.62E-11	4.04E-06
Cs-137+D	0.296	30.0	0.296	0.28	0.198	4.33E-11	5.00E-05	5.31E-10	5.70E-05
Ag-108m+D	0.008	127.0	0.008	0.01	0.007	1.92E-11	7.62E-06	7.84E-12	2.66E-07
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.049	29.0	0.049	0.05	0.032	1.44E-10	1.53E-04	2.90E-10	2.87E-05
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0.165	210000.0	0.165	0.16	0.165	7.66E-12	1.46E-06	6.92E-11	1.10E-06
Sb-125	0.049	3.0	0.049	0.03	0.0022	1.32E-11	2.81E-06	7.44E-12	2.36E-07
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0.052	28.0	0.052	0.05	0.034	2.05E-10	2.51E-03	4.33E-10	4.98E-04
Total								1.4E-09	5.9E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	3.65E+01	IF (dose) = IR x EF x CF =	1.52E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	1.82E+01	IF (dose) = IR x EF x CF =	3.04E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	30
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.1-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.011	5.3	0.011	0.01	0.0015	4.03E-11	2.69E-05	7.82E-12	6.84E-07
Cs-137+D	0.24	30.0	0.240	0.22	0.1604	4.33E-11	5.00E-05	4.30E-10	4.63E-05
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.0000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.056	29.0	0.056	0.05	0.0369	1.44E-10	1.53E-04	3.31E-10	3.29E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.048	3.0	0.048	0.03	0.0022	1.32E-11	2.81E-06	7.29E-12	2.31E-07
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0.034	5.0	0.034	0.02	0.0043	5.40E-12	1.53E-06	3.12E-12	1.17E-07
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								7.8E-10	8.0E-05

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	3.65E+01	IF (dose) = IR x EF x CF =	1.52E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	1.82E+01	IF (dose) = IR x EF x CF =	3.04E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	30
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.1-5
 Drinking Water Intake -- Tritium
 Human Health Radiological Risk Assessment
 Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):	0							
H-3	0	12.0	0.0	0.0	5.07E-14	6.40E-08	0.00E+00	0.00
Total							0.0E+00	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	7.30E+02	IF (dose) = IR x EF x CF =	3.04E+01
Intake Factor (IF) -- child	IR x EF x ED x CF	=	9.12E+01	IF (dose) = IR x EF x CF =	1.52E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	30		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

**Table F.2
Human Health Radiological Risks
Forseable Future Use -- Recreational
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	9%	0.065	2.75E-08	1.69E-11	2.86E-12	6.47E-08
Cs-137+D	55%	0.296	4.23E-07	1.30E-09	1.06E-09	
Ag-108m+D	6%	0.008	5.46E-08	2.22E-11		
H-3						
C-14						
Fe-55						
Ni-63						
Sr-90	29%	0.049	5.3E-10	7.1E-10	8.08E-10	
Nb-94						
Tc-99	20%	0.165	1.5E-11	2.1E-10	5.53E-11	
Sb-125	17%	0.049	3.6E-10	1.9E-11	1.88E-11	
Cs-134						
Eu-152						
Eu-154						
Eu-155					7.10E-12	
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243	10%	0.052	1.2E-08	1.1E-09		
Totals:			5.2E-07	2.6E-09	8.9E-10	6.5E-08
Overall:			5.8E-07			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Groundwater risks assuming well outside BUD (MW-106A -- 3,010 pCi/L tritium) -- assuming exposure begins immediately.

Sr-90 (soil) and Cs-137 (sediment) included as COPCs for information only -- both are respectively within background.

**Table F.2-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor		Forseeable Future Use Recreational
	Adult	Child	
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.5	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.167	0.167	4 hr/day
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	91	91	April - October, 3 days/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.2-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.065	5.3	0.008	0.002	1.24E-05	1.62E+01	2.75E-08	1.2E-03	3.9E-02
Cs-137+D	0.296	30.0	0.205	0.148	2.55E-06	3.41E+00	4.23E-07	1.9E-02	3.8E-02
Ag-108m+D	0.0	127.0	0.007	0.007	7.18E-06	9.65E+00	5.5E-08	2.4E-03	2.9E-03
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.049	29.0	0.033	0.024	1.96E-08	2.46E-02	5.3E-10	2.2E-05	4.5E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.2	210000.0	0.165	0.165	8.14E-11	1.26E-04	1.5E-11	7.8E-07	7.8E-07
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	3.6E-10	1.6E-05	4.5E-03
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.1	28.0	0.035	0.025	4.19E-07	5.83E-01	1.2E-08	5.4E-04	1.1E-03
Total:							4.50E-07	2.0E-02	7.7E-02

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	1.12E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.75E-02

where:

EF	=	Exposure Frequency (d/yr)	91	April - October, 3 days/week
ED	=	Adult + Child Exposure Duration(yr)	30	MADEP (1995)
ACF	=	Area Correction Factor	0.9	0.5 acre (EPA, 2000)
ET _{out}	=	Exposure time outside (fraction of day)	0.167	4 hr/day
ET _{in}	=	Exposure time inside (fraction of day)	0	No structures at site
GSF	=	gamma shielding factor	0.40	(EPA, 2000)
		ACF x (ET _{out} +(ET _{in} x GSF)) =	1.50E-01	
		Exposure time at site (hr/day)	4.0	
		Away from site (hr/day)	20.0	

**Table F.2-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.065	5.3	0.008	0.01	0.001	4.03E-11	2.69E-05	1.69E-11	1.48E-06
Cs-137+D	0.296	30.0	0.205	0.28	0.137	4.33E-11	5.00E-05	1.30E-09	1.57E-04
Ag-108m+D	0.008	127.0	0.007	0.01	0.007	1.92E-11	7.62E-06	2.22E-11	7.78E-07
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.049	29.0	0.033	0.05	0.022	1.44E-10	1.53E-04	7.07E-10	7.91E-05
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0.165	210000.0	0.165	0.16	0.165	7.66E-12	1.46E-06	2.07E-10	3.30E-06
Sb-125	0.049	3.0	0.001	0.03	0.0001	1.32E-11	2.81E-06	1.92E-11	6.80E-07
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0.052	28.0	0.035	0.05	0.023	2.05E-10	2.51E-03	1.05E-09	1.37E-03
Total								3.3E-09	1.6E-03

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.2-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.011	5.3	0.001	0.00	0.0002	4.03E-11	2.69E-05	2.86E-12	2.50E-07
Cs-137+D	0.24	30.0	0.166	0.22	0.1108	4.33E-11	5.00E-05	1.06E-09	1.27E-04
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.0000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.056	29.0	0.038	0.05	0.0252	1.44E-10	1.53E-04	8.08E-10	9.04E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0.044	210000.0	0.044	0.04	0.0440	7.66E-12	1.46E-06	5.53E-11	8.79E-07
Sb-125	0.048	3.0	0.001	0.03	0.0001	1.32E-11	2.81E-06	1.88E-11	6.66E-07
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0.034	5.0	0.004	0.02	0.0005	5.40E-12	1.53E-06	7.10E-12	3.25E-07
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								1.9E-09	2.2E-04

Intake Factor (IF) -- adult	$IR \times EF \times ED \times CF$	=	1.09E+02	$IF \text{ (dose)} = IR \times EF \times CF =$	4.56E+00
Intake Factor (IF) -- child	$IR \times EF \times ED \times CF$	=	5.47E+01	$IF \text{ (dose)} = IR \times EF \times CF =$	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.2-5
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure): 16								
H-3	1,195	12.0	1,009.5	457.0	5.07E-14	6.40E-08	6.47E-08	0.01
Total							6.5E-08	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	2.19E+03	IF (dose) = IR x EF x CF =	9.12E+01
Intake Factor (IF) -- child	IR x EF x ED x CF	=	2.74E+02	IF (dose) = IR x EF x CF =	4.56E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Table F.3
Human Health Radiological Risks
Hypothetical Future Use -- Commercial YAEC Outside BUD/TSCA
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Soil Exposure Pathways				Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion	
Co-60	5.0%	0.007	1.59E-08	3.15E-12	3.87E-08
Cs-137+D	56%	0.22	1.51E-06	1.56E-09	
Ag-108m+D					
H-3					
C-14	14%	0.098	3.93E-12	8.51E-11	
Fe-55			n/a		
Ni-63					
Sr-90	37%	0.094	4.9E-09	2.2E-09	
Nb-94					
Tc-99	7%	0.084	3.5E-11	2.0E-10	
Sb-125	11%	0.032	1.3E-09	5.7E-13	
Cs-134					
Eu-152					
Eu-154					
Eu-155					
Pu-238					
Pu-239					
Pu-241					
Am-241					
Cm-243					
Totals:			1.7E-08	2.9E-10	3.9E-08
Overall:			5.6E-08		
MCP Benchmark			1.0E-05		

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Groundwater risks based on well outside BUD (MW-106A -- 3,010 pCi/L tritium)

Sr-90 and Cs-137 included as COPCs for information only -- both are within background. Risks not included in totals.

Exposure scenarios assume exposure beginning 16 years from present (radionuclide concentrations decay adjusted).

Table F.3-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA

Exposure Factor	Receptor Adult	Future Use -- Commercial
<i>Soil Ingestion</i>		
IR Ingestion Rate (mg/d)	50	MADEP (1995)
<i>Drinking Water Intake</i>		
IR Ingestion Rate (L/d)	1	50% of daily drinking water (2 L/day)
<i>External Radiation</i>		
ETout Exposure time outside (fraction of day)	0.33	Assumes 8 hrs/day outside
ETin Exposure time inside (fraction of day)	0	100% of time outdoors (conservative)
<i>Frequency/Duration Defaults</i>		
EF Exposure Frequency (days/yr)	250	MADEP (1995)
ED Exposure Duration(yr)	25	MADEP (1995)

Table F.3-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.007	5.3	0.001	0.000	1.24E-05	1.62E+01	1.59E-08	8.3E-04	2.3E-02
Cs-137+D	0.220	30.0	0.152	0.115	2.55E-06	3.41E+00	1.51E-06	8.1E-02	1.5E-01
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.1	5730.0	0.098	0.098	7.83E-12	1.34E-05	3.9E-12	2.7E-07	2.7E-07
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.094	29.0	0.064	0.048	1.96E-08	2.46E-02	4.9E-09	2.4E-04	4.8E-04
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.1	210000.0	0.084	0.084	8.14E-11	1.26E-04	3.5E-11	2.2E-06	2.2E-06
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	1.3E-09	6.9E-05	1.6E-02
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							1.53E-06	8.2E-02	1.8E-01

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	5.14E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	2.05E-01

where:

EF	=	Exposure Frequency (d/yr)	250
ED	=	Exposure Duration(yr)	25
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.33
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF x (ET _{out} +(ET _{in} x GSF)) =	3.00E-01
		Exposure time at site (hr/day)	8.0
		Away from site (hr/day)	16.0

**Table F.3-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.007	5.3	0.001	0.000	4.03E-11	2.69E-05	3.15E-12	8.40E-08
Cs-137+D	0.22	30.0	0.152	0.115	4.33E-11	5.00E-05	1.56E-09	7.22E-05
Ag-108m+D	0	127.0	0.000	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0.098	5730.0	0.098	0.098	2.79E-12	2.09E-06	8.51E-11	2.55E-06
Fe-55	0	3.0	0.000	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.094	29.0	0.064	0.048	1.44E-10	1.53E-04	2.17E-09	9.23E-05
Nb-94	0	20000.0	0.000	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0.084	210000.0	0.084	0.084	7.66E-12	1.46E-06	2.01E-10	1.53E-06
Sb-125	0.032	3.0	0.001	0.0001	1.32E-11	2.81E-06	5.65E-13	4.81E-09
Cs-134	0	2.0	0.000	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total							4.0E-09	1.7E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	3.13E+02	IF (dose) = IR x EF x CF =	1.25E+01

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	25
EF	Exposure Frequency (d/yr)	250
CF	Conversion Factor (g/mg)	1.00E-03

Table F.3-4
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):	16						
H-3	231	12.0	122.0	5.07E-14	6.40E-08	3.87E-08	0.00
Total						3.9E-08	0.0

Intake Factor (IF) -- adult	IR x EF x ED	=	6.25E+03	IF (dose) = IR x EF =	2.50E+02
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	25		
	EF	Exposure Frequency (d/yr)	250		

Note:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

**Table F.4
Human Health Radiological Risks
Walk Through Recreational -- Background
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	94%	0.73	1.26E-07	1.31E-09	7.53E-10	
Cs-137+D						
Ag-108m+D						
H-3						
C-14	57%	0.355	4.7E-10	2.1E-09	1.00E-10	
Fe-55						
Ni-63						
Sr-90						
Nb-94						
Tc-99						
Sb-125						
Cs-134						
Eu-152						
Eu-154						
Eu-155						
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243						
Totals:			1.3E-07	1.3E-09	7.5E-10	n/a
Overall:			1.3E-07			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Sr-90 included as COPC for information only -- it is within background. Risks not included in totals.

**Table F.4-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor		Current Use
	Adult	Child	Walk Through Recreational
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.5	50% of daily drinking water intake (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.042	0.042	1 hr/day walk through recreator
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	30	30	assume April - October, 1 day/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.4-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 0 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.000	5.3	0.000	0.000	1.24E-05	1.62E+01	0.00E+00	0.0E+00	0.0E+00
Cs-137+D	0.730	30.0	0.730	0.527	2.55E-06	3.41E+00	1.26E-07	5.6E-03	7.8E-03
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.355	29.0	0.355	0.253	1.96E-08	2.46E-02	4.7E-10	1.9E-05	2.7E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.000	0.000	1.81E-06	2.45E+00	0.0E+00	0.0E+00	0.0E+00
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							1.26E-07	5.6E-03	7.8E-03

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	9.37E-02
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.12E-03

where:

EF	=	Exposure Frequency (d/yr)	30	Implicit
ED	=	Adult + Child Exposure Duration(yr)	30	MADEP (1995)
ACF	=	Area Correction Factor	0.9	0.5 acre (EPA, 2000)
ET _{out}	=	Exposure time outside (fraction of day)	0.042	1 hr/day walk through recreator
ET _{in}	=	Exposure time inside (fraction of day)	0	No structures at site
GSF	=	gamma shielding factor	0.40	(EPA, 2000)
		ACF x (ET _{out} +(ET _{in} x GSF)) =	3.75E-02	
		Exposure time at site (hr/day)	1.0	
		Away from site (hr/day)	23.0	

**Table F.4-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.73	30.0	0.730	0.68	0.488	4.33E-11	5.00E-05	1.31E-09	1.41E-04
Ag-108m+D	0	127.0	0.000	0.00	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.355	29.0	0.355	0.33	0.234	1.44E-10	1.53E-04	2.10E-09	2.08E-04
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0	3.0	0.000	0.00	0.0000	1.32E-11	2.81E-06	0.00E+00	0.00E+00
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								3.4E-09	3.5E-04

Intake Factor (IF) -- adult	IR x EF x ED	=	3.65E+01	IF (dose) = IR x EF =	1.52E+00
Intake Factor (IF) -- child	IR x EF x ED	=	1.82E+01	IF (dose) = IR x EF =	3.04E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	30
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.4-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.0000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.42	30.0	0.420	0.39	0.2807	4.33E-11	5.00E-05	7.53E-10	8.09E-05
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.0000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.017	29.0	0.017	0.02	0.0112	1.44E-10	1.53E-04	1.00E-10	9.97E-06
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0	3.0	0.000	0.00	0.0000	1.32E-11	2.81E-06	0.00E+00	0.00E+00
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.0000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								8.5E-10	9.1E-05

Intake Factor (IF) -- adult	IR x EF x ED	=	3.65E+01	IF (dose) = IR x EF =	1.52E+00
Intake Factor (IF) -- child	IR x EF x ED	=	1.82E+01	IF (dose) = IR x EF =	3.04E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	30
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.4-5
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):	0							
H-3	0	12.0	0.0	0.0	5.07E-14	6.40E-08	0.00E+00	0.00
Total							0.0E+00	0.0

Intake Factor (IF) -- adult	IR x EF x ED	=	7.30E+02	IF (dose) = IR x EF =	3.04E+01
Intake Factor (IF) -- child	IR x EF x ED	=	9.12E+01	IF (dose) = IR x EF =	1.52E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	30		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

**Table F.5
Human Health Radiological Risks
Future Use Recreational -- Background
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	94%	0.73	1.51E-06	3.93E-09	2.26E-09	
Cs-137+D						
Ag-108m+D						
H-3						
C-14	57%	0.355	5.6E-09	6.3E-09	3.01E-10	
Fe-55						
Ni-63						
Sr-90						
Nb-94						
Tc-99						
Sb-125						
Cs-134						
Eu-152						
Eu-154						
Eu-155						
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243						
Totals:			1.51E-06	3.9E-09	2.3E-09	n/a
Overall:			1.51E-06			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Groundwater risks assuming well outside BUD (MW-106A -- 3,010 pCi/L tritium), assuming exposure begins immediately.

Sr-90 included as COPC for information only -- it is within background. Risks not included in totals.

**Table F.5-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor		Future Use Recreational
	Adult	Child	
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.5	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.167	0.167	4 hr/day frequent recreator
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	91	91	assume April - October, 3 day/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.5-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 0 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.000	5.3	0.000	0.000	1.24E-05	1.62E+01	0.00E+00	0.0E+00	0.0E+00
Cs-137+D	0.730	30.0	0.730	0.527	2.55E-06	3.41E+00	1.51E-06	6.7E-02	9.3E-02
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.355	29.0	0.355	0.253	1.96E-08	2.46E-02	5.6E-09	2.3E-04	3.3E-04
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.000	0.000	1.81E-06	2.45E+00	0.0E+00	0.0E+00	0.0E+00
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							1.51E-06	6.7E-02	9.3E-02

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	1.12E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.75E-02

where:

EF	=	Exposure Frequency (d/yr)	91	Implicit
ED	=	Adult + Child Exposure Duration(yr)	30	MADEP (1995)
ACF	=	Area Correction Factor	0.9	0.5 acre (EPA, 2000)
ET _{out}	=	Exposure time outside (fraction of day)	0.167	4 hr/day frequent recreator
ET _{in}	=	Exposure time inside (fraction of day)	0	No structures at site
GSF	=	gamma shielding factor	0.40	(EPA, 2000)
		ACF x (ET _{out} +(ET _{in} x GSF)) =	1.50E-01	
		Exposure time at site (hr/day)	4.0	
		Away from site (hr/day)	20.0	

**Table F.5-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.73	30.0	0.730	0.68	0.488	4.33E-11	5.00E-05	3.93E-09	4.22E-04
Ag-108m+D	0	127.0	0.000	0.00	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.355	29.0	0.355	0.33	0.234	1.44E-10	1.53E-04	6.29E-09	6.25E-04
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0	3.0	0.000	0.00	0.0000	1.32E-11	2.81E-06	0.00E+00	0.00E+00
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								1.0E-08	1.0E-03

Intake Factor (IF) -- adult	$IR \times EF \times ED \times CF$	=	1.09E+02	$IF \text{ (dose)} = IR \times EF \times CF =$	4.56E+00
Intake Factor (IF) -- child	$IR \times EF \times ED \times CF$	=	5.47E+01	$IF \text{ (dose)} = IR \times EF \times CF =$	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.5-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 0 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.0000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.42	30.0	0.420	0.39	0.2807	4.33E-11	5.00E-05	2.26E-09	2.43E-04
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.0000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.017	29.0	0.017	0.02	0.0112	1.44E-10	1.53E-04	3.01E-10	2.99E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0	3.0	0.000	0.00	0.0000	1.32E-11	2.81E-06	0.00E+00	0.00E+00
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.0000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								2.6E-09	2.7E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.5-5
 Drinking Water Intake -- Tritium
 Human Health Radiological Risk Assessment
 Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):								
	0							
H-3	3,010	12.0	2,543.8	1,151.5	5.07E-14	6.40E-08	1.63E-07	0.01
Total							1.6E-07	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	2.19E+03	IF (dose) = IR x EF x CF =	9.12E+01
Intake Factor (IF) -- child	IR x EF x ED x CF	=	2.74E+02	IF (dose) = IR x EF x CF =	4.56E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

**Table F.6
Human Health Radiological Risks
Hypothetical Commercial Exposure -- Background Areas
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion	
Co-60	94%	0.73	5.02E-06	5.18E-09	n/a
Cs-137+D					
Ag-108m+D					
H-3					
C-14					
Fe-55					
Ni-63					
Sr-90	57%	0.355	1.8E-08	8.2E-09	
Nb-94					
Tc-99					
Sb-125					
Cs-134					
Eu-152					
Eu-154					
Eu-155					
Pu-238					
Pu-239					
Pu-241					
Am-241					
Cm-243					
Totals:			5.0E-06	5.2E-09	0.0E+00
Overall:			5.0E-06		
MCP Benchmark			1.0E-05		

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 included as COPC for information only -- it is within background. Risks not included in totals.

Exposure scenarios assume exposure beginning 16 years from present (radionuclide concentrations decay adjusted).

**Table F.6-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor Adult	Future Use -- Commercial
<i>Soil Ingestion</i>		
IR Ingestion Rate (mg/d)	50	MADEP (1995)
<i>Drinking Water Intake</i>		
IR Ingestion Rate (L/d)	1	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>		
ETout Exposure time outside (fraction of day)	0.33	8 hrs/day outdoors
ETin Exposure time inside (fraction of day)	0	assume 100% outdoors
<i>Frequency/Duration Defaults</i>		
EF Exposure Frequency (days/yr)	250	MADEP (1995)
ED Exposure Duration(yr)	25	MADEP (1995)

Table F.6-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.000	5.3	0.000	0.000	1.24E-05	1.62E+01	0.00E+00	0.0E+00	0.0E+00
Cs-137+D	0.730	30.0	0.504	0.383	2.55E-06	3.41E+00	5.02E-06	2.7E-01	5.1E-01
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.355	29.0	0.242	0.182	1.96E-08	2.46E-02	1.8E-08	9.2E-04	1.8E-03
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.000	0.000	1.81E-06	2.45E+00	0.0E+00	0.0E+00	0.0E+00
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							5.02E-06	2.7E-01	5.1E-01

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	5.14E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	2.05E-01

where:

EF	=	Exposure Frequency (d/yr)	250
ED	=	Exposure Duration(yr)	25
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.33
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF x (ET _{out} +(ET _{in} x GSF)) =	3.00E-01
		Exposure time at site (hr/day)	8.0
		Away from site (hr/day)	16.0

**Table F.6-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.73	30.0	0.504	0.383	4.33E-11	5.00E-05	5.18E-09	2.39E-04
Ag-108m+D	0	127.0	0.000	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	0	3.0	0.000	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.355	29.0	0.242	0.182	1.44E-10	1.53E-04	8.20E-09	3.49E-04
Nb-94	0	20000.0	0.000	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0	3.0	0.000	0.0000	1.32E-11	2.81E-06	0.00E+00	0.00E+00
Cs-134	0	2.0	0.000	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total							1.3E-08	5.9E-04

Intake Factor (IF) -- adult	IR x FS x EF x ED x CF	=	3.13E+02	IF (dose) = IR x FS x EF x CF =	1.25E+01

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	25
EF	Exposure Frequency (d/yr)	250
CF	Conversion Factor (g/mg)	1.00E-03

Table F.7
Human Health Radiological Risks
Hypothetical Future Use -- Commercial YAEC Within BUD/TSCA Area
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Soil Exposure Pathways				Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion	
Co-60	20%	0.092	2.09E-07	4.14E-11	2.06E-06
Cs-137+D	43%	0.155	1.07E-06	1.10E-09	
Ag-108m+D					
H-3	6%	0.695		4.22E-12	
C-14	18%	0.214	8.58E-12	1.86E-10	
Fe-55			n/a		
Ni-63					
Sr-90	2%	0.008	4.1E-10	1.8E-10	
Nb-94					
Tc-99					
Sb-125	16%	0.046	1.8E-09	8.1E-13	
Cs-134					
Eu-152					
Eu-154					
Eu-155					
Pu-238					
Pu-239					
Pu-241					
Am-241					
Cm-243					
Totals:			2.1E-07	2.3E-10	2.1E-06
Overall:			2.3E-06		
MCP Benchmark			1.0E-05		

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 and Cs-137 included as COPCs for information only -- they are within background. Risks not included in totals.

Groundwater risks based on well outside BUD (MW-106A -- 3,010 pCi/L tritium)

Exposure scenarios assume exposure beginning 16 years from present (radionuclide concentrations decay adjusted).

**Table F.7-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor Adult	Future Use -- Commercial
<i>Soil Ingestion</i>		
IR Ingestion Rate (mg/d)	50	MADEP (1995)
<i>Drinking Water Intake</i>		
IR Ingestion Rate (L/d)	1	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>		
ETout Exposure time outside (fraction of day)	0.33	8 hrs/day (100% outdoors)
ETin Exposure time inside (fraction of day)	0	0 hrs/day
<i>Frequency/Duration Defaults</i>		
EF Exposure Frequency (days/yr)	250	MADEP (1995)
ED Exposure Duration(yr)	25	MADEP (1995)

Table F.7-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.092	5.3	0.011	0.003	1.24E-05	1.62E+01	2.09E-07	1.1E-02	3.1E-01
Cs-137+D	0.155	30.0	0.107	0.081	2.55E-06	3.41E+00	1.07E-06	5.7E-02	1.1E-01
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.7	12.0	0.276	0.146					
C-14	0.2	5730.0	0.214	0.213	7.83E-12	1.34E-05	8.6E-12	5.9E-07	5.9E-07
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.008	29.0	0.005	0.004	1.96E-08	2.46E-02	4.1E-10	2.1E-05	4.0E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	1.8E-09	9.9E-05	2.3E-02
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							1.27E-06	6.8E-02	4.1E-01

IF _{risk}	(EF/365) × ED × ACF × (ET _{out} + (ET _{in} × GSF))	5.14E+00
IF _{dose}	(EF/365) × ACF × (ET _{out} + (ET _{in} × GSF))	2.05E-01

where:

EF	=	Exposure Frequency (d/yr)	250
ED	=	Exposure Duration(yr)	25
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.333
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF × (ET _{out} + (ET _{in} × GSF)) =	3.00E-01
		Exposure time at site (hr/day)	8.0
		Away from site (hr/day)	16.0

**Table F.7-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.092	5.3	0.011	0.003	4.03E-11	2.69E-05	4.14E-11	1.10E-06
Cs-137+D	0.155	30.0	0.107	0.081	4.33E-11	5.00E-05	1.10E-09	5.08E-05
Ag-108m+D	0	127.0	0.000	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0.695	12.0	0.276	0.146	9.25E-14	6.40E-08	4.22E-12	1.17E-07
C-14	0.214	5730.0	0.214	0.213	2.79E-12	2.09E-06	1.86E-10	5.57E-06
Fe-55	0	3.0	0.000	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.008	29.0	0.005	0.004	1.44E-10	1.53E-04	1.85E-10	7.86E-06
Nb-94	0	20000.0	0.000	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.046	3.0	0.001	0.0002	1.32E-11	2.81E-06	8.12E-13	6.92E-09
Cs-134	0	2.0	0.000	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total							1.5E-09	6.6E-05

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	3.13E+02	IF (dose) = IR x EF =	1.25E+01

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	25
EF	Exposure Frequency (d/yr)	250
CF	Conversion Factor (g/mg)	1.00E-03

Table F.7-4
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):	16						
H-3	12,263	12.0	6,488.0	5.07E-14	6.40E-08	2.06E-06	0.10
Total						2.1E-06	0.1

Intake Factor (IF) -- adult	IR x EF x ED	=	6.25E+03	IF (dose) = IR x EF =	2.50E+02
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	25		
	EF	Exposure Frequency (d/yr)	250		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Table F.8
Human Health Radiological Risks
Hypothetical Future Use -- Commercial TransCanada Property
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Soil Exposure Pathways				Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion	
Co-60					
Cs-137+D	42%	0.102	7.01E-07	7.24E-10	
Ag-108m+D					
H-3					2.00E-07
C-14					
Fe-55	13%	6.657	n/a	1.86E-11	
Ni-63					
Sr-90	10%	0.013	6.7E-10	3.0E-10	
Nb-94					
Tc-99					
Sb-125	15%	0.047	1.9E-09	8.3E-13	
Cs-134					
Eu-152					
Eu-154					
Eu-155					
Pu-238					
Pu-239					
Pu-241					
Am-241					
Cm-243					
Totals:			1.9E-09	1.9E-11	2.0E-07
Overall:				2.0E-07	
MCP Benchmark				1.0E-05	

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 and Cs-137 included as COPCs for information only -- they are within background. Risks not included in totals.

Groundwater risks based on well outside BUD (MW-106A -- 3,010 pCi/L tritium)

Exposure scenarios assume exposure beginning 16 years from present (radionuclide concentrations decay adjusted).

**Table F.8-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor Adult	Future Use -- Commercial
<i>Soil Ingestion</i>		
IR Ingestion Rate (mg/d)	50	MADEP (1995)
<i>Drinking Water Intake</i>		
IR Ingestion Rate (L/d)	1	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>		
ETout Exposure time outside (fraction of day)	0.33	8 hr/day (100% outdoors)
ETin Exposure time inside (fraction of day)	0	0 hr/day
<i>Frequency/Duration Defaults</i>		
EF Exposure Frequency (days/yr)	250	MADEP (1995)
ED Exposure Duration(yr)	25	MADEP (1995)

Table F.8-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.000	5.3	0.000	0.000	1.24E-05	1.62E+01	0.00E+00	0.0E+00	0.0E+00
Cs-137+D	0.102	30.0	0.070	0.054	2.55E-06	3.41E+00	7.01E-07	3.8E-02	7.1E-02
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	6.7	3.0	0.165	0.028					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.013	29.0	0.009	0.007	1.96E-08	2.46E-02	6.7E-10	3.4E-05	6.6E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	1.9E-09	1.0E-04	2.4E-02
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							7.01E-07	3.8E-02	7.1E-02

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	5.14E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	2.05E-01

where:

EF	=	Exposure Frequency (d/yr)	250
ED	=	Exposure Duration(yr)	25
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.333
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF x (ET _{out} +(ET _{in} x GSF)) =	3.00E-01
		Exposure time at site (hr/day)	8.0
		Away from site (hr/day)	16.0

**Table F.8-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.102	30.0	0.070	0.054	4.33E-11	5.00E-05	7.24E-10	3.35E-05
Ag-108m+D	0	127.0	0.000	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	6.657	3.0	0.165	0.0285	2.09E-12	6.07E-07	1.86E-11	2.16E-07
Ni-63	0	100.0	0.000	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.013	29.0	0.009	0.007	1.44E-10	1.53E-04	3.00E-10	1.28E-05
Nb-94	0	20000.0	0.000	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.047	3.0	0.001	0.0002	1.32E-11	2.81E-06	8.30E-13	7.07E-09
Cs-134	0	2.0	0.000	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total							1.0E-09	4.6E-05

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	3.13E+02	IF (dose) = IR x EF x CF =	1.25E+01

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	25
EF	Exposure Frequency (d/yr)	250
CF	Conversion Factor (g/mg)	1.00E-03

Table F.8-4
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure):	16						
H-3	1,195	12.0	632.0	5.07E-14	6.40E-08	2.00E-07	0.01
Total						2.0E-07	0.0

Intake Factor (IF) -- adult	IR x EF x ED	=	6.25E+03	IF (dose) = IR x EF x CF =	2.50E+02
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	25		
	EF	Exposure Frequency (d/yr)	250		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Table F.9
Human Health Radiological Risks
Forseable Future Use -- Recreational YAEC Outside BUD/TSCA Areas
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	5%	0.007	2.96E-09	1.82E-12	3.07E-11	1.29E-07
Cs-137+D	56%	0.22	3.14E-07	9.68E-10	1.76E-09	
Ag-108m+D						
H-3						
C-14	14%	0.098	8.60E-13	4.48E-11	7.76E-12	
Fe-55						
Ni-63						
Sr-90	37%	0.094	1.0E-09	1.4E-09	5.34E-10	
Nb-94						
Tc-99	7%	0.084	7.7E-12	1.1E-10		
Sb-125	11%	0.032	2.3E-10	1.3E-11	3.57E-11	
Cs-134						
Eu-152						
Eu-154						
Eu-155					1.38E-11	
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243						
Totals:			3.2E-09	1.6E-10	6.2E-10	1.3E-07
Overall:					1.3E-07	
MCP Benchmark					1.0E-05	

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 (soil) and Cs-137 (soil and sediment) included as COPCs for information only -- both are respectively within background.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Groundwater risks assuming well outside BUD (MW-106A -- 3,010 pCi/L tritium).

All exposure point concentrations decay-adjusted to the beginning of future exposures in 16 years.

Table F.9-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA

Exposure Factor	Receptor	
	Adult	Child
<i>Soil Ingestion</i>		
IR Ingestion Rate (mg/d)	50	100
<i>Sediment Ingestion</i>		
IR Ingestion Rate (mg/d)	50	100
<i>Drinking Water Intake</i>		
IR Ingestion Rate (L/d)	2	1
<i>External Radiation</i>		
ETout Exposure time outside (fraction of day)	0.167	0.167
ETin Exposure time inside (fraction of day)	0	0
<i>Frequency/Duration Defaults</i>		
EF Exposure Frequency (days/yr)	91	91
ED Exposure Duration(yr)	24	6

Table F.9-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave x IF x SF)	Dose - 30 yr (Cave x IF x DCF) (mrem/yr)	Dose - 1 yr (C x IF x DCF) (mrem/yr)
Co-60	0.007	5.3	0.001	0.000	1.24E-05	1.62E+01	2.96E-09	1.3E-04	4.3E-03
Cs-137+D	0.220	30.0	0.152	0.110	2.55E-06	3.41E+00	3.14E-07	1.4E-02	2.8E-02
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.1	5730.0	0.098	0.098	7.83E-12	1.34E-05	8.6E-13	4.9E-08	4.9E-08
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.094	29.0	0.064	0.046	1.96E-08	2.46E-02	1.0E-09	4.2E-05	8.7E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.1	210000.0	0.084	0.084	8.14E-11	1.26E-04	7.7E-12	4.0E-07	4.0E-07
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	2.3E-10	1.1E-05	2.9E-03
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							3.17E-07	1.4E-02	3.2E-02

IF_{risk}	$(EF/365) \times ED \times ACF \times (ET_{out} + (ET_{in} \times GSF))$	1.12E+00
IF_{dose}	$(EF/365) \times ACF \times (ET_{out} + (ET_{in} \times GSF))$	3.75E-02

where:

EF	=	Exposure Frequency (d/yr)	91
ED	=	Adult + Child Exposure Duration(yr)	30
ACF	=	Area Correction Factor	0.9
ETout	=	Exposure time outside (fraction of day)	0.167
ETin	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
ACF x (ETout + (ETin x GSF)) =			1.50E-01
Exposure time at site (hr/day)			4.0
Away from site (hr/day)			20.0

**Table F.9-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.007	5.3	0.001	0.00	0.000	4.03E-11	2.69E-05	1.82E-12	1.59E-07
Cs-137+D	0.22	30.0	0.152	0.21	0.102	4.33E-11	5.00E-05	9.68E-10	1.17E-04
Ag-108m+D	0	127.0	0.000	0.00	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0.098	5730.0	0.098	0.10	0.098	2.79E-12	2.09E-06	4.48E-11	2.80E-06
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.094	29.0	0.064	0.09	0.042	1.44E-10	1.53E-04	1.36E-09	1.52E-04
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0.084	210000.0	0.084	0.08	0.084	7.66E-12	1.46E-06	1.06E-10	1.68E-06
Sb-125	0.032	3.0	0.001	0.02	0.0000	1.32E-11	2.81E-06	1.26E-11	4.44E-07
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								2.5E-09	2.7E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00
	IR	Ingestion Rate--adult (mg/day)	50		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (mg/day)	100		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		
	CF	Conversion Factor (g/mg)	1.00E-03		

**Table F.9-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.118	5.3	0.014	0.01	0.0020	4.03E-11	2.69E-05	3.07E-11	2.68E-06
Cs-137+D	0.399	30.0	0.276	0.37	0.1842	4.33E-11	5.00E-05	1.76E-09	2.12E-04
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0.017	5730.0	0.017	0.02	0.0169	2.79E-12	2.09E-06	7.76E-12	4.85E-07
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.037	29.0	0.025	0.03	0.0166	1.44E-10	1.53E-04	5.34E-10	5.97E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.091	3.0	0.002	0.05	0.0001	1.32E-11	2.81E-06	3.57E-11	1.26E-06
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0.066	5.0	0.007	0.04	0.0009	5.40E-12	1.53E-06	1.38E-11	6.32E-07
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								2.4E-09	2.8E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

Table F.9-5
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure): 16								
H-3	1,195	12.0	1,009.5	457.0	5.07E-14	6.40E-08	1.29E-07	0.01
Total							1.3E-07	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	4.38E+03	IF (dose) = IR x EF x CF =	1.82E+02
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+02	IF (dose) = IR x EF x CF =	9.12E+01
	IR	Ingestion Rate--adult (L/day)	2		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	1		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Table F.10
Human Health Radiological Risks
Forseable Future Use -- Recreational Inside BUD/TSCA Areas
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60	20%	0.092	3.89E-08	2.39E-11	3.07E-11	6.47E-08
Cs-137+D	43%	0.155	2.22E-07	6.82E-10	1.76E-09	
Ag-108m+D						
H-3	6%	0.695		4.04E-12		
C-14	18%	0.214	1.88E-12	9.77E-11	7.76E-12	
Fe-55						
Ni-63						
Sr-90	2%	0.008	8.6E-11	1.2E-10	5.34E-10	
Nb-94						
Tc-99						
Sb-125	16%	0.046	3.3E-10	1.8E-11	3.57E-11	
Cs-134						
Eu-152						
Eu-154						
Eu-155					1.38E-11	
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243						
Totals:			2.6E-07	8.3E-10	6.2E-10	6.5E-08
Overall:			3.3E-07			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 (soil) and Cs-137 (sediment) included as COPCs for information only -- both are respectively within background.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Groundwater risks assuming well outside BUD (MW-106A -- 3,010 pCi/L tritium).

All exposure point concentrations decay-adjusted to the beginning of future exposures in 16 years.

Table F.10-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA

Exposure Factor	Receptor		Forseeable Future Use Recreational
	Adult	Child	
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.5	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.167	0.167	4 hr/day
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	91	91	April - October, 3 days/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.10-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.092	5.3	0.011	0.003	1.24E-05	1.62E+01	3.89E-08	1.7E-03	5.6E-02
Cs-137+D	0.155	30.0	0.107	0.077	2.55E-06	3.41E+00	2.22E-07	9.9E-03	2.0E-02
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.7	12.0	0.276	0.131					
C-14	0.2	5730.0	0.214	0.213	7.83E-12	1.34E-05	1.9E-12	1.1E-07	1.1E-07
Fe-55	0.0	3.0	0.000	0.000					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.008	29.0	0.005	0.004	1.96E-08	2.46E-02	8.6E-11	3.6E-06	7.4E-06
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	3.3E-10	1.5E-05	4.2E-03
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							2.60E-07	1.2E-02	7.6E-02

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	1.12E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.75E-02

where:

EF	=	Exposure Frequency (d/yr)	91
ED	=	Adult + Child Exposure Duration(yr)	30
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.167
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF x (ET _{out} +(ET _{in} x GSF)) =	1.50E-01
		Exposure time at site (hr/day)	4.0
		Away from site (hr/day)	20.0

**Table F.10-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.092	5.3	0.011	0.01	0.002	4.03E-11	2.69E-05	2.39E-11	2.09E-06
Cs-137+D	0.155	30.0	0.107	0.14	0.072	4.33E-11	5.00E-05	6.82E-10	8.23E-05
Ag-108m+D	0	127.0	0.000	0.00	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0.695	12.0	0.276	0.59	0.106	9.25E-14	6.40E-08	4.04E-12	3.74E-07
C-14	0.214	5730.0	0.214	0.21	0.213	2.79E-12	2.09E-06	9.77E-11	6.11E-06
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.008	29.0	0.005	0.01	0.004	1.44E-10	1.53E-04	1.15E-10	1.29E-05
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.046	3.0	0.001	0.02	0.0001	1.32E-11	2.81E-06	1.80E-11	6.38E-07
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								9.4E-10	1.0E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.10-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0.118	5.3	0.014	0.01	0.0020	4.03E-11	2.69E-05	3.07E-11	2.68E-06
Cs-137+D	0.399	30.0	0.276	0.37	0.1842	4.33E-11	5.00E-05	1.76E-09	2.12E-04
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0.017	5730.0	0.017	0.02	0.0169	2.79E-12	2.09E-06	7.76E-12	4.85E-07
Fe-55	0	3.0	0.000	0.00	0.0000	2.09E-12	6.07E-07	0.00E+00	0.00E+00
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.037	29.0	0.025	0.03	0.0166	1.44E-10	1.53E-04	5.34E-10	5.97E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.091	3.0	0.002	0.05	0.0001	1.32E-11	2.81E-06	3.57E-11	1.26E-06
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0.066	5.0	0.007	0.04	0.0009	5.40E-12	1.53E-06	1.38E-11	6.32E-07
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								2.4E-09	2.8E-04

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.10-5
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure): 16								
H-3	1,195	12.0	1,009.5	457.0	5.07E-14	6.40E-08	6.47E-08	0.01
Total							6.5E-08	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	2.19E+03	IF (dose) = IR x EF x CF =	9.12E+01
Intake Factor (IF) -- child	IR x EF x ED x CF	=	2.74E+02	IF (dose) = IR x EF x CF =	4.56E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

**Table F.11
Human Health Radiological Risks
Forseable Future Use -- Recreational TransCanada Property (Non-Shoreline Area)
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Soil Exposure Pathways				Sediment Ingestion	Drinking Water
	Det Freq.	Soil (pCi/g)	External Radiation	Soil Ingestion		
Co-60						
Cs-137+D	42%	0.102	1.46E-07	4.49E-10	4.49E-10	6.47E-08
Ag-108m+D						
H-3						
C-14						
Fe-55	13%	6.657	n/a	4.14E-10	4.1E-10	
Ni-63						
Sr-90	10%	0.013	1.4E-10	1.9E-10	1.9E-10	
Nb-94						
Tc-99						
Sb-125	15%	0.047	3.4E-10	1.8E-11	1.8E-11	
Cs-134						
Eu-152						
Eu-154						
Eu-155						
Pu-238						
Pu-239						
Pu-241						
Am-241						
Cm-243						
Totals:			3.4E-10	4.3E-10	6.2E-10	6.5E-08
Overall:			6.6E-08			
MCP Benchmark			1.0E-05			

Blanks indicate radionuclide not a COPC in medium or pathway not complete for this scenario.

Sr-90 (soil) and Cs-137 (soil and sediment) included as COPCs for information only -- both are respectively within background.

Overall risks based on including the maximum of soil or sediment ingestion pathways.

Radiological sampling during the FSS in the West Storm Ditch area logged samples as "soil" in the FSS database. Thus sediment in WSD assigned same concentration as soil.

Groundwater risks assuming well outside BUD (MW-106A -- 3,010 pCi/L tritium).

All exposure point concentrations decay-adjusted to the beginning of future exposures in 16 years.

**Table F.11-1
Exposure Factors -- Radiological Risk Calculations
Yankee Nuclear Power Station, Rowe, MA**

Exposure Factor	Receptor		Forseeable Future Use Recreational
	Adult	Child	
<i>Soil Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Sediment Ingestion</i>			
IR Ingestion Rate (mg/d)	50	100	MADEP (1995)
<i>Drinking Water Intake</i>			
IR Ingestion Rate (L/d)	1	0.5	Assumes 50% of daily intake (2 L/day)
<i>External Radiation</i>			
ETout Exposure time outside (fraction of day)	0.167	0.167	4 hr/day
ETin Exposure time inside (fraction of day)	0	0	No structures at site
<i>Frequency/Duration Defaults</i>			
EF Exposure Frequency (days/yr)	91	91	April - October, 3 days/week
ED Exposure Duration(yr)	24	6	MADEP (1995)

Table F.11-2

External Radiation Risk

Human Health Radiological Risk Assessment

Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Concentration (Co) (pCi/g)	Half-Life t _{1/2} (yrs)	C at Yr = 16 (pCi/g)	Ave. Conc. (Cave) (pCi/g)	Slope Factor (SF) (Risk/yr- pCi/g)	DCF (mrem/yr - pCi/g)	Cancer Risk (Cave × IF × SF)	Dose - 30 yr (Cave × IF × DCF) (mrem/yr)	Dose - 1 yr (C × IF × DCF) (mrem/yr)
Co-60	0.000	5.3	0.000	0.000	1.24E-05	1.62E+01	0.00E+00	0.0E+00	0.0E+00
Cs-137+D	0.102	30.0	0.070	0.051	2.55E-06	3.41E+00	1.46E-07	6.5E-03	1.3E-02
Ag-108m+D	0.0	127.0	0.000	0.000	7.18E-06	9.65E+00	0.0E+00	0.0E+00	0.0E+00
H-3	0.0	12.0	0.000	0.000					
C-14	0.0	5730.0	0.000	0.000	7.83E-12	1.34E-05	0.0E+00	0.0E+00	0.0E+00
Fe-55	6.7	3.0	0.165	0.024					
Ni-63	0.000	100.0	0.000	0.000					
Sr-90	0.013	29.0	0.009	0.006	1.96E-08	2.46E-02	1.4E-10	5.8E-06	1.2E-05
Nb-94	0.0	20000.0	0.000	0.000	7.29E-06	9.68E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99	0.0	210000.0	0.000	0.000	8.14E-11	1.26E-04	0.0E+00	0.0E+00	0.0E+00
Sb-125	0.0	3.0	0.001	0.000	1.81E-06	2.45E+00	3.4E-10	1.5E-05	4.3E-03
Cs-134	0.0	2.0	0.000	0.0000	5.02E-08	9.47E+00	0.0E+00	0.0E+00	0.0E+00
Eu-152	0.0	13.0	0.000	0.000	5.30E-06	7.01E+00	0.0E+00	0.0E+00	0.0E+00
Eu-154	0.0	8.0	0.000	0.000	5.83E-06	7.68E+00	0.0E+00	0.0E+00	0.0E+00
Eu-155	0.0	5.0	0.000	0.000	1.24E-07	1.82E-01	0.0E+00	0.0E+00	0.0E+00
Pu-238	0.0	88.0	0.000	0.000	7.22E-11	1.51E-04	0.0E+00	0.0E+00	0.0E+00
Pu-239	0.0	24000.0	0.000	0.000	2.00E-10	2.95E-04	0.0E+00	0.0E+00	0.0E+00
Pu-241	0.0	14.0	0.000	0.000	4.11E-12	1.89E-05	0.0E+00	0.0E+00	0.0E+00
Am-241	0.0	432.0	0.000	0.000	2.76E-08	4.37E-02	0.0E+00	0.0E+00	0.0E+00
Cm-243	0.0	28.0	0.000	0.000	4.19E-07	5.83E-01	0.0E+00	0.0E+00	0.0E+00
Total:							1.46E-07	6.5E-03	1.3E-02

IF _{risk}	(EF/365) x ED x ACF x (ET _{out} +(ET _{in} x GSF))	1.12E+00
IF _{dose}	(EF/365) x ACF x (ET _{out} +(ET _{in} x GSF))	3.75E-02

where:

EF	=	Exposure Frequency (d/yr)	91
ED	=	Adult + Child Exposure Duration(yr)	30
ACF	=	Area Correction Factor	0.9
ET _{out}	=	Exposure time outside (fraction of day)	0.167
ET _{in}	=	Exposure time inside (fraction of day)	0
GSF	=	gamma shielding factor	0.40
		ACF x (ET _{out} +(ET _{in} x GSF)) =	1.50E-01
		Exposure time at site (hr/day)	4.0
		Away from site (hr/day)	20.0

**Table F.11-3
Incidental Soil Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.102	30.0	0.070	0.10	0.047	4.33E-11	5.00E-05	4.49E-10	5.42E-05
Ag-108m+D	0	127.0	0.000	0.00	0.000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	6.657	3.0	0.165	3.60	0.0074	2.09E-12	6.07E-07	4.14E-10	2.00E-05
Ni-63	0	100.0	0.000	0.00	0.000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.013	29.0	0.009	0.01	0.006	1.44E-10	1.53E-04	1.88E-10	2.10E-05
Nb-94	0	20000.0	0.000	0.00	0.000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.047	3.0	0.001	0.03	0.0001	1.32E-11	2.81E-06	1.84E-11	6.52E-07
Cs-134	0	2.0	0.000	0.00	0.00000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								1.1E-09	9.6E-05

Intake Factor (IF) -- adult	$IR \times EF \times ED \times CF$	=	1.09E+02	$IF \text{ (dose)} = IR \times EF \times CF =$	4.56E+00
Intake Factor (IF) -- child	$IR \times EF \times ED \times CF$	=	5.47E+01	$IF \text{ (dose)} = IR \times EF \times CF =$	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.11-4
Incidental Sediment Ingestion
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/g)	Half-Life $t_{1/2}$ (yrs)	C at Yr = 16 (pCi/g)	Cadj child (pCi/g)	Cadj adult (pCi/g)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr) (30 yr)
Co-60	0	5.3	0.000	0.00	0.0000	4.03E-11	2.69E-05	0.00E+00	0.00E+00
Cs-137+D	0.102	30.0	0.070	0.10	0.0471	4.33E-11	5.00E-05	4.49E-10	5.42E-05
Ag-108m+D	0	127.0	0.000	0.00	0.0000	1.92E-11	7.62E-06	0.00E+00	0.00E+00
H-3	0	12.0	0.000	0.00	0.0000	9.25E-14	6.40E-08	0.00E+00	0.00E+00
C-14	0	5730.0	0.000	0.00	0.0000	2.79E-12	2.09E-06	0.00E+00	0.00E+00
Fe-55	6.657	3.0	0.165	3.60	0.0074	2.09E-12	6.07E-07	4.14E-10	2.00E-05
Ni-63	0	100.0	0.000	0.00	0.0000	1.79E-12	5.77E-07	0.00E+00	0.00E+00
Sr-90	0.013	29.0	0.009	0.01	0.0058	1.44E-10	1.53E-04	1.88E-10	2.10E-05
Nb-94	0	20000.0	0.000	0.00	0.0000	2.05E-11	7.14E-06	0.00E+00	0.00E+00
Tc-99	0	210000.0	0.000	0.00	0.0000	7.66E-12	1.46E-06	0.00E+00	0.00E+00
Sb-125	0.047	3.0	0.001	0.03	0.0001	1.32E-11	2.81E-06	1.84E-11	6.52E-07
Cs-134	0	2.0	0.000	0.00	0.0000	8.84E-14	7.33E-05	0.00E+00	0.00E+00
Eu-152	0	13.0	0.000	0.00	0.0000	1.62E-11	6.48E-06	0.00E+00	0.00E+00
Eu-154	0	8.0	0.000	0.00	0.0000	2.85E-11	9.55E-06	0.00E+00	0.00E+00
Eu-155	0	5.0	0.000	0.00	0.0000	5.40E-12	1.53E-06	0.00E+00	0.00E+00
Pu-238	0	88.0	0.000	0.00	0.0000	2.72E-10	3.20E-03	0.00E+00	0.00E+00
Pu-239	0	24000.0	0.000	0.00	0.0000	2.76E-10	3.54E-03	0.00E+00	0.00E+00
Pu-241	0	14.0	0.000	0.00	0.0000	3.29E-12	6.85E-05	0.00E+00	0.00E+00
Am-241	0	432.0	0.000	0.00	0.0000	2.17E-10	3.64E-03	0.00E+00	0.00E+00
Cm-243	0	28.0	0.000	0.00	0.0000	2.05E-10	2.51E-03	0.00E+00	0.00E+00
Total								1.1E-09	9.6E-05

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	1.09E+02	IF (dose) = IR x EF x CF =	4.56E+00
Intake Factor (IF) -- child	IR x EF x ED x CF	=	5.47E+01	IF (dose) = IR x EF x CF =	9.12E+00

IR	Ingestion Rate--adult (mg/day)	50
ED	Exposure Duration--adult (yr)	24
IR	Ingestion Rate -- child (mg/day)	100
ED	Exposure Duration - child (yr)	6
EF	Exposure Frequency (d/yr)	91
CF	Conversion Factor (g/mg)	1.00E-03

**Table F.11-5
Drinking Water Intake -- Tritium
Human Health Radiological Risk Assessment
Yankee Nuclear Power Station, Rowe, MA**

Radionuclide	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)
Exposure Begins in Year (after site closure): 16								
H-3	1,195	12.0	1,009.5	457.0	5.07E-14	6.40E-08	6.47E-08	0.01
Total							6.5E-08	0.0

Intake Factor (IF) -- adult	IR x EF x ED x CF	=	2.19E+03	IF (dose) = IR x EF x CF =	9.12E+01
Intake Factor (IF) -- child	IR x EF x ED x CF	=	2.74E+02	IF (dose) = IR x EF x CF =	4.56E+01
	IR	Ingestion Rate--adult (L/day)	1		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	0.5		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	91		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Appendix G

IEUBK Lead Model Outputs

Inside RUA IEUBK Model Output

YAEC Non-BUD/TSCA (SW) IEUBK Model Output

LEAD MODEL FOR WINDOWS Version 1.0

Model Version: 1.0 Build 263
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

***** Air *****

Indoor Air Pb Concentration: 30.000 percent of outdoor.

Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m ³ /day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m ³)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

***** Diet *****

Age	Diet Intake(ug/day)
.5-1	3.160
1-2	2.600
2-3	2.870
3-4	2.740
4-5	2.610
5-6	2.740
6-7	2.990

***** Drinking Water *****

Water Consumption:

Age Water (L/day)

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 5.200 ug Pb/L

***** Soil & Dust *****

Multiple Source Analysis Used

Average multiple source concentration: 30.062 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700

Outdoor airborne lead to indoor household dust lead concentration: 100.000

Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	28.660	30.062
1-2	28.660	30.062
2-3	28.660	30.062
3-4	28.660	30.062
4-5	28.660	30.062
5-6	28.660	30.062
6-7	28.660	30.062

***** Alternate Intake *****

Age Alternate (ug Pb/day)

.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

***** Maternal Contribution: Infant Model *****

Maternal Blood Concentration: 2.500 ug Pb/dL

CALCULATED BLOOD LEAD AND LEAD UPTAKES:

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	1.531	0.000	0.504
1-2	0.034	1.259	0.000	1.259
2-3	0.062	1.395	0.000	1.314
3-4	0.067	1.337	0.000	1.345
4-5	0.067	1.280	0.000	1.403
5-6	0.093	1.346	0.000	1.482
6-7	0.093	1.471	0.000	1.509

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	0.727	2.784	1.5
1-2	1.154	3.707	1.6
2-3	1.158	3.929	1.5
3-4	1.163	3.912	1.4
4-5	0.866	3.615	1.2
5-6	0.781	3.703	1.1
6-7	0.738	3.811	1.1

Average blood lead: 1.3 µg/dL

Appendix H
Human Health Sensitivity Analysis

List of Tables

Table H.1.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC Non-BUD/TSCA
Table H.2.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC BUD/TSCA (Including Arsenic)
Table H.3.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC BUD/TSCA (Excluding Arsenic)
Table H.4.1	Detailed OHM Risk Tables for Future Recreators Use – TransCanada

Sensitivity Analyses

As part of the Risk Characterization, Gradient performed a sensitivity analysis of the various hypothetical scenarios presented at the Site. The results of this sensitivity analysis were compared to the baseline risk exposure scenario. This appendix describes exposure scenarios for the sensitivity analysis.

H.1 Recreator Scenarios

The following additional exposure scenarios were evaluated for the sensitivity analysis:

YAEC Future Recreator Exposure Scenarios

1. Exposed to soils and groundwater YAEC Non-BUD/TSCA area, nearshore sediments (Sherman Shoreline)
2. Exposed to soils and groundwater YAEC BUD/TSCA area, nearshore sediments (Sherman Shoreline)
3. Exposed to soils and groundwater YAEC BUD/TSCA area, nearshore sediments (Sherman Shoreline) – excluding arsenic in soil and groundwater

TransCanada Property Future Recreator Exposure Scenario

4. Exposed to soils and groundwater on TransCanada property plus sediments in West Storm Ditch.

All exposure factors were those used for the baseline recreator scenario, and only the exposure point concentrations differ based on the particular exposure area in the assessment. The potential OHM cancer risks for these scenarios are presented in Appendix Tables H.1 to H.4 (the potential radionuclide risks are presented in Appendix Tables F.9 through F.11). A summary of the results is provided below.

Human Health Cancer Risk Calculations –Sensitivity Analysis				
Exposure Scenario	Radionuclides	Chemicals	Cumulative Risks ^[a]	
			Site	Background
Future Use Recreator – Baseline Case	5.8×10^{-7}	1.6×10^{-6}	2×10^{-6}	2×10^{-6}
Future Use Recreator Sensitivity Calculations				
1. YAEC Non-BUD/TSCA	1.3×10^{-7}	2.1×10^{-6}	2×10^{-6}	2×10^{-6}
2. YAEC BUD/TSCA	3.3×10^{-7}	4.2×10^{-5}	4×10^{-5}	2×10^{-6}
3. YAEC BUD/TSCA (excluding arsenic)	3.3×10^{-7}	4.6×10^{-6}	5×10^{-6}	2×10^{-6}
4. TransCanada and WSD Sediments ^[b]	6.6×10^{-8}	5.1×10^{-6}	5×10^{-6}	2×10^{-6}
MADEP Risk Benchmark			1×10^{-5}	

Notes:

[a] Differences in the cumulative risks and the summation of radionuclide plus chemical risk is caused by rounding (individual results are expressed to only one significant figure).

[b] Any sediment samples from the WSD area for radionuclides are logged as "soil" as the environmental matrix in the FSS database and therefore included with the "soil" exposure pathway.

As these results indicate the calculated potential cancer risks for future recreators are comparable to the baseline recreator risk (2×10^{-6}), with the exception of scenario #2.

In both scenario #1 and #2 above, arsenic in soil and groundwater was included in the evaluation for information purposes. As discussed in the body of the report, arsenic in groundwater is not considered indicative of a site-related release, and the concentration detected is within background concentrations found in public drinking water supplies in the State. As also discussed in the body of this report, arsenic in soils on the YAEC property is statistically no different from local background.

Only scenario #2 has a hypothetical risk above 10^{-5} . This is entirely due to including arsenic in drinking water in the assessment (as can be seen by comparing the results to scenario #3). The maximum arsenic concentration detected (and used in the risk calculation) is from a monitoring well within the C&A Fill BUD area. There are no current drinking water wells in this area, and no drinking water wells can be installed in the future under the BUD restrictions. Moreover, the maximum arsenic concentration (0.0101 mg/L) is essentially equal to its drinking water standard (0.01 mg/L). Based on the fact that arsenic is naturally occurring; detected sporadically with no apparent indication of a site-related release; the lack of any current exposure *via* groundwater ingestion; and the fact that the detected concentration is effectively equivalent to public health drinking water standards; this weight of evidence indicates the hypothetical calculation of risk under scenario #2 is not indication of significant site-related risk.

The non-cancer Hazard Indices for OHM are presented in Appendix Tables H.1 to H.4, and summarized below. In all cases, the HI values are below the MADEP (1995) Hazard Index threshold of one (e.g., HI<1).

Summary of Human Health Non-Cancer Chemical Hazard		
Exposure Scenario	Hazard Index	
	Site	Background
Future Use Recreator – Child Baseline	0.2	0.05
Future Use Recreator – Sensitivity Calculations		
1. YAEC Non-TSCA/BUD Area	0.23	0.05
2. YAEC TSCA/BUD Area	0.73	0.05
3. YAEC TSCA/BUD Area (excluding arsenic)	0.44	0.05
4. TransCanada and WSD Sediments	0.14	0.05
MADEP Benchmark	1	

References

Massachusetts Department of Environmental Protection (MADEP). 1995. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim final policy)." Bureau of Waste Site Cleanup and Office of Research and Standards. BWSC/ORS-95-141. July.

Appendix H Tables

Appendix Table H.1.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC Non-BUD/TSCA, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks			Non Cancer Risks		
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator						
Dermal Contact with Soil	1.8E-07	24.4%	Dioxin/Furan (65%)	2.6E-02	11.3%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	6.2E-08			1.7E-02		
Inhalation of Fugitive Dust	1.3E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			3.4E-02	14.7%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	4.0E-07	56.1%	Aroclor-1254 (65%)	1.4E-01	60.3%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07	19.3%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	3.1E-02	13.5%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	7.2E-07			2.3E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	1.0E-07	13.0%	Dioxin/Furan (65%)	8.3E-03	5.2%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	2.1E-08			3.1E-03		
Inhalation of Fugitive Dust	2.4E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			2.5E-02	15.8%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	6.3E-07	80.7%	Aroclor-1254 (65%)	1.2E-01	75.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08	6.0%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	5.7E-03	3.6%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	7.9E-07			1.6E-01		
Future Adult Recreator						
Dermal Contact with Soil	8.1E-08	13.0%	Dioxin/Furan (65%)	6.0E-03	5.2%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	1.7E-08			2.3E-03		
Inhalation of Fugitive Dust	2.6E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			1.8E-02	15.8%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	5.0E-07	80.6%	Aroclor-1254 (65%)	8.7E-02	75.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08	6.0%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	4.2E-03	3.6%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	6.3E-07			1.2E-01		
Child + Adolescent + Adult	2.1E-06					

Appendix Table H.1.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	9.33E-08	53.2%	N/A	
Inorganics								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		1.92E-04	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		2.84E-03	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		1.85E-05	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		5.91E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	5.28E-09	3.0%	4.40E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	7.08E-09	4.0%	2.07E-03	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	4.97E-08	28.3%	1.45E-02	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	2.01E-08	11.4%	5.85E-03	22.6%
Total Cancer Risk:					1.75E-07		Hazard Index:	2.60E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			2,434
AF	Soil Skin Adherence Factor (mg/cm ²)			0.35
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	1.10E-08	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		3.76E-04	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		9.54E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		1.09E-03	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		3.47E-04	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	3.30E-09	5.3%	2.75E-04	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	4.42E-09	7.1%	1.29E-03	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	49.8%	9.03E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	1.25E-08	20.1%	3.65E-03	21.5%
Total Cancer Risk:					6.21E-08		Hazard Index:	1.70E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
	IR Ingestion Rate (mg/day)			100
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			6
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			15.7
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	4.04E-21	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	1.31E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	3.25E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	4.35E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	3.05E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	1.23E-12	<1%	7.19E-09	3.6%
Total Cancer Risk:					1.32E-09	Hazard Index:		1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposur Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration ($32 \mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor ($10^{-6} \text{ kg}/\text{mg}$) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg}/\text{mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

**Appendix Table H.1.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		7.02E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		2.59E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		8.03E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		5.89E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		5.22E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		1.61E-03	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		5.18E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		2.09E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		3.37E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		6.67E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		4.82E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.40E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

	IR-G	Groundwater Ingestion Rate (L/day)	0.5
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1
	EP	Exposure Period (yr)	6
N/A - Not available	BW	Body Weight (kg)	15.7
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non- Cancer (d)	2,190

Appendix Table H.1.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table H.1.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00	Hazard Index:		3.63E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	5.44E-08	53.2%	N/A	
Inorganics								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		6.12E-05	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		9.05E-04	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		5.88E-06	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		1.88E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	3.08E-09	3.0%	1.40E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	4.13E-09	4.0%	6.57E-04	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	2.90E-08	28.3%	4.61E-03	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	1.17E-08	11.4%	1.86E-03	22.6%
Total Cancer Risk:					1.02E-07		Hazard Index:	8.26E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			5,657
AF	Soil Skin Adherence Factor (mg/cm ²)			0.13
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	3.70E-09	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		6.94E-05	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		1.76E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		2.00E-04	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		6.39E-05	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	1.11E-09	5.3%	5.06E-05	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	1.49E-09	7.1%	2.37E-04	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	1.05E-08	49.8%	1.66E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	4.23E-09	20.1%	6.73E-04	21.5%
Total Cancer Risk:					2.10E-08		Hazard Index:	3.13E-03

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$ =		4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50
EF	Exposure Frequency (ev/yr)		92
ED	Exposure Duration (day/ev)		1
EP	Exposure Period (yr)		11
CF	Conversion Factor (kg/mg)		0.000001
BW	Body Weight (kg)		42.6
AP	Averaging Period - Cancer (d)		25,550
	Averaging Period - Non- Cancer (d)		4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE \div RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	7.40E-21	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	2.41E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	5.95E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	7.97E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	5.59E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	2.26E-12	<1%	7.19E-09	3.6%
Total Cancer Risk:					2.42E-09	Hazard Index:		1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (hr/ev)			8
	EP Exposure Period (yr)			11
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration ($32 \mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor ($10^{-6} \text{ kg}/\text{mg}$) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg}/\text{mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.1.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		5.17E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		1.91E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		5.92E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		4.34E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		3.85E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		1.18E-03	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		3.82E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		1.54E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		2.49E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		4.92E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		3.55E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	2.50E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 11
- N/A - Not available BW Body Weight (kg) 42.6
- Blank - Not a COPC for this Study Area AP Averaging Period - Cancer (d) 25,550
- ADD (mg/kg-d) = EPC*IF*RAF** Averaging Period - Non- Cancer (d) 4,015

Appendix Table H.1.1.13

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07		Hazard Index:	1.19E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.14

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	4.33E-08	53.2%	N/A	
Inorganics								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		4.47E-05	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		6.60E-04	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		4.29E-06	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		1.37E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	2.45E-09	3.0%	1.02E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	3.29E-09	4.0%	4.79E-04	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	2.30E-08	28.3%	3.36E-03	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	9.32E-09	11.4%	1.36E-03	22.6%
Total Cancer Risk:					8.14E-08		Hazard Index:	6.02E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			5,657
AF	Soil Skin Adherence Factor (mg/cm ²)			0.13
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	2.95E-09	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		5.06E-05	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		1.28E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		1.46E-04	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		4.66E-05	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	8.86E-10	5.3%	3.69E-05	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	1.19E-09	7.1%	1.73E-04	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	8.32E-09	49.8%	1.21E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	3.37E-09	20.1%	4.91E-04	21.5%
Total Cancer Risk:					1.67E-08		Hazard Index:	2.29E-03

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$ =		3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50
EF	Exposure Frequency (ev/yr)		92
ED	Exposure Duration (day/ev)		1
EP	Exposure Period (yr)		12
CF	Conversion Factor (kg/mg)		0.000001
BW	Body Weight (kg)		58.4
AP	Averaging Period - Cancer (d)		25,550
	Averaging Period - Non- Cancer (d)		4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	8.07E-21	<1%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	2.63E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	6.49E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	8.70E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	6.10E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	2.47E-12	<1%	7.19E-09	3.6%
					Total Cancer Risk:	2.64E-09	Hazard Index:	1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.1.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		3.77E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		1.39E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.32E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		3.17E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		2.81E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		8.63E-04	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		2.78E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		1.12E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		1.81E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		3.59E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		2.59E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.83E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

	IR-G	Groundwater Ingestion Rate (L/day)	1
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
	EP	Exposure Period (yr)	12
N/A - Not available	BW	Body Weight (kg)	58.4
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non- Cancer (d)	4,380

Appendix Table H.1.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
	IR	Ingestion Rate (mg/day)		50
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (day/ev)		1
	EP	Exposure Period (yr)		12
	CF	Conversion Factor (kg/mg)		0.000001
	BW	Body Weight (kg)		58.4
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from BUD/TSCA (Including Arsenic), Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	6.9E-07	5.3%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	7.3E-02	10.0%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	9.4E-07	7.3%	Arsenic (65%)	6.1E-02	8.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	4.6E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.1E-05	84.2%	Arsenic (96%)	4.5E-01	62.4%	Arsenic (60%)
Dermal Contact with Sediment	4.0E-07	3.1%	Aroclor-1254 (65%)	1.4E-01	19.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07			3.1E-02		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	1.3E-05			7.3E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	4.0E-07	2.5%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	2.3E-02	4.7%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	3.2E-07	2.0%	Arsenic (65%)	1.1E-02	2.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	8.4E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.5E-05	91.5%	Arsenic (96%)	3.3E-01	68.5%	Arsenic (60%)
Dermal Contact with Sediment	6.3E-07	4.0%	Aroclor-1254 (65%)	1.2E-01	24.4%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08			5.7E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	1.6E-05			4.9E-01		
Future Adult Recreator						
Dermal Contact with Soil	3.2E-07	2.5%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	1.7E-02	4.7%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	2.5E-07	2.0%	Arsenic (65%)	8.1E-03	2.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	9.2E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.2E-05	91.5%	Arsenic (96%)	2.4E-01	68.5%	Arsenic (60%)
Dermal Contact with Sediment	5.0E-07	4.0%	Aroclor-1254 (65%)	8.7E-02	24.4%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08			4.2E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	1.3E-05			3.6E-01		
Child + Adolescent + Adult	4.2E-05					

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution for pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.2.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.09E-07	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		1.65E-03	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	1.55E-07	22.6%	4.03E-03	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		2.83E-04	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		5.42E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		2.96E-03	4.1%
Selenium	4.57E+00	2.00E-03	N/A	5.00E-03	N/A		2.50E-05	<1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		7.86E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	1.47E-07	21.4%	4.29E-02	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	6.90E-08	10.0%	2.01E-02	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		4.03E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		4.42E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		9.75E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		1.07E-06	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	5.85E-09	<1%	3.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-08	7.9%	2.89E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-09	<1%	3.16E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		1.06E-05	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-10	<1%	3.02E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	4.60E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	6.50E-10	<1%	3.46E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	3.19E-08	4.6%	1.70E-06	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		1.95E-05	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		6.78E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	3.95E-09	<1%	2.10E-06	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		1.31E-05	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		1.55E-05	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		2.36E-05	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		3.42E-08	<1%
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		9.91E-08	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		1.85E-06	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		2.55E-07	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		1.94E-06	<1%

Total Cancer Risk: 6.89E-07 **Hazard Index:** 7.28E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.46E-08	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		6.98E-04	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	6.08E-07	64.9%	1.58E-02	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		5.54E-04	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.27E-03	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		9.93E-04	1.6%
Selenium	4.57E+00	1.00E+00	N/A	5.00E-03	N/A		1.47E-03	2.4%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		4.61E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	9.17E-08	9.8%	2.68E-02	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	4.30E-08	4.6%	1.26E-02	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		1.70E-05	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		1.87E-06	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		4.12E-06	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		4.51E-07	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	9.61E-09	1.0%	5.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	8.93E-08	9.5%	4.76E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	9.75E-09	1.0%	5.20E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		4.46E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	9.32E-10	<1%	4.97E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	5.40E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	1.07E-09	<1%	5.69E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	5.25E-08	5.6%	2.80E-06	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		8.22E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		2.87E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	6.49E-09	<1%	3.46E-06	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		5.54E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		6.57E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		9.99E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		4.01E-08	<1%
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.16E-07	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		2.17E-07	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		3.00E-08	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		1.90E-06	<1%
Total Cancer Risk:					9.38E-07	Hazard Index:		6.06E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	9.05E-21	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	2.92E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	1.37E-09	29.8%	3.33E-08	<1%
Selenium	4.57E+00	1.46E-04	N/A	3.00E+03	N/A		4.10E-09	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	9.04E-12	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.24E-12	<1%	2.47E-08	<1%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	1.64E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	1.53E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	1.67E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	1.59E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	1.83E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	8.97E-11	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	1.11E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Carbon Disulfide	1.35E-02	4.32E-07	N/A	7.00E+05	N/A		5.19E-14	<1%
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%
Total Cancer Risk:					4.59E-09	Hazard Index:		3.47E-06

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table H.2.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.81E-02	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.04E-05	96.1%	2.70E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		8.03E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		8.59E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		6.42E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		2.19E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.87E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		4.01E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.03E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.61E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		4.01E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.53E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	6.72E-09	<1%	3.58E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		4.49E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.93E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	8.70E-08	<1%	9.23E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		2.58E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.11E-09	<1%	1.36E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.27E-07	3.0%	2.39E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		3.57E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		4.41E-04	<1%

Total Cancer Risk: 1.08E-05 **Hazard Index:** 4.54E-01

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non-Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
	IR	Ingestion Rate (mg/day)		100
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (day/ev)		1
	EP	Exposure Period (yr)		6
	CF	Conversion Factor (kg/mg)		0.000001
	BW	Body Weight (kg)		15.7
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.63E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
	IR Ingestion Rate (L/d)			0.01
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (d/ev)			1
	EP Exposure Period (yr)			6
	BW Body Weight (kg)			15.7
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	1.22E-07	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		5.25E-04	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	9.07E-08	22.6%	1.28E-03	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		9.01E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.72E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		9.42E-04	4.1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		2.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	8.58E-08	21.4%	1.37E-02	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	4.03E-08	10.0%	6.41E-03	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		1.28E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.41E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		3.10E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		3.40E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	3.41E-09	<1%	9.91E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	3.17E-08	7.9%	9.21E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	3.46E-09	<1%	1.01E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		3.36E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	3.31E-10	<1%	9.61E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.69E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.79E-10	<1%	1.10E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	4.6%	5.41E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		6.19E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		2.16E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	2.30E-09	<1%	6.69E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		4.17E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		7.52E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		1.09E-08	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		3.15E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		8.12E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		6.18E-07	<1%
Total Cancer Risk:					4.02E-07	Hazard Index:		2.32E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	8.30E-09	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		1.29E-04	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	2.05E-07	64.9%	2.91E-03	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		1.02E-04	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		2.34E-04	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.83E-04	1.6%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		8.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	9.8%	4.93E-03	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.45E-08	4.6%	2.31E-03	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		3.14E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		3.44E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		7.59E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		8.31E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	3.25E-09	1.0%	9.43E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	3.02E-08	9.5%	8.76E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	3.30E-09	1.0%	9.58E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		8.22E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	3.15E-10	<1%	9.15E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.83E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	3.61E-10	<1%	1.05E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.77E-08	5.6%	5.15E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.51E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		5.28E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	2.19E-09	<1%	6.37E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		1.02E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		1.21E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.84E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		7.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		2.14E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.52E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		3.50E-07	<1%

Total Cancer Risk: 3.17E-07 **Hazard Index:** 1.12E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.66E-20	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	5.35E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.51E-09	29.8%	3.33E-08	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.66E-11	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	7.77E-12	<1%	2.47E-08	<1%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.01E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	2.80E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.06E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	2.92E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.35E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.64E-10	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.03E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%
Total Cancer Risk:					8.42E-09	Hazard Index:		3.47E-06

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.2.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.33E-02	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.41E-05	96.1%	1.99E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		5.92E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		6.33E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.73E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.62E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.38E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.96E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		8.28E-03	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		5.92E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.18E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.96E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.13E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	9.08E-09	<1%	2.64E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		3.31E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.42E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	1.18E-07	<1%	6.80E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.90E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.85E-09	<1%	1.01E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	4.42E-07	3.0%	1.76E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		2.63E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		3.25E-04	<1%

Total Cancer Risk: 1.47E-05 **Hazard Index:** 3.34E-01

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
--	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 11
- BW Body Weight (kg) 42.6
- AP Averaging Period - Cancer (d) 25,550
- Averaging Period - Non-Cancer (d) 4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07		Hazard Index:	1.19E-01

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
	SA	Surface Area Exposed to Soil (cm ² /day)	5657	
	AF	Soil Skin Adherence Factor (mg/cm ²)	1	
	EF	Exposure Frequency (ev/yr)	92	
	ED	Exposure Duration (day/ev)	1	
	EP	Exposure Period (yr)	11	
	CF	Conversion Factor (kg/mg)	0.000001	
	BW	Body Weight (kg)	42.6	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	9.71E-08	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		3.83E-04	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	7.21E-08	22.6%	9.35E-04	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		6.57E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.26E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		6.87E-04	4.1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		1.82E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	6.83E-08	21.4%	9.96E-03	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	3.20E-08	10.0%	4.67E-03	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		9.35E-06	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.03E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		2.26E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		2.48E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	2.71E-09	<1%	7.23E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	2.52E-08	7.9%	6.72E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	2.76E-09	<1%	7.34E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		2.45E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	2.63E-10	<1%	7.01E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.14E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.02E-10	<1%	8.04E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.48E-08	4.6%	3.95E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		4.51E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		1.57E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	1.83E-09	<1%	4.88E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		3.04E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		3.61E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		5.49E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		7.94E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		2.30E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.92E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		4.51E-07	<1%
Total Cancer Risk:					3.20E-07		Hazard Index:	1.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	6.60E-09	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		9.38E-05	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	1.63E-07	64.9%	2.12E-03	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		7.45E-05	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.71E-04	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.33E-04	1.6%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		6.20E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	2.47E-08	9.8%	3.60E-03	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.16E-08	4.6%	1.69E-03	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		2.29E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		2.51E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		5.54E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		6.06E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	2.58E-09	1.0%	6.88E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	2.40E-08	9.5%	6.39E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	2.62E-09	1.0%	6.99E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		6.00E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	2.51E-10	<1%	6.67E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.45E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	2.87E-10	<1%	7.65E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.41E-08	5.6%	3.76E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		3.85E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	1.74E-09	<1%	4.65E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		7.45E-07	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		8.83E-07	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.34E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		5.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.56E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		4.03E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		2.55E-07	<1%

Total Cancer Risk: 2.52E-07 **Hazard Index:** 8.15E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.81E-20	<1%	N/A	
<i>Extractable Petroleum Hydrocarbons</i>								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
<i>Inorganics</i>								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	5.84E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.74E-09	29.8%	3.33E-08	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.81E-11	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	8.48E-12	<1%	2.47E-08	<1%
<i>Semivolatile Organic Compounds</i>								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.28E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	3.05E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.33E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	3.19E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.65E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.79E-10	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.22E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
<i>Volatile Organic Compounds</i>								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 9.18E-09 Hazard Index: 3.47E-06

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)
 N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.2.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		9.71E-03	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.12E-05	96.1%	1.45E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		4.32E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		4.62E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		3.45E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.18E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.00E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.16E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		6.04E-03	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		4.32E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.63E-04	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.16E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		8.23E-04	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	7.23E-09	<1%	1.92E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		2.41E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.04E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	9.36E-08	<1%	4.96E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.39E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.26E-09	<1%	7.34E-05	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.51E-07	3.0%	1.28E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		1.92E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		2.37E-04	<1%

Total Cancer Risk: 1.17E-05 **Hazard Index:** 2.44E-01

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
--	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 12
- BW Body Weight (kg) 58.4
- AP Averaging Period - Cancer (d) 25,550
- AP Averaging Period - Non-Cancer (d) 4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
	IR Ingestion Rate (mg/day)			50
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			12
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			58.4
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from BUD/TSCA (Excluding Arsenic), Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	5.3E-07	31.5%	Dioxin/Furan (39%), Aroclor-1254 (28%)	6.9E-02	15.8%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	3.3E-07	19.5%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	4.5E-02	10.3%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	1.7E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	4.2E-07	25.0%	Tetrahydrofuran (77%)	1.8E-01	42.0%	Thallium (22%)
Dermal Contact with Sediment	4.0E-07	23.9%	Aroclor-1254 (65%)	1.4E-01	31.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07			3.1E-02		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	1.7E-06			4.4E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	3.1E-07	19.1%	Dioxin/Furan (39%), Aroclor-1254 (28%)	2.2E-02	7.7%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	1.1E-07	6.8%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	8.3E-03	2.9%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	3.1E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	5.7E-07	35.0%	Tetrahydrofuran (77%)	1.4E-01	47.5%	Thallium (22%)
Dermal Contact with Sediment	6.3E-07	38.9%	Aroclor-1254 (65%)	1.2E-01	41.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08			5.7E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	1.6E-06			2.8E-01		
Future Adult Recreator						
Dermal Contact with Soil	2.5E-07	19.1%	Dioxin/Furan (39%), Aroclor-1254 (28%)	1.6E-02	7.7%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	8.9E-08	6.8%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	6.0E-03	2.9%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	3.3E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	4.5E-07	35.0%	Tetrahydrofuran (77%)	9.9E-02	47.5%	Thallium (22%)
Dermal Contact with Sediment	5.0E-07	38.9%	Aroclor-1254 (65%)	8.7E-02	41.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08			4.2E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	1.3E-06			2.1E-01		
Child + Adolescent + Adult	4.6E-06					

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.3.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.09E-07	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		1.65E-03	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		2.83E-04	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		5.42E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		2.96E-03	4.3%
Selenium	4.57E+00	2.00E-03	N/A	5.00E-03	N/A		2.50E-05	<1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		7.86E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	1.47E-07	27.6%	4.29E-02	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	6.90E-08	12.9%	2.01E-02	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		4.03E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		4.42E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		9.75E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		1.07E-06	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	5.85E-09	1.1%	3.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-08	10.2%	2.89E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-09	1.1%	3.16E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		1.06E-05	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-10	<1%	3.02E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	4.60E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	6.50E-10	<1%	3.46E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	3.19E-08	6.0%	1.70E-06	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		1.95E-05	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		6.78E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	3.95E-09	<1%	2.10E-06	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		1.31E-05	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		1.55E-05	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		2.36E-05	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		3.42E-08	<1%
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		9.91E-08	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		1.85E-06	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		2.55E-07	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		1.94E-06	<1%

Total Cancer Risk: 5.33E-07 **Hazard Index:** 6.88E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.46E-08	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		6.98E-04	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		5.54E-04	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.27E-03	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		9.93E-04	2.2%
Selenium	4.57E+00	1.00E+00	N/A	5.00E-03	N/A		1.47E-03	3.3%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		4.61E-04	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	9.17E-08	27.8%	2.68E-02	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	4.30E-08	13.1%	1.26E-02	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		1.70E-05	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		1.87E-06	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		4.12E-06	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		4.51E-07	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	9.61E-09	2.9%	5.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	8.93E-08	27.1%	4.76E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	9.75E-09	3.0%	5.20E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		4.46E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	9.32E-10	<1%	4.97E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	5.40E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	1.07E-09	<1%	5.69E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	5.25E-08	15.9%	2.80E-06	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		8.22E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		2.87E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	6.49E-09	2.0%	3.46E-06	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		5.54E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		6.57E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		9.99E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		4.01E-08	<1%
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.16E-07	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		2.17E-07	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		3.00E-08	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		1.90E-06	<1%

Total Cancer Risk: 3.29E-07 **Hazard Index:** 4.49E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	9.05E-21	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	1.37E-09	81.9%	3.33E-08	11.2%
Selenium	4.57E+00	1.46E-04	N/A	3.00E+03	N/A		4.10E-09	1.4%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	9.04E-12	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.24E-12	<1%	2.47E-08	8.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	1.64E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	1.53E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	1.67E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	1.59E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	1.83E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	8.97E-11	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	1.11E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Carbon Disulfide	1.35E-02	4.32E-07	N/A	7.00E+05	N/A		5.19E-14	<1%
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 1.67E-09 **Hazard Index:** 2.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposur Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

**Appendix Table H.3.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.81E-02	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		8.03E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		8.59E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		6.42E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		2.19E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.87E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		4.01E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.03E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.61E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		4.01E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.53E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	6.72E-09	1.6%	3.58E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		4.49E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.93E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	8.70E-08	20.6%	9.23E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		2.58E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.11E-09	<1%	1.36E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.27E-07	77.3%	2.39E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		3.57E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		4.41E-04	<1%
Total Cancer Risk:					4.23E-07		Hazard Index:	1.83E-01

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \begin{matrix} 6.88\text{E-}04 \\ \text{(cancer)} \end{matrix} \quad \begin{matrix} 8.03\text{E-}03 \\ \text{(non-cancer)} \end{matrix}$$

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.63E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)		0.01
EF	Exposure Frequency (ev/yr)		92
ED	Exposure Duration (d/ev)		1
EP	Exposure Period (yr)		6
BW	Body Weight (kg)		15.7
AP	Averaging Period - Cancer (d)		25,550
	Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	1.22E-07	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		5.25E-04	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		9.01E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.72E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		9.42E-04	4.3%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		2.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	8.58E-08	27.6%	1.37E-02	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	4.03E-08	12.9%	6.41E-03	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		1.28E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.41E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		3.10E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		3.40E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	3.41E-09	1.1%	9.91E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	3.17E-08	10.2%	9.21E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	3.46E-09	1.1%	1.01E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		3.36E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	3.31E-10	<1%	9.61E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.69E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.79E-10	<1%	1.10E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	6.0%	5.41E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		6.19E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		2.16E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	2.30E-09	<1%	6.69E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		4.17E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		7.52E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		1.09E-08	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		3.15E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		8.12E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		6.18E-07	<1%

Total Cancer Risk: 3.11E-07 **Hazard Index:** 2.19E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	8.30E-09	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		1.29E-04	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		1.02E-04	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		2.34E-04	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.83E-04	2.2%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		8.50E-05	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	27.8%	4.93E-03	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.45E-08	13.1%	2.31E-03	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		3.14E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		3.44E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		7.59E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		8.31E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	3.25E-09	2.9%	9.43E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	3.02E-08	27.1%	8.76E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	3.30E-09	3.0%	9.58E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		8.22E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	3.15E-10	<1%	9.15E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.83E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	3.61E-10	<1%	1.05E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.77E-08	15.9%	5.15E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.51E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		5.28E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	2.19E-09	2.0%	6.37E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		1.02E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		1.21E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.84E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		7.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		2.14E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.52E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		3.50E-07	<1%

Total Cancer Risk: 1.11E-07 **Hazard Index:** 8.27E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
	IR	Ingestion Rate (mg/day)	50	
	EF	Exposure Frequency (ev/yr)	92	
	ED	Exposure Duration (day/ev)	1	
	EP	Exposure Period (yr)	11	
	CF	Conversion Factor (kg/mg)	0.000001	
	BW	Body Weight (kg)	42.6	
	AP	Averaging Period - Cancer (d)	25,550	
		Averaging Period - Non- Cancer (d)	4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE \div RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.66E-20	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.51E-09	81.9%	3.33E-08	11.2%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.66E-11	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	7.77E-12	<1%	2.47E-08	8.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.01E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	2.80E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.06E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	2.92E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.35E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.64E-10	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.03E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 3.06E-09 **Hazard Index:** 2.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposur Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

Appendix Table H.3.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.33E-02	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		5.92E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		6.33E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.73E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.62E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.38E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.96E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		8.28E-03	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		5.92E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.18E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.96E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.13E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	9.08E-09	1.6%	2.64E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		3.31E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.42E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	1.18E-07	20.6%	6.80E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.90E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.85E-09	<1%	1.01E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	4.42E-07	77.3%	1.76E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		2.63E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		3.25E-04	<1%
Total Cancer Risk:					5.71E-07		Hazard Index:	1.35E-01

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \begin{matrix} 9.30\text{E-}04 \\ \text{(cancer)} \end{matrix} \quad \begin{matrix} 5.92\text{E-}03 \\ \text{(non-cancer)} \end{matrix}$$

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07	Hazard Index:	1.19E-01	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.14

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
	IR Ingestion Rate (mg/day)			50
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			11
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	9.71E-08	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		3.83E-04	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		6.57E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.26E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		6.87E-04	4.3%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		1.82E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	6.83E-08	27.6%	9.96E-03	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	3.20E-08	12.9%	4.67E-03	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		9.35E-06	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.03E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		2.26E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		2.48E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	2.71E-09	1.1%	7.23E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	2.52E-08	10.2%	6.72E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	2.76E-09	1.1%	7.34E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		2.45E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	2.63E-10	<1%	7.01E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.14E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.02E-10	<1%	8.04E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.48E-08	6.0%	3.95E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		4.51E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		1.57E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	1.83E-09	<1%	4.88E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		3.04E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		3.61E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		5.49E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		7.94E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		2.30E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.92E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		4.51E-07	<1%
Total Cancer Risk:					2.47E-07	Hazard Index:		1.60E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	6.60E-09	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		9.38E-05	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		7.45E-05	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.71E-04	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.33E-04	2.2%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		6.20E-05	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	2.47E-08	27.8%	3.60E-03	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.16E-08	13.1%	1.69E-03	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		2.29E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		2.51E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		5.54E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		6.06E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	2.58E-09	2.9%	6.88E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	2.40E-08	27.1%	6.39E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	2.62E-09	3.0%	6.99E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		6.00E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	2.51E-10	<1%	6.67E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.45E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	2.87E-10	<1%	7.65E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.41E-08	15.9%	3.76E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		3.85E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	1.74E-09	2.0%	4.65E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		7.45E-07	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		8.83E-07	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.34E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		5.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.56E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		4.03E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		2.55E-07	<1%

Total Cancer Risk: 8.86E-08 **Hazard Index:** 6.03E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		12	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		58.4	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.81E-20	<1%	N/A	
<i>Extractable Petroleum Hydrocarbons</i>								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
<i>Inorganics</i>								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.74E-09	81.9%	3.33E-08	11.2%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.81E-11	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	8.48E-12	<1%	2.47E-08	8.3%
<i>Semivolatile Organic Compounds</i>								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.28E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	3.05E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.33E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	3.19E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.65E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.79E-10	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.22E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
<i>Volatile Organic Compounds</i>								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 3.34E-09 Hazard Index: 2.97E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6}$ kg/mg

$ADE = EPC_{dust} * IF$

Appendix Table H.3.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		9.71E-03	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		4.32E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		4.62E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		3.45E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.18E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.00E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.16E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		6.04E-03	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		4.32E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.63E-04	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.16E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		8.23E-04	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	7.23E-09	1.6%	1.92E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		2.41E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.04E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	9.36E-08	20.6%	4.96E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.39E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.26E-09	<1%	7.34E-05	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.51E-07	77.3%	1.28E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		1.92E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		2.37E-04	<1%
Total Cancer Risk:					4.55E-07		Hazard Index:	9.85E-02

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \begin{matrix} 7.40\text{E-}04 \\ \text{(cancer)} \end{matrix} \quad \begin{matrix} 4.32\text{E-}03 \\ \text{(non-cancer)} \end{matrix}$$

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	12
BW	Body Weight (kg)	58.4
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,380

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from TransCanada Property, Sediment from TransCanada West Storm Drain, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	1.3E-07	7.3%	Benzo(a)pyrene (46%)	1.3E-02	9.1%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	1.9E-07			7.9E-03		
Inhalation of Fugitive Dust	2.3E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	8.2E-03	5.8%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	9.9E-07	55.6%	Benzo(a)pyrene (35%)	9.4E-02	67.0%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	6.6E-07	36.9%	Arsenic (44%), Benzo(a)pyrene (30%)	2.5E-02	17.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.1E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.3E-05	<1%	Cadmium (65%)
Total Risks*:	1.8E-06			1.4E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	7.6E-08	4.1%	Benzo(a)pyrene (46%)	4.0E-03	4.3%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	6.4E-08			1.5E-03		
Inhalation of Fugitive Dust	4.2E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	6.0E-03	6.3%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	1.5E-06	83.7%	Benzo(a)pyrene (35%)	8.0E-02	84.3%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	2.2E-07	12.0%	Arsenic (44%), Benzo(a)pyrene (30%)	4.6E-03	4.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.2E-05	<1%	Cadmium (65%)
Total Risks*:	1.9E-06			9.5E-02		
Future Adult Recreator						
Dermal Contact with Soil	6.0E-08	4.1%	Benzo(a)pyrene (46%)	2.9E-03	4.3%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	5.1E-08			1.1E-03		
Inhalation of Fugitive Dust	4.6E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	4.4E-03	6.3%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	1.2E-06	83.6%	Benzo(a)pyrene (35%)	5.8E-02	84.3%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	1.8E-07	12.0%	Arsenic (44%), Benzo(a)pyrene (30%)	3.3E-03	4.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.9E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	8.8E-06	<1%	Cadmium (65%)
Total Risks*:	1.5E-06			6.9E-02		
Child + Adolescent + Adult 5.1E-06						

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.4.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		3.41E-03	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		3.47E-04	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		4.27E-03	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		2.02E-05	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		5.70E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	1.08E-08	8.3%	3.15E-03	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	4.46E-09	3.4%	1.30E-03	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		3.86E-06	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		8.79E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		9.67E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	7.51E-09	5.8%	4.00E-06	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	5.97E-08	46.0%	3.18E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	6.71E-09	5.2%	3.57E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		1.20E-05	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	6.10E-10	<1%	3.25E-06	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		1.50E-05	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	4.64E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	7.60E-10	<1%	4.05E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	3.00E-08	23.1%	1.60E-06	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		2.61E-05	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		5.13E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	4.57E-09	3.5%	2.44E-06	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		1.57E-05	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		3.09E-05	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		6.36E-07	<1%
Total Cancer Risk:					1.30E-07		Hazard Index:	1.27E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		1.44E-03	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		6.78E-04	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		1.43E-03	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		1.19E-03	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		3.35E-04	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	6.74E-09	3.5%	1.97E-03	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	2.78E-09	1.5%	8.11E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		1.63E-06	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		3.72E-06	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		4.09E-07	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	1.23E-08	6.5%	6.57E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	9.81E-08	51.5%	5.23E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	1.10E-08	5.8%	5.87E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		5.06E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	1.00E-09	<1%	5.34E-06	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		1.76E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	5.45E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	1.25E-09	<1%	6.66E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	4.93E-08	25.9%	2.63E-06	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		2.17E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	7.51E-09	3.9%	4.00E-06	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		6.62E-06	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		1.31E-05	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		6.22E-07	<1%
Total Cancer Risk:					1.91E-07		Hazard Index:	7.93E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	1.97E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	6.64E-13	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	2.74E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	2.11E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	1.68E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	1.88E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	1.71E-12	<1%	1.92E-11	<1%
Butyl benzyl phthalate	2.20E-01	7.03E-06	N/A	N/A	N/A		N/A	
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	2.14E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	8.43E-11	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	1.28E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%
Total Cancer Risk:					2.28E-09	Hazard Index:		1.96E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

**Appendix Table H.4.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		3.13E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		7.22E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		6.26E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.40E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		1.22E-03	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		3.87E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.78E-03	21.9%
Total Cancer Risk:					0.00E+00	Hazard Index:		8.15E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		4.74E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	2.11E-07	21.4%	5.47E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		2.62E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		1.42E-03	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.80E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		3.11E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	1.50E-07	15.2%	4.37E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	3.71E-08	3.8%	1.08E-02	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		2.07E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		4.61E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	3.78E-08	3.8%	2.01E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	3.46E-07	35.0%	1.84E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	3.32E-08	3.4%	1.77E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		5.59E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	2.84E-09	<1%	1.51E-05	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	1.65E-10	<1%	6.86E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	2.45E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	3.61E-09	<1%	1.92E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.20E-07	12.2%	6.41E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		5.67E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		1.55E-04	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		3.24E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	2.04E-08	2.1%	1.09E-05	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		4.32E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.81E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		1.53E-04	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	2.76E-12	<1%	7.16E-08	<1%
Total Cancer Risk:					9.87E-07		Hazard Index:	9.35E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		1.95E-03	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	2.89E-07	44.1%	7.49E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		7.67E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		9.74E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		7.39E-04	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		6.39E-04	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	3.27E-08	5.0%	9.54E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	8.09E-09	1.2%	2.36E-03	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		3.06E-06	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		6.81E-07	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	2.18E-08	3.3%	1.16E-05	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	1.99E-07	30.3%	1.06E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	1.91E-08	2.9%	1.02E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		8.27E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	1.63E-09	<1%	8.71E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	3.38E-10	<1%	1.41E-05	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	1.01E-09	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	2.08E-09	<1%	1.11E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	6.93E-08	10.6%	3.69E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		2.33E-04	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		2.29E-05	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		4.80E-06	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	1.17E-08	1.8%	6.26E-06	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		6.39E-06	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		2.68E-05	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		2.27E-05	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	1.14E-12	<1%	2.94E-08	<1%
Total Cancer Risk:					6.56E-07		Hazard Index:	2.49E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.03E-05	3.3%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.11E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		8.09E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.28E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
	IR Ingestion Rate (L/d)			0.01
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (d/ev)			1
	EP Exposure Period (yr)			6
	BW Body Weight (kg)			15.7
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		1.08E-03	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		1.10E-04	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		1.36E-03	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		6.43E-06	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		1.81E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	6.30E-09	8.3%	1.00E-03	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	2.60E-09	3.4%	4.14E-04	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		1.23E-06	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		2.80E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		3.08E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	4.38E-09	5.8%	1.27E-06	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	3.48E-08	46.0%	1.01E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	3.91E-09	5.2%	1.14E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		3.81E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	3.56E-10	<1%	1.03E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	2.71E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	4.44E-10	<1%	1.29E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	1.75E-08	23.1%	5.09E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		8.31E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		1.63E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	2.67E-09	3.5%	7.75E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		4.98E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		9.83E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		2.02E-07	<1%
Total Cancer Risk:					7.57E-08		Hazard Index:	4.04E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
----------------------	---	---	-------------------	-----------------------

SA	Surface Area Exposed to Soil (cm ² /day)	5,657
AF	Soil Skin Adherence Factor (mg/cm ²)	0.13
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	11
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.10

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		2.65E-04	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		1.25E-04	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		2.64E-04	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		2.19E-04	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		6.17E-05	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	2.28E-09	3.5%	3.62E-04	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	9.40E-10	1.5%	1.50E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		3.01E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		6.85E-07	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		7.53E-08	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	4.17E-09	6.5%	1.21E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	3.31E-08	51.5%	9.63E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	3.72E-09	5.8%	1.08E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		9.33E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	3.39E-10	<1%	9.85E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	1.84E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	4.22E-10	<1%	1.23E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	1.67E-08	25.9%	4.84E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		2.03E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		3.99E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	2.54E-09	3.9%	7.38E-07	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		1.22E-06	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		2.41E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		1.15E-07	<1%
Total Cancer Risk:					6.44E-08		Hazard Index:	1.46E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	3.61E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	1.22E-12	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	5.02E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	3.87E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	3.07E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	3.45E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	3.14E-12	<1%	1.92E-11	<1%
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	3.92E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	1.54E-10	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	2.35E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%
Total Cancer Risk:					4.18E-09	Hazard Index:		1.96E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (hr/ev)			8
	EP Exposure Period (yr)			11
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table H.4.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		2.31E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		5.33E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		4.62E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		2.66E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		9.02E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.85E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.31E-03	21.9%
Total Cancer Risk:					0.00E+00	Hazard Index:		6.01E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		4.06E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	3.31E-07	21.4%	4.69E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		2.24E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		1.22E-03	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.54E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		2.66E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	2.35E-07	15.2%	3.74E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	5.82E-08	3.8%	9.27E-03	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		1.77E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		3.95E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-08	3.8%	1.73E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-07	35.0%	1.58E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	5.22E-08	3.4%	1.52E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		4.79E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	4.46E-09	<1%	1.30E-05	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	2.58E-10	<1%	5.87E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.84E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-09	<1%	1.65E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.89E-07	12.2%	5.49E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		4.86E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		1.33E-04	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		2.78E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	3.21E-08	2.1%	9.32E-06	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		3.70E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.55E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		1.31E-04	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	4.34E-12	<1%	6.14E-08	<1%

Total Cancer Risk: 1.55E-06 **Hazard Index:** 8.01E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		3.59E-04	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	9.77E-08	44.1%	1.38E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		1.41E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		1.79E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.36E-04	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		1.18E-04	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	1.11E-08	5.0%	1.76E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	2.73E-09	1.2%	4.35E-04	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		5.65E-07	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		1.26E-07	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	7.35E-09	3.3%	2.14E-06	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	6.71E-08	30.3%	1.95E-06	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	6.45E-09	2.9%	1.88E-06	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		1.52E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	5.52E-10	<1%	1.60E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	1.14E-10	<1%	2.60E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.40E-10	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	7.02E-10	<1%	2.04E-06	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	2.34E-08	10.6%	6.80E-07	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		4.30E-05	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		4.22E-06	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		8.84E-07	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	3.97E-09	1.8%	1.15E-06	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		1.18E-06	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		4.18E-06	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	3.84E-13	<1%	5.42E-09	<1%
Total Cancer Risk:					2.21E-07		Hazard Index:	4.58E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08	2.96E-07
			(cancer)	(non-cancer)
	IR Ingestion Rate (mg/day)			50
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			11
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	95.7%
Thallium										
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		8.80E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.67E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table H.4.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	65.2%
Thallium								
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		2.98E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.21E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
	IR Ingestion Rate (L/d)			0.01
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (d/ev)			1
	EP Exposure Period (yr)			11
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		7.91E-04	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		8.05E-05	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		9.90E-04	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		4.69E-06	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		1.32E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	5.02E-09	8.3%	7.32E-04	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	2.07E-09	3.4%	3.02E-04	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		8.97E-07	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		2.04E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		2.24E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	3.49E-09	5.8%	9.28E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	2.77E-08	46.0%	7.38E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	3.11E-09	5.2%	8.29E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		2.78E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	2.83E-10	<1%	7.55E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		3.48E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	2.15E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	3.53E-10	<1%	9.40E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	1.39E-08	23.1%	3.71E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		6.06E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		1.19E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	2.12E-09	3.5%	5.65E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		3.63E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		7.17E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		1.48E-07	<1%
Total Cancer Risk:					6.02E-08		Hazard Index:	2.95E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		1.94E-04	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		9.12E-05	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		1.92E-04	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		1.60E-04	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		4.50E-05	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	1.81E-09	3.5%	2.64E-04	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	7.48E-10	1.5%	1.09E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		2.20E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		5.00E-07	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		5.49E-08	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	3.32E-09	6.5%	8.84E-07	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	2.64E-08	51.5%	7.03E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	2.96E-09	5.8%	7.89E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		6.81E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	2.70E-10	<1%	7.18E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		2.37E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	1.46E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	3.36E-10	<1%	8.95E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	1.33E-08	25.9%	3.53E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		1.48E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		2.91E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	2.02E-09	3.9%	5.38E-07	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		8.90E-07	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		1.76E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		8.36E-08	<1%
Total Cancer Risk:					5.12E-08		Hazard Index:	1.07E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	3.94E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	1.33E-12	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	5.48E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	4.22E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	3.35E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	3.77E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	3.43E-12	<1%	1.92E-11	<1%
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	4.27E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	1.69E-10	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	2.57E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%

Total Cancer Risk: 4.56E-09 Hazard Index: 1.96E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.4.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		1.68E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		3.88E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		3.37E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		1.94E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-05	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		6.58E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.08E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		9.58E-04	21.9%
Total Cancer Risk:					0.00E+00		Hazard Index:	4.38E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	12
BW	Body Weight (kg)	58.4
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		2.96E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	2.64E-07	21.4%	3.42E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		1.63E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		8.89E-04	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		1.94E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	1.87E-07	15.2%	2.73E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	4.63E-08	3.8%	6.76E-03	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		1.29E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		2.88E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	4.73E-08	3.8%	1.26E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	4.32E-07	35.0%	1.15E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	4.15E-08	3.4%	1.11E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		3.49E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	3.55E-09	<1%	9.46E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.28E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.06E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	4.51E-09	<1%	1.20E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.50E-07	12.2%	4.01E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		3.54E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		9.67E-05	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		2.03E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	2.55E-08	2.1%	6.80E-06	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		2.70E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.13E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		9.58E-05	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	3.45E-12	<1%	4.48E-08	<1%

Total Cancer Risk: 1.23E-06 **Hazard Index:** 5.84E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		2.62E-04	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	7.77E-08	44.1%	1.01E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		1.03E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		1.31E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		9.94E-05	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		8.58E-05	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	8.79E-09	5.0%	1.28E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	2.18E-09	1.2%	3.17E-04	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		4.12E-07	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		9.16E-08	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	5.85E-09	3.3%	1.56E-06	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	5.34E-08	30.3%	1.42E-06	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	5.14E-09	2.9%	1.37E-06	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		1.11E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	4.39E-10	<1%	1.17E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	9.09E-11	<1%	1.89E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	2.70E-10	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	5.58E-10	<1%	1.49E-06	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	1.86E-08	10.6%	4.96E-07	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		3.13E-05	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		3.08E-06	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		6.45E-07	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	3.16E-09	1.8%	8.41E-07	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		8.59E-07	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		3.60E-06	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		3.05E-06	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	3.05E-13	<1%	3.96E-09	<1%
Total Cancer Risk:					1.76E-07		Hazard Index:	3.34E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		6.42E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.94E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		2.17E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	8.83E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix H
Human Health Sensitivity Analysis

List of Tables

Table H.1.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC Non-BUD/TSCA
Table H.2.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC BUD/TSCA (Including Arsenic)
Table H.3.1	Detailed OHM Risk Tables for Future Recreators Use – YAEC BUD/TSCA (Excluding Arsenic)
Table H.4.1	Detailed OHM Risk Tables for Future Recreators Use – TransCanada

Sensitivity Analyses

As part of the Risk Characterization, Gradient performed a sensitivity analysis of the various hypothetical scenarios presented at the Site. The results of this sensitivity analysis were compared to the baseline risk exposure scenario. This appendix describes exposure scenarios for the sensitivity analysis.

H.1 Recreator Scenarios

The following additional exposure scenarios were evaluated for the sensitivity analysis:

YAEC Future Recreator Exposure Scenarios

1. Exposed to soils and groundwater YAEC Non-BUD/TSCA area, nearshore sediments (Sherman Shoreline)
2. Exposed to soils and groundwater YAEC BUD/TSCA area, nearshore sediments (Sherman Shoreline)
3. Exposed to soils and groundwater YAEC BUD/TSCA area, nearshore sediments (Sherman Shoreline) – excluding arsenic in soil and groundwater

TransCanada Property Future Recreator Exposure Scenario

4. Exposed to soils and groundwater on TransCanada property plus sediments in West Storm Ditch.

All exposure factors were those used for the baseline recreator scenario, and only the exposure point concentrations differ based on the particular exposure area in the assessment. The potential OHM cancer risks for these scenarios are presented in Appendix Tables H.1 to H.4 (the potential radionuclide risks are presented in Appendix Tables F.9 through F.11). A summary of the results is provided below.

Human Health Cancer Risk Calculations –Sensitivity Analysis				
Exposure Scenario	Radionuclides	Chemicals	Cumulative Risks ^[a]	
			Site	Background
Future Use Recreator – Baseline Case	5.8×10^{-7}	1.6×10^{-6}	2×10^{-6}	2×10^{-6}
Future Use Recreator Sensitivity Calculations				
1. YAEC Non-BUD/TSCA	1.3×10^{-7}	2.1×10^{-6}	2×10^{-6}	2×10^{-6}
2. YAEC BUD/TSCA	3.3×10^{-7}	4.2×10^{-5}	4×10^{-5}	2×10^{-6}
3. YAEC BUD/TSCA (excluding arsenic)	3.3×10^{-7}	4.6×10^{-6}	5×10^{-6}	2×10^{-6}
4. TransCanada and WSD Sediments ^[b]	6.6×10^{-8}	5.1×10^{-6}	5×10^{-6}	2×10^{-6}
MADEP Risk Benchmark			1×10^{-5}	

Notes:

[a] Differences in the cumulative risks and the summation of radionuclide plus chemical risk is caused by rounding (individual results are expressed to only one significant figure).

[b] Any sediment samples from the WSD area for radionuclides are logged as "soil" as the environmental matrix in the FSS database and therefore included with the "soil" exposure pathway.

As these results indicate the calculated potential cancer risks for future recreators are comparable to the baseline recreator risk (2×10^{-6}), with the exception of scenario #2.

In both scenario #1 and #2 above, arsenic in soil and groundwater was included in the evaluation for information purposes. As discussed in the body of the report, arsenic in groundwater is not considered indicative of a site-related release, and the concentration detected is within background concentrations found in public drinking water supplies in the State. As also discussed in the body of this report, arsenic in soils on the YAEC property is statistically no different from local background.

Only scenario #2 has a hypothetical risk above 10^{-5} . This is entirely due to including arsenic in drinking water in the assessment (as can be seen by comparing the results to scenario #3). The maximum arsenic concentration detected (and used in the risk calculation) is from a monitoring well within the C&A Fill BUD area. There are no current drinking water wells in this area, and no drinking water wells can be installed in the future under the BUD restrictions. Moreover, the maximum arsenic concentration (0.0101 mg/L) is essentially equal to its drinking water standard (0.01 mg/L). Based on the fact that arsenic is naturally occurring; detected sporadically with no apparent indication of a site-related release; the lack of any current exposure *via* groundwater ingestion; and the fact that the detected concentration is effectively equivalent to public health drinking water standards; this weight of evidence indicates the hypothetical calculation of risk under scenario #2 is not indication of significant site-related risk.

The non-cancer Hazard Indices for OHM are presented in Appendix Tables H.1 to H.4, and summarized below. In all cases, the HI values are below the MADEP (1995) Hazard Index threshold of one (e.g., HI<1).

Summary of Human Health Non-Cancer Chemical Hazard		
Exposure Scenario	Hazard Index	
	Site	Background
Future Use Recreator – Child Baseline	0.2	0.05
Future Use Recreator – Sensitivity Calculations		
1. YAEC Non-TSCA/BUD Area	0.23	0.05
2. YAEC TSCA/BUD Area	0.73	0.05
3. YAEC TSCA/BUD Area (excluding arsenic)	0.44	0.05
4. TransCanada and WSD Sediments	0.14	0.05
MADEP Benchmark	1	

References

Massachusetts Department of Environmental Protection (MADEP). 1995. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim final policy)." Bureau of Waste Site Cleanup and Office of Research and Standards. BWSC/ORS-95-141. July.

Appendix H Tables

Appendix Table H.1.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from YAEC Non-BUD/TSCA, Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	Cancer Risks			Non Cancer Risks		
	Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway	Non Cancer Risks	Percent Contribution	COPC Contributing Majority of Risks by Receptor & Pathway
Future Child Recreator						
Dermal Contact with Soil	1.8E-07	24.4%	Dioxin/Furan (65%)	2.6E-02	11.3%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	6.2E-08			1.7E-02		
Inhalation of Fugitive Dust	1.3E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			3.4E-02	14.7%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	4.0E-07	56.1%	Aroclor-1254 (65%)	1.4E-01	60.3%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07	19.3%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	3.1E-02	13.5%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	7.2E-07			2.3E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	1.0E-07	13.0%	Dioxin/Furan (65%)	8.3E-03	5.2%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	2.1E-08			3.1E-03		
Inhalation of Fugitive Dust	2.4E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			2.5E-02	15.8%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	6.3E-07	80.7%	Aroclor-1254 (65%)	1.2E-01	75.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08	6.0%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	5.7E-03	3.6%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	7.9E-07			1.6E-01		
Future Adult Recreator						
Dermal Contact with Soil	8.1E-08	13.0%	Dioxin/Furan (65%)	6.0E-03	5.2%	Aroclor-1254 (56%)
Incidental Ingestion of Soil	1.7E-08			2.3E-03		
Inhalation of Fugitive Dust	2.6E-09	<1%	Nickel (100%)	2.0E-07	<1%	Zinc (63%)
Ingestion of Groundwater	0.0E+00			1.8E-02	15.8%	Cadmium (24%), Barium (21%)
Dermal Contact with Sediment	5.0E-07	80.6%	Aroclor-1254 (65%)	8.7E-02	75.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08	6.0%	Benzo(a)pyrene (51%), Aroclor-1254 (41%)	4.2E-03	3.6%	Aroclor-1254 (54%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	6.3E-07			1.2E-01		
Child + Adolescent + Adult	2.1E-06					

Appendix Table H.1.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	9.33E-08	53.2%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		1.92E-04	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		2.84E-03	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		1.85E-05	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		5.91E-05	<1%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	5.28E-09	3.0%	4.40E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	7.08E-09	4.0%	2.07E-03	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	4.97E-08	28.3%	1.45E-02	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	2.01E-08	11.4%	5.85E-03	22.6%
Total Cancer Risk:					1.75E-07		Hazard Index:	2.60E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			2,434
AF	Soil Skin Adherence Factor (mg/cm ²)			0.35
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	1.10E-08	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		3.76E-04	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		9.54E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		1.09E-03	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		3.47E-04	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	3.30E-09	5.3%	2.75E-04	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	4.42E-09	7.1%	1.29E-03	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	49.8%	9.03E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	1.25E-08	20.1%	3.65E-03	21.5%
Total Cancer Risk:					6.21E-08		Hazard Index:	1.70E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
	IR	Ingestion Rate (mg/day)		100
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (day/ev)		1
	EP	Exposure Period (yr)		6
	CF	Conversion Factor (kg/mg)		0.000001
	BW	Body Weight (kg)		15.7
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	4.04E-21	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	1.31E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	3.25E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	4.35E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	3.05E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	1.23E-12	<1%	7.19E-09	3.6%
Total Cancer Risk:					1.32E-09	Hazard Index:		1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (hr/ev)			8
	EP Exposur Period (yr)			6
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration ($32 \mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor ($10^{-6} \text{ kg}/\text{mg}$) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg}/\text{mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

**Appendix Table H.1.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		7.02E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		2.59E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		8.03E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		5.89E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		5.22E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		1.61E-03	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		5.18E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		2.09E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		3.37E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		6.67E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		4.82E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.40E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

	IR-G	Groundwater Ingestion Rate (L/day)	0.5
	EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
	ED	Groundwater Ingestion Exposure Duration (d/ev)	1
	EP	Exposure Period (yr)	6
N/A - Not available	BW	Body Weight (kg)	15.7
Blank - Not a COPC for this Study Area	AP	Averaging Period - Cancer (d)	25,550
ADD (mg/kg-d) = EPC*IF*RAF		Averaging Period - Non- Cancer (d)	2,190

Appendix Table H.1.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.8
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00	Hazard Index:		3.63E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available
 Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	5.44E-08	53.2%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		6.12E-05	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		9.05E-04	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		5.88E-06	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		1.88E-05	<1%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	3.08E-09	3.0%	1.40E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	4.13E-09	4.0%	6.57E-04	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	2.90E-08	28.3%	4.61E-03	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	1.17E-08	11.4%	1.86E-03	22.6%
Total Cancer Risk:					1.02E-07		Hazard Index:	8.26E-03

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			5,657
AF	Soil Skin Adherence Factor (mg/cm ²)			0.13
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	3.70E-09	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		6.94E-05	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		1.76E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		2.00E-04	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		6.39E-05	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	1.11E-09	5.3%	5.06E-05	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	1.49E-09	7.1%	2.37E-04	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	1.05E-08	49.8%	1.66E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	4.23E-09	20.1%	6.73E-04	21.5%
Total Cancer Risk:					2.10E-08		Hazard Index:	3.13E-03

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE \div RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	7.40E-21	<1%	N/A	
Inorganics								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	2.41E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	5.95E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	7.97E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	5.59E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	2.26E-12	<1%	7.19E-09	3.6%
Total Cancer Risk:					2.42E-09	Hazard Index:		1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration ($32 \mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor ($10^{-6} \text{ kg}/\text{mg}$) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg}/\text{mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.1.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		5.17E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		1.91E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		5.92E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		4.34E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		3.85E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		1.18E-03	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		3.82E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		1.54E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		2.49E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		4.92E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		3.55E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	2.50E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 11
- N/A - Not available BW Body Weight (kg) 42.6
- Blank - Not a COPC for this Study Area AP Averaging Period - Cancer (d) 25,550
- ADD (mg/kg-d) = EPC*IF*RAF** Averaging Period - Non- Cancer (d) 4,015

Appendix Table H.1.1.13

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07		Hazard Index:	1.19E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.14

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		5,657	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		11	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		42.6	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
	IR	Ingestion Rate (L/d)		0.01
	EF	Exposure Frequency (ev/yr)		92
	ED	Exposure Duration (d/ev)		1
	EP	Exposure Period (yr)		11
	BW	Body Weight (kg)		42.6
	AP	Averaging Period - Cancer (d)		25,550
		Averaging Period - Non- Cancer (d)		4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	4.33E-08	53.2%	N/A	
Inorganics								
Copper	9.38E+00	6.00E-02	N/A	4.00E-02	N/A		4.47E-05	<1%
Nickel	1.19E+01	3.50E-01	N/A	2.00E-02	N/A		6.60E-04	11.0%
Selenium	3.38E+00	2.00E-03	N/A	5.00E-03	N/A		4.29E-06	<1%
Zinc	6.48E+01	2.00E-02	N/A	3.00E-01	N/A		1.37E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	1.60E-01	2.00E+00	7.00E-05	2.45E-09	3.0%	1.02E-04	1.7%
Aroclor-1248	1.89E-02	1.60E-01	2.00E+00	2.00E-05	3.29E-09	4.0%	4.79E-04	8.0%
Aroclor-1254	1.32E-01	1.60E-01	2.00E+00	2.00E-05	2.30E-08	28.3%	3.36E-03	55.8%
Aroclor-1260	5.35E-02	1.60E-01	2.00E+00	2.00E-05	9.32E-09	11.4%	1.36E-03	22.6%
Total Cancer Risk:					8.14E-08		Hazard Index:	6.02E-03

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)			5,657
AF	Soil Skin Adherence Factor (mg/cm ²)			0.13
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	5.31E-07	1.00E+00	1.50E+05	N/A	2.95E-09	17.6%	N/A	
Inorganics								
Copper	9.38E+00	1.00E+00	N/A	4.00E-02	N/A		5.06E-05	2.2%
Nickel	1.19E+01	1.00E+00	N/A	2.00E-02	N/A		1.28E-04	5.6%
Selenium	3.38E+00	1.00E+00	N/A	5.00E-03	N/A		1.46E-04	6.4%
Zinc	6.48E+01	1.00E+00	N/A	3.00E-01	N/A		4.66E-05	2.0%
Polychlorinated Biphenyls								
Aroclor-1016	1.41E-02	8.50E-01	2.00E+00	7.00E-05	8.86E-10	5.3%	3.69E-05	1.6%
Aroclor-1248	1.89E-02	8.50E-01	2.00E+00	2.00E-05	1.19E-09	7.1%	1.73E-04	7.6%
Aroclor-1254	1.32E-01	8.50E-01	2.00E+00	2.00E-05	8.32E-09	49.8%	1.21E-03	53.1%
Aroclor-1260	5.35E-02	8.50E-01	2.00E+00	2.00E-05	3.37E-09	20.1%	4.91E-04	21.5%
Total Cancer Risk:					1.67E-08	Hazard Index:		2.29E-03

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$ =		3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50
EF	Exposure Frequency (ev/yr)		92
ED	Exposure Duration (day/ev)		1
EP	Exposure Period (yr)		12
CF	Conversion Factor (kg/mg)		0.000001
BW	Body Weight (kg)		58.4
AP	Averaging Period - Cancer (d)		25,550
	Averaging Period - Non- Cancer (d)		4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	5.31E-07	1.70E-11	3.30E-08	N/A	8.07E-21	<1%	N/A	
<i>Inorganics</i>								
Copper	9.38E+00	3.00E-04	N/A	3.00E+03	N/A		8.41E-09	4.3%
Nickel	1.19E+01	3.80E-04	4.80E-04	1.00E+03	2.63E-09	99.6%	3.20E-08	16.2%
Selenium	3.38E+00	1.08E-04	N/A	3.00E+03	N/A		3.03E-09	1.5%
Zinc	6.48E+01	2.07E-03	N/A	1.40E+03	N/A		1.24E-07	63.1%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1016	1.41E-02	4.51E-07	1.00E-04	2.00E+01	6.49E-13	<1%	1.89E-09	<1%
Aroclor-1248	1.89E-02	6.04E-07	1.00E-04	2.00E+01	8.70E-13	<1%	2.54E-09	1.3%
Aroclor-1254	1.32E-01	4.24E-06	1.00E-04	2.00E+01	6.10E-12	<1%	1.78E-08	9.0%
Aroclor-1260	5.35E-02	1.71E-06	1.00E-04	2.00E+01	2.47E-12	<1%	7.19E-09	3.6%
					Total Cancer Risk:	2.64E-09	Hazard Index:	1.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration ($32 \mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor ($10^{-6} \text{ kg}/\text{mg}$) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg}/\text{mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.1.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC Non-BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Barium	6.12E-02	1.00E+00	N/A	7.00E-02	N/A		3.77E-03	20.7%
Boron	6.46E-02	1.00E+00	N/A	2.00E-01	N/A		1.39E-03	7.6%
Cadmium	5.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.32E-03	23.6%
Chromium	2.20E-03	1.00E+00	N/A	3.00E-03	N/A		3.17E-03	17.3%
Copper	2.60E-03	1.00E+00	N/A	4.00E-02	N/A		2.81E-04	1.5%
Mercury	6.00E-05	1.00E+00	N/A	3.00E-04	N/A		8.63E-04	4.7%
Nickel	1.29E-02	1.00E+00	N/A	2.00E-02	N/A		2.78E-03	15.2%
Silver	1.30E-03	1.00E+00	N/A	5.00E-03	N/A		1.12E-03	6.1%
Zinc	1.26E-02	1.00E+00	N/A	3.00E-01	N/A		1.81E-04	<1%
Volatile Organic Compounds								
Acetone	7.48E-02	1.00E+00	N/A	9.00E-01	N/A		3.59E-04	2.0%
Carbon Disulfide	6.00E-04	1.00E+00	N/A	1.00E-01	N/A		2.59E-05	<1%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.83E-02

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 12
- N/A - Not available BW Body Weight (kg) 58.4
- Blank - Not a COPC for this Study Area AP Averaging Period - Cancer (d) 25,550
- ADD (mg/kg-d) = EPC*IF*RAF** Averaging Period - Non- Cancer (d) 4,380

Appendix Table H.1.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.1.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from BUD/TSCA (Including Arsenic), Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	6.9E-07	5.3%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	7.3E-02	10.0%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	9.4E-07	7.3%	Arsenic (65%)	6.1E-02	8.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	4.6E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.1E-05	84.2%	Arsenic (96%)	4.5E-01	62.4%	Arsenic (60%)
Dermal Contact with Sediment	4.0E-07	3.1%	Aroclor-1254 (65%)	1.4E-01	19.2%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07			3.1E-02		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	1.3E-05			7.3E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	4.0E-07	2.5%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	2.3E-02	4.7%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	3.2E-07	2.0%	Arsenic (65%)	1.1E-02	2.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	8.4E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.5E-05	91.5%	Arsenic (96%)	3.3E-01	68.5%	Arsenic (60%)
Dermal Contact with Sediment	6.3E-07	4.0%	Aroclor-1254 (65%)	1.2E-01	24.4%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08			5.7E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	1.6E-05			4.9E-01		
Future Adult Recreator						
Dermal Contact with Soil	3.2E-07	2.5%	Dioxin/Furan (30%), Arsenic (23%), Aroclor-1254 (21%)	1.7E-02	4.7%	Aroclor-1254 (59%)
Incidental Ingestion of Soil	2.5E-07	2.0%	Arsenic (65%)	8.1E-03	2.3%	Aroclor-1254 (44%)
Inhalation of Fugitive Dust	9.2E-09	<1%	Arsenic (64%), Mercury (30%)	3.5E-06	<1%	Arsenic (91%)
Ingestion of Groundwater	1.2E-05	91.5%	Arsenic (96%)	2.4E-01	68.5%	Arsenic (60%)
Dermal Contact with Sediment	5.0E-07	4.0%	Aroclor-1254 (65%)	8.7E-02	24.4%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08			4.2E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	1.3E-05			3.6E-01		
Child + Adolescent + Adult	4.2E-05					

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution for pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.2.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.09E-07	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		1.65E-03	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	1.55E-07	22.6%	4.03E-03	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		2.83E-04	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		5.42E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		2.96E-03	4.1%
Selenium	4.57E+00	2.00E-03	N/A	5.00E-03	N/A		2.50E-05	<1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		7.86E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	1.47E-07	21.4%	4.29E-02	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	6.90E-08	10.0%	2.01E-02	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		4.03E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		4.42E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		9.75E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		1.07E-06	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	5.85E-09	<1%	3.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-08	7.9%	2.89E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-09	<1%	3.16E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		1.06E-05	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-10	<1%	3.02E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	4.60E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	6.50E-10	<1%	3.46E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	3.19E-08	4.6%	1.70E-06	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		1.95E-05	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		6.78E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	3.95E-09	<1%	2.10E-06	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		1.31E-05	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		1.55E-05	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		2.36E-05	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		3.42E-08	<1%
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		9.91E-08	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		1.85E-06	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		2.55E-07	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		1.94E-06	<1%

Total Cancer Risk: 6.89E-07 **Hazard Index:** 7.28E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.46E-08	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		6.98E-04	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	6.08E-07	64.9%	1.58E-02	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		5.54E-04	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.27E-03	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		9.93E-04	1.6%
Selenium	4.57E+00	1.00E+00	N/A	5.00E-03	N/A		1.47E-03	2.4%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		4.61E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	9.17E-08	9.8%	2.68E-02	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	4.30E-08	4.6%	1.26E-02	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		1.70E-05	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		1.87E-06	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		4.12E-06	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		4.51E-07	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	9.61E-09	1.0%	5.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	8.93E-08	9.5%	4.76E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	9.75E-09	1.0%	5.20E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		4.46E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	9.32E-10	<1%	4.97E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	5.40E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	1.07E-09	<1%	5.69E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	5.25E-08	5.6%	2.80E-06	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		8.22E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		2.87E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	6.49E-09	<1%	3.46E-06	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		5.54E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		6.57E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		9.99E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		4.01E-08	<1%
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.16E-07	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		2.17E-07	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		3.00E-08	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		1.90E-06	<1%
Total Cancer Risk:					9.38E-07	Hazard Index:		6.06E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	9.05E-21	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	2.92E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	1.37E-09	29.8%	3.33E-08	<1%
Selenium	4.57E+00	1.46E-04	N/A	3.00E+03	N/A		4.10E-09	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	9.04E-12	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.24E-12	<1%	2.47E-08	<1%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	1.64E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	1.53E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	1.67E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	1.59E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	1.83E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	8.97E-11	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	1.11E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Carbon Disulfide	1.35E-02	4.32E-07	N/A	7.00E+05	N/A		5.19E-14	<1%
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%
Total Cancer Risk:					4.59E-09	Hazard Index:		3.47E-06

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non-Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$EPC_{dust} = EPC_{soil} * PM_{10} * 10^{-6} \text{ kg/mg}$

$ADE = EPC_{dust} * IF$

Appendix Table H.2.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.81E-02	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.04E-05	96.1%	2.70E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		8.03E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		8.59E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		6.42E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		2.19E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.87E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		4.01E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.03E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.61E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		4.01E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.53E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	6.72E-09	<1%	3.58E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		4.49E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.93E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	8.70E-08	<1%	9.23E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		2.58E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.11E-09	<1%	1.36E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.27E-07	3.0%	2.39E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		3.57E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		4.41E-04	<1%
Total Cancer Risk:					1.08E-05		Hazard Index:	4.54E-01

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \frac{6.88\text{E-}04}{(\text{cancer})} \quad \frac{8.03\text{E-}03}{(\text{non-cancer})}$$

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non-Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.63E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
	IR Ingestion Rate (L/d)			0.01
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (d/ev)			1
	EP Exposure Period (yr)			6
	BW Body Weight (kg)			15.7
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	1.22E-07	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		5.25E-04	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	9.07E-08	22.6%	1.28E-03	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		9.01E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.72E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		9.42E-04	4.1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		2.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	8.58E-08	21.4%	1.37E-02	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	4.03E-08	10.0%	6.41E-03	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		1.28E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.41E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		3.10E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		3.40E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	3.41E-09	<1%	9.91E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	3.17E-08	7.9%	9.21E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	3.46E-09	<1%	1.01E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		3.36E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	3.31E-10	<1%	9.61E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.69E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.79E-10	<1%	1.10E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	4.6%	5.41E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		6.19E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		2.16E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	2.30E-09	<1%	6.69E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		4.17E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		7.52E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		1.09E-08	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		3.15E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		8.12E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		6.18E-07	<1%

Total Cancer Risk: 4.02E-07 **Hazard Index:** 2.32E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
--	---	-------------------	-----------------------

SA	Surface Area Exposed to Soil (cm ² /day)	5,657
AF	Soil Skin Adherence Factor (mg/cm ²)	0.13
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	11
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non-Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	8.30E-09	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		1.29E-04	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	2.05E-07	64.9%	2.91E-03	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		1.02E-04	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		2.34E-04	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.83E-04	1.6%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		8.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	9.8%	4.93E-03	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.45E-08	4.6%	2.31E-03	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		3.14E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		3.44E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		7.59E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		8.31E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	3.25E-09	1.0%	9.43E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	3.02E-08	9.5%	8.76E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	3.30E-09	1.0%	9.58E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		8.22E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	3.15E-10	<1%	9.15E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.83E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	3.61E-10	<1%	1.05E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.77E-08	5.6%	5.15E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.51E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		5.28E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	2.19E-09	<1%	6.37E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		1.02E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		1.21E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.84E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		7.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		2.14E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.52E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		3.50E-07	<1%

Total Cancer Risk: 3.17E-07 **Hazard Index:** 1.12E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.66E-20	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	5.35E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.51E-09	29.8%	3.33E-08	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.66E-11	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	7.77E-12	<1%	2.47E-08	<1%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.01E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	2.80E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.06E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	2.92E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.35E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.64E-10	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.03E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%
Total Cancer Risk:					8.42E-09	Hazard Index:		3.47E-06

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.2.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.33E-02	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.41E-05	96.1%	1.99E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		5.92E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		6.33E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.73E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.62E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.38E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.96E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		8.28E-03	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		5.92E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.18E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.96E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.13E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	9.08E-09	<1%	2.64E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		3.31E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.42E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	1.18E-07	<1%	6.80E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.90E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.85E-09	<1%	1.01E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	4.42E-07	3.0%	1.76E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		2.63E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		3.25E-04	<1%
Total Cancer Risk:					1.47E-05		Hazard Index:	3.34E-01

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \begin{matrix} 9.30\text{E-}04 \\ \text{(cancer)} \end{matrix} \quad \begin{matrix} 5.92\text{E-}03 \\ \text{(non-cancer)} \end{matrix}$$

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non-Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07		Hazard Index:	1.19E-01

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	9.71E-08	30.4%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		3.83E-04	2.3%
Inorganics								
Arsenic	2.95E+00	3.00E-02	1.50E+00	3.00E-04	7.21E-08	22.6%	9.35E-04	5.5%
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		6.57E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.26E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		6.87E-04	4.1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		1.82E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	6.83E-08	21.4%	9.96E-03	59.0%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	3.20E-08	10.0%	4.67E-03	27.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		9.35E-06	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.03E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		2.26E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		2.48E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	2.71E-09	<1%	7.23E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	2.52E-08	7.9%	6.72E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	2.76E-09	<1%	7.34E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		2.45E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	2.63E-10	<1%	7.01E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.14E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.02E-10	<1%	8.04E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.48E-08	4.6%	3.95E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		4.51E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		1.57E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	1.83E-09	<1%	4.88E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		3.04E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		3.61E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		5.49E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		7.94E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		2.30E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.92E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		4.51E-07	<1%
Total Cancer Risk:					3.20E-07		Hazard Index:	1.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	6.60E-09	2.6%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		9.38E-05	1.2%
Inorganics								
Arsenic	2.95E+00	1.00E+00	1.50E+00	3.00E-04	1.63E-07	64.9%	2.12E-03	26.0%
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		7.45E-05	<1%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.71E-04	2.1%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.33E-04	1.6%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		6.20E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	2.47E-08	9.8%	3.60E-03	44.1%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.16E-08	4.6%	1.69E-03	20.7%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		2.29E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		2.51E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		5.54E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		6.06E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	2.58E-09	1.0%	6.88E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	2.40E-08	9.5%	6.39E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	2.62E-09	1.0%	6.99E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		6.00E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	2.51E-10	<1%	6.67E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.45E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	2.87E-10	<1%	7.65E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.41E-08	5.6%	3.76E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		3.85E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	1.74E-09	<1%	4.65E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		7.45E-07	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		8.83E-07	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.34E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		5.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.56E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		4.03E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		2.55E-07	<1%

Total Cancer Risk: 2.52E-07 **Hazard Index:** 8.15E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.81E-20	<1%	N/A	
<i>Extractable Petroleum Hydrocarbons</i>								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
<i>Inorganics</i>								
Arsenic	2.95E+00	9.43E-05	4.30E-03	2.50E+00	5.84E-09	63.6%	3.17E-06	91.4%
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	<1%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.74E-09	29.8%	3.33E-08	<1%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	4.8%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.81E-11	<1%	5.27E-08	1.5%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	8.48E-12	<1%	2.47E-08	<1%
<i>Semivolatile Organic Compounds</i>								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.28E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	3.05E-10	3.3%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.33E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	3.19E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.65E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.79E-10	2.0%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.22E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
<i>Volatile Organic Compounds</i>								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 9.18E-09 Hazard Index: 3.47E-06

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)
 N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.2.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		9.71E-03	4.0%
Arsenic	1.01E-02	1.00E+00	1.50E+00	3.00E-04	1.12E-05	96.1%	1.45E-01	59.6%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		4.32E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		4.62E-03	1.9%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		3.45E-03	1.4%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.18E-02	4.8%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.00E-02	4.1%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.16E-03	<1%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		6.04E-03	2.5%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		4.32E-03	1.8%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.63E-04	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.16E-02	8.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		8.23E-04	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	7.23E-09	<1%	1.92E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		2.41E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.04E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	9.36E-08	<1%	4.96E-03	2.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.39E-02	5.7%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.26E-09	<1%	7.34E-05	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.51E-07	3.0%	1.28E-03	<1%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		1.92E-03	<1%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		2.37E-04	<1%

Total Cancer Risk: 1.17E-05 **Hazard Index:** 2.44E-01

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
--	---	----------------------	--------------------------

- IR-G Groundwater Ingestion Rate (L/day) 1
- EF Groundwater Ingestion Exposure Frequency (ev/yr) 92
- ED Groundwater Ingestion Exposure Duration (d/ev) 1.0
- EP Exposure Period (yr) 12
- BW Body Weight (kg) 58.4
- AP Averaging Period - Cancer (d) 25,550
- AP Averaging Period - Non-Cancer (d) 4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.2.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from BUD/TSCA (Excluding Arsenic), Sediment from Near shore Sherman Reservoir, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	5.3E-07	31.5%	Dioxin/Furan (39%), Aroclor-1254 (28%)	6.9E-02	15.8%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	3.3E-07	19.5%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	4.5E-02	10.3%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	1.7E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	4.2E-07	25.0%	Tetrahydrofuran (77%)	1.8E-01	42.0%	Thallium (22%)
Dermal Contact with Sediment	4.0E-07	23.9%	Aroclor-1254 (65%)	1.4E-01	31.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	1.4E-07			3.1E-02		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.2E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.6E-05	<1%	Cadmium (59%)
Total Risks*:	1.7E-06			4.4E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	3.1E-07	19.1%	Dioxin/Furan (39%), Aroclor-1254 (28%)	2.2E-02	7.7%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	1.1E-07	6.8%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	8.3E-03	2.9%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	3.1E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	5.7E-07	35.0%	Tetrahydrofuran (77%)	1.4E-01	47.5%	Thallium (22%)
Dermal Contact with Sediment	6.3E-07	38.9%	Aroclor-1254 (65%)	1.2E-01	41.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	4.7E-08			5.7E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.3E-05	<1%	Cadmium (59%)
Total Risks*:	1.6E-06			2.8E-01		
Future Adult Recreator						
Dermal Contact with Soil	2.5E-07	19.1%	Dioxin/Furan (39%), Aroclor-1254 (28%)	1.6E-02	7.7%	Aroclor-1254 (62%)
Incidental Ingestion of Soil	8.9E-08	6.8%	Aroclor-1254 (28%), Benzo(a)pyrene (27%)	6.0E-03	2.9%	Aroclor-1254 (60%)
Inhalation of Fugitive Dust	3.3E-09	<1%	Nickel (82%)	3.0E-07	<1%	Zinc (56%)
Ingestion of Groundwater	4.5E-07	35.0%	Tetrahydrofuran (77%)	9.9E-02	47.5%	Thallium (22%)
Dermal Contact with Sediment	5.0E-07	38.9%	Aroclor-1254 (65%)	8.7E-02	41.9%	Aroclor-1254 (55%)
Incidental Ingestion of Sediment	3.7E-08			4.2E-03		
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.0E-04	<1%	Cadmium (94%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	9.8E-06	<1%	Cadmium (59%)
Total Risks*:	1.3E-06			2.1E-01		
Child + Adolescent + Adult	4.6E-06					

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.3.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.09E-07	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		1.65E-03	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		2.83E-04	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		5.42E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		2.96E-03	4.3%
Selenium	4.57E+00	2.00E-03	N/A	5.00E-03	N/A		2.50E-05	<1%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		7.86E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	1.47E-07	27.6%	4.29E-02	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	6.90E-08	12.9%	2.01E-02	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		4.03E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		4.42E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		9.75E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		1.07E-06	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	5.85E-09	1.1%	3.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-08	10.2%	2.89E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-09	1.1%	3.16E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		1.06E-05	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-10	<1%	3.02E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	4.60E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	6.50E-10	<1%	3.46E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	3.19E-08	6.0%	1.70E-06	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		1.95E-05	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		6.78E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	3.95E-09	<1%	2.10E-06	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		1.31E-05	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		1.55E-05	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		2.36E-05	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		3.42E-08	<1%
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		9.91E-08	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		1.85E-06	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		2.55E-07	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		1.94E-06	<1%

Total Cancer Risk: 5.33E-07 **Hazard Index:** 6.88E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	2.46E-08	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		6.98E-04	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		5.54E-04	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.27E-03	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		9.93E-04	2.2%
Selenium	4.57E+00	1.00E+00	N/A	5.00E-03	N/A		1.47E-03	3.3%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		4.61E-04	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	9.17E-08	27.8%	2.68E-02	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	4.30E-08	13.1%	1.26E-02	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		1.70E-05	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		1.87E-06	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		4.12E-06	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		4.51E-07	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	9.61E-09	2.9%	5.12E-06	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	8.93E-08	27.1%	4.76E-06	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	9.75E-09	3.0%	5.20E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		4.46E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	9.32E-10	<1%	4.97E-06	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	5.40E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	1.07E-09	<1%	5.69E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	5.25E-08	15.9%	2.80E-06	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		8.22E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		2.87E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	6.49E-09	2.0%	3.46E-06	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		5.54E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		6.57E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		9.99E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		4.01E-08	<1%
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.16E-07	<1%
Carbon Disulfide	1.35E-02	1.00E+00	N/A	1.00E-01	N/A		2.17E-07	<1%
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		3.00E-08	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		1.90E-06	<1%

Total Cancer Risk: 3.29E-07 **Hazard Index:** 4.49E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)		100	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	9.05E-21	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	1.37E-09	81.9%	3.33E-08	11.2%
Selenium	4.57E+00	1.46E-04	N/A	3.00E+03	N/A		4.10E-09	1.4%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	9.04E-12	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	4.24E-12	<1%	2.47E-08	8.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	1.64E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	1.53E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	1.67E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	1.59E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	1.83E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	8.97E-11	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	1.11E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Carbon Disulfide	1.35E-02	4.32E-07	N/A	7.00E+05	N/A		5.19E-14	<1%
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 1.67E-09 **Hazard Index:** 2.97E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposur Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

**Appendix Table H.3.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.81E-02	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		8.03E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		8.59E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		6.42E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		2.19E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.87E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		4.01E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.03E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.61E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		4.01E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.53E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	6.72E-09	1.6%	3.58E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		4.49E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.93E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	8.70E-08	20.6%	9.23E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		2.58E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.11E-09	<1%	1.36E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.27E-07	77.3%	2.39E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		3.57E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		4.41E-04	<1%
Total Cancer Risk:					4.23E-07		Hazard Index:	1.83E-01

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		4.15E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		4.00E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.63E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		6.77E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.35E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.57E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		2.26E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		1.08E-02	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.86E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	2.62E-07	64.9%	7.64E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		9.93E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		1.04E-05	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		3.13E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.22E-08	3.0%	6.52E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.23E-07	30.4%	6.55E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.56E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.31E-10	<1%	5.47E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.21E-09	<1%	6.46E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.34E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		1.04E-04	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.76E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	5.38E-09	1.3%	2.87E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.36E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		8.23E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.95E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.37E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.33E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		8.68E-07	<1%
Total Cancer Risk:					4.04E-07		Hazard Index:	1.39E-01

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		1.71E-03	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		5.48E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		1.99E-03	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		6.18E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.07E-03	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		9.27E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.27E-03	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		5.88E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	5.72E-08	41.1%	1.67E-02	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.47E-05	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		1.54E-06	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		4.62E-07	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	7.04E-09	5.1%	3.75E-06	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	7.07E-08	50.9%	3.77E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		2.31E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	2.70E-10	<1%	1.12E-05	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	6.97E-10	<1%	3.71E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		9.63E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		4.25E-06	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		2.60E-06	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	3.09E-09	2.2%	1.65E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		9.68E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		3.38E-07	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		8.01E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		5.62E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		5.45E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		2.97E-07	<1%
Total Cancer Risk:					1.39E-07		Hazard Index:	3.11E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.46E-05	4.6%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.16E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		1.15E-05	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.63E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)		0.01
EF	Exposure Frequency (ev/yr)		92
ED	Exposure Duration (d/ev)		1
EP	Exposure Period (yr)		6
BW	Body Weight (kg)		15.7
AP	Averaging Period - Cancer (d)		25,550
	Averaging Period - Non- Cancer (d)		2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	1.22E-07	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		5.25E-04	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		9.01E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.72E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		9.42E-04	4.3%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		2.50E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	8.58E-08	27.6%	1.37E-02	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	4.03E-08	12.9%	6.41E-03	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		1.28E-05	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.41E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		3.10E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		3.40E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	3.41E-09	1.1%	9.91E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	3.17E-08	10.2%	9.21E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	3.46E-09	1.1%	1.01E-06	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		3.36E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	3.31E-10	<1%	9.61E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.69E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.79E-10	<1%	1.10E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.86E-08	6.0%	5.41E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		6.19E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		2.16E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	2.30E-09	<1%	6.69E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		4.17E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		7.52E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		1.09E-08	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		3.15E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		8.12E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		6.18E-07	<1%

Total Cancer Risk: 3.11E-07 **Hazard Index:** 2.19E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.10
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	8.30E-09	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		1.29E-04	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		1.02E-04	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		2.34E-04	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.83E-04	2.2%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		8.50E-05	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	3.10E-08	27.8%	4.93E-03	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.45E-08	13.1%	2.31E-03	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		3.14E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		3.44E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		7.59E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		8.31E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	3.25E-09	2.9%	9.43E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	3.02E-08	27.1%	8.76E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	3.30E-09	3.0%	9.58E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		8.22E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	3.15E-10	<1%	9.15E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.83E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	3.61E-10	<1%	1.05E-06	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.77E-08	15.9%	5.15E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.51E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		5.28E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	2.19E-09	2.0%	6.37E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		1.02E-06	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		1.21E-06	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.84E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		7.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		2.14E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.52E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		3.50E-07	<1%

Total Cancer Risk: 1.11E-07 **Hazard Index:** 8.27E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		11	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		42.6	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.11

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.66E-20	<1%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
Inorganics								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.51E-09	81.9%	3.33E-08	11.2%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.66E-11	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	7.77E-12	<1%	2.47E-08	8.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.01E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	2.80E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.06E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	2.92E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.35E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.64E-10	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.03E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 3.06E-09 **Hazard Index:** 2.97E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposur Period (yr)		11	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

Appendix Table H.3.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		1.33E-02	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		5.92E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		6.33E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		4.73E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.62E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.38E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.96E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		8.28E-03	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		5.92E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		1.18E-03	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.96E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		1.13E-03	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	9.08E-09	1.6%	2.64E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		3.31E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.42E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	1.18E-07	20.6%	6.80E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.90E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.85E-09	<1%	1.01E-04	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	4.42E-07	77.3%	1.76E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		2.63E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		3.25E-04	<1%
Total Cancer Risk:					5.71E-07		Hazard Index:	1.35E-01

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		3.56E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		3.43E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		2.26E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		5.80E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		1.16E-02	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		1.34E-03	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.93E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		9.24E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		2.45E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	4.11E-07	64.9%	6.54E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		8.50E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		8.93E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		2.68E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.92E-08	3.0%	5.58E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.93E-07	30.4%	5.61E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		1.34E-05	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.69E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.90E-09	<1%	5.53E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		2.01E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		8.87E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.51E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	8.45E-09	1.3%	2.45E-06	<1%
Volatile Organic Compounds								
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		2.02E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		7.05E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.67E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		1.17E-07	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.14E-06	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		7.44E-07	<1%
Total Cancer Risk:					6.34E-07	Hazard Index:	1.19E-01	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.14

Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		3.14E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		1.01E-04	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		6.65E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		3.66E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		1.14E-03	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.98E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.71E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		2.33E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		1.08E-04	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.93E-08	41.1%	3.07E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		2.71E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.84E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		8.52E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	2.38E-09	5.1%	6.91E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	2.39E-08	50.9%	6.94E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		4.26E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	9.11E-11	<1%	2.07E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	2.35E-10	<1%	6.84E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.78E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		7.84E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		4.79E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	1.05E-09	2.2%	3.04E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.78E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		6.23E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.48E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		1.00E-08	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		5.48E-08	<1%
Total Cancer Risk:					4.69E-08		Hazard Index:	5.74E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
	IR Ingestion Rate (mg/day)			50
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (day/ev)			1
	EP Exposure Period (yr)			11
	CF Conversion Factor (kg/mg)			0.000001
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.25E-05	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.70E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		5,657	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		11	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		42.6	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		4.25E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.34E-05

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			11
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	9.71E-08	39.2%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	1.00E-01	N/A	3.00E-02	N/A		3.83E-04	2.4%
Inorganics								
Copper	1.38E+01	6.00E-02	N/A	4.00E-02	N/A		6.57E-05	<1%
Mercury	2.38E-01	5.00E-02	N/A	3.00E-04	N/A		1.26E-04	<1%
Nickel	1.24E+01	3.50E-01	N/A	2.00E-02	N/A		6.87E-04	4.3%
Zinc	8.62E+01	2.00E-02	N/A	3.00E-01	N/A		1.82E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	1.60E-01	2.00E+00	2.00E-05	6.83E-08	27.6%	9.96E-03	62.4%
Aroclor-1260	1.84E-01	1.60E-01	2.00E+00	2.00E-05	3.20E-08	12.9%	4.67E-03	29.3%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	1.00E-01	N/A	4.00E-03	N/A		9.35E-06	<1%
Acenaphthene	1.94E-01	1.00E-01	N/A	6.00E-02	N/A		1.03E-06	<1%
Acenaphthylene	2.14E-01	1.00E-01	N/A	3.00E-02	N/A		2.26E-06	<1%
Anthracene	2.34E-01	1.00E-01	N/A	3.00E-01	N/A		2.48E-07	<1%
Benzo(a)anthracene	3.42E-01	2.00E-02	7.30E-01	3.00E-02	2.71E-09	1.1%	7.23E-07	<1%
Benzo(a)pyrene	3.17E-01	2.00E-02	7.30E+00	3.00E-02	2.52E-08	10.2%	6.72E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.00E-02	7.30E-01	3.00E-02	2.76E-09	1.1%	7.34E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	1.00E-01	N/A	3.00E-02	N/A		2.45E-06	<1%
Benzo(k)fluoranthene	3.31E-01	2.00E-02	7.30E-02	3.00E-02	2.63E-10	<1%	7.01E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	2.14E-09	<1%	N/A	
Chrysene	3.80E-01	2.00E-02	7.30E-02	3.00E-02	3.02E-10	<1%	8.04E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.00E-02	7.30E+00	3.00E-02	1.48E-08	6.0%	3.95E-07	<1%
Fluoranthene	5.69E-01	1.00E-01	N/A	4.00E-02	N/A		4.51E-06	<1%
Fluorene	1.98E-01	1.00E-01	N/A	4.00E-02	N/A		1.57E-06	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.00E-02	7.30E-01	3.00E-02	1.83E-09	<1%	4.88E-07	<1%
Naphthalene	1.92E-01	1.00E-01	N/A	2.00E-02	N/A		3.04E-06	<1%
Phenanthrene	3.41E-01	1.00E-01	N/A	3.00E-02	N/A		3.61E-06	<1%
Pyrene	5.19E-01	1.00E-01	N/A	3.00E-02	N/A		5.49E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E-01	N/A	6.00E-01	N/A		7.94E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E-01	N/A	9.00E-01	N/A		2.30E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		5.92E-08	<1%
Toluene	9.47E-02	1.20E-01	N/A	8.00E-02	N/A		4.51E-07	<1%

Total Cancer Risk: 2.47E-07 **Hazard Index:** 1.60E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Dioxin/Furans								
Dioxin/Furan TEQ	1.19E-06	1.00E+00	1.50E+05	N/A	6.60E-09	7.5%	N/A	
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	3.62E+01	3.60E-01	N/A	3.00E-02	N/A		9.38E-05	1.6%
Inorganics								
Copper	1.38E+01	1.00E+00	N/A	4.00E-02	N/A		7.45E-05	1.2%
Mercury	2.38E-01	1.00E+00	N/A	3.00E-04	N/A		1.71E-04	2.8%
Nickel	1.24E+01	1.00E+00	N/A	2.00E-02	N/A		1.33E-04	2.2%
Zinc	8.62E+01	1.00E+00	N/A	3.00E-01	N/A		6.20E-05	1.0%
Polychlorinated Biphenyls								
Aroclor-1254	3.92E-01	8.50E-01	2.00E+00	2.00E-05	2.47E-08	27.8%	3.60E-03	59.7%
Aroclor-1260	1.84E-01	8.50E-01	2.00E+00	2.00E-05	1.16E-08	13.1%	1.69E-03	28.0%
Semivolatile Organic Compounds								
1-Methylnaphthalene	1.18E-01	3.60E-01	N/A	4.00E-03	N/A		2.29E-06	<1%
Acenaphthene	1.94E-01	3.60E-01	N/A	6.00E-02	N/A		2.51E-07	<1%
Acenaphthylene	2.14E-01	3.60E-01	N/A	3.00E-02	N/A		5.54E-07	<1%
Anthracene	2.34E-01	3.60E-01	N/A	3.00E-01	N/A		6.06E-08	<1%
Benzo(a)anthracene	3.42E-01	2.80E-01	7.30E-01	3.00E-02	2.58E-09	2.9%	6.88E-07	<1%
Benzo(a)pyrene	3.17E-01	2.80E-01	7.30E+00	3.00E-02	2.40E-08	27.1%	6.39E-07	<1%
Benzo(b)fluoranthene	3.47E-01	2.80E-01	7.30E-01	3.00E-02	2.62E-09	3.0%	6.99E-07	<1%
Benzo(g,h,i)perylene	2.32E-01	3.60E-01	N/A	3.00E-02	N/A		6.00E-07	<1%
Benzo(k)fluoranthene	3.31E-01	2.80E-01	7.30E-02	3.00E-02	2.51E-10	<1%	6.67E-07	<1%
Carbazole	1.96E-01	1.00E+00	2.00E-02	N/A	1.45E-10	<1%	N/A	
Chrysene	3.80E-01	2.80E-01	7.30E-02	3.00E-02	2.87E-10	<1%	7.65E-07	<1%
Dibenzo(a,h)anthracene	1.87E-01	2.80E-01	7.30E+00	3.00E-02	1.41E-08	15.9%	3.76E-07	<1%
Fluoranthene	5.69E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-06	<1%
Fluorene	1.98E-01	3.60E-01	N/A	4.00E-02	N/A		3.85E-07	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	2.80E-01	7.30E-01	3.00E-02	1.74E-09	2.0%	4.65E-07	<1%
Naphthalene	1.92E-01	3.60E-01	N/A	2.00E-02	N/A		7.45E-07	<1%
Phenanthrene	3.41E-01	3.60E-01	N/A	3.00E-02	N/A		8.83E-07	<1%
Pyrene	5.19E-01	3.60E-01	N/A	3.00E-02	N/A		1.34E-06	<1%
Volatile Organic Compounds								
2-Butanone	1.50E-02	1.00E+00	N/A	6.00E-01	N/A		5.40E-09	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	1.00E+00	N/A	9.00E-01	N/A		1.56E-08	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.00E+00	N/A	3.00E-01	N/A		4.03E-09	<1%
Toluene	9.47E-02	1.00E+00	N/A	8.00E-02	N/A		2.55E-07	<1%

Total Cancer Risk: 8.86E-08 **Hazard Index:** 6.03E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
	IR Ingestion Rate (mg/day)		50	
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (day/ev)		1	
	EP Exposure Period (yr)		12	
	CF Conversion Factor (kg/mg)		0.000001	
	BW Body Weight (kg)		58.4	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from YAEC BUD/TSCA

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC (µg/m ³)	Unit Risk (m ³ /µg)	Reference Concentration (RfC) (µg/m ³)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
<i>Dioxin/Furans</i>								
Dioxin/Furan TEQ	1.19E-06	3.81E-11	3.30E-08	N/A	1.81E-20	<1%	N/A	
<i>Extractable Petroleum Hydrocarbons</i>								
Adjusted C11-C22 Aromatics	3.62E+01	1.16E-03	N/A	5.00E+04	N/A		1.95E-09	<1%
<i>Inorganics</i>								
Copper	1.38E+01	4.42E-04	N/A	3.00E+03	N/A		1.24E-08	4.2%
Mercury	2.38E-01	7.60E-06	N/A	3.00E+02	N/A		2.13E-09	<1%
Nickel	1.24E+01	3.96E-04	4.80E-04	1.00E+03	2.74E-09	81.9%	3.33E-08	11.2%
Zinc	8.62E+01	2.76E-03	N/A	1.40E+03	N/A		1.66E-07	55.7%
<i>Polychlorinated Biphenyls</i>								
Aroclor-1254	3.92E-01	1.26E-05	1.00E-04	2.00E+01	1.81E-11	<1%	5.27E-08	17.7%
Aroclor-1260	1.84E-01	5.89E-06	1.00E-04	2.00E+01	8.48E-12	<1%	2.47E-08	8.3%
<i>Semivolatile Organic Compounds</i>								
1-Methylnaphthalene	1.18E-01	3.77E-06	N/A	5.00E+04	N/A		6.34E-12	<1%
Acenaphthene	1.94E-01	6.20E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Acenaphthylene	2.14E-01	6.85E-06	N/A	5.00E+04	N/A		1.15E-11	<1%
Anthracene	2.34E-01	7.49E-06	N/A	5.00E+04	N/A		1.26E-11	<1%
Benzo(a)anthracene	3.42E-01	1.09E-05	2.09E-04	5.00E+04	3.28E-11	<1%	1.84E-11	<1%
Benzo(a)pyrene	3.17E-01	1.02E-05	2.09E-03	5.00E+04	3.05E-10	9.1%	1.71E-11	<1%
Benzo(b)fluoranthene	3.47E-01	1.11E-05	2.09E-04	5.00E+04	3.33E-11	<1%	1.86E-11	<1%
Benzo(g,h,i)perylene	2.32E-01	7.41E-06	N/A	5.00E+04	N/A		1.25E-11	<1%
Benzo(k)fluoranthene	3.31E-01	1.06E-05	2.09E-05	5.00E+04	3.19E-12	<1%	1.78E-11	<1%
Carbazole	1.96E-01	6.28E-06	N/A	N/A	N/A		N/A	
Chrysene	3.80E-01	1.22E-05	2.09E-05	5.00E+04	3.65E-12	<1%	2.04E-11	<1%
Dibenzo(a,h)anthracene	1.87E-01	5.97E-06	2.09E-03	5.00E+04	1.79E-10	5.4%	1.00E-11	<1%
Fluoranthene	5.69E-01	1.82E-05	N/A	5.00E+04	N/A		3.06E-11	<1%
Fluorene	1.98E-01	6.35E-06	N/A	5.00E+04	N/A		1.07E-11	<1%
Indeno(1,2,3-cd)pyrene	2.31E-01	7.38E-06	2.09E-04	5.00E+04	2.22E-11	<1%	1.24E-11	<1%
Naphthalene	1.92E-01	6.14E-06	N/A	3.00E+03	N/A		1.72E-10	<1%
Phenanthrene	3.41E-01	1.09E-05	N/A	5.00E+04	N/A		1.83E-11	<1%
Pyrene	5.19E-01	1.66E-05	N/A	5.00E+04	N/A		2.79E-11	<1%
<i>Volatile Organic Compounds</i>								
2-Butanone	1.50E-02	4.80E-07	N/A	5.00E+06	N/A		8.07E-15	<1%
4-Methyl-2-Pentanone								
Acetone	6.52E-02	2.09E-06	N/A	8.00E+05	N/A		2.19E-13	<1%
Dichlorodifluoromethane								
Trichlorofluoromethane	5.60E-03	1.79E-07	N/A	7.00E+05	N/A		2.15E-14	<1%
Toluene	9.47E-02	3.03E-06	N/A	5.00E+06	N/A		5.09E-14	<1%

Total Cancer Risk: 3.34E-09 Hazard Index: 2.97E-07

Notes

Intake Factor (IF) =	$\frac{EF \times ED \times EP \times CF}{AP}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air (ug/m ³)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 µg/m³) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

EPC_{dust} = EPC_{soil} * PM₁₀ * 10⁻⁶ kg/mg

ADE = EPC_{dust} * IF

Appendix Table H.3.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from YAEC BUD/TSCA

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	9.00E-04	1.00E+00	N/A	4.00E-04	N/A		9.71E-03	9.9%
Beryllium	2.00E-04	1.00E+00	N/A	2.00E-03	N/A		4.32E-04	<1%
Boron	2.14E-01	1.00E+00	N/A	2.00E-01	N/A		4.62E-03	4.7%
Cadmium	4.00E-04	1.00E+00	N/A	5.00E-04	N/A		3.45E-03	3.5%
Chromium	8.20E-03	1.00E+00	N/A	3.00E-03	N/A		1.18E-02	12.0%
Copper	9.30E-02	1.00E+00	N/A	4.00E-02	N/A		1.00E-02	10.2%
Mercury	1.50E-04	1.00E+00	N/A	3.00E-04	N/A		2.16E-03	2.2%
Nickel	2.80E-02	1.00E+00	N/A	2.00E-02	N/A		6.04E-03	6.1%
Selenium	5.00E-03	1.00E+00	N/A	5.00E-03	N/A		4.32E-03	4.4%
Silver	1.00E-03	1.00E+00	N/A	5.00E-03	N/A		8.63E-04	<1%
Thallium	4.00E-04	1.00E+00	N/A	8.00E-05	N/A		2.16E-02	21.9%
Zinc	5.72E-02	1.00E+00	N/A	3.00E-01	N/A		8.23E-04	<1%
Semivolatile Organic Compounds								
Benzo(k)fluoranthene	1.47E-04	9.10E-01	7.30E-02	3.00E-02	7.23E-09	1.6%	1.92E-05	<1%
Volatile Organic Compounds								
1,1-Dichloroethane	4.30E-03	1.30E+00	N/A	1.00E-01	N/A		2.41E-04	<1%
1,1-Dichloroethene	1.20E-03	1.00E+00	N/A	5.00E-02	N/A		1.04E-04	<1%
1,4-Dioxane	1.15E-02	1.00E+00	1.10E-02	1.00E-02	9.36E-08	20.6%	4.96E-03	5.0%
Acetone	2.89E+00	1.00E+00	N/A	9.00E-01	N/A		1.39E-02	14.1%
Methyl-t-butyl ether	1.70E-03	1.00E+00	1.80E-03	1.00E-01	2.26E-09	<1%	7.34E-05	<1%
Tetrahydrofuran	6.25E-02	1.00E+00	7.60E-03	2.10E-01	3.51E-07	77.3%	1.28E-03	1.3%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	1.78E-02	1.00E+00	N/A	4.00E-02	N/A		1.92E-03	1.9%
Adjusted C9-C12 Aliphatics	5.49E-03	1.00E+00	N/A	1.00E-01	N/A		2.37E-04	<1%
Total Cancer Risk:					4.55E-07		Hazard Index:	9.85E-02

Notes

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED} \times \text{EP}}{\text{BW} \times \text{AP}} = \begin{matrix} 7.40\text{E-}04 \\ \text{(cancer)} \end{matrix} \quad \begin{matrix} 4.32\text{E-}03 \\ \text{(non-cancer)} \end{matrix}$$

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	12
BW	Body Weight (kg)	58.4
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,380

N/A - Not available
Blank - Not a COPC for this Study Area
ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E-01	N/A	4.00E-04	N/A		2.59E-03	3.0%
Beryllium	6.83E-01	3.00E-02	N/A	2.00E-03	N/A		2.50E-04	<1%
Boron	4.49E+00	3.00E-02	N/A	2.00E-01	N/A		1.65E-05	<1%
Cadmium	6.19E-01	1.40E-01	N/A	5.00E-04	N/A		4.23E-03	4.9%
Chromium	1.16E+01	9.00E-02	N/A	3.00E-03	N/A		8.47E-03	9.7%
Copper	2.68E+01	6.00E-02	N/A	4.00E-02	N/A		9.81E-04	1.1%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.41E-02	16.2%
Nickel	1.58E+01	3.50E-01	N/A	2.00E-02	N/A		6.74E-03	7.8%
Zinc	1.10E+02	2.00E-02	N/A	3.00E-01	N/A		1.79E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	1.60E-01	2.00E+00	2.00E-05	3.27E-07	64.9%	4.77E-02	54.9%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	1.00E-01	N/A	1.00E-03	N/A		6.20E-05	<1%
Acenaphthene	1.60E-01	1.00E-01	N/A	6.00E-02	N/A		6.51E-06	<1%
Anthracene	2.40E-01	1.00E-01	N/A	3.00E-01	N/A		1.95E-06	<1%
Benzo(a)anthracene	2.50E-01	2.00E-02	7.30E-01	3.00E-02	1.53E-08	3.0%	4.07E-06	<1%
Benzo(a)pyrene	2.51E-01	2.00E-02	7.30E+00	3.00E-02	1.54E-07	30.4%	4.09E-06	<1%
Benzo(g,h,i)perylene	1.20E-01	1.00E-01	N/A	3.00E-02	N/A		9.77E-06	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	2.00E-02	1.40E-02	2.00E-02	1.64E-10	<1%	3.42E-06	<1%
Chrysene	2.48E-01	2.00E-02	7.30E-02	3.00E-02	1.51E-09	<1%	4.03E-06	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.46E-03	1.7%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		6.47E-05	<1%
Fluorene	1.80E-01	1.00E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.00E-02	7.30E-01	3.00E-02	6.72E-09	1.3%	1.79E-06	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.47E-06	<1%
1,1-Dichloroethene	1.05E-02	1.00E-01	N/A	5.00E-02	N/A		5.14E-07	<1%
2-Butanone	2.99E-02	1.00E-01	N/A	6.00E-01	N/A		1.22E-07	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E-01	N/A	8.00E-02	N/A		8.55E-08	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		8.28E-07	<1%
Toluene	1.48E-02	1.20E-01	N/A	8.00E-02	N/A		5.42E-07	<1%
Total Cancer Risk:					5.04E-07		Hazard Index:	8.69E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Near shore Sherman Reservoir

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.25E-01	1.00E+00	N/A	4.00E-04	N/A		2.29E-04	5.5%
Beryllium	6.83E-01	1.00E+00	N/A	2.00E-03	N/A		7.37E-05	1.8%
Boron	4.49E+00	1.00E+00	N/A	2.00E-01	N/A		4.85E-06	<1%
Cadmium	6.19E-01	1.00E+00	N/A	5.00E-04	N/A		2.67E-04	6.4%
Chromium	1.16E+01	1.00E+00	N/A	3.00E-03	N/A		8.31E-04	19.9%
Copper	2.68E+01	1.00E+00	N/A	4.00E-02	N/A		1.44E-04	3.5%
Lithium	1.15E+01	1.00E+00	N/A	2.00E-02	N/A		1.25E-04	3.0%
Nickel	1.58E+01	1.00E+00	N/A	2.00E-02	N/A		1.70E-04	4.1%
Zinc	1.10E+02	1.00E+00	N/A	3.00E-01	N/A		7.90E-05	1.9%
Polychlorinated Biphenyls								
Aroclor-1254	2.44E-01	8.50E-01	2.00E+00	2.00E-05	1.54E-08	41.1%	2.24E-03	53.5%
Semivolatile Organic Compounds								
2,6-Dinitrotoluene	2.54E-02	3.60E-01	N/A	1.00E-03	N/A		1.97E-06	<1%
Acenaphthene	1.60E-01	3.60E-01	N/A	6.00E-02	N/A		2.07E-07	<1%
Anthracene	2.40E-01	3.60E-01	N/A	3.00E-01	N/A		6.22E-08	<1%
Benzo(a)anthracene	2.50E-01	2.80E-01	7.30E-01	3.00E-02	1.89E-09	5.1%	5.04E-07	<1%
Benzo(a)pyrene	2.51E-01	2.80E-01	7.30E+00	3.00E-02	1.90E-08	50.9%	5.06E-07	<1%
Benzo(g,h,i)perylene	1.20E-01	3.60E-01	N/A	3.00E-02	N/A		3.11E-07	<1%
bis(2-Ethylhexyl)phthalate	1.40E-01	1.00E+00	1.40E-02	2.00E-02	7.25E-11	<1%	1.51E-06	<1%
Chrysene	2.48E-01	2.80E-01	7.30E-02	3.00E-02	1.87E-10	<1%	4.99E-07	<1%
Dibenzofuran	1.20E-01	1.00E+00	N/A	2.00E-03	N/A		1.29E-05	<1%
Di-n-octyl phthalate	2.65E-01	1.00E+00	N/A	1.00E-01	N/A		5.72E-07	<1%
Fluorene	1.80E-01	3.60E-01	N/A	4.00E-02	N/A		3.50E-07	<1%
Indeno(1,2,3-cd)pyrene	1.10E-01	2.80E-01	7.30E-01	3.00E-02	8.32E-10	2.2%	2.22E-07	<1%
1,2,4-Trimethylbenzene	3.01E-03	1.00E+00	N/A	5.00E-02	N/A		1.30E-08	<1%
1,1-Dichloroethene	1.05E-02	1.00E+00	N/A	5.00E-02	N/A		4.55E-08	<1%
2-Butanone	2.99E-02	1.00E+00	N/A	6.00E-01	N/A		1.08E-08	<1%
4-Methyl-2-Pentanone	2.80E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-09	<1%
Carbon Disulfide	3.39E-03	1.00E+00	N/A	1.00E-01	N/A		7.32E-09	<1%
Toluene	1.48E-02	1.00E+00	N/A	8.00E-02	N/A		4.00E-08	<1%
Total Cancer Risk:					3.73E-08		Hazard Index:	4.19E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	94.3%
Zinc	2.15E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		9.14E-06	4.6%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.97E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.3.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	9.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	59.0%
Zinc	2.15E-02	1.00E+00	N/A	3.00E-01	N/A		3.10E-06	31.8%
Total Cancer Risk:					0.00E+00		Hazard Index:	9.75E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1

**Chemical Total Excess Lifetime Cancer and Non-Cancer Risk by Receptor and Pathway for Future Recreational Use
Yankee Nuclear Power Station, Rowe, MA**

Exposed to Surface Soils (0-3 ft bgs) and Groundwater from TransCanada Property, Sediment from TransCanada West Storm Drain, and Surface Water from Sherman Reservoir

Receptor/Exposure Pathway	COPC Contributing Majority of Risks by Receptor & Pathway			COPC Contributing Majority of Risks by Receptor & Pathway		
	Cancer Risks	Percent Contribution		Non Cancer Risks	Percent Contribution	
Future Child Recreator						
Dermal Contact with Soil	1.3E-07	7.3%	Benzo(a)pyrene (46%)	1.3E-02	9.1%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	1.9E-07			7.9E-03		
Inhalation of Fugitive Dust	2.3E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	8.2E-03	5.8%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	9.9E-07	55.6%	Benzo(a)pyrene (35%)	9.4E-02	67.0%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	6.6E-07	36.9%	Arsenic (44%), Benzo(a)pyrene (30%)	2.5E-02	17.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	3.1E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	3.3E-05	<1%	Cadmium (65%)
Total Risks*:	1.8E-06			1.4E-01		
Future Adolescent Recreator						
Dermal Contact with Soil	7.6E-08	4.1%	Benzo(a)pyrene (46%)	4.0E-03	4.3%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	6.4E-08			1.5E-03		
Inhalation of Fugitive Dust	4.2E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	6.0E-03	6.3%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	1.5E-06	83.7%	Benzo(a)pyrene (35%)	8.0E-02	84.3%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	2.2E-07	12.0%	Arsenic (44%), Benzo(a)pyrene (30%)	4.6E-03	4.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	2.7E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	1.2E-05	<1%	Cadmium (65%)
Total Risks*:	1.9E-06			9.5E-02		
Future Adult Recreator						
Dermal Contact with Soil	6.0E-08	4.1%	Benzo(a)pyrene (46%)	2.9E-03	4.3%	Nickel (34%), C11-C22 Aromatic (27%), Aroclor-1254 (25%)
Incidental Ingestion of Soil	5.1E-08			1.1E-03		
Inhalation of Fugitive Dust	4.6E-09	<1%	Nickel (86%)	2.0E-07	<1%	Zinc (61%)
Ingestion of Groundwater	0.0E+00		No carcinogenic COCs detected	4.4E-03	6.3%	C9-C10 Aromatics (48%)
Dermal Contact with Sediment	1.2E-06	83.6%	Benzo(a)pyrene (35%)	5.8E-02	84.3%	Aroclor-1254 (47%)
Incidental Ingestion of Sediment	1.8E-07	12.0%	Arsenic (44%), Benzo(a)pyrene (30%)	3.3E-03	4.8%	Aroclor-1254 (38%), Arsenic (30%)
Dermal Contact with Surface Water	0.0E+00		No carcinogenic COCs detected	1.9E-04	<1%	Cadmium (96%)
Incidental Ingestion of Surface Water	0.0E+00		No carcinogenic COCs detected	8.8E-06	<1%	Cadmium (65%)
Total Risks*:	1.5E-06			6.9E-02		
Child + Adolescent + Adult 5.1E-06						

*Total risks were calculated by summing the higher of the soil or sediment incidental ingestion risks and risks from all other pathways.

Percent contribution of pathways not used to calculate the total risks are presented as blanks.

Appendix Table H.4.1.1
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		3.41E-03	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		3.47E-04	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		4.27E-03	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		2.02E-05	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		5.70E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	1.08E-08	8.3%	3.15E-03	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	4.46E-09	3.4%	1.30E-03	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		3.86E-06	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		8.79E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		9.67E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	7.51E-09	5.8%	4.00E-06	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	5.97E-08	46.0%	3.18E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	6.71E-09	5.2%	3.57E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		1.20E-05	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	6.10E-10	<1%	3.25E-06	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		1.50E-05	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	4.64E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	7.60E-10	<1%	4.05E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	3.00E-08	23.1%	1.60E-06	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		2.61E-05	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		5.13E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	4.57E-09	3.5%	2.44E-06	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		1.57E-05	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		3.09E-05	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		6.36E-07	<1%
Total Cancer Risk:					1.30E-07		Hazard Index:	1.27E-02

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.17E-06 (cancer)	1.37E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2,434	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.35	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.2
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		1.44E-03	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		6.78E-04	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		1.43E-03	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		1.19E-03	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		3.35E-04	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	6.74E-09	3.5%	1.97E-03	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	2.78E-09	1.5%	8.11E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		1.63E-06	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		3.72E-06	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		4.09E-07	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	1.23E-08	6.5%	6.57E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	9.81E-08	51.5%	5.23E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	1.10E-08	5.8%	5.87E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		5.06E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	1.00E-09	<1%	5.34E-06	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		1.76E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	5.45E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	1.25E-09	<1%	6.66E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	4.93E-08	25.9%	2.63E-06	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		1.10E-05	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		2.17E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	7.51E-09	3.9%	4.00E-06	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		6.62E-06	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		1.31E-05	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		6.22E-07	<1%
Total Cancer Risk:					1.91E-07		Hazard Index:	7.93E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.3
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE/RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	1.97E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	6.64E-13	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	2.74E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	2.11E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	1.68E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	1.88E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	1.71E-12	<1%	1.92E-11	<1%
Butyl benzyl phthalate	2.20E-01	7.03E-06	N/A	N/A	N/A		N/A	
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	2.14E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	8.43E-11	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	1.28E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%

Total Cancer Risk: 2.28E-09 **Hazard Index:** 1.96E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	7.20E-03 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		6	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.4.1.4
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		3.13E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		7.22E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		6.26E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		3.61E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.40E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		1.22E-03	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		3.87E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.78E-03	21.9%
Total Cancer Risk:					0.00E+00		Hazard Index:	8.15E-03

Notes

Intake Factor (IF) =	$\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	6.88E-04 (cancer)	8.03E-03 (non-cancer)
----------------------	---	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	0.5
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1
EP	Exposure Period (yr)	6
BW	Body Weight (kg)	15.7
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.5
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		4.74E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	2.11E-07	21.4%	5.47E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		2.62E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		1.42E-03	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.80E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		3.11E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	1.50E-07	15.2%	4.37E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	3.71E-08	3.8%	1.08E-02	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		2.07E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		4.61E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	3.78E-08	3.8%	2.01E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	3.46E-07	35.0%	1.84E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	3.32E-08	3.4%	1.77E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		5.59E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	2.84E-09	<1%	1.51E-05	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	1.65E-10	<1%	6.86E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	2.45E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	3.61E-09	<1%	1.92E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.20E-07	12.2%	6.41E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		5.67E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		1.55E-04	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		3.24E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	2.04E-08	2.1%	1.09E-05	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		4.32E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.81E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		1.53E-04	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	2.76E-12	<1%	7.16E-08	<1%
Total Cancer Risk:					9.87E-07		Hazard Index:	9.35E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	3.35E-06 (cancer)	3.91E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		2434	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		6	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		15.7	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.6
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA

Child Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		1.95E-03	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	2.89E-07	44.1%	7.49E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		7.67E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		9.74E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		7.39E-04	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		6.39E-04	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	3.27E-08	5.0%	9.54E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	8.09E-09	1.2%	2.36E-03	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		3.06E-06	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		6.81E-07	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	2.18E-08	3.3%	1.16E-05	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	1.99E-07	30.3%	1.06E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	1.91E-08	2.9%	1.02E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		8.27E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	1.63E-09	<1%	8.71E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	3.38E-10	<1%	1.41E-05	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	1.01E-09	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	2.08E-09	<1%	1.11E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	6.93E-08	10.6%	3.69E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		2.33E-04	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		2.29E-05	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		4.80E-06	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	1.17E-08	1.8%	6.26E-06	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		6.39E-06	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		2.68E-05	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		2.27E-05	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	1.14E-12	<1%	2.94E-08	<1%
Total Cancer Risk:					6.56E-07		Hazard Index:	2.49E-02

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	1.38E-07 (cancer)	1.61E-06 (non-cancer)
IR	Ingestion Rate (mg/day)			100
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			6
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.7

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
<i>Inorganics</i>										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		3.26E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.98E-04	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		1.03E-05	3.3%
Total Cancer Risk:							0.00E+00		Hazard Index:	3.11E-04

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.34E-02 (cancer)	1.56E-01 (non-cancer)
	SA	Surface Area Exposed to Surface Water (cm ²)		2,434	
	EF	Exposure Frequency (ev/yr)		92	
	ED	Exposure Duration (hr/ev)		4	
	EP	Exposure Period (yr)		6	
	CF	Conversion Factor (L/cm ³)		0.001	
	BW	Body Weight (kg)		15.7	
	AP	Averaging Period - Cancer (d)		25,550	
		Averaging Period - Non- Cancer (d)		2,190	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.8

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Child Recreator
Yankee Nuclear Power Station, Rowe, MA**

Child Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		3.34E-06	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		2.14E-05	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		8.09E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	3.28E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	1.38E-05 (cancer)	1.61E-04 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			6
BW	Body Weight (kg)			15.7
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			2,190

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.9
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		1.08E-03	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		1.10E-04	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		1.36E-03	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		6.43E-06	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		1.81E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	6.30E-09	8.3%	1.00E-03	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	2.60E-09	3.4%	4.14E-04	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		1.23E-06	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		2.80E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		3.08E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	4.38E-09	5.8%	1.27E-06	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	3.48E-08	46.0%	1.01E-06	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	3.91E-09	5.2%	1.14E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		3.81E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	3.56E-10	<1%	1.03E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	2.71E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	4.44E-10	<1%	1.29E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	1.75E-08	23.1%	5.09E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		8.31E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		1.63E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	2.67E-09	3.5%	7.75E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		4.98E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		9.83E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		2.02E-07	<1%
Total Cancer Risk:					7.57E-08		Hazard Index:	4.04E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	6.84E-07 (cancer)	4.35E-06 (non-cancer)
----------------------	---	---	-------------------	-----------------------

SA	Surface Area Exposed to Soil (cm ² /day)	5,657
AF	Soil Skin Adherence Factor (mg/cm ²)	0.13
EF	Exposure Frequency (ev/yr)	92
ED	Exposure Duration (day/ev)	1
EP	Exposure Period (yr)	11
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.10

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		2.65E-04	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		1.25E-04	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		2.64E-04	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		2.19E-04	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		6.17E-05	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	2.28E-09	3.5%	3.62E-04	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	9.40E-10	1.5%	1.50E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		3.01E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		6.85E-07	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		7.53E-08	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	4.17E-09	6.5%	1.21E-06	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	3.31E-08	51.5%	9.63E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	3.72E-09	5.8%	1.08E-06	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		9.33E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	3.39E-10	<1%	9.85E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	1.84E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	4.22E-10	<1%	1.23E-06	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	1.67E-08	25.9%	4.84E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		2.03E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		3.99E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	2.54E-09	3.9%	7.38E-07	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		1.22E-06	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		2.41E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		1.15E-07	<1%
Total Cancer Risk:					6.44E-08		Hazard Index:	1.46E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)		50	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.11
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	3.61E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	1.22E-12	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	5.02E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	3.87E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	3.07E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	3.45E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	3.14E-12	<1%	1.92E-11	<1%
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	3.92E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	1.54E-10	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	2.35E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%
Total Cancer Risk:					4.18E-09	Hazard Index:		1.96E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.32E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (hr/ev)			8
	EP Exposure Period (yr)			11
	CF Conversion factor (d/hr)			0.042
	AP Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)			3.2E+01

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.4.1.12
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		2.31E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		5.33E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		4.62E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		2.66E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		1.04E-04	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		9.02E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.85E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		1.31E-03	21.9%
Total Cancer Risk:					0.00E+00		Hazard Index:	6.01E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-04 (cancer)	5.92E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	11
BW	Body Weight (kg)	42.6
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.13
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		4.06E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	3.31E-07	21.4%	4.69E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		2.24E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		1.22E-03	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.54E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		2.66E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	2.35E-07	15.2%	3.74E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	5.82E-08	3.8%	9.27E-03	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		1.77E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		3.95E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	5.94E-08	3.8%	1.73E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	5.43E-07	35.0%	1.58E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	5.22E-08	3.4%	1.52E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		4.79E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	4.46E-09	<1%	1.30E-05	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	2.58E-10	<1%	5.87E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.84E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	5.67E-09	<1%	1.65E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.89E-07	12.2%	5.49E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		4.86E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		1.33E-04	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		2.78E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	3.21E-08	2.1%	9.32E-06	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		3.70E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.55E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		1.31E-04	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	4.34E-12	<1%	6.14E-08	<1%

Total Cancer Risk: 1.55E-06 **Hazard Index:** 8.01E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	5.26E-06 (cancer)	3.35E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		11	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		42.6	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.14
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA

Adolescent Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		3.59E-04	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	9.77E-08	44.1%	1.38E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		1.41E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		1.79E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.36E-04	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		1.18E-04	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	1.11E-08	5.0%	1.76E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	2.73E-09	1.2%	4.35E-04	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		5.65E-07	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		1.26E-07	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	7.35E-09	3.3%	2.14E-06	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	6.71E-08	30.3%	1.95E-06	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	6.45E-09	2.9%	1.88E-06	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		1.52E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	5.52E-10	<1%	1.60E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	1.14E-10	<1%	2.60E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.40E-10	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	7.02E-10	<1%	2.04E-06	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	2.34E-08	10.6%	6.80E-07	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		4.30E-05	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		4.22E-06	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		8.84E-07	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	3.97E-09	1.8%	1.15E-06	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		1.18E-06	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		4.94E-06	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		4.18E-06	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	3.84E-13	<1%	5.42E-09	<1%
Total Cancer Risk:					2.21E-07		Hazard Index:	4.58E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	4.65E-08 (cancer)	2.96E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			11
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			42.6
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.15

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.79E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		2.55E-04	95.7%
Thallium										
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		8.80E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	2.67E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	2.10E-02 (cancer)	1.34E-01 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			11	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			42.6	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,015	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

**Appendix Table H.4.1.16
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adolescent Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adolescent Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		1.23E-06	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		7.89E-06	65.2%
Thallium								
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		2.98E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	1.21E-05

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP}{BW \times AP}$	=	9.30E-06 (cancer)	5.92E-05 (non-cancer)
	IR Ingestion Rate (L/d)			0.01
	EF Exposure Frequency (ev/yr)			92
	ED Exposure Duration (d/ev)			1
	EP Exposure Period (yr)			11
	BW Body Weight (kg)			42.6
	AP Averaging Period - Cancer (d)			25,550
	AP Averaging Period - Non- Cancer (d)			4,015

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.17
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	1.00E-01	N/A	3.00E-02	N/A		7.91E-04	26.9%
Inorganics								
Copper	1.69E+01	6.00E-02	N/A	4.00E-02	N/A		8.05E-05	2.7%
Nickel	1.78E+01	3.50E-01	N/A	2.00E-02	N/A		9.90E-04	33.6%
Selenium	3.70E+00	2.00E-03	N/A	5.00E-03	N/A		4.69E-06	<1%
Zinc	6.25E+01	2.00E-02	N/A	3.00E-01	N/A		1.32E-05	<1%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	1.60E-01	2.00E+00	2.00E-05	5.02E-09	8.3%	7.32E-04	24.8%
Aroclor-1260	1.19E-02	1.60E-01	2.00E+00	2.00E-05	2.07E-09	3.4%	3.02E-04	10.3%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	1.00E-01	N/A	6.00E-02	N/A		8.97E-07	<1%
Acenaphthylene	1.93E-01	1.00E-01	N/A	3.00E-02	N/A		2.04E-06	<1%
Anthracene	2.12E-01	1.00E-01	N/A	3.00E-01	N/A		2.24E-07	<1%
Benzo(a)anthracene	4.39E-01	2.00E-02	7.30E-01	3.00E-02	3.49E-09	5.8%	9.28E-07	<1%
Benzo(a)pyrene	3.49E-01	2.00E-02	7.30E+00	3.00E-02	2.77E-08	46.0%	7.38E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.00E-02	7.30E-01	3.00E-02	3.11E-09	5.2%	8.29E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	1.00E-01	N/A	3.00E-02	N/A		2.78E-06	<1%
Benzo(k)fluoranthene	3.57E-01	2.00E-02	7.30E-02	3.00E-02	2.83E-10	<1%	7.55E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		3.48E-06	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	2.15E-09	3.6%	N/A	
Chrysene	4.44E-01	2.00E-02	7.30E-02	3.00E-02	3.53E-10	<1%	9.40E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.00E-02	7.30E+00	3.00E-02	1.39E-08	23.1%	3.71E-07	<1%
Fluoranthene	7.64E-01	1.00E-01	N/A	4.00E-02	N/A		6.06E-06	<1%
Fluorene	1.50E-01	1.00E-01	N/A	4.00E-02	N/A		1.19E-06	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.00E-02	7.30E-01	3.00E-02	2.12E-09	3.5%	5.65E-07	<1%
Phenanthrene	3.44E-01	1.00E-01	N/A	3.00E-02	N/A		3.63E-06	<1%
Pyrene	6.78E-01	1.00E-01	N/A	3.00E-02	N/A		7.17E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.20E-01	N/A	8.00E-02	N/A		1.48E-07	<1%
Total Cancer Risk:					6.02E-08		Hazard Index:	2.95E-03

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$	=	5.44E-07 (cancer)	3.17E-06 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5,657	
AF	Soil Skin Adherence Factor (mg/cm ²)		0.13	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.18
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Soil (0-3 ft bgs) from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	RAF Soil Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	3.60E-01	N/A	3.00E-02	N/A		1.94E-04	18.2%
Inorganics								
Copper	1.69E+01	1.00E+00	N/A	4.00E-02	N/A		9.12E-05	8.6%
Nickel	1.78E+01	1.00E+00	N/A	2.00E-02	N/A		1.92E-04	18.0%
Selenium	3.70E+00	1.00E+00	N/A	5.00E-03	N/A		1.60E-04	15.0%
Zinc	6.25E+01	1.00E+00	N/A	3.00E-01	N/A		4.50E-05	4.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	8.50E-01	2.00E+00	2.00E-05	1.81E-09	3.5%	2.64E-04	24.8%
Aroclor-1260	1.19E-02	8.50E-01	2.00E+00	2.00E-05	7.48E-10	1.5%	1.09E-04	10.2%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	3.60E-01	N/A	6.00E-02	N/A		2.20E-07	<1%
Acenaphthylene	1.93E-01	3.60E-01	N/A	3.00E-02	N/A		5.00E-07	<1%
Anthracene	2.12E-01	3.60E-01	N/A	3.00E-01	N/A		5.49E-08	<1%
Benzo(a)anthracene	4.39E-01	2.80E-01	7.30E-01	3.00E-02	3.32E-09	6.5%	8.84E-07	<1%
Benzo(a)pyrene	3.49E-01	2.80E-01	7.30E+00	3.00E-02	2.64E-08	51.5%	7.03E-07	<1%
Benzo(b)fluoranthene	3.92E-01	2.80E-01	7.30E-01	3.00E-02	2.96E-09	5.8%	7.89E-07	<1%
Benzo(g,h,i)perylene	2.63E-01	3.60E-01	N/A	3.00E-02	N/A		6.81E-07	<1%
Benzo(k)fluoranthene	3.57E-01	2.80E-01	7.30E-02	3.00E-02	2.70E-10	<1%	7.18E-07	<1%
Butyl benzyl phthalate	2.20E-01	1.00E+00	N/A	2.00E-01	N/A		2.37E-07	<1%
Carbazole	1.98E-01	1.00E+00	2.00E-02	N/A	1.46E-10	<1%	N/A	
Chrysene	4.44E-01	2.80E-01	7.30E-02	3.00E-02	3.36E-10	<1%	8.95E-07	<1%
Dibenzo(a,h)anthracene	1.75E-01	2.80E-01	7.30E+00	3.00E-02	1.33E-08	25.9%	3.53E-07	<1%
Fluoranthene	7.64E-01	3.60E-01	N/A	4.00E-02	N/A		1.48E-06	<1%
Fluorene	1.50E-01	3.60E-01	N/A	4.00E-02	N/A		2.91E-07	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	2.80E-01	7.30E-01	3.00E-02	2.02E-09	3.9%	5.38E-07	<1%
Phenanthrene	3.44E-01	3.60E-01	N/A	3.00E-02	N/A		8.90E-07	<1%
Pyrene	6.78E-01	3.60E-01	N/A	3.00E-02	N/A		1.76E-06	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	1.00E+00	N/A	8.00E-02	N/A		8.36E-08	<1%
Total Cancer Risk:					5.12E-08		Hazard Index:	1.07E-03

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.19
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Inhalation of Fugitive Dust from Trans Canada

Chemical of Potential Concern	Soil EPC (mg/kg)	Fugitive Dust EPC ($\mu\text{g}/\text{m}^3$)	Unit Risk ($\text{m}^3/\mu\text{g}$)	Reference Concentration (RfC) ($\mu\text{g}/\text{m}^3$)	Cancer Risk CR = ADE x UR	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADE÷RfC	Percent Contribution to Total Non-Cancer Risk
Extractable Petroleum Hydrocarbons								
Adjusted C11-C22 Aromatics	7.48E+01	2.39E-03	N/A	5.00E+04	N/A		4.02E-09	2.0%
Inorganics								
Copper	1.69E+01	5.41E-04	N/A	3.00E+03	N/A		1.51E-08	7.7%
Nickel	1.78E+01	5.70E-04	4.80E-04	1.00E+03	3.94E-09	86.4%	4.79E-08	24.4%
Selenium	3.70E+00	1.18E-04	N/A	3.00E+03	N/A		3.31E-09	1.7%
Zinc	6.25E+01	2.00E-03	N/A	1.40E+03	N/A		1.20E-07	61.2%
Polychlorinated Biphenyls								
Aroclor-1254	2.88E-02	9.22E-07	1.00E-04	2.00E+01	1.33E-12	<1%	3.87E-09	2.0%
Aroclor-1260	1.19E-02	3.81E-07	1.00E-04	2.00E+01	5.48E-13	<1%	1.60E-09	<1%
Semivolatile Organic Compounds								
Acenaphthene	1.70E-01	5.42E-06	N/A	5.00E+04	N/A		9.12E-12	<1%
Acenaphthylene	1.93E-01	6.17E-06	N/A	5.00E+04	N/A		1.04E-11	<1%
Anthracene	2.12E-01	6.79E-06	N/A	5.00E+04	N/A		1.14E-11	<1%
Benzo(a)anthracene	4.39E-01	1.40E-05	2.09E-04	5.00E+04	4.22E-11	<1%	2.36E-11	<1%
Benzo(a)pyrene	3.49E-01	1.12E-05	2.09E-03	5.00E+04	3.35E-10	7.3%	1.88E-11	<1%
Benzo(b)fluoranthene	3.92E-01	1.25E-05	2.09E-04	5.00E+04	3.77E-11	<1%	2.11E-11	<1%
Benzo(g,h,i)perylene	2.63E-01	8.41E-06	N/A	5.00E+04	N/A		1.41E-11	<1%
Benzo(k)fluoranthene	3.57E-01	1.14E-05	2.09E-05	5.00E+04	3.43E-12	<1%	1.92E-11	<1%
Carbazole	1.98E-01	6.33E-06	N/A	N/A	N/A		N/A	
Chrysene	4.44E-01	1.42E-05	2.09E-05	5.00E+04	4.27E-12	<1%	2.39E-11	<1%
Dibenzo(a,h)anthracene	1.75E-01	5.61E-06	2.09E-03	5.00E+04	1.69E-10	3.7%	9.43E-12	<1%
Fluoranthene	7.64E-01	2.45E-05	N/A	5.00E+04	N/A		4.11E-11	<1%
Fluorene	1.50E-01	4.80E-06	N/A	5.00E+04	N/A		8.07E-12	<1%
Indeno(1,2,3-cd)pyrene	2.67E-01	8.55E-06	2.09E-04	5.00E+04	2.57E-11	<1%	1.44E-11	<1%
Phenanthrene	3.44E-01	1.10E-05	N/A	5.00E+04	N/A		1.85E-11	<1%
Pyrene	6.78E-01	2.17E-05	N/A	5.00E+04	N/A		3.64E-11	<1%
Volatile Organic Compounds								
Toluene	3.10E-02	9.92E-07	N/A	5.00E+06	N/A		1.67E-14	<1%

Total Cancer Risk: 4.56E-09 Hazard Index: 1.96E-07

Notes

Intake Factor (IF) =	$\frac{\text{EF} \times \text{ED} \times \text{EP} \times \text{CF}}{\text{AP}}$	=	1.44E-02 (cancer)	8.40E-02 (non-cancer)
	EF Exposure Frequency (ev/yr)		92	
	ED Exposure Duration (hr/ev)		8	
	EP Exposure Period (yr)		12	
	CF Conversion factor (d/hr)		0.042	
	AP Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	
	PM ₁₀ Respirable particulate concentration in air ($\mu\text{g}/\text{m}^3$)		3.2E+01	

Fugitive dust EPCs were calculated using soil EPCs, the MADEP-recommended PM₁₀ concentration (32 $\mu\text{g}/\text{m}^3$) for enhanced exposures and a conversion factor (10⁻⁶ kg/mg) (MADEP, 1995)

N/A - Not available

Blank - Not a COPC for this Study Area

$\text{EPC}_{\text{dust}} = \text{EPC}_{\text{soil}} * \text{PM}_{10} * 10^{-6} \text{ kg/mg}$

$\text{ADE} = \text{EPC}_{\text{dust}} * \text{IF}$

Appendix Table H.4.1.20
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Ingestion of Groundwater from Trans Canada

Chemical of Potential Concern	Groundwater EPC (mg/L)	RAF GW Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD ÷ RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	7.80E-03	1.00E+00	N/A	2.00E-01	N/A		1.68E-04	3.8%
Copper	3.60E-03	1.00E+00	N/A	4.00E-02	N/A		3.88E-04	8.9%
Volatile Organic Compounds								
1,1-Dichloroethane	6.00E-04	1.30E+00	N/A	1.00E-01	N/A		3.37E-05	<1%
m+p-Xylenes	9.00E-04	1.00E+00	N/A	2.00E-01	N/A		1.94E-05	<1%
Toluene	1.40E-03	1.00E+00	N/A	8.00E-02	N/A		7.55E-05	1.7%
Volatile Petroleum Hydrocarbons								
Adjusted C5-C8 Aliphatics	6.10E-03	1.00E+00	N/A	4.00E-02	N/A		6.58E-04	15.0%
Adjusted C9-C10 Aromatics	1.59E-02	9.10E-01	N/A	3.00E-02	N/A		2.08E-03	47.5%
Adjusted C9-C12 Aliphatics	2.22E-02	1.00E+00	N/A	1.00E-01	N/A		9.58E-04	21.9%
Total Cancer Risk:					0.00E+00		Hazard Index:	4.38E-03

Notes

Intake Factor (IF) = $\frac{IR-G \times EF \times ED \times EP}{BW \times AP}$	=	7.40E-04 (cancer)	4.32E-03 (non-cancer)
--	---	----------------------	--------------------------

IR-G	Groundwater Ingestion Rate (L/day)	1
EF	Groundwater Ingestion Exposure Frequency (ev/yr)	92
ED	Groundwater Ingestion Exposure Duration (d/ev)	1.0
EP	Exposure Period (yr)	12
BW	Body Weight (kg)	58.4
AP	Averaging Period - Cancer (d)	25,550
	Averaging Period - Non- Cancer (d)	4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.21
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Dermal Contact with Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Dermal	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E-01	N/A	4.00E-04	N/A		2.96E-03	5.1%
Arsenic	1.40E+00	3.00E-02	1.50E+00	3.00E-04	2.64E-07	21.4%	3.42E-03	5.9%
Cadmium	2.39E-01	1.40E-01	N/A	5.00E-04	N/A		1.63E-03	2.8%
Copper	2.43E+01	6.00E-02	N/A	4.00E-02	N/A		8.89E-04	1.5%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		1.12E-02	19.2%
Zinc	1.19E+02	2.00E-02	N/A	3.00E-01	N/A		1.94E-04	<1%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	1.60E-01	2.00E+00	2.00E-05	1.87E-07	15.2%	2.73E-02	46.7%
Aroclor-1260	3.46E-02	1.60E-01	2.00E+00	2.00E-05	4.63E-08	3.8%	6.76E-03	11.6%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	1.00E-01	N/A	6.00E-02	N/A		1.29E-05	<1%
Anthracene	3.54E-01	1.00E-01	N/A	3.00E-01	N/A		2.88E-06	<1%
Benzo(a)anthracene	7.73E-01	2.00E-02	7.30E-01	3.00E-02	4.73E-08	3.8%	1.26E-05	<1%
Benzo(a)pyrene	7.07E-01	2.00E-02	7.30E+00	3.00E-02	4.32E-07	35.0%	1.15E-05	<1%
Benzo(b)fluoranthene	6.79E-01	2.00E-02	7.30E-01	3.00E-02	4.15E-08	3.4%	1.11E-05	<1%
Benzo(g,h,i)perylene	4.29E-01	1.00E-01	N/A	3.00E-02	N/A		3.49E-05	<1%
Benzo(k)fluoranthene	5.81E-01	2.00E-02	7.30E-02	3.00E-02	3.55E-09	<1%	9.46E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	2.00E-02	1.40E-02	2.00E-02	2.06E-10	<1%	4.28E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	3.06E-08	2.5%	N/A	
Chrysene	7.39E-01	2.00E-02	7.30E-02	3.00E-02	4.51E-09	<1%	1.20E-05	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.00E-02	7.30E+00	3.00E-02	1.50E-07	12.2%	4.01E-06	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		3.54E-03	6.1%
Fluoranthene	1.58E+00	1.00E-01	N/A	4.00E-02	N/A		9.67E-05	<1%
Fluorene	3.32E-01	1.00E-01	N/A	4.00E-02	N/A		2.03E-05	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.00E-02	7.30E-01	3.00E-02	2.55E-08	2.1%	6.80E-06	<1%
Naphthalene	2.21E-01	1.00E-01	N/A	2.00E-02	N/A		2.70E-05	<1%
Phenanthrene	1.39E+00	1.00E-01	N/A	3.00E-02	N/A		1.13E-04	<1%
Pyrene	1.18E+00	1.00E-01	N/A	3.00E-02	N/A		9.58E-05	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E-01	7.50E-03	6.00E-02	3.45E-12	<1%	4.48E-08	<1%

Total Cancer Risk: 1.23E-06 **Hazard Index:** 5.84E-02

Notes

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	4.19E-06 (cancer)	2.44E-05 (non-cancer)
SA	Surface Area Exposed to Soil (cm ² /day)		5657	
AF	Soil Skin Adherence Factor (mg/cm ²)		1	
EF	Exposure Frequency (ev/yr)		92	
ED	Exposure Duration (day/ev)		1	
EP	Exposure Period (yr)		12	
CF	Conversion Factor (kg/mg)		0.000001	
BW	Body Weight (kg)		58.4	
AP	Averaging Period - Cancer (d)		25,550	
	Averaging Period - Non- Cancer (d)		4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.22
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Sediment from Trans Canada WSD

Chemical of Potential Concern	Sediment EPC (mg/kg)	RAF Sediment Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Antimony	4.86E-01	1.00E+00	N/A	4.00E-04	N/A		2.62E-04	7.8%
Arsenic	1.40E+00	1.00E+00	1.50E+00	3.00E-04	7.77E-08	44.1%	1.01E-03	30.1%
Cadmium	2.39E-01	1.00E+00	N/A	5.00E-04	N/A		1.03E-04	3.1%
Copper	2.43E+01	1.00E+00	N/A	4.00E-02	N/A		1.31E-04	3.9%
Lithium	9.21E+00	1.00E+00	N/A	2.00E-02	N/A		9.94E-05	3.0%
Zinc	1.19E+02	1.00E+00	N/A	3.00E-01	N/A		8.58E-05	2.6%
Polychlorinated Biphenyls								
Aroclor-1254	1.40E-01	8.50E-01	2.00E+00	2.00E-05	8.79E-09	5.0%	1.28E-03	38.4%
Aroclor-1260	3.46E-02	8.50E-01	2.00E+00	2.00E-05	2.18E-09	1.2%	3.17E-04	9.5%
Semivolatile Organic Compounds								
Acenaphthene	3.18E-01	3.60E-01	N/A	6.00E-02	N/A		4.12E-07	<1%
Anthracene	3.54E-01	3.60E-01	N/A	3.00E-01	N/A		9.16E-08	<1%
Benzo(a)anthracene	7.73E-01	2.80E-01	7.30E-01	3.00E-02	5.85E-09	3.3%	1.56E-06	<1%
Benzo(a)pyrene	7.07E-01	2.80E-01	7.30E+00	3.00E-02	5.34E-08	30.3%	1.42E-06	<1%
Benzo(b)fluoranthene	6.79E-01	2.80E-01	7.30E-01	3.00E-02	5.14E-09	2.9%	1.37E-06	<1%
Benzo(g,h,i)perylene	4.29E-01	3.60E-01	N/A	3.00E-02	N/A		1.11E-06	<1%
Benzo(k)fluoranthene	5.81E-01	2.80E-01	7.30E-02	3.00E-02	4.39E-10	<1%	1.17E-06	<1%
bis(2-Ethylhexyl)phthalate	1.75E-01	1.00E+00	1.40E-02	2.00E-02	9.09E-11	<1%	1.89E-06	<1%
Carbazole	3.65E-01	1.00E+00	2.00E-02	N/A	2.70E-10	<1%	N/A	
Chrysene	7.39E-01	2.80E-01	7.30E-02	3.00E-02	5.58E-10	<1%	1.49E-06	<1%
Dibenzo(a,h)anthracene	2.46E-01	2.80E-01	7.30E+00	3.00E-02	1.86E-08	10.6%	4.96E-07	<1%
Dibenzofuran	2.90E-01	1.00E+00	N/A	2.00E-03	N/A		3.13E-05	<1%
Fluoranthene	1.58E+00	3.60E-01	N/A	4.00E-02	N/A		3.08E-06	<1%
Fluorene	3.32E-01	3.60E-01	N/A	4.00E-02	N/A		6.45E-07	<1%
Indeno(1,2,3-cd)pyrene	4.18E-01	2.80E-01	7.30E-01	3.00E-02	3.16E-09	1.8%	8.41E-07	<1%
Naphthalene	2.21E-01	3.60E-01	N/A	2.00E-02	N/A		8.59E-07	<1%
Phenanthrene	1.39E+00	3.60E-01	N/A	3.00E-02	N/A		3.60E-06	<1%
Pyrene	1.18E+00	3.60E-01	N/A	3.00E-02	N/A		3.05E-06	<1%
Volatile Organic Compounds								
Methylene Chloride	1.10E-03	1.00E+00	7.50E-03	6.00E-02	3.05E-13	<1%	3.96E-09	<1%
Total Cancer Risk:					1.76E-07		Hazard Index: 3.34E-03	

Notes

Intake Factor (IF) =	$\frac{IR \times EF \times ED \times EP \times CF}{BW \times AP}$	=	3.70E-08 (cancer)	2.16E-07 (non-cancer)
IR	Ingestion Rate (mg/day)			50
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (day/ev)			1
EP	Exposure Period (yr)			12
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.23

**Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA**

Adult Recreator Dermal Contact with Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	Kp (cm/hr)	RAF dermal - cancer	RAF dermal - non-cancer	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics										
Boron	4.17E-03	1.00E-03	1.00E+00	1.00E+00	N/A	2.00E-01	N/A		2.03E-06	1.0%
Cadmium	6.67E-05	1.00E-03	1.00E+00	1.43E+01	N/A	5.00E-04	N/A		1.86E-04	95.7%
Zinc	1.51E-02	6.00E-04	1.00E+00	2.17E+00	N/A	3.00E-01	N/A		6.42E-06	3.3%
Total Cancer Risk:							0.00E+00	Hazard Index:	1.94E-04	

Notes

Intake Factor (IF) =	$\frac{SA \times AF \times EF \times ED \times EP \times CF}{BW \times AP}$		=	1.67E-02 (cancer)	9.77E-02 (non-cancer)
SA	Surface Area Exposed to Surface Water (cm ²)			5,657	
EF	Exposure Frequency (ev/yr)			92	
ED	Exposure Duration (hr/ev)			4	
EP	Exposure Period (yr)			12	
CF	Conversion Factor (L/cm ³)			0.001	
BW	Body Weight (kg)			58.4	
AP	Averaging Period - Cancer (d)			25,550	
	Averaging Period - Non- Cancer (d)			4,380	

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix Table H.4.1.24
Excess Lifetime Cancer and Non-Cancer Risk by Chemical and Pathway for Future Adult Recreator
Yankee Nuclear Power Station, Rowe, MA

Adult Recreator Incidental Ingestion of Surface Water from Sherman Reservoir

Chemical of Potential Concern	Surface Water EPC (mg/L)	RAF Water Ingestion	Cancer Slope Factor (SF) (kg-d/mg)	Reference Dose (RfD) (mg/kg-d)	Cancer Risk CR = ADD x SF	Percent Contribution to Total Cancer Risk	Hazard Quotient HQ = ADD÷RfD	Percent Contribution to Total Non-Cancer Risk
Inorganics								
Boron	4.17E-03	1.00E+00	N/A	2.00E-01	N/A		8.99E-07	10.2%
Cadmium	6.67E-05	1.00E+00	N/A	5.00E-04	N/A		5.75E-06	65.2%
Zinc	1.51E-02	1.00E+00	N/A	3.00E-01	N/A		2.17E-06	24.6%
Total Cancer Risk:					0.00E+00		Hazard Index:	8.83E-06

Notes

Intake Factor (IF) = $\frac{IR \times EF \times ED \times EP}{BW \times AP}$		=	7.40E-06 (cancer)	4.32E-05 (non-cancer)
IR	Ingestion Rate (L/d)			0.01
EF	Exposure Frequency (ev/yr)			92
ED	Exposure Duration (d/ev)			1
EP	Exposure Period (yr)			12
BW	Body Weight (kg)			58.4
AP	Averaging Period - Cancer (d)			25,550
	Averaging Period - Non- Cancer (d)			4,380

N/A - Not available

Blank - Not a COPC for this Study Area

ADD (mg/kg-d) = EPC*IF*RAF

Appendix I: Environmental Risk Characterization _____

Appendix I
Environmental Risk Characterization
Former Yankee Nuclear Power Station
Rowe, Massachusetts

Prepared for:

Yankee Atomic Electric Company
49 Yankee Road
Rowe, MA 01367

Prepared by:

Gradient Corporation
20 University Road
Cambridge, MA 02138

November 2007

Table of Contents

1	Introduction	1
1.1	Risk Assessment Goals	2
1.2	Risk Assessment Framework	3
2	Stage I Environmental Screening	6
2.1	Definition of Ecological Areas of Concern	6
2.1.1	Ecological Habitats	6
2.1.1.1	Local Habitats and Species	7
2.1.1.2	Threatened and Endangered Species and Species of Special Concern	8
2.1.1.3	Study Areas	9
2.2	Screening Evaluation	11
2.2.1	Background Determination	12
2.2.2	OHM COPCs	13
2.2.3	Radionuclide COPCs	14
3	Stage II Environmental Risk Characterization	18
3.1	Problem Formulation	18
3.1.1	Current and Future Conditions Affecting Fate and Transport Characteristics of COPCs	19
3.1.2	Exposure Pathways	20
3.1.3	Ecological Endpoints	21
3.1.3.1	Assessment Endpoints	21
3.1.3.2	Representative Food Web (Receptors)	22
3.1.3.3	Measurement Endpoints	24
3.2	Exposure Assessment	25
3.2.1	Exposure Point Concentrations	26
3.2.1.1	Soil	26
3.2.1.2	Sediment	27
3.2.1.3	Surface Water	27
3.2.1.4	Fish	27
3.2.1.5	Plants, Invertebrates, and Small Mammals	28
3.2.2	Estimation of COPC Intake	29
3.3	Biological Effects Assessment	30
3.3.1	Toxicological Benchmarks for Benthic Invertebrates	31
3.3.2	Toxicological Benchmarks for Fish	32
3.3.3	Toxicological Benchmarks for Amphibians	32
3.3.4	Toxicological Benchmarks for Terrestrial Invertebrates	33
3.3.5	Toxicological Benchmarks for Terrestrial Plants	33
3.3.6	Toxicity Reference Values	33
3.4	Risk Characterization	35
3.4.1	Comparison to Media Toxicity Benchmarks	35
3.4.1.1	Benthic Invertebrates	35
3.4.1.2	Fish	39
3.4.1.3	Amphibians	40
3.4.1.4	Terrestrial Invertebrates	40
3.4.1.5	Terrestrial Plants	41
3.4.2	Food Web Hazard Quotient and Hazard Indices	42

3.4.2.1	Short-tailed Shrew	43
3.4.2.2	American Robin	44
3.4.2.3	Eastern Cottontail	44
3.4.2.4	Raccoon	44
3.4.2.5	Red Fox.....	45
3.4.2.6	Mink.....	45
3.4.2.7	Belted Kingfisher.....	45
3.4.2.8	Bald Eagle.....	46
4.0	Ecological Significance	47
5.0	Uncertainty Analysis	50
5.1	Media Screening Benchmarks	50
5.2	Exposure Estimates.....	50
5.3	Toxicity Reference Values (TRVs)	51
5.4	Risks Associated with Background	52
6.0	Conclusions	53
7.0	References	57

Attachments

Attachment A Estimation of COPC Uptake in Biota

Tables

Table 2-1	Chemicals Detected in Surface Soil (0-3 ft bgs) – Background Areas
Table 2-2	Chemicals Detected in Sediment – Background Areas
Table 2-3	Chemicals Detected in Surface Water – Background Areas
Table 2-4	Chemical COPCs in Surface Soil (0-3ft bgs) – Combined Study Areas
Table 2-5	Chemical COPCs in Surface Soil (0-3ft bgs) – YAEC Non-BUD Study Area
Table 2-6	Chemical COPCs in Surface Soil (0-3ft bgs) – TransCanada Study Area
Table 2-7	Chemical COPCs in Sediment – Combined Study Areas
Table 2-8	Chemical COPCs in Sediment – Sherman Reservoir
Table 2-9	Chemical COPCs in Sediment – Deerfield River Adjacent to the Site
Table 2-10	Chemical COPCs in Sediment – Wheeler Brook
Table 2-11	Chemical COPCs in Sediment – TransCanada West Storm Ditch (WSD)
Table 2-12	Chemical COPCs in Surface Water – Combined Study Areas
Table 2-13	Chemical COPCs in Surface Water – Sherman Reservoir
Table 2-14	Chemical COPCs in Surface Water – Deerfield River
Table 2-15	Chemical COPCs in Surface Water – Wheeler Brook
Table 2-16	Chemical COPCs in Surface Water – TransCanada West Storm Ditch (WSD)
Table 2-17	Fish Sample Results – OHM
Table 2-18	OHM Constituents of Potential Concern
Table 2-19	Radionuclide Biota Concentration Guidelines (BCG)
Table 2-20a	Radionuclide COPCs in Surface Soil – Combined Study Areas
Table 2-20b	Radionuclide COPCs in Surface Soil – TransCanada Property
Table 2-21	Radionuclide COPCs in Sediment – Sherman Reservoir and Deerfield River
Table 3-1	Wildlife Exposure Parameters
Table 3-2	Exposure Point Concentrations for COPCs in Soil, Sediment, Surface Water, and Fish
Table 3-3	Estimated Chemical Concentrations in Terrestrial Plants
Table 3-4	Estimated Chemical Concentrations in Terrestrial Invertebrates
Table 3-5	Estimated Chemical Concentrations in Benthic Invertebrates
Table 3-6	Estimated Chemical Concentrations in Small Mammals and Birds
Table 3-7	Toxicity Reference Values (TRVs) for Terrestrial Plants, Terrestrial Invertebrates, Benthic Macroinvertebrates, and Freshwater Organisms
Table 3-8	Toxicity Reference Values (TRVs) for Avian and Mammalian Receptors
Table 3-9	Sediment Benchmark Values – Benthic Macroinvertebrates – Sherman Reservoir
Table 3-10	PCB and PAH Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – Sherman Reservoir
Table 3-11	Sediment Benchmark Values – Benthic Macroinvertebrates – Cooling Water Discharge Area
Table 3-12	PCB and PAH Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – Cooling Water Discharge Area
Table 3-13	Sediment Benchmark Values – Benthic Macroinvertebrates – Sherman Reservoir Cooling Water Intake Area
Table 3-14	PCB and PAH Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – Sherman Reservoir Cooling Water Intake Area
Table 3-15	Sediment Benchmark Values – Benthic Macroinvertebrates – East Storm Discharge Area
Table 3-16	PCB Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – East Storm Discharge Area
Table 3-17	Sediment Benchmark Values – Benthic Macroinvertebrates – East Storm Drain Area 2
Table 3-18	PCB Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – East Storm Drain Area 2

Table 3-19	Sediment Benchmark Values – Benthic Macroinvertebrates – Deerfield River Adjacent to the Site
Table 3-20	PCB and PAH Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – Deerfield River Adjacent to the Site
Table 3-21	Sediment Benchmark Values – Benthic Macroinvertebrates – West Storm Ditch (WSD)
Table 3-22	PCB and PAH Probable Effects Concentration Sediment Benchmark Values – Benthic Macroinvertebrates – West Storm Ditch
Table 3-23	Comparison of Whole-Body Fish Tissue Chemical Residue to TRVs
Table 3-24	Surface Water Benchmark Values – Amphibians – Sherman Reservoir
Table 3-25	Surface Water Benchmark Values – Amphibians – Deerfield River Adjacent to the Site
Table 3-26	Surface Water Benchmark Values – Amphibians – Wheeler Brook
Table 3-27	Surface Water Benchmark Values – Amphibians – TransCanada West Storm Ditch (WSD)
Table 3-28	Soil Benchmark Values – Earthworms – YAEC Non-BUD
Table 3-29	Soil Benchmark Values – Earthworms – TransCanada Property
Table 3-30	Soil Benchmark Values – Terrestrial Plants – YAEC Non-BUD
Table 3-31	Soil Benchmark Values – Terrestrial Plants – TransCanada Property
Table 3-32	NOAEL Hazard Indices – Combined Study Areas
Table 3-33	LOAEL Hazard Indices – Combined Study Areas
Table 4-1	Summary of Benchmark Ratios
Table 4-2	Summary of Modeled Food Web Hazard Indices
Table 5-1	NOAEL Hazard Indices – Background Areas
Table 5-2	Sediment Benchmark Values – Benthic Invertebrates – Background Areas
Table 5-3	Soil Benchmark Values – Terrestrial Invertebrates – Background Areas
Table 5-4	Soil Benchmark Values – Terrestrial Plants – Background Areas
Table 5-5	Surface Water Benchmark Values – Amphibians – Background Areas

Figures

Figure 1-1	YNPS Property Boundary and Site Features
Figure 1-2	YNPS Environmental Assessment Approach
Figure 2-1	YNPS Study Areas and Restricted Areas
Figure 2-2	Subareas of Sherman Reservoir Sediment Sampling Locations
Figure 3-1	Food Web Exposure Pathways
Figure 3-2	Sherman Reservoir Sediment Averaging Areas For Benchmark Comparisons
Figure 3-3	Sediment Benthic Macroinvertebrate Benchmark Comparisons for PCBs
Figure 3-4	Sediment Benthic Macroinvertebrate Benchmark Quotients -- PAHs
Figure 3-5	Sediment Benthic Macroinvertebrate Benchmark Quotients -- Inorganics
Figure 3-6	Soil Invertebrate (Earthworms) Benchmark Quotients -- Inorganics

1 Introduction

This report presents the results the Environmental Risk Characterization conducted as a component of the Method 3 Risk Characterization to support the environmental site closure underway at the Yankee Nuclear Power Station (YNPS) in Rowe, Massachusetts (Figure 1-1). This Environmental Risk Characterization uses the same environmental characterization data presented in the body of the Method 3 Risk Characterization report. For brevity, the review of the environmental sampling, summary tables and figures, *etc.*, presented for the body of the Risk Characterization are not repeated in this report. Table and figure references to those presented in the main body of the report are cited as "Risk Characterization Table #" for clarity; tables or figures presented for the Environmental Risk Characterization are simply referenced by their appropriate table or figure number.

The Yankee Atomic Electric Company (YAEC) operated the YNPS from 1961 until 1992, when operations ceased. The plant has been dismantled, and site remediation and restoration has been completed. YAEC is seeking to terminate the YNPS federal license with the Nuclear Regulatory Commission (NRC). In order to terminate its operating license, YAEC has completed a process of radiological sampling and cleanup, as necessary, defined by the NRC and set forth in YAEC's License Termination Plan (LTP). In addition, YAEC is complying with the Massachusetts Department of Public Health (MADPH) requirements for meeting radiological guidelines set forth in 105 CMR 120.291. Both the NRC and MADPH require compliance with radiological "dose-based" requirements for the protection of human health.

In parallel with the license termination and completed cleanup to meet the NRC and MADPH radiological dose requirements, YAEC has conducted a comprehensive environmental closure to ensure that the property poses no adverse human or environmental risks once YAEC transfers title of the property. The environmental site closure is being performed as a voluntary action in accordance with guidelines established by the Massachusetts Department of Environmental Protection (MADEP) and U.S. Environmental Protection Agency (US EPA), as well as requirements established by NRC and MADPH.

Because the NRC and MADPH standards or guidelines only address the possible impacts of radiological constituents to humans, this additional assessment of environmental risks was conducted following MADEP and US EPA guidelines for oil and hazardous materials (OHM), and following U.S. Department of Energy (US DOE) guidelines for radiological constituents (in the absence of MADEP or US EPA guidance exists).

1.1 Risk Assessment Goals

Although the assessment methods and standards for radiological and OHM risk assessment differ somewhat in their approach (*e.g.*, dose *versus* risk), both share the common purpose of ensuring protection of the environment. The overall goal of the environmental risk assessment approach described herein is to establish whether post-closure site conditions (*e.g.*, existing structures removed, remediation of radionuclides and chemicals, and site restoration) meet environmental conditions that do not pose a significant risk to the environment.

This environmental risk assessment evaluated potential ecological risks (or hazards) above those associated with exposure to naturally-occurring or ubiquitous constituents in the environment. This is particularly important for naturally-occurring inorganic constituents (*e.g.*, metals), and other chemicals and radionuclides (*e.g.*, Cs-137 and Sr-90) associated with ubiquitous natural and anthropogenic sources. Thus, as described in the risk characterization report, background concentrations of OHM and radionuclides were evaluated in the vicinity of the site, in order to provide a comparison of site risks to background risks.

In addition to this environmental risk assessment for the overall site closure, a focused risk assessment in support of the Toxic Substances Control Act (TSCA) Risk-Based Disposal Approval Application (RBDAA) for polychlorinated biphenyls (PCB) cleanup in Sherman Reservoir was prepared pursuant to a request by US EPA Region I. That assessment, along with subsequent revisions based on comments received from the US EPA, was completed and approved by the US EPA on September 28, 2004. As outlined in this ecological risk assessment, the cumulative risk assessment for the site includes an evaluation of residual PCBs in Sherman Reservoir sediments, and other possible chemicals of potential concern (COPCs), after the sediment remediation was completed under US EPA and MADEP oversight.

1.2 Risk Assessment Framework

This report was prepared in accordance with the requirements of a MADEP Method 3 Risk Characterization pursuant to Section 310 CMR 40.0900 of the Massachusetts Contingency Plan (MCP). The cumulative ecological risk assessment was conducted primarily according to MCP Risk Characterization guidance for performing a Method 3 Environmental Risk Characterization, found in

Chapter 9 of the Guidance for Disposal Site Risk Characterization (MADEP, 1996). The MADEP and US EPA ecological risk assessment guidelines share a common framework and foundation such that the approaches adopted here following MADEP guidelines are generally consistent with US EPA methods. Because MADEP does not have any published radiological risk assessment guidance, the ecological risk evaluation described in this report adopted guidelines from the US DOE's "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (US DOE, 2002).

A Method 3 Environmental Risk Characterization is a site-specific risk characterization taking into account site-specific ecological exposure patterns, the distribution of constituents of potential concern, as well as exposures to multiple constituents. The principal ecological concern at YNPS is the potential effects to ecological receptors associated with exposures to OHM and radionuclides in soil, sediment, and surface water along with possible accumulation of site-related COPCs in biological tissues (*e.g.*, plant, invertebrates, mammals, fish, and birds).

The MCP divides the Environmental Risk Characterization into two stages: Stage I Environmental Screening, and Stage II Environmental Risk Characterization, an approach also recommended by US EPA. Both stages of the environmental risk characterization are illustrated in Figure 1-2. It should be noted that the Stage I Environmental Screening is not intended to estimate actual hazard (*e.g.*, adverse effects) to ecological receptors. The conservative methods and assumptions used in the Stage I evaluation are intended to identify possible hazards and are designed so that potential risks to ecological receptors are not underestimated. If the results of the Stage I evaluation indicate a potential hazard cannot be ruled out using conservative approaches, then a Stage II quantitative evaluation is required to assess hazards to potential ecological receptors at the site in more detail.

A Stage I Environmental Screening was performed pursuant to Section 310 CMR 40.0995 of the MCP to evaluate risks to biota and habitats at the site and its vicinity. The steps followed in the screening evaluation included:

- Identification of potential receptors and exposure pathways.
- Identification of COPCs based on site chemical use history and monitoring data.
- Comparison of median and maximum detected concentrations in media with applicable background median and maximum concentrations to determine whether concentrations of site COPCs exceed background concentrations.
- Comparison of the concentration of OHM in soil, sediment, and surface water with their respective benchmarks.

- Comparison of maximum detected radiological constituents with US DOE benchmarks.

The Stage II environmental risk characterization was conducted following MADEP (1996) ecological risk assessment guidance including other established Agency guidance summarized below:

- Ecological Assessment at Hazardous Waste Sites: A Field and Laboratory Reference (US EPA, 1989a)
- Eco Updates (US EPA, 1991; 1992a), which supersede earlier guidance for conducting environmental evaluations for the baseline risk assessment (US EPA, 1989b)
- Framework for Ecological Risk Assessment (US EPA, 1992b)
- Wildlife Exposure Factors Handbook (US EPA, 1993)
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (US EPA, 1997)
- Guidelines for Ecological Risk Assessment (US EPA, 1998)
- Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (US EPA, 1999)
- A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota (US DOE, 2002)
- Methodology for Estimating Radiation Dose Rates to Freshwater Biota Exposed to Radionuclides in the Environment (Blaylock *et al.*, 1993)
- Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants (Sample *et al.*, 1997)

The ecological characterization for the site was performed in accordance with methodology recommended by MADEP (1996) that was modified from the approach developed by the National Academy of Sciences for assessing human health risks (NRC, 1983), outlined below.

- *Problem Formulation:* This component of the assessment defines the ecological assessment's objectives and focuses on collecting information to conduct exposure and ecological effects assessments by defining assessment and measurement endpoints. A conceptual site model outlines sources of constituents and potential pathways of exposure.
- *Exposure Assessment* refers to the magnitude and type of actual and/or potential exposure of receptors to constituents released from the site, with emphasis on characterizing receptors and quantifying exposure point concentrations of constituents.
- *Biological Effects Assessment* refers to the quantitative evaluation of the link between concentrations of constituents in environmental media to potential adverse effects in receptors. It involves evaluating toxicology information from literature, field, and/or

laboratory studies that link the concentrations of constituents in various environmental media to adverse biological effects in organisms.

- *Risk Characterization:* Risk characterization compares the results of the exposure assessment with the results of the biological effects assessments to evaluate whether adverse effects are occurring or will occur as a result of constituents present at the site. An interpretation of the ecological significance and uncertainties in the assessment are components of the risk characterization step.

The sections that follow describe the Stage I and Stage II environmental risk characterization approach implemented at the YNPS.

2 Stage I Environmental Screening

The purpose of the Stage I Environmental Screening is to assess whether historic constituent releases could pose a potential hazard to ecological receptors. This type of screening is not intended to estimate actual hazard (*e.g.*, adverse effects) to ecological receptors. The methods and assumptions used in the Stage I evaluation are designed so that potential risks to ecological receptors at various exposure areas are not underestimated. As specified in the MCP, a subsequent Stage II environmental risk characterization is required if COPCs exceed site-specific background concentrations and screening levels.

2.1 Definition of Ecological Areas of Concern

The YNPS site consists of approximately 1,800 acres, most of which is undeveloped eastern hardwood and pine forest. The YNPS is situated adjacent to two prominent water bodies, Sherman Reservoir and the Deerfield River, which provide human recreation and habitat typical of eastern coldwater streams. YAEC has conducted a natural resource survey to identify the ecological resources associated with the site. The survey identified vegetation composition and habitat types (*e.g.*, wetland, upland forest), characterized wildlife habitat (*e.g.*, availability of foraging and nesting habitat), identified the presence of wildlife species and endangered species (based on available habitat), and assessed forest health and value (Woodlot, 2004). The natural resource survey was used to establish site habitat conditions. It provided the basis for establishing site habitat conditions to be evaluated in the environmental risk assessment.

2.1.1 Ecological Habitats

The site is located along the eastern shore of the Deerfield River adjacent to Sherman Dam, one of the several dams along the Deerfield River used for hydroelectric power generation (Figure 1-1). YAEC owns YNPS and the surrounding lands. The site is divided into two parcels, separated by the Deerfield River.

- Rowe Parcel – Approximately 1,800 acres located in the northwest corner of Rowe, Massachusetts, to the east of the Deerfield River. The former nuclear plant itself occupied approximately 12 of the 1,800 acres of the Rowe Parcel.

- Monroe Parcel – Approximately 89 acres located in Monroe, Massachusetts, to the west of the Deerfield River.

In 2003, Woodlot Associates conducted a Natural Resource Inventory of the site. The inventory identified vegetation composition and habitats (*e.g.*, wetland, upland forest), characterized wildlife habitat (*e.g.*, availability of foraging and nesting habitat), identified the presence of wildlife species and endangered species (based on available habitat), and assessed forest health and value (Woodlot, 2004).

2.1.1.1 Local Habitats and Species

The site, which is predominantly woodland, consists of an assemblage of upland terrestrial areas, freshwater wetland areas, and lotic ("flowing") and lentic ("still") water bodies (Woodlot, 2004). Along the eastern shore of the Deerfield River, the forest is primarily a hardwood community of high density. Trees are typically 40-60 feet tall with approximately 80-100 percent crown closure. To the west of the Deerfield River, the forest is comprised of mixed hardwoods and softwoods 40-60 feet tall with approximately 80-100 percent crown closure. South of YNPS, the forest is predominantly hardwoods, trees measuring 20-40 feet in height with greater than 80 percent crown closure.

The site is situated adjacent to the Deerfield River and Sherman Reservoir, both Class B water bodies – suited for agricultural and industrial cooling water purposes, though not designated for drinking water. These surface water bodies provide a habitat for fish, other aquatic life, and wildlife, as well as a place for recreational activities. Three perennial streams are present on the Rowe parcel: Wheeler Brook, Shippee Brook, and Lord Brook (Figure 1-1). These streams are generally steep and very rocky. Cobbles and boulders are typical substrates on moderate to steep hillsides and finer mineral substrates, such as gravel and coarse sand occur amid boulder and cobble where gradients are less steep. A number of intermittent stream channels also occur across the property. These streams occur in topographic settings similar to perennial streams, and, consequently, have similar substrates. However, because these stream channels do not contain water during parts of the year, substrates are often covered by mosses and upland vegetation occasionally grows within them (Woodlot, 2004).

In addition to natural stream channels, the YNPS had a storm drainage system that carried runoff from the site. This system consisted of a series of catch basins connected by buried pipe, which was divided into east and west drainage systems. The outlet for the East Storm Drain (ESD) emptied into Sherman Reservoir. The West Storm Drain outlet emptied into an unnamed ditch/tributary, the West

Storm Ditch (WSD), which in turn discharged into the Deerfield River downstream of Sherman Reservoir (Figure 2-1). Both the East and West Storm Drain discharges were episodic in nature and the West Storm Drain frequently had a low flow water regime (often no water) during parts of the year.

The site fauna was found to be dominated by aquatic and terrestrial invertebrates, birds, mammals, reptiles, and amphibians, which use the on-site habitat for cover, feeding, nesting and a migratory stopover point (Woodlot, 2004). In the aquatic habitats of Sherman Reservoir, freshwater fish species such as Yellow Perch (*Perca flavescens*), White Sucker (*Catostomus commersoni*), Brown Bullheads (*Ameiurus nebulosus*), Chain Pickerels (*Esox niger*), Fallfish (*Semotilus corporalis*), and Rock Bass (*Ambloplites rupestris*) were observed (Woodlot, 2004). Numerous avian species (terrestrial and semi aquatic, as well as migratory and residential) observed on the site included Canada goose (*Branta canadensis*), Mallard (*Anas platyrhynchos*), Red-tailed hawk (*Buteo jamaicensis*), Downy woodpecker (*Picoides pubescens*), and Eastern kingbird (*Tyrannus tyrannus*). Observed mammalian species include Snowshoe hare (*Lepus americanus*), Beaver (*Castor canadensis*), Red fox (*Vulpes vulpes*), and Coyote (*Canis latrans*). Reptiles and amphibians included, but were not limited to: Common Snapping Turtle (*Chelydra serpentina*), Painted Turtle (*Chrysemys picta*), Northern Redbelly Snake (*Storeria occipitomaculata*), Eastern Garter Snake (*Thamnophis sirtalis*), Red-spotted Newt (*Notophthalmus viridescens*), Northern Redback Salamander (*Plethodon cinereus*), and Green frog (*Rana clamitans*) (Woodlot, 2004). A complete list of 210 species observed and expected to occur on-site based on a complete ecological habitat assessment is presented in the YNPS National Resources Inventory and Management Plan (Woodlot, 2004).

2.1.1.2 Threatened and Endangered Species and Species of Special Concern

Portions of the site are mapped as "Priority Habitats of Rare and/or Endangered Species" under the National Heritage and Endangered Species Program (NHESP) based on the presence of habitat for the American Bald Eagle (*Haliaeetus leucocephalus*) (Woodlot, 2004). Suitable nesting, feeding, and roosting habitats for bald eagles are identified along the Sherman Reservoir; however, none are presently known to be used (Woodlot, 2004). Field personnel discovered a northern spring salamander (*Gyrinophilus porphyriticus*), an NHESP species of special concern. One late-stage larva was observed in the headwaters of Wheeler Brook located on the northwestern border of the site approximately 5,000 feet from YNPS (Woodlot, 2004). Bristly black currant (*Ribes lacustre*), an NHESP species of special concern, was found outside the fence line of YNPS (Woodlot, 2004). It was observed in a wet drainage

area located along the Wheeler Brook Divertment, just southeast of YNPS. These areas of interest are identified in Figure 2-1.

2.1.1.3 Study Areas

The majority of the property surrounding the former nuclear plant represents an area where there is no reasonable possibility (extremely low probability) of residual impacts from operations at the YNPS. An ASTM Phase I survey (ERM, 2006a) confirmed the lack of Recognized Environmental Conditions (RECs) as defined by ASTM Standard 1527-05 in the outlying areas. These areas have, therefore, been excluded from the risk analysis, although a portion of the outlying area was used as a background sample location and included in that respect.

Based on different historical uses and the large area of the site, the YNPS was divided the following areas, which (Figure 2-1) have been extensively investigated for OHM and radionuclides.

Terrestrial Habitats

- **Beneficial Use Determination (BUD) Area.** This area is within the footprint of the former industrial area occupied by the former nuclear plant. According to the BUD approved by MADEP, certain concrete and asphalt (C&A) materials remain as fill in the C&A BUD area (see Figure 2-1). As a component of the final site restoration/grading plan, a 3-foot overburden was placed in the C&A BUD Area after demolition and removal of plant structures, and remediation of impacted soils. Cover depths vary from one to three feet in the BUD area outside the C&A area. The notice on the deed of the BUD contains restrictions that prohibit (i) disturbing the soil cover, (ii) excavation in the BUD area, and (iii) invasive procedures including installation of soil borings or wells, without prior MADEP approval and the oversight of a Licensed Site Professional (LSP).
- **Southeast Construction Fill Area (SCFA).** The SCFA encompasses a former construction debris landfill, composed primarily of re-graded native soils (excavated to facilitate construction of the YNPS) with minor amounts of construction debris and rubble. Approximately 13,050 yd³ of OHM-impacted soil (primarily PCBs in paint and lead from sandblast grit) were removed from the SCFA during Phase IV remedial response actions in compliance with the MCP. A notice of former landfill operations for the SCFA will be filed. The notice on the deed prohibits any future use of the SCFA area other than its present use, without prior MADEP approval.
- **TSCA Deed Restricted Area.** A Declaration of Land Use Restrictive Covenant under the Toxic Substances Control Act (TSCA), will be filed to cover those areas of the site where PCBs remain in soils above 1.0 mg/kg, the TSCA threshold for "unrestricted" use. This deed restriction will preclude any residential development in those designated areas of the site (surveyed and recorded on the deed). The TSCA deed restricted areas overlap the BUD and SCFA areas.

- **Restricted Use Area (RUA).** YAEC intends to file a deed restriction that precludes future residential development on the YAEC property in those areas in the vicinity of the former power plant (see Figure 2-1). Note that the RUA will encompass the areas the YAEC and TransCanada properties designated as the Combined Study Area on Figure 2-1.
- **TransCanada Property Study Area** – This study area includes former parking areas and a former leach field on property owned by TransCanada. The portion of the TransCanada property bordering Sherman Reservoir is termed the Shoreline Study Area. A portion of the BUD Area extends onto the TransCanada property within the Shoreline Study Area.
- **West Storm Ditch (WSD)** – The WSD is an intermittent drainage channel that carries stormwater runoff from former parking areas and a portion of the former industrial area. The WSD starts at the western portion of the former industrial area and flows under the paved access road and into the Deerfield River, south of Sherman Reservoir. In the fall of 2004, sediment and soil with PCB concentrations above 1 mg/kg and radionuclides exceeding FSS criteria were removed from the WSD (ERM, 2006b). In addition, as part of the decommissioning and site restoration process, the majority of the stormwater collection system in the former plant area was removed and sealed, reducing future runoff flows in the WSD.

Aquatic Habitats

- **Sherman Reservoir** – Sherman Reservoir is the impoundment of the Deerfield River behind the Sherman Dam. This reservoir was formerly used as a source of circulating cooling water during YNPS operations. The reservoir is about 2 miles long, ¼ mile wide, and up to 75 feet deep along its central channel with steep, heavily forested shorelines. Sediment remediation for PCBs in the vicinity of the East Storm Drain (ESD) outfall was completed in 2004 (ERM, 2006b). Study areas of interest included the Cooling Water Discharge area and the ESD area (see Figure 2-2).
- **Deerfield River** – The Deerfield River starts in Vermont and travels through the northwestern portion of Massachusetts. The river abuts the site along its eastern shore for over a mile. The river flows rapidly immediately downstream of Sherman Reservoir and then flows moderately to the Monroe Bridge Dam. The river was divided into two sections, the Deerfield River adjacent to the site, and the Deerfield River downriver from the site.
- **Wheeler Brook** – Wheeler Brook, with associated wetlands, is a perennial stream that transects the northeastern corner of the YNPS site and flows into Sherman Reservoir, directly north of the BUD Area. This perennial brook may dry up or be reduced in size during the dry season, making it an ill-suited habitat for fish. The Wheeler Brook Divertment was constructed by YAEC in 1980 to divert stormwater and surface water from upland areas around the industrial area into Wheeler Brook (ERM, 2004).

The majority of the YAEC property, was not used for, and is unaffected by, historical industrial processes, as confirmed in the ASTM Phase I Investigation (ERM, 2006a), and therefore is not evaluated

in the ecological risk assessment. This is true for the Monroe Parcel and outlying areas of the Rowe Parcel, including the small perennial and intermittent streams (Shippee Brook, Lord Brook, and smaller unnamed streams and tributaries of these two brooks). As shown on Figure 1-1, these streams do not intersect the former industrial area and there is no indication or reason to believe that these areas could have been impacted by historical industrial activities.

Collectively, the study areas defined above are referred to here as the Combined Study Area which covers an area of nearly 100 acres, including the area of Sherman Reservoir (approximately 20 acres) shown on Figure 2-1. For brevity, study areas on the YAEC property that fall within the BUD, TSCA, and SCFA areas, are referred to here as the "BUD/TSCA" areas. Areas within the YAEC RUA outside of these areas are referred to as the "non-BUD/TSCA" areas or "outside BUD/TSCA" areas. The areas comprising the YAEC and TC properties within the above-defined study areas are comprised of similar habitats. As noted in Section 2.1.1, and discussed again later in Section 3, the habitats in these study areas consist of upland ("terrestrial") areas, riparian areas adjacent to water bodies (*e.g.*, Sherman Reservoir, Deerfield River), and aquatic habitats.

The environmental risk characterization evaluated risks to receptors from exposure to oil and hazardous material (OHM) and radionuclides in the Combined Study Areas (those mentioned above) for terrestrial, riparian, and aquatic receptors. As noted above, 3 feet of overburden was placed in the C&A Fill area, and the BUD area received from one to 3 feet of overburden as part of the final site restoration/grading plan (these areas combined comprise approximately 13 acres). As a conservative approach, this natural soil exposure buffer was ignored in this environmental risk characterization.

2.2 Screening Evaluation

Surface soil, sediment, surface water, and fish samples were collected within the Combined Study Area. All samples collected during 2000 through 2006 sampling events, but not representing areas that were subsequently remediated, were used in the risk assessment. A description of the sources of the environmental characterization data for the site is presented in the Risk Characterization Section 2. Appendix A of the Risk Characterization contains sample results for chemicals (OHM) and Appendix B contains sampling results for radionuclides that were used in the human health and this environmental risk assessment.

Surface soil 0 to 3 feet bgs (below ground surface), sediment and surface water from the Combined Study Areas, and fish samples from Sherman Reservoir and the Deerfield River were used for the screening evaluation to identify constituents of potential concern.

2.2.1 Background Determination

Chemicals and radionuclides were selected as COPCs only if they exceeded their respective concentrations in background samples. The MCP 310 CMR 40.0006 (MADEP, 2006a) defines background as "levels of oil and hazardous material that would exist in the absence of the disposal site of concern which are either:

- (a) ubiquitous and consistently present in the environment at and in the vicinity of the disposal site of concern, and attributable to geologic or ecological conditions, or atmospheric deposition of industrial process or engine emission;
- (b) attributable to coal ash or wood ash associated with fill material;
- (c) releases to groundwater from a public water supply system; or
- (d) petroleum residues that are incidental to the normal operation of motor vehicles. "

As described in Section 3 of the Risk Characterization report, background samples were located in areas that are not believed to be impacted by historical site uses. Site-specific summary statistics of the detected OHM background concentrations observed in soil (0 – 3 ft), sediment, and surface water are presented in Tables 2-1 to 2-3, respectively .

Given their ubiquitous presence in the environment, MADEP (2002a) has developed statewide background levels for inorganics and PAHs representing both "natural" soil and soil containing fill material. In comparing MADEP background concentrations to the site-specific background concentrations (Tables 2-1 through 2-3), the site-specific concentrations are comparable to, although in many cases less than, those reported by MADEP (2002a).

Similarly, Section 3 of the Risk Characterization provides a discussion of the sample locations and results for background concentrations of Cs-137 and Sr-90. Without repeating that discussion, site-specific summary statistics of the background concentrations of radionuclides in soil and sediment are presented in Risk Characterization Tables 3-4 and 3-5, respectively.

As discussed in Section 3.1.1 of the Risk Characterization, PCBs, metals and radionuclides were analyzed in fish from the Deerfield River, Sherman Reservoir, and Harriman Reservoir (the background location). The results indicated the fish from the Deerfield River and Sherman Reservoir sampling areas did not contain these constituents above their respective concentrations in the Harriman Reservoir background samples. Nevertheless, given the presence of habitat that supports threatened and endangered species (Bald Eagle), OHM detected sporadically in fish were included in the environmental risk characterization, even though their concentrations were comparable to background.

2.2.2 OHM COPCs

As specified in the MCP, constituents detected in soil, sediment, and surface water were retained as COPCs if both of the following conditions were met:

1. Constituents were detected in greater than 5% of environmental samples; and
2. Constituent concentrations exceeded background or local conditions.

As discussed above, site-specific information was used to characterize local background conditions in order to identify COPCs, for soils, surface water, and sediment. Median and maximum detected concentrations of constituents in specific media were compared to the site background levels following MADEP protocols. Detected concentrations were also compared to detected background concentrations using statistical models (*i.e.*, box and whisker plots presented in Appendix J of the Risk Characterization Report), to determine if chemicals and radionuclides were comparable to background concentrations.

A Stage I Screening of OHM against background concentrations and detection frequencies in accordance with MCP guidelines for OHM is provided in Table 2-4 through Table 2-16. Sediment (Table 2-7 through 2-11) and surface water (Table 2-12 through 2-16) results also are shown relative to sediment and surface water benchmarks, although COPCs were not determined on the basis of whether or not they exceeded these benchmarks. The following OHM COPC categories are evaluated in this environmental risk characterization on the basis of their detection frequency and whether or not they exceeded respective concentrations from background samples:

OHM COPCs	
Soils	Dioxin/Furans, EPH, Inorganics, PCBs, SVOCs, VOCs, and VPH
Sediment	Inorganics, PCBs, SVOCs, VOCs, and VPH
Surface Water	Inorganics, SVOCs, and VOCs
Fish	Inorganics and PCBs (evaluated for completeness – comparable to background. See Table 2-17)

Note: PCBs – Polychlorinated Biphenyls, SVOCs – Semivolatile Organic Compounds, PAHs – Polycyclic Aromatic Hydrocarbons, VOCs – Volatile Organic Compounds, EPH – Extractable Petroleum Hydrocarbons and VPH – Volatile Petroleum Hydrocarbons.

These OHM COPCs (chemical-specific summaries in Table 2-18) required further evaluation to determine if they posed a risk to wildlife and were carried through to the Stage II environmental risk characterization baseline ecological risk assessment.

2.2.3 Radionuclide COPCs

Guidelines to protect humans from the harmful effects of radiation are generally considered adequate to protect other organisms, but there may be scenarios where human-based guidelines do not address environmental/ecological conditions and pathways (US DOE, 2002). For example, scenarios that limit human access to contact with contaminated areas may not restrict ecological receptors. Animals and plants may encounter contaminants due to exposure pathways that are not considered in human assessments. In addition, an evaluation of rare and endangered species, or other unique ecological considerations for the plant or animal populations, may not be captured by evaluations of human health (US DOE, 2002). For these reasons, an environmental assessment for radionuclides was conducted at the YNPS.

The MCP does not specifically address requirements and procedures for addressing environmental risks due to radionuclides. An approach developed by the US DOE, that shares a common framework with the chemical assessment, was therefore used for this assessment.

The ecological risk assessment for radiological COPCs followed the methods set forth in the "Biota Dose Assessment Committee (BDAC) A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (US DOE, 2002). The intent of the graded approach is to protect populations of aquatic and terrestrial animals, and terrestrial plants from the effects of exposure to ionizing radiation. Because certain ecological receptors are more sensitive to ionizing radiation than

others, it is generally assumed that protecting the more sensitive receptors will adequately protect other less sensitive ones. Thus, the US DOE approach identifies receptors that:

- Are important to the structure and function of the community;
- Are expected to receive a comparatively high degree of exposure; and
- Have a comparatively high degree of radiosensitivity (*e.g.*, radiation effects occur at relatively low doses in comparison with other receptors in the same community).

US DOE's graded approach consists of a step-wise process that is designed to proceed from an initial conservative screening to, if needed, a more rigorous analysis using site-specific information. The process is summarized below (US DOE, 2002).

<i>(1) Data Assembly</i>
Knowledge of sources, receptors, and routes of exposures for the area to be evaluated. Measured radionuclide concentrations in water, sediment, and soil are assembled for subsequent screening.
<i>(2) General Screening</i>
Maximum measured radionuclide concentrations in environmental media are compared with a set of Biota Concentration Guides (BCGs). Each radionuclide-specific BCG represents the limiting radionuclide concentration in an environmental medium that should not result in exceedence of recommended dose standards.
<i>(3) Site-Specific Analysis</i>
This phase consists of three increasingly more detailed steps of analysis: <i>(a) Site-specific Screening:</i> Uses more realistic site-representative lumped parameters (<i>e.g.</i> , bioaccumulation factors) in place of conservative default parameters. Use of mean radionuclide concentrations in place of maximum values, taking into account time dependence and spatial extent of accumulation, may be considered. <i>(b) Site-specific Analysis:</i> Uses a modeling tool that incorporates multiple parameters representing contributions to the organism's internal dose (<i>e.g.</i> , body mass, consumption rate of food/soil, inhalation rate, lifespan, biological elimination rates) that represent site and organism-specific characteristics. The model employs allometric equations relating body mass to these internal dose parameters. <i>(c) Biota Dose Assessment:</i> Involves an actual site-specific biota dose assessment using collected and analyzed biota samples. The dose assessment would involve a problem formulation, analysis, and risk characterization protocol consistent with the ecological risk assessment methodology.

Soil, sediment, and surface water biota concentration guidelines (BCGs)¹ for aquatic and riparian plants and animals are based on exposure to radionuclides in soil, sediment, and surface water, also accounting for dietary intake of radionuclides. A BCG represents the limiting radionuclide concentration in soil, sediment, or surface water that is conservatively estimated such that the corresponding dose to the plant or animal receptor exactly equals the "allowable dose."

¹ The BCGs are analogous to soil screening levels (SSLs).

The general equation for calculating the BCG is given by US DOE (2002):

$$\text{BCG} = \frac{\text{Dose}_{\text{limit}}}{\text{AF} \times (\text{UF} \times \text{DCF}_{\text{int}} + \text{DCF}_{\text{ext}})} \quad (2-1)$$

where

BCG	=	Biota concentration guideline (pCi/g) soil/sediment, or (pCi/L) water
Dose _{limit}	=	Acceptable dose (0.1 rad/day terrestrial animals; 1.0 rad/day aquatic animals and terrestrial plants)
DCF _{int}	=	Dose conversion factor for internal radiation (rad/day)/(pCi/g)
DCF _{ext}	=	Dose conversion factor for external radiation (rad/day)/(pCi/g) for soil/sediment, or (rad/day)/(pCi/L) for water
UF	=	Media to biota empirical uptake factor (pCi/g-biota)/(pCi/g-media) for soil/sediment, or (pCi/g-biota)/(pCi/L-media) for water – accounts for dietary intake
AF	=	Area correction factor to account for biota habitat/foraging area and residence time (default set to 1.0 for screening level BCGs)

The default screening BCGs assume 100% absorption for radionuclides and also do not correct for the foraging area relative to the size of the impacted habitat for the receptors (*e.g.*, default AF = 1.0). Both assumptions lead to a conservative estimate of the BCG. These BCGs are available in the RESRAD-BIOTA web-based model, and RESRAD-BIOTA was used as the source of BCGs.² A summary of the BCGs is provided in Table 2-19.

For the Stage I screening, the maximum detected concentrations of radionuclide COPCs in surface soil and sediment were compared to the corresponding plant and animal BCGs. As summarized in Tables 2-20a, 2-20b and 2-21, the maximum detected concentrations of radionuclide COPCs are in all cases less than their corresponding BCG values.

As discussed in Section 3 of the Risk Characterization, fish from the Deerfield River and Sherman Reservoir sample locations did not contain site-related radionuclides, nor were site-related radionuclides detected in Deerfield River and Sherman Reservoir surface water samples.

² Available at: <http://homer.ornl.gov/oepa/public/bdac/>

The initial conservative screening against BCGs indicated no unacceptable risk, therefore no additional analysis was performed for radionuclides. A site-specific ecological analysis (or Stage II assessment) that models site- and organism-specific characteristics was therefore not needed for radionuclides.

3 Stage II Environmental Risk Characterization

A Stage II Environmental Risk Characterization is a quantitative, site-specific characterization of hazard to ecological receptors. The approach used in performing the Stage II Environmental Risk Characterization consists of a process by which measured or estimated concentrations, or doses of constituents in environmental samples, are compared to criteria considered protective of ecological receptors. Thus, the Stage II assessment evaluated whether the constituent concentrations at the site pose a threat to ecological receptors. Media or areas of concern that exceeded the Stage I screening level benchmarks were included in the Stage II risk characterization process, which developed a more detailed site-specific environmental risk characterization that identified:

- Species-specific exposure pathways and constituent exposure concentrations; and
- Likelihood of adverse effects to individuals and populations in the environment.

The methods and assumptions used in this evaluation were intended to identify possible hazards and were designed so that potential risks to ecological receptors were not underestimated. The discussion below follows the four steps for a Stage II Environmental Risk Characterization. As described in Section 2, only OHM COPCs were identified in the Stage I analysis and thus carried through to Stage II. No radiological constituents were found at concentrations exceeding the screening levels evaluated in Stage I, so no further evaluation was necessary for radionuclides.

3.1 Problem Formulation

The first step of a quantitative Stage II evaluation is the Problem Formulation. The outcome of this step is the selection of assessment endpoints (*e.g.*, endpoints that address biological stress or potential harm) that are subsequently quantified in the risk characterization through specific measurement endpoints (*e.g.*, specific quantitative measures that relate chemical concentration or intake to possible biological harm). The Problem Formulation step includes the following components:

- Identification of COPCs and their fate and transport characteristics;
- Identification of exposure pathways and receptors of concern; and
- Definition and selection of ecological assessment and measurement endpoints.

Using information developed from these components of the analysis, a conceptual site model was developed to guide the site-specific environmental assessments. The conceptual site model represents pathways by which constituents move through the environment to potential exposure points and through the food web to higher trophic level consumers. In addition to providing a basis for identifying key receptors, the conceptual model also provides a reference point for selecting measurement methods that could be used to evaluate the effects of possible concern.

3.1.1 Current and Future Conditions Affecting Fate and Transport Characteristics of COPCs

This ecological risk assessment evaluated site conditions as they currently exist after the demolition of the YNPS and restoration of the former industrial areas, Sherman Reservoir sediments in the East Storm Drain discharge area, and remediation of West Storm Ditch areas. The majority of the YAEC property will remain in its current state of undeveloped woodlands. In accordance with the site restoration plan, the majority of the former industrial area received a graded surface covering, including 3 feet of graded surface material in the C&A Fill area of under the BUD. The site has also been revegetated. With the demolition and removal of plant structures, the reduction in impervious surfaces returned the site to more natural conditions with reduced surface water runoff. Furthermore, as part of the decommissioning and site restoration process, much of the stormwater collection system in the 12-acre plant site footprint was removed or sealed (the stormwater drainage system will remain in place for the ISFSI area), thereby reducing the runoff from this engineered migration pathway from the site to Sherman Reservoir and the Deerfield River.

Possible direct radiation exposure from residual radionuclides beneath the overburden may occur at the former industrial area. However, because all detected concentrations were below their respective BCG screening benchmarks, no radionuclide COPCs were identified. Note that this condition is met even assuming that the 3 feet of graded material/overburden in the BUD C&A Fill area provides no exposure barrier (when in fact surface contact is eliminated and burrowing deeper than 3 feet is unlikely). As noted earlier, the environmental risk characterization evaluated exposure to chemical COPCs for as though the soil cover was non-existent.

Historically, surface water runoff resulted in migration of PCB-containing paint chips from the site through the storm drain system, depositing paint chips and sediment in areas of the Sherman Reservoir and West Storm Ditch. The PCB remediation program included road sand removal, catch basin maintenance and sediment removal, exterior building paint characterization and abatement, and a building

inspection-monitoring program. In addition, sediments in Sherman Reservoir near the ESD outfall were dredged and removed from the site. Soil/sediment up to a depth of 2 feet was removed along 500 linear feet of the West Storm Ditch from the outfall to the culvert (ERM, 2006b).

3.1.2 Exposure Pathways

An exposure pathway is the link between a source of a constituent release and a receptor *via* a particular environmental medium and route of contact or intake. Thus, an exposure pathway defines the mode of COPC transport from the source of contamination to the point of intake by receptors, whereas an exposure route refers to the methods by which COPCs enter the body of the receptor. For an exposure pathway to be complete, a constituent must be able to migrate from the source to an area of contact with ecological receptors and be taken up by the receptors *via* one or more exposure routes (*e.g.*, ingestion, direct contact, inhalation, *etc.*). The food web diagrams (Figure 3-1) illustrate the potential exposure pathways and exposure routes of possible concern for aquatic and terrestrial receptors at the site. The potential exposure routes evaluated for ecological receptors at the site were the following:

- Ingestion of COPCs in soil, sediment, or surface water;
- Transfer of COPCs into plant or prey items that are subsequently ingested; and
- Direct contact with COPCs in soil, sediment, or surface water.

As depicted in Figure 3-1, the environmental media of concern for the terrestrial higher vertebrate receptors is surface soils through the ingestion of prey items and incidental soil ingestion. These terrestrial prey items are exposed through direct contact and uptake from soils. The exposure pathways of concern for the freshwater ponds/wetlands receptors are exposure through the direct contact of aquatic life with COPCs in surface water and sediments. Higher semi-aquatic vertebrate species are primarily exposed through the ingestion of sediment-exposed prey and incidental ingestion of soils or sediments. Incidental ingestion of surface water by higher order receptors is not considered a significant pathway relative to other pathways of exposure. Additionally, limited data are available in the literature for an estimate of daily incidental ingestion of surface water. Even though this pathway was not quantified, this omission is considered of minimal importance due to the limited number of COPCs detected in surface water. Incidental ingestion of sediment and surface soils was evaluated for higher trophic level receptors.

3.1.3 Ecological Endpoints

Environmental risk characterization guidance distinguishes between two types of ecological endpoints: assessment and measurement (MADEP, 1996). Assessment endpoints are defined as the environmental attributes upon which the ecological risk assessment focuses, whereas measurement endpoints are defined as the measurable, observable changes used to estimate whether adverse impacts as defined by the assessment endpoints might exist. Selection of appropriate endpoint receptors that specifically address the assessment endpoint is key such that the endpoint receptors evaluated must be amenable to the measurement endpoints (*i.e.*, easily testable or measurable).

3.1.3.1 Assessment Endpoints

Potential adverse effects on the reproductive success, growth, or survival of receptor species were used as assessment endpoints for this evaluation. As outlined in MADEP (1996) guidance, the following five key characteristics define assessment endpoints:

- Operational definition, which provides direction for testing or modeling;
- Accessibility to prediction and measurement, which means that the response of an endpoint can be measured or estimated reliably from field measurements and/or modeling;
- Susceptibility to the constituent of concern, which addresses the potential for exposure and responsiveness to the exposure;
- Biological relevance, which is a measure of the importance of the endpoint to a higher level of the biological system; and
- Relevance to program objectives, which means that the endpoint either must be valued by the decision-maker and the public, or be linked to an effect that is valued.

The assessment endpoints for the environmental characterization focused on the following fundamental indicators of ecological health/viability with respect to chemical stressors:

- Avoid or minimize habitat impairment in order to maintain natural diversity, nutrient cycling, and trophic structure of biological communities.
- Avoid or minimize conditions that adversely impact growth, survival, and reproductive success.
- Avoid or minimize bioaccumulative concerns whereby constituents in environmental media and food sources could accumulate through the food web and adversely impact "higher order" consumers.

3.1.3.2 Representative Food Web (Receptors)

The ecological risk assessment process acknowledges that it is neither technically feasible nor practical to assess risk to every potential environmental receptor in an exposure pathway. The MCP guidance recommends the selection of representative receptor species to represent a trophic level or functional group for assessing local food chain effects. This selection process was used to develop and refine a simple conceptual food web, which incorporates a variety of ecological receptors deemed representative of ecology of the site. The conceptual food model considered the following:

- Ecological receptors common to or expected to occur on-site;
- A simple food web applicable to the habitats observed on-site;
- Key endpoint receptors in the food web that may have the potential to bioaccumulate/bioconcentrate contaminants through contact with abiotic media or consumption of contaminated biota;
- Selection of species whose life history and ecology are documented in the scientific literature; and
- A basis for empirically determining potential threats to key trophic level receptors based upon the scientific literature, and fate and transport characteristics for contaminants of concern.

The trophic levels included in the assessment endpoints are: producers (plants), benthic and terrestrial invertebrates, primary consumers (fish and amphibians), insectivores (mammal and bird), an omnivore (mammal), piscivores (mammal and birds), carnivore (mammal), and an herbivore (mammal). Figure 3-1 presents the conceptual food web and representative species for each functional group identified for the site ecological risk assessment.

Ecological receptors evaluated in the ecological risk assessment include representative terrestrial/aquatic plants, benthic macroinvertebrates, soil invertebrates, birds, mammals, amphibians, and fish. Each receptor was chosen based on its diet, suitability of the habitats found at the site, and the bioaccumulating characteristics of PCBs, a COPC. The following is a list of species and communities selected for evaluation in the ecological risk assessment.

Benthic Macroinvertebrates

- Benthic macroinvertebrates are the principal faunal assemblage present in freshwater aquatic and wetland sediments. They represent a major dietary component for fish populations in the aquatic food chain.

Freshwater Fish

- Freshwater fish represent the most diverse group of vertebrates present in the aquatic food chain. Fish are sensitive to degradation of their habitat (*i.e.*, disappearance of a food source) and may have difficulty adapting to new environmental conditions. Multiple trophic guilds comprising insectivorous, omnivorous, and carnivorous species are represented in typical warm water fish communities.

Avian Species

- Belted kingfisher (*Megaceryle alcyon*) – This representative piscivorous species lives and feeds in most freshwater bodies. It primarily feeds on fish, but other aquatic prey such as amphibians, crustaceans, and aquatic animals may also be consumed. This species was selected for its small home range and primary fish diet. This species is expected to breed in moderate numbers at the site (Woodlot, 2004).
- Bald eagle (*Haliaeetus leucocephalus*) – Suitable nesting and roosting habits for this federally threatened and Massachusetts endangered species are identified along Sherman Reservoir; however, none are presently known to be used. Although this migratory species was not observed at the site, this piscivorous raptor species was selected for its endangered species status, large home range, and primary fish diet.
- American robin (*Turdus migratorius*) – This representative insectivorous species lives in upland areas and primarily feeds on terrestrial insects, soil arthropods, and worms. This abundant species is frequently observed at the site (Woodlot, 2004).

Mammalian Species

- Mink (*Mustela vison*) – This representative piscivorous mammalian species is found in most areas near water. They primarily feed on fish and aquatic and terrestrial vertebrates. The habitats present at the site indicate the occurrence of mink is uncommon. Although this resident species is believed to be present in low numbers, this sensitive species was chosen based on its primary fish diet and its sensitivity to PCBs.
- Raccoon (*Procyon lotor*) – This representative omnivore exploits a variety of potential dietary components in and around aquatic environments and woodlands. This resident species was observed in moderate numbers at the aquatic and terrestrial habitats of the site (Woodlot, 2004).
- Short-tailed shrew (*Blarina brevicauda*) – This representative insectivore feeds on insects, worms, snails, and other invertebrates. This burrowing mammal inhabits round, underground nests and maintains underground runaways within the top 10 cm of soil. This resident species was observed in moderate numbers at the site (Woodlot, 2004).
- Red fox (*Vulpes vulpes*) – This representative carnivorous mammal preys extensively on mice and voles, but also feeds on small mammals, insects, hares, game birds and occasionally seeds, berries, and fruit. The fox usually inhabits an underground den or abandoned burrow. This resident species was observed in moderate numbers at the site (Woodlot, 2004).
- Eastern cottontail (*Sylvilagus floridanus*) – This representative herbivore is associated with shrub swamps and upland shrub lands. Its diet consists of trees, shrubs and vines, herbs, grasses, sedges, and rushes. This resident species is common within the habitats of YNPS (Woodlot, 2004).

Amphibian Species

- Field personnel observed a northern spring salamander (*Gyrinophilus porphyriticus*), a state species of concern in the northeastern portion of the site during the wildlife habitat assessment (Woodlot, 2004). Amphibians are most sensitive during the early developmental life stages (*i.e.*, embryo and tadpole). Amphibians were evaluated using surface-water concentration benchmarks.

Terrestrial Plants and Soil Invertebrates

- Terrestrial plants form the basis of the terrestrial food chain and represent a major energy introduction into the terrestrial food web. This group of receptors was evaluated at the community level using community level benchmarks.
- Soil invertebrates such as earthworms are important receptors responsible for nutrient recycling and decomposition of organic matter within the detrital food web. This group of receptors was evaluated using soil benchmarks.

Exposure parameters for each of the avian and mammalian terrestrial and semi-aquatic species are presented in Table 3-1.

3.1.3.3 Measurement Endpoints

A measurement endpoint is a measurable response to a constituent that is related to the assessment endpoint. Although the measurement endpoints vary, they are selected in general to be indicative of adverse effects on survival, reproduction, or growth of the endpoint species. As outlined in MADEP guidance (MADEP, 1996), three key characteristics define measurement endpoints:

- Strength of association, which refers to the applicability of the measurement endpoint to the assessment endpoint and the correlation between the results of the measurement and the level of risk;
- Relatedness to assessment endpoint, which refers to the degree to which the collected data are relevant to the assessment endpoint; and
- Ease of measurement, which refers to the ability of the study, or measurement, to detect effects of concern.

The relationships between measurement endpoints and assessment endpoints enable the risk assessor to use the results of field observations and literature studies to determine whether impacts are associated with site-specific exposures to COPCs.

Three types of measurement endpoints were used to assess chemical risks: benchmark approach, toxicity quotient method, and tissue residue analysis. The benchmark approach involves comparing

water, sediment or tissue concentrations with benchmark values identified in the literature. These benchmarks are protective of specific receptors (*i.e.*, terrestrial plants, benthic macroinvertebrates, amphibians, soil invertebrates) exposed to environmental media. The toxicity quotient method characterizes risk by calculating the ratio of the COPC intake from the site exposure to toxicity reference values obtained from the literature with known endpoints. Tissue residue analysis, which is often the method used to evaluate risk for fish species, involves analyzing fish samples to determine whether the contaminants of concern have accumulated in the organism. Fish were collected and analyzed for PCBs because of its bioaccumulation potential and the historic releases at the site. This measure of exposure was then combined with available data on toxic effects, in order to assess the potential for ecological risk associated with the degree of bioaccumulation or exposure (MADEP, 1996). A summary of the types of measurement endpoints used in the ecological risk assessment is given below.

Assessment Endpoint (Receptor Group)	Measurement Endpoint
Benthic Invertebrates	Compare COPC concentrations in the sediment of Sherman Reservoir, Deerfield River, and Wheeler Brook to sediment benchmarks in MacDonald <i>et al.</i> (2000).
Fish	Compare COPC body burden concentrations of collected fish tissues to toxicity reference values relating effects to tissue-based concentrations (Jarvinen and Ankley, 1999).
Mammals and Birds	Estimate COPC uptake from environmental media and food. Compare COPC uptake to representative toxicity reference values.
Amphibians	Compare surface water quality data for COPCs to toxicity reference values (where available) for amphibian survival (US EPA, 1996a).
Terrestrial Plants and Soil Invertebrates	Compare COPC concentrations in soil of terrestrial habitats present at the site to ecological benchmarks present in Efroymsen <i>et al.</i> (1997a, 1997b).

3.2 Exposure Assessment

In the exposure assessment step, the assessment endpoints were evaluated using the measurement endpoints. This step involved the collection and integration of information on constituent concentrations found at the Combined Study Areas and exposure conditions. The exposure assessment identified:

- Exposure pathways defining exposure media where constituent transfers/uptake is possible;
- Routes of constituent exposure such as direct contact, ingestion, *etc.*; and
- Constituent concentrations in environmental media and estimated constituent intakes as needed.

Specific receptors selected for the ecological risk assessment are identified in Table 3-1. In general, aquatic organisms may be exposed to COPCs in sediment and surface water *via* direct contact and/or assimilation of sediment-sorbed constituents, and dissolved or suspended constituents in the water column. Both invertebrates and vertebrates such as fish or amphibians in direct contact with water or sediment may also serve as contaminant vectors for indirect exposure to higher trophic level consumers.

Semi-aquatic and terrestrial wildlife that forage on either aquatic or terrestrial food sources may be exposed to constituents in sediment/soil and food. Exposure routes to be considered included dermal contact and ingestion of soil/sediment, water, and ingestion of food and prey items that may have accumulated COPCs. In order to quantify environmental exposures, the COPC concentrations at the point of exposure were defined as described in the following sections.

3.2.1 Exposure Point Concentrations

In order to conduct the environmental risk characterization, exposure point concentrations (EPCs) were estimated in the soil, sediment, surface water, benthic invertebrates, fish, terrestrial and aquatic plants and invertebrates, and small mammals. The following sub-sections present the approach used to quantify EPCs for these media.

3.2.1.1 Soil

Soil data from the environmental site investigations collected throughout the Combined Study Areas were used to calculate the average EPCs of COPCs in soil. Surface and shallow subsurface soil samples (within the top 1 to 3 feet) were used to estimate potential exposures for ecological receptors. EPCs were calculated by averaging concentrations for each constituent, using the detected values and, in cases where the constituent was not detected, using a proxy value equal to $\frac{1}{2}$ the detection limit, per MADEP (1995) guidance. In cases where the average EPC concentration was higher than the maximum detected concentration (an occasional artifact of using elevated detection limits for non-detects), the maximum detected concentration was used as the EPC. EPCs for the Combined Study Area are presented in Table 3-2. As described earlier, OHM data from within the BUD area, where soil cover has been placed, were used in the EPC values as though this soil cover did not provide any reduction of exposure (a conservative assumption). As noted later, EPCs were also evaluated for particular portions of the site when evaluating potential risks for invertebrate species.

3.2.1.2 Sediment

Sediment data from Sherman Reservoir, the Deerfield River (study area adjacent to the site, excluding downstream samples), the WSD, and Sherman Spring were pooled together to calculate the average EPCs of COPCs in sediment (see Tables 2-7 and 3-2), when evaluating potential risks for higher order species with diverse foraging areas. For sediment invertebrate species, EPCs were determined over smaller averaging areas as discussed later. Note that Wheeler Brook sediments did not contain COPCs above background, and those sample results were not included in the EPC calculations.

The East Storm Drain discharge area of Sherman Reservoir and West Storm Ditch area were remediated for PCBs. Samples from those areas represent post-PCB remediation conditions (*e.g.*, they excluded samples that were removed and include confirmation samples). Similar to soils, EPCs were calculated by averaging concentrations for each constituent, using the detected values and, in cases where the constituent was not detected, using a proxy value equal to ½ the detection limit, per MADEP (1995) guidance. In cases where the average EPC concentration was higher than the maximum detected concentration, the maximum detected concentration was used as the EPC.

3.2.1.3 Surface Water

Surface water data from environmental site investigations conducted during 2000 to 2006 were used to calculate the average EPCs of COPCs. EPCs were calculated by averaging concentrations from Sherman Reservoir, the Deerfield River, Sherman Spring, and Wheeler Brook. A proxy value equal to ½ the detection limit was used for non-detected sample results. In cases where the average EPC concentration was higher than the maximum detected concentration, the maximum detected concentration was used as the EPC (see Table 3-2).

3.2.1.4 Fish

As discussed in the Risk Characterization, although fish from the Sherman and/or Deerfield sporadically contained measurable concentrations of metals and PCBs, these constituents were detected in Harriman Reservoir (background) fish samples as well. The concentrations in the Sherman and Deerfield samples were not "elevated" above the Harriman samples. Nevertheless, fish consumption by piscivorous mammals and birds, including the Bald Eagle, was included as a conservative assessment here.

The average EPCs in fish were calculated from the 2006 Sherman and Deerfield whole-body fish results (Table 2-17), including a proxy value equal to ½ the detection limit for non-detects. In cases where the average EPC concentration was higher than the maximum detected concentration, the maximum detected concentration was used as the EPC (see Table 3-2).

3.2.1.5 Plants, Invertebrates, and Small Mammals

Constituent concentrations in aquatic or terrestrial forage food items (terrestrial plants, terrestrial invertebrates, and benthic macroinvertebrates) were estimated by multiplying the average COPC concentrations in sediment or soil, respectively, by uptake factors published in the scientific literature. Based on the availability of information, one of two types of uptake factors was used to estimate COPC concentrations in forage food items: (i) linear uptake factors; or (ii) log-linear regression uptake factors.

Because constituent uptake is influenced by characteristics of the organism (*i.e.*, forage food species), separate uptake factors are recommended for each taxonomic group considered (Sample *et al.*, 1997). The linear and log-linear uptake models are summarized in Attachment A. EPCs of terrestrial plants, terrestrial invertebrates, and benthic invertebrates exposed to Combined Study Areas media are presented in Tables 3-3 to 3-5, respectively.

Exposure point concentrations of small mammals and birds as a foraging food item were estimated with a linear uptake approach using US EPA (1999) recommended bioconcentration factor (BCF) and biotransfer factors. EPCs for the short-tailed shrew, American robin, and deer mouse were calculated as representative omnivore mammals, small bird, and herbivore mammal, respectively. The equations for calculating small mammal and bird EPCs are presented in Attachment A. In cases where metal BCFs were not available, a biotransfer factor of 1.0 was applied to the equations. When calculating the EPCs for these small mammal and bird food items, the home range of the species was not applied because it was assumed that these prey items were exposed to media from the Combined Study Areas equally, regardless of their home ranges. The average media concentrations from the Combined Study Areas, as well as derived terrestrial plant, terrestrial invertebrates, and benthic invertebrates concentrations were applied in estimating the EPCs for small mammals and birds (Table 3-6).

3.2.2 Estimation of COPC Intake

The daily intake of COPCs is determined by summing intakes from all media of potential concern (after Sample *et al.*, 1997):

$$DI = \sum_i \frac{(EPC_i * IR_i)}{BW} \tag{3-5}$$

where:

- DI = Daily intake of COPC (mg/kg-day)
- EPC_i = Exposure point concentration in ith media representing soil, sediment, water, food sources, *etc.* (mg/kg)
- IR_i = Ingestion rate of the ith media, representing soil, sediment, water, food, *etc.* (kg/day)
- BW = Body weight of organism (kg)

Total COPC exposures are the summation of exposure *via* each pathway:

$$DI = \frac{(EPC_{soil / sed} * IR_{soil/sed}) + (EPC_{water} * IR_{water}) + (EPC_{food} * IR_{food})}{BW}$$

where the subscripts "soil/sed," "water," and "food" indicate media concentrations and intake rates. The methods used to estimate COPC concentrations in food items are presented in Attachment A.

The calculated intake of chemicals took into account the average foraging range for the selected ecological receptors. For species with foraging ranges larger than the Combined Study Areas, no chemical intake would occur when the species forages beyond that area, so only a fraction of the dietary intake would contain site-related constituents. In order to account for this, when calculating exposure (intake), the concentration terms were adjusted based on the area of the site-related contamination in soil or sediments relative to the typical foraging ranges as follows:

$$EPC_i = \frac{A_{YNPS}}{A_{forage}} C_i \tag{3-6}$$

where

- EPC_i = Exposure point concentration of constituent in "ith" environmental medium – soil, sediment, diet (mg/kg)
- C_i = Concentration of constituent in "ith" environmental medium (mg/kg)

A_{YNPS} = Area containing residual chemicals or radionuclides (acres)

A_{forage} = Foraging range of target species (acres)

The exposure factors defining ingestion rates, animal body weights, and foraging ranges for the identified receptors are summarized in Table 3-1. These exposure factors were obtained primarily from US EPA's Wildlife Exposure Factors Handbook (US EPA, 1993), adopting average or median values when multiple values were reported. It was conservatively assumed that the Combined Study Areas are approximately 20 acres. Because the Combined Study Areas are smaller than the home range of the raccoon, red fox, mink, belted kingfisher and bald eagle, an area use factor was applied to these receptors. For the American robin, short-tailed shrew and eastern cottontail, an area use factor was not applied due to their smaller home ranges.

3.3 Biological Effects Assessment

The biological effects assessment consisted of two types of environmental comparisons following MADEP guidance. One element of the biological effects assessment involved a comparison of COPC concentrations in soil, sediment, water, and fish to published "benchmark" concentrations in each of these media for the protection of benthic and terrestrial organisms, plants, and fish. The second element of the biological effects assessment involved an estimation of COPC intake for modeled food web receptors. The COPC intake within the food web was then compared to No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) for each receptor.

Published benchmark concentrations, and NOAEL and LOAEL values were obtained from MADEP guidance and the scientific literature, including:

- Toxicological benchmarks for benthic invertebrates, fish, amphibians, and terrestrial invertebrates and plants (MADEP, 2006b, 2006c; MacDonald *et al.*, 2000; Efrogmson, 1997a; Persaud *et al.*, 1993; Jarvinen and Ankley, 1999, NOAA, 1999; US EPA, 1996a, 1996b, 1999, 2002; Efrogmson *et al.*, 1997a, 1997b); and
- Toxicity reference values (TRVs) for COPCs based on NOAELs and LOAELs (Sample *et al.*, 1996; US EPA, 1999, 2005).

3.3.1 Toxicological Benchmarks for Benthic Invertebrates

Benthic organisms provide substrate (food) for higher level organisms within the food web. Based on laboratory and field studies, the response of benthic populations (diversity, population density, growth, survival, *etc.*) to chemicals in sediment has been evaluated, and concentration benchmarks that indicate an impairment in the biological function of benthic organisms have been published in the literature. The MADEP (2006c) "Revised Sediment Screening Values, Technical Update" adopts the so-called "consensus" based sediment quality guidelines for metals, PAHs, and PCBs published by MacDonald *et al.* (2000). The MADEP recommends using the Probable Effects Concentration (PEC) for inorganics, and the Threshold Effects Concentration (TEC) for PCBs and PAHs. The TEC benchmarks are concentration values below which adverse biological effects to benthic organisms are considered unlikely. However, exceeding a TEC concentration does not mean that adverse biological effects will occur, merely that some adverse biological response in benthic organisms cannot necessarily be ruled out. The PEC benchmarks represent chemical concentrations in sediment which if exceeded adverse biological effects are more likely to occur, although factors such as the size of the area where such exceedances exist must be assessed in terms of potential ecological significance.

For COPCs not listed in the MADEP (2006c) guidelines, the following sources were used:

- MacDonald, DD; Ingersoll, CG; Berge, TA. 2000. "Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems." *Arch. Environ. Contam. Toxicol.* 39:20-31;
- US EPA. 1999. "Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities." Solid Waste and Emergency Response. EPA 530-D-99-001;
- Efrogmson, RA; Suter, II GW; Sample, BE; Jones, DS. 1997c. "Preliminary Remediation Goals for Ecological Endpoints." Office of Environmental Management, Oak Ridge National Laboratories, Oak Ridge, TN; and
- Persaud, D; *et al.* 1993. "Guidelines for the protection and management of aquatic sediment quality in Ontario." Ontario Ministry of the Environment (Toronto, Ont.). 27p.

The sediment benchmarks are summarized in Table 3-7.

3.3.2 Toxicological Benchmarks for Fish

Whole body fish samples were collected from Sherman Reservoir and the Deerfield River in June and July 2006 *via* electrofishing (ERM, 2006c). All fish samples were inspected for evidence of lacerations, deterioration, and/or injury. After inspection, fish samples were weighed, measured, prepared, and preserved in accordance to US EPA's "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories" (US EPA, 2000).

Detected COPC concentrations in the fish samples were compared against tissue residue values of similar fish species of known effects (Jarvinen and Ankley, 1999). The tissue residue endpoints reflect impairment of fish survival, growth, and/or reproduction. In cases where tissue residue values of specific species were not available, the detected concentrations were compared to the lowest effects value of all species. This comparison is discussed later in Section 3.4.

3.3.3 Toxicological Benchmarks for Amphibians

Amphibians typically live at the edges of ponds, lakes, vernal pools, and slow-moving streams. They are sensitive to contaminants in water bodies because they generally lay their eggs in water and have aquatic larvae. Woodlot (2004) observed several amphibian species at the site such as the Red-spotted Newt (*Notophthalmus viridescens*), Northern Redback Salamander (*Plethodon cinereus*), Green frog (*Rana clamitans*), and the Northern Spring Salamander (*Gyrinophilus porphyriticus*), an NHESP species of special concern. Risks to amphibians were assessed by comparing maximum surface water concentrations of Sherman Reservoir and the Deerfield River to Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) using robust endpoints (*i.e.*, mortality and reproductive impairment). Benchmarks focused on the egg and larval stages were used because these stages are the most sensitive, and come into direct contact with constituents in surface water.

Two vernal pools were identified on the site (Figure 1-1). These pools, which are favorable for amphibians, are located in areas that are not likely to be impacted by historical releases. Water samples were not collected in these areas, but surface water samples from Sherman Reservoir and the Deerfield River adjacent to the site, with closer proximity to historical site operations, were used for this comparison. This comparison is discussed later in Section 3.4.

3.3.4 Toxicological Benchmarks for Terrestrial Invertebrates

Terrestrial invertebrates serve an important function in the terrestrial food web by consuming plants, detritus, *etc.*, and they are a main food source for birds and mammals. They represent an important link between organic matter and higher trophic level consumers. They are in intimate contact with soil and may be highly exposed to absorbed contaminants. Reducing or impairing the function of invertebrate organisms may disrupt the flow of energy in the ecosystem. Therefore, impacts to this community may have consequences to wildlife receptors, potentially resulting in decreases in avian and mammalian populations. Soil invertebrates also improve aeration, drainage, and aggregation of soil, and serve as a forage base for many terrestrial species.

The soil benchmarks used in this environmental risk characterization (Table 3-7) are those published in Efroymson *et al.* (1997a). These benchmarks are based on soil invertebrates (earthworms), and are based on the assessment endpoints of growth, reproduction, and activity level.

3.3.5 Toxicological Benchmarks for Terrestrial Plants

As primary producers, plants are an important food source to various trophic levels in the food web. In addition, plants provide essential habitat for a variety of aquatic and terrestrial species at all life stages. Plants are an essential component of ecosystems, providing food, cover and nesting material, and chemical stressors may result in a loss of productivity within an ecosystem. Loss of vegetation cover can also result in erosion of surface soils, inhibiting revegetation. Adverse effects of contaminants on plants include failure to germinate, stunted growth, failure to produce viable seeds, and death.

The soil benchmarks protective of terrestrial plants used in this risk characterization (Table 3-7) are published in Efroymson *et al.* (1997b). These endpoints are based on plant growth and yield.

3.3.6 Toxicity Reference Values

TRVs are derived from studies that report either NOAEL or LOAEL values. A NOAEL is a concentration or chemical intake that has been determined from laboratory tests not to produce any observable toxicity in the test organism, whereas an LOAEL is the lowest chemical intake that has been shown to produce a toxic effect. The MCP recommends evaluating ecological risk using comparisons of chemical exposure to both NOAELs and LOAELs. The primary source of NOAELs and LOAELs for the

ecological risk assessment was Sample *et al.* (1996). In cases where multiple NOAEL values are reported for a representative test organism, the highest NOAEL was used, consistent with MCP guidance. In cases where a NOAEL was not available, but an LOAEL was available, a surrogate NOAEL was estimated from the LOAEL using a factor of ten (*e.g.*, the NOAEL is 1/10 the LOAEL) as per MCP guidance. For chemicals that do not have a reported LOAEL, a surrogate LOAEL was estimated as three times the NOAEL, per MCP guidance. Toxicity profiles for mammalian and avian receptors for inorganics, PAHs and PCBs are presented in Appendix C.2 of the Risk Characterization Report.

Benchmarks were drawn from studies that considered reproductive and developmental effects, or other critical effects, indicative of overt impacts to individual organisms that may affect populations. Studies incorporating chronic exposure durations, multiple exposure levels, and statistical evaluation of test results were preferred. As appropriate, NOAEL and LOAEL values were extrapolated from the published value for the tested organism to the selected receptors using a conversion based on a body size allometric equation discussed below. In general, smaller sized organisms are more tolerant of constituent exposures because of the higher rate of metabolism and greater detoxification capabilities (smaller size in this case does not refer to life-cycle phases). To account for this source of variation in sensitivity, published NOAEL and LOAEL values were adjusted to estimate wildlife surrogate toxicity values using the following equation (Sample *et al.*, 1996):

Non-Avian Receptors:

$$\begin{aligned} TRV_{NOAEL} &= NOAEL_{test} \times (BW_{test}/BW_{wildlife})^{0.25} \\ TRV_{LOAEL} &= LOAEL_{test} \times (BW_{test}/BW_{wildlife})^{0.25} \end{aligned}$$

where:

- NOAEL_{test} = No-observable-adverse-effect level for test species
- LOAEL_{test} = Lowest-observable-adverse-effect level for test species
- BW_{test} = Body weight for test species
- BW_{wildlife} = Body weight for wildlife species

Research by Mineau *et al.* (1996) suggested that the scaling factors developed for avian receptors for the majority of constituents evaluated (29 of 37 pesticides) were not significantly different from 1.0. Based on this information, the above equations reduce to:

Avian Receptors:

$$\text{TRV} = \text{NOAEL}_{\text{test}}$$

$$\text{TRV} = \text{LOAEL}_{\text{test}}$$

Thus, an avian wildlife species NOAEL or LOAEL is equivalent to an avian test species NOAEL or LOAEL without any adjustment for body weight. Body weight adjusted TRVs for modeled receptors are presented in Table 3-8.

3.4 Risk Characterization

In this step, current and potential future risks associated with exposure of ecological receptors to COPCs are estimated. Two approaches were used to evaluate the potential for adverse effects to ecological receptors at the site:

- Comparison of toxicological benchmarks for effects on benthic invertebrates, fish, amphibians, terrestrial invertebrates, and plants; and
- Hazard quotient approach for selected receptors in a food web model.

3.4.1 Comparison to Media Toxicity Benchmarks

Potential risks to benthic invertebrates, amphibians, terrestrial invertebrates, and terrestrial plant communities were assessed by comparing benchmarks protective of these receptors to COPC concentrations in sediment, soil, or water. In cases where no benchmark was available for a COPC, potential risks cannot be evaluated. For fish communities, risks were assessed by comparing detected body burden concentrations to published fish tissue residue values associated with adverse effects.

3.4.1.1 Benthic Invertebrates

Mean and maximum EPCs for each of the Sherman Reservoir and Deerfield River sediments were compared against sediment benthic invertebrate benchmarks described earlier. Sediment samples from the West Storm Ditch were also compared to sediment macroinvertebrate benchmarks. No COPCs were detected in Wheeler Brook sediments above background levels..

Sherman Reservoir

Comparisons of sediment data from Sherman Reservoir to sediment benchmarks are presented in Table 3-9. For brevity, the ratio of the chemical concentration in sediment to its respective benchmark concentration is termed a benchmark quotient. When this ratio is above 1.0, it indicates the constituent exceeds the benchmark.

Benchmark quotients based on comparing the average COPC concentration to its respective benchmark exceed 1.0 for Aroclor 1254 (ratio = 3.8), benzo(a)anthracene (2.6) and chrysene (1.5). Several other metals (copper and mercury) and additional PAHs, exceed their respective sediment benchmark when maximum concentrations (*e.g.*, on a sample by sample basis) are compared.

As noted earlier, the MADEP recommended sediment benchmarks for PCBs and PAHs are based on the so-called Threshold Effects Concentration consensus benchmark values. When Sherman Reservoir sediment samples are compared against the consensus Probable Effects Concentrations, on average the PEC-based benchmark quotients for PCBs and PAHs are less than one (Table 3-10).

The above comparisons of average benchmark quotients are based on averaging all sediment results within Sherman Reservoir. MADEP guidance suggests using 1,000 square feet averaging areas when comparing environmental data to sediment benchmarks. The data density within Sherman Reservoir does not allow meaningful averaging over such small areas. Sampling areas within Sherman Reservoir were divided into the following four sub-areas (see Figure 3-2):

- Former Cooling Water discharge area (11,225 ft², or 0.26 acre)
- Former Cooling Water Intake area (3,375 ft², or 0.08 acre)
- East Storm Drain (ESD) discharge area (13, 830 ft², or 0.32 acre)
- ESD Area 2 (10,200 ft², or 0.23 acre)

These averaging areas were selected based on nearshore areas that were potentially impacted by similar releases.

In the Cooling Water Discharge area, mercury (average ratio 2.6) and Aroclor 1254 (average ratio 2.8), are elevated above their respective sediment benchmarks (Table 3-11). The PEC-based average benchmark quotients for PCBs and PAHs in the Cooling Water Discharge area are less than one (Table 3-

12). The limited size of the Cooling Water Discharge area, and its proximity to the Sherman Dam intake structure, likely diminish the possible ecological significance of this localized habitat.

In the Cooling Water Intake area, the COPC concentrations averaged within this area are below their respective benthic benchmarks except the TEC benchmarks for PCBs and several PAHs (Table 3-13). The average PCB and PAH concentrations in this study area are below their respective PEC benchmarks (Table 3-14).

In the East Storm Drain discharge area, the COPC concentrations averaged within this area are below their respective benthic benchmarks except the TEC benchmark for Aroclor 1254 with a benchmark quotient of 4.7 (Table 3-15). The average Aroclor 1254 concentration (282 $\mu\text{g}/\text{kg}$) is below its PEC (676 $\mu\text{g}/\text{kg}$), such that the benchmark quotient is less than one on average (Table 3-16). The average PCB concentration in ESD Area 2 (109 $\mu\text{g}/\text{kg}$) exceeds its TEC benchmark (59.8 $\mu\text{g}/\text{kg}$) as shown in Table 3-17, but the average PCB concentration is below the PEC benchmark in this study area (Table 3-18).

Sediment remediation to remove PCBs within Sherman Reservoir to the Agency-approved cleanup level of 1 mg/kg (1,000 $\mu\text{g}/\text{kg}$) was completed by YAEC. The MADEP-recommended sediment benchmarks for PCBs represents a Threshold Effects Concentration value (59.8 $\mu\text{g}/\text{kg}$). This TEC represents a low-end percentile concentration (*e.g.*, approximate lower 10th percentile) where some adverse response in benthic organisms has been observed under environmental conditions reported in the literature studies, but does not imply that concentrations above the TEC will necessarily cause biological injury to benthic invertebrates (merely that such harm cannot be ruled out). Literature-reported consensus Probable Effects Concentrations (MacDonald *et al.*, 2000) represent concentrations above which adverse biological responses in benthic organisms is considered to be probable. As summarized below, on average the Aroclor concentrations in Sherman Reservoir sediments are all below the PEC benchmarks, and even when compared on a sample by sample basis, the vast majority of samples are below the PEC values.

Comparison of PCB Results and Sediment Benchmarks				
Sherman Reservoir				
Chemical	N	Mean (µg/kg)	Maximum (µg/kg)	N > PEC
<i>Cooling Water Discharge Area</i>				
Aroclor 1254	18	168	1,660	1
Aroclor 1260	18	30.8	251	0
<i>Cooling Water Intake Area</i>				
Aroclor 1254	10	473	2,200	1
Aroclor 1260	10	68.6	382	0
<i>East Storm Drain Discharge Area</i>				
Aroclor 1254	98	282	3,400	11
Aroclor 1260	98	ND	ND	--
<i>East Storm Drain Discharge Area 2</i>				
Aroclor 1254	19	109	430	0
Aroclor 1260	19	ND	ND	--
Sediment Benchmarks	TEC = 59.8 µg/kg PEC = 676 µg/kg			

Figure 3-3 shows the location of sediment samples for PCBs, and the small number of sample locations where samples exceed their PEC benchmarks (discussed further below).

As discussed above, several PAHs also exceeded their sediment TEC benchmarks in the Sherman Reservoir. As shown on Figure 3-4, none of the PAHs detected in Sherman Reservoir sediments exceed PECs published in MacDonald *et al.* (2000). On this figure, each sample location depicts the benchmark quotient of all the PAHs for which PEC values are published. For any location where a benchmark quotient exceeds 1.5, the Station ID is given, and the particular PAH(s) is given along with the value of its benchmark quotient.

In a similar manner, Figure 3-5 shows the benchmark quotients for the inorganics. Copper exceeds the PEC benchmark in 4 samples from the Cooling Water Discharge area, and mercury exceeds the PEC benchmark at one sample location in this same area.³

³ See also Figure 2-14 through Figure 2-17 of the Method 3 Risk Characterization.

Deerfield River

Comparisons of COPC concentrations in sediment from the Deerfield River adjacent to the site to benchmarks protective of benthic macroinvertebrate communities are presented in Table 3-19. Average TEC benchmark quotients for Aroclor-1254 (1.8) and several PAHs (range 1.2 to 5.8) are above one. The average Aroclor-1254 concentration (107 mg/kg) is well below the PEC benchmark, and only a single sample (SD-205) exceeds the PEC (Table 3-20; Figure 3-3). None of the sediment samples in the Deerfield River adjacent to the site exceed the PEC values for PAHs (Table 3-20; Figure 3-4).

West Storm Ditch (WSD)

The sediment benchmark quotients for the WSD are summarized in Table 3-21. None of the inorganics exceed their respective sediment benchmarks. The maximum and average concentrations of PCBs and PAHs exceed their respective TEC benchmarks. However, this result is not considered an indication of environmental risk, for two reasons. First, when the sediment samples are compared to their PEC benchmarks, on average the benchmark quotients for PCBs and PAHs do not exceed one (Table 3-22). Second, only 1 of 57 sediment samples for PCBs (SD-302, 950 $\mu\text{g}/\text{kg}$)⁴ exceeds the Aroclor 1254 PEC, and only 1 of 12 sediment samples for PAHs (SD-303) exceeds their respective PEC values (see Figure 3-3 and 3-4).

On the basis of the foregoing comparisons of COPCs to benthic macroinvertebrate benchmarks, benthic communities in sediments in Sherman Reservoir and the Deerfield River adjacent to the site are not expected to be adversely impacted.

3.4.1.2 Fish

Yellow perch, brown trout, and rainbow trout were collected from the three sampling locations (East Storm Drain, North Sherman Reservoir, and Harriman Reservoir). As previously noted, metals and PCBs detected in Sherman/Deerfield fish were comparable to their respective concentrations in Harriman Reservoir samples. Nevertheless, for perspective, detected chemical concentrations were compared against fish tissue residue values (Table 3-23).

⁴ A resample of the SD-302 location in June 2004 had Aroclor 1254 at 120 $\mu\text{g}/\text{kg}$, and the duplicate of this resample was a non-detect.

With a single exception, all chemical concentrations in fish from Sherman Reservoir and the Deerfield River samples were below their respective tissue residue values. The silver concentration (0.066 mg/kg) in a field duplicate brown trout sample (FH-FD-12) from Sherman Reservoir was the only analyte that exceeded a corresponding tissue residue value; silver was not detected in the parent sample (FH-11/12). The silver concentration in this sample (0.066 mg/kg) marginally exceeded the lowest effects value reported across fish species (bluegill; 0.06 mg/kg). Silver was detected at a comparable concentration (0.054 mg/kg) in a rainbow trout from Harriman Reservoir. Field observations indicate no evidence of lacerations, deterioration, and/or injury to the fish.

Thus, not only were inorganic and PCB concentrations in Sherman and Deerfield fish comparable to Harriman fish samples, detected chemical concentrations were with one minor exception below published fish tissue TRVs. These results indicate no significant risks to fish populations in Sherman Reservoir and the Deerfield River.

3.4.1.3 Amphibians

Maximum COPC concentrations in Sherman Reservoir, Deerfield River, Wheeler Brook, and West Storm Ditch surface water samples were compared to published Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a). None of the detected COPCs exceeded available benchmarks (Tables 3-24 to 3-27). Therefore, these COPC concentrations do not pose a risk to the amphibian community.

3.4.1.4 Terrestrial Invertebrates

As noted earlier, the EPCs for the Combined Study area included all soil samples, including those from the BUD area of the YAEC property, and those soil EPCs were used in the food web uptake modeling. The soil data were also compared directly to soil invertebrate benchmarks. The comparison to soil invertebrate benchmarks, evaluated the data from two perspectives. Because, the BUD and SCFA areas received soil cover, soil samples within these areas were excluded from the benchmark comparisons. The COPC concentrations in soil in the YAEC property and TransCanada property outside the BUD/restricted areas were compared against published benchmarks protective of soil dwelling invertebrates (Efroymson *et al.*, 1997a). Average concentrations of COPCs in soil from the non-BUD study areas were below their respective benchmarks (Table 3-28). The zinc concentration (520 mg/kg) in a single soil sample (SB0490006I) exceeded the benchmark value (200 mg/kg). Maximum (and mean)

concentrations of COPCs in soil from the TransCanada property outside the BUD area were below their respective benchmarks (Table 3-29), with the exception of zinc (sample SB-507, 250 mg/kg, or benchmark quotient 1.25).

In addition, the benchmark quotients for inorganics were calculated at every soil sample location. Figure 3-6 shows the benchmark quotients for inorganics for all soil samples on the YAEC and TransCanada properties, labeling those where the benchmark quotients are 1.5 or greater (*e.g.*, those which are greater than one to one significant digit). Only four (4) soil samples on the YAEC property in the vicinity of the former YNPS plant exceed benchmark quotients of one, with zinc and copper marginally above their benchmarks. Copper and zinc also had benchmark quotients above one in an additional sample (SB116) in the "hair pin turn" area. A single soil sample on the TransCanada property, SB111 in the BUD area, has a benchmark quotient greater than one for both copper and zinc. As is evident from Figure 3-6, there is no apparent pattern in the data (*e.g.*, no "hot spots").

Benchmarks were not available for EPHs and several VOCs. However, the concentrations are low and these COPCs are not expected to impact the terrestrial invertebrate community.

3.4.1.5 Terrestrial Plants

In a similar manner, the soil data were compared to benchmarks for terrestrial plants. Mean and maximum soil concentrations of the COPCs identified in the YAEC property non-BUD area and the TransCanada property study areas were compared against published soil benchmarks protective of terrestrial plants (Efroymsen *et al.*, 1997b).

Maximum concentrations of COPCs in the non-BUD areas were below their respective benchmarks (Table 3-30) with the exception of lead, nickel, selenium, and zinc, with maximum benchmark quotients ranging from 1.3 (lead) to 12 (selenium). Only selenium and zinc had average benchmark quotients above 1.0. The average zinc concentration in this study area (65 mg/kg) is comparable to the background concentration in local soils (54 mg/kg), and below the MADEP published background levels (100 mg/kg). The average selenium concentration in this study area (3.4 mg/kg) is somewhat higher than the local background concentration (1.6 mg/kg).⁵

⁵ For perspective, the MADEP S-1 criteria for selenium in residential soils is 400 mg/kg.

Maximum concentrations of COPCs in the TransCanada property were below their respective benchmarks (Table 3-31), with the exception of several metals. Selenium and zinc were the only two COPCs with mean concentrations in this study area exceeding their soil-plant benchmarks. However, the average zinc concentration (62.2 mg/kg) is comparable to background (53.5 mg/kg). Similarly, the average selenium concentration (2.9 mg/kg), is comparable to background (1.6 mg/kg).

In addition to the benchmark comparison, a qualitative habitat survey for terrestrial habitats was performed to look for evidence of stressed vegetation and barren soils, but found none (Woodlot, 2004). That assessment provides further support that chemicals are not contributing to significant harm of the local environment (including those for which soil-plant benchmarks are not available).

3.4.2 Food Web Hazard Quotient and Hazard Indices

In the hazard quotient (HQ) approach, the estimated total exposure to COPCs for each receptor is compared to its corresponding TRV. A hazard quotient is the ratio of the estimated chemical intake (or exposure concentration) to the TRVs discussed above:

$$HQ = \frac{\text{Chemical Intake (or Concentration)}}{\text{TRV}}$$

The MCP (MADEP, 1996) recognizes the following general considerations for using hazard quotients to characterize risk.

- When the site COPC intake exceeds the LOAEL such that the LOAEL-based hazard quotient is greater than 1.0, it is reasonable to conclude that the quotient evaluation method provides evidence of potential harm.
- When the site COPC intake is lower than the NOAEL such that the NOAEL-based hazard quotient is less than 1.0, it is reasonable to conclude that the quotient method does not provide evidence of harm.
- When the site COPC intake is greater than the NOAEL, but less than the LOAEL, no conclusion may be reached based on the predictive method alone, and additional assessment efforts are necessary to determine whether the oil or hazardous material has harmed or may harm the environment.

As Menzie *et al.* (1993) point out, NOAEL HQs > 1 only indicate that a lower threshold of effect has been exceeded that is "considered to be indicative of potential risk." They further judge NOAEL HQs as follows (Menzie *et al.*, 1993):

- NOAEL HQ between 1.0 and 10: some small potential for environmental effects,
- NOAEL HQ > 10: significant potential that greater exposures could result in effects based on experimental evidence,
- NOAEL HQ > 100: adverse effects may be expected.

Chemical Hazard Quotients were summed for each receptor to calculate a Hazard Index (HI). The HI provides a conservative estimate of cumulative risks due to all COPCs. It is conservative because HQs reflect toxicity occurring through different mechanisms and to different organs (*e.g.*, reproductive effects *vs.* liver effects). Chemical toxicity with different modes of action and endpoints are not necessarily additive, but, in calculating the HI, the adverse response mechanisms are assumed to be additive. The NOAEL and LOAEL Hazard Indices for each receptor are presented in Tables 3-32 and 3-33, respectively. Hazard Quotients and Hazard Indices associated with exposure to COPCs at their respective background concentrations were also evaluated, as discussed in Section 5.4 (summarized in Tables 4-1, 4-2 and 5-1).

3.4.2.1 Short-tailed Shrew

The shrew is a terrestrial insectivorous mammal that feeds primarily on terrestrial invertebrates with a small percentage of the diet consisting of terrestrial plants. Soil invertebrates such as insects, earthworms, slugs, and snails make up the bulk of this species' diet. Approximately 5.9% of the shrew's diet is soil that is incidentally ingested (Beyer *et al.*, 1994). This mammalian species is found in areas of abundant vegetative cover. The foraging home range of the shrew is approximately 1.0 acre; therefore, an area use factor was not applied to the Combined Study Areas. None of the NOAEL- or LOAEL based HQs exceed one (Tables 3-32 and 3-33). The LOAEL HI equaled 1.0 (Table 3-33). The NOAEL-based HI is 2.9 (Table 3-33), with mercury (HQ=0.96) contributing 33%, Aroclor-1254 (HQ=0.46) contributing 16%, and EPH (HQ=0.45) contributing 15% of the total HQ, respectively. These results are not substantially different from the NOAEL-based background HI (1.4) for the shrew. While the maximum mercury concentration in soil on-site (0.73 mg/kg) exceeded the maximum mercury concentration in background samples (0.32 mg/kg), the median mercury concentration (0.29 mg/kg) on site was less than the median background value (0.36 mg/kg).

3.4.2.2 American Robin

This insectivorous bird lives in terrestrial habitats and primarily consumes terrestrial insects, soil arthropods, and earthworms. In addition, approximately 10% of the robin's diet is composed of soil ingested incidentally. An area use factor was not applied for the assessment because the home range of the robin (1.0 acre) is smaller than the Combined Study Areas. No LOAEL-based HQs exceed one; the sum of the HQs yield a LOAEL HI of 1.3 (Table 3-33), which to one significant figure is one (1). Lead (HQ=4.4) was the only COPC with a NOAEL HQ greater than 1.0, contributing 50% of the total NOAEL HI of 7.0 (Table 3-32). The average lead concentration from the Combined Study Areas (26.7 mg/kg) is approximately 2-fold greater than site-specific average background lead concentration (16.3 mg/kg), but much lower than the MADEP (2002a) background concentration for lead (100 mg/kg). The site-related NOAEL HI (7.0) is not significantly different from the background NOAEL HI (3.8).

3.4.2.3 Eastern Cottontail

This small browsing herbivorous mammalian species is associated with terrestrial habitats. The eastern cottontail primarily feeds on woody plants, forbs, and grasses found on the surface. No area-use factor was applied to the EPCs for the cottontail because its home range (8 acres) is smaller than the Combined Study Areas. No NOAEL- or LOAEL-based HQs exceeded 1.0, nor did the LOAEL-based HI (Tables 3-32 and 3-33). The NOAEL-based HI is 1.3, which, to one significant figure, is not different than HI=1.

3.4.2.4 Raccoon

This omnivorous mammalian species exploits a variety of potential dietary components in and around aquatic environments and woodlands. The diet of these opportunistic feeders consists primarily of terrestrial plants, aquatic invertebrates, and small mammals. Although the raccoon spends its time in both the wetland and upland areas, the 9.4% incidental ingestion of solid media in its diet was assumed to be 100% soil, because the site is predominantly uplands. An area use factor of 0.039 was applied to reflect the ratio of the upland Combined Study Areas (60 acres excluding the C&A Fill and BUD areas) to the home range of the raccoon is 1,550 acres. None of the NOAEL- or LOAEL-based HQs exceeded 1.0, and the NOAEL and LOAEL HI are less than one as well (Tables 3-32 and 3-33).

3.4.2.5 Red Fox

This carnivorous mammalian species is associated with both terrestrial and wetland habitats. The red fox primarily feeds on small mammals, birds, insects, and fruit. An area use factor of 0.023 was applied to reflect the ratio of the upland Combined Study Areas (60 acres excluding the C&A Fill and BUD areas) to the home range of the fox 2,560 acres. None of the NOAEL- or LOAEL-based HQs exceeded 1.0, and the NOAEL and LOAEL HI are less than one as well (Tables 3-32 and 3-33).

3.4.2.6 Mink

The mink is a piscivorous mammal whose diet consists of 100% fish.⁶ Approximately 5% of its diet is incidentally ingested sediments. The mink's primary route of exposure is the dietary ingestion of fish and incidental ingestion of sediment. Mink are found along all types of aquatic habitats, but prefer irregular shorelines to more open exposed banks. They use the brushy or wooded cover along the shoreline where prey is abundant and suitable breeding dens are located. Although minks are generally exposed to sediments along the shoreline, the sediment data used to determine EPCs included samples within Sherman Reservoir where water depths of 10 feet or more exist. An area use factor of 0.029 was applied to reflect the ratio of the Sherman Study Area (~18 acres) to the home range of the mink of 700 acres. None of the NOAEL- or LOAEL-based HQs exceeded 1.0, and the NOAEL and LOAEL HI are less than one as well (Tables 3-32 and 3-33).

3.4.2.7 Belted Kingfisher

The belted kingfisher is a piscivorous bird whose diet consists of 100% fish. Kingfishers generally feed on fish near the surface or in shallow waters by diving. They are typically found along rivers, streams, and pond edges. They prefer water free of thick vegetation with low turbidity, allowing for optimal viewing of prey. Kingfishers nest in burrows within earthen banks devoid of vegetation along water bodies. An area use factor of 0.057 was applied to reflect the ratio of the Sherman Study Area (~18 acres) to the home range of the kingfisher (351 acres). None of the NOAEL- or LOAEL-based HQs exceeded 1.0, and the NOAEL and LOAEL HI are less than one as well (Tables 3-32 and 3-33).

⁶ As previously noted, fish are not affected by site-related chemicals above background. This assessment was performed for perspective on the detected chemical concentrations.

3.4.2.8 Bald Eagle

Although a representative piscivorous bird (belted kingfisher) was evaluated in this risk assessment, the bald eagle was also included in this assessment because it is a threatened and endangered species. In addition, this piscivorous bird is larger than the kingfisher, consuming more fish per day. Bald eagles prefer large open bodies of water, using large nest trees along the water as breeding sites. An area use factor of 0.003 was applied to reflect the ratio of the Sherman Study Area (~18 acres) to the home range of the eagle which is approximately 5,800 acres. None of the NOAEL- or LOAEL-based HQs exceeded 1.0, and the NOAEL and LOAEL HI are less than one as well (Tables 3-32 and 3-33).

4.0 Ecological Significance

The Stage II Ecological Risk Characterization evaluated whether potential exposures to COPCs found in the site media could pose adverse impacts based on an evaluation of the ecological endpoints described earlier in Section 3.1.3. A summary of the benchmark comparison results for sediment, soil, and surface water is presented in Table 4-1. A summary of the food web Hazard Indices is presented in Table 4-2. The significance of these results is discussed below.

All of the radionuclide sample results were below soil and sediment benchmarks, hence there is no indication of a threat to the environment from radionuclides at the site. As summarized below, the vast majority of OHM results also were below sediment and oils benchmarks, as the summaries below indicate.

Sediment Benchmark Comparison Summary			
Study Area	OHM	Number of Samples	Number Above Benchmark ^[a]
Sherman Reservoir	PCBs	177	14
	PAHs	26	0
	Inorganics	58 ^[b]	4
Deerfield River (Adjacent to Site)^[c]	PCBs	31	2
	PAHs	6	0
	Inorganics	27 ^[b]	0
West Storm Ditch (TransCanada)	PCBs	58	1
	PAHs	12	1
	Inorganics	11 ^[b]	0

Notes:

[a] Probable Effects Concentration for sediment macroinvertebrates.

[b] Number of samples varies by analyte, number here is representative (see tables).

[c] Samples downstream of site at Monroe Bridge, Bear Swamp, and No. 4 Dam, are below benchmarks.

Soil Benchmark Comparison Summary				
Study Area	OHM	Number of Samples	Number Above Invertebrate Benchmark	Number Above Plant Benchmark
YAEC Non-BUD Areas	PCBs	241	0	0
	PAHs	-- ^[a]	-- ^[a]	-- ^[a]
	Inorganics	63 ^[b]	1 ^[c]	[e]
TransCanada	PCBs	99	0	0
	PAHs	30	0	0
	Inorganics	44 ^[b]	1 ^[d]	[e]

Notes:

- [a] Not COPCs in soil for this study area.*
- [b] Number of samples for inorganics other than lead -- lead was sampled in a somewhat larger number of samples.*
- [c] 3 samples within the YAEC BUD area exceeded benchmarks (clean soil cover exists currently).*
- [d] Sample in the BUD area (clean soil cover exists currently).*
- [e] Selenium and zinc exceed soil benchmarks for plants, however, their respective benchmarks are less than the average background concentrations of selenium and zinc in soil (see text for discussion).*

- Benthic Invertebrate Communities:** As discussed earlier, several COPCs (mercury, several PAHs, and Aroclor-1254) exceeded their respective sediment benchmarks on average in Sherman and Deerfield sediments. However, PAHs and Aroclor-1254 were below their respective PEC benchmarks. Given the conservative nature of the benchmarks, and the limited size of the areas where several benchmarks were exceeded, these results indicate little if any potential adverse impacts to benthic communities from site-related chemicals, although possible adverse impacts cannot be ruled out with certainty.
- Fish Communities:** Detected chemical concentrations were comparable to the Harriman background fish samples. A single silver result of 0.066 mg/kg (not confirmed in a duplicate analysis) in a Sherman fish sample was only slightly higher than the fish TRV (0.06 mg/kg). In addition, field observations indicated no evidence of lacerations, deterioration, or injury to fish. These results indicate fish in the Sherman Reservoir and the Deerfield River are not adversely impacted at the site.
- Amphibian Communities:** Maximum COPC surface water concentrations from Sherman Reservoir and the Deerfield River were all below benchmarks protective of amphibians. Conservative benchmarks targeting all embryo and larvae stages with endpoints of mortality and reproductive impairment were chosen.
- Terrestrial Invertebrate Communities:** With the exception of zinc, the maximum concentration of COPCs were all below benchmark values for soil invertebrates (earthworms) in the non-BUD and TransCanada Study Areas. Zinc exceeded the soil benchmark in 1 of 63 samples on the YAEC non-BUD study area, and 1 of 44 soil samples on the TransCanada property. Furthermore, the average zinc concentration 64.8 mg/kg (YAEC non-BUD) and 62.2 mg/kg (TransCanada) is well below the soil benchmark (200 mg/kg). On the basis of these results, there is little likelihood of adverse impacts to terrestrial invertebrate communities from site-related chemicals.

- **Terrestrial Plant Communities:** The maximum concentration of several metals (lead, nickel, selenium and zinc) exceeded soil-plant benchmarks. A comparison of average concentrations to the soil-plant benchmarks indicated that selenium and zinc exceeded their respective benchmarks on the YAEC non-BUD areas and the TransCanada property. In both instances, the concentration of zinc and selenium do not differ significantly from their background concentrations, and the average concentration of both selenium and zinc in background soil samples is greater than the plant benchmark. Thus, the comparison to soil-plant benchmarks is unlikely to be an indicator of chemical-induced impacts at the site (above local background).
- **Insectivorous Mammalian Community:** Based on the results of the food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to result in adverse impacts to insectivorous mammals. Areas where NOAEL Hazard Indices marginally exceed 1.0 do so because of mercury concentrations that are comparable to site-specific background concentrations and lower than MADEP (2002a) background concentrations. The LOAEL-based HI value equal to one (1) also supports the conclusion that site COPCs are not likely to be associated with adverse impacts to insectivorous mammals.
- **Insectivorous Avian Community:** Based on the results of the food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to adversely impact insectivorous birds. Areas where the NOAEL HQ and HI marginally exceed 1.0 do so because of lead concentrations that are comparable to site-specific background concentrations and lower than MADEP (2002a) background concentrations. The LOAEL-based HI of 1.3, no different from an HI of one (1) to one significant digit, also supports the conclusion that site COPCs are not likely to be associated with adverse impacts to insectivorous birds.
- **Terrestrial Herbivorous Mammalian Community:** Based on the results of the food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to result in adverse impacts to herbivorous mammals. The NOAEL HI (1.3) is no different from an HI value of one (1), to one significant figure. The LOAEL HI<1 also supports the conclusion that site COPCs are not likely to be associated with adverse impacts to herbivorous mammals.
- **Omnivorous Mammalian Community:** Based on the results of food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to be associated with adverse impacts to omnivorous mammals (NOAEL and LOAEL HI<1).
- **Omnivorous Avian Community:** Based on the results of food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to be associated with adverse impacts to omnivorous birds (NOAEL and LOAEL HI<1).
- **Carnivorous Mammalian Community:** Based on the results of food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to be associated with adverse impacts to carnivorous mammals (NOAEL and LOAEL HI<1).
- **Piscivorous Mammalian Community:** Based on the results of food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to be associated with adverse impacts to piscivorous mammals (NOAEL and LOAEL HI<1).
- **Piscivorous Avian Community:** Based on the results of food web modeling, potential exposure to COPCs from the Combined Study Areas is not likely to be associated with adverse impacts to piscivorous birds, including bald eagles (NOAEL and LOAEL HI<1).

5.0 Uncertainty Analysis

The ecological risk assessment process contains unavoidable uncertainties. Following agency guidelines, benchmark values are intentionally conservative so that the potential hazard to ecological receptors represents a high-end risk estimate. The qualitative effects of the major assumptions made in this ecological risk assessment are discussed below.

5.1 Media Benchmarks

Benchmark values are useful for comparing media chemistry data for potential negative effects on benthic organisms, fish, amphibians, and terrestrial invertebrates and plants. However, there is some uncertainty associated with the use of these values for ecological risk assessment. Benchmark values were designed to minimize the chance for false negatives and therefore increase the chance of false positives, which makes their use conservative by design. For example, while it is reasonable to conclude there is little likelihood of adverse environmental impacts from chemicals when the chemical concentration is below a Threshold Effects Concentration, exceeding a TEC does not imply adverse harm exists, merely that it cannot necessarily be ruled out. The approach adopted here was a weight of evidence approach, whereby both TEC and PEC benchmarks were considered, as well as the number of samples that may have exceeded the respective benchmarks, and the area over which benchmarks may have been exceeded. With few potential exceptions, the benchmark comparisons presented here support the conclusion that adverse impacts to benthic macroinvertebrate populations are unlikely. In those exceptions (individual sample locations) where benchmarks were exceeded, some adverse impacts to invertebrates cannot be ruled out with a high degree of certainty. The results of the food web modeling reinforce the conclusion that adverse impacts to the environment are unlikely.

5.2 Exposure Estimates

The concentration of chemicals of concern in invertebrates, plants, and small mammals were estimated using uptake factors obtained from the published scientific literature. Actual concentrations of site-related chemicals in plant and invertebrate tissues would vary depending upon actual chemical intake, species of plant or invertebrate organism, and other site-specific factors (such as particle sizes in sediment and soil, organic carbon content).

Soil-to-plant uptake factors are used in ecological risk assessment to estimate the concentration of chemicals in plants as a result of uptake from soil. The soil-to-plant uptake factors recommended for organic chemicals in the Screening-Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (US EPA, 1999) are calculated from regression equations that relate chemical uptake to $\log K_{ow}$. These regression equations may not accurately represent the behavior of all organic chemicals under site-specific conditions.

Exposure parameters for the selected receptors are published average values. Dietary intake fractions of ingested food items (*i.e.*, plants, invertebrates, fish and small mammals) by the selected receptors are considered representative, but necessarily cannot account for a likely more varied diet. In addition, it was assumed that different invertebrates or plants take up chemicals at the same rate. This simplifying assumption does not take into account site-specific conditions (*e.g.*, TOC) or variability among the different species, resulting in a potential over- or under-estimation of hazards. Despite these types of necessary assumptions, the results of the food web evaluation are considered reasonable based on available information.

5.3 Toxicity Reference Values (TRVs)

Uncertainties surrounding dose extrapolations include the evaluation of potential effects on sensitive or protected species, and consideration of the bioavailability and toxicity of the forms of the COPCs present at the site. Uncertainty arises when using published benchmark values to estimate wildlife toxicity and includes the following:

- Extrapolation from acute or sub chronic exposures to chronic exposure durations;
- Extrapolation from a more toxicologically-sensitive species to a selected receptor;
- Extrapolation from LOAEL to NOAEL;
- Extrapolation across different species of varying taxonomic relatedness, feeding habits, and body size;
- Extrapolation to sensitive or protected species; and
- Consideration of bioavailability, assimilation, and relative toxicity of forms of chemicals used in toxicity testing *versus* forms occurring at the site.

Although there is some information regarding an appropriate scaling factor to use to derive TRVs for mammalian receptors, we selected 0.75 as proposed by Sample *et al.* (1996) in the absence of an

alternative value. It should be noted that some information exists for scaling factors based on acute data (Sample and Arenal, 1999), which suggests a value of 0.94. However, this scaling factor was not used here because, as the authors state: "[The] scaling factors presented here are most appropriate for acute toxicity data. Their applicability to chronic toxicity data is unknown. The modes of action for acute and chronic effects differ for many chemicals. As a consequence, it is likely that scaling factors based on chronic toxicity data will also differ..." Furthermore, the use of a 0.94 scaling factor is less conservative than the use of a scaling factor of 0.75. Therefore, it is unlikely that hazards were underestimated in the risk assessment.

5.4 Risks Associated with Background

In order to provide perspective on the environmental assessment of potentially site-related chemicals, a comparable evaluation of risks for each receptor was performed based on the chemical concentrations of COPCs measured in background areas. This assessment of background risks included the site COPCs (if detected in background samples), the same exposure parameters (including area-use factors), and the same toxicity values as the baseline risk evaluation. Because some COPCs were not detected in background soil or sediment, the list of COPCs in the background assessment is a subset of the site COPC list. No chemicals were included in the risk calculation for background that were not also included in the risk assessment for site COPCs.

The NOAEL HQ and HI calculations are presented in Table 5-1, and the comparisons to sediment, soil and surface water benchmarks (benchmark quotients) are presented in Tables 5-2 to 5-5. All LOAEL HQs and HIs using background EPCs are less than 1.0. Note that the benchmark tables also contain the benchmark quotients for chemicals in background soil/sediment (such as chromium, boron, *etc.*), even though these chemicals are not COPCs. These non-COPCs are noted in the tables, and this information is provided simply for perspective; it is not used in the comparisons of background benchmark quotients to site-related benchmark quotients.

As discussed earlier, in comparing the site-related HI values and benchmark quotients, the site-related values are not significantly elevated above comparable background values. Given that the calculated site-related HQ, HI and benchmark quotients include chemicals that are also present in background media, the calculated site-related risks inevitably include this background component, and thus attributing the site-related HQ, HI, or benchmark quotient entirely to the site overstates potential site-related environmental risks.

6.0 Conclusions

This environmental risk characterization evaluated representative habitats and species either found at the site, or typical of northeastern deciduous hardwood habitats, including appropriately sensitive species. This evaluation included an assessment of aquatic, riparian, and upland habitats. The MADEP environmental risk characterization guidelines include a two-stage process that allows for a Stage I screening of detected chemical concentrations against MADEP benchmarks, followed by a detailed food web analysis in Stage II as necessary. This environmental risk assessment for chemical constituents included the full Stage II assessment (*i.e.*, no screening out of chemicals on the basis of soil, sediment, or water benchmarks).

Because no MADEP guidelines exist for the assessment of ecological risks for radionuclides, guidance developed by the US DOE was used for the environmental assessment of radionuclide risks. During meetings and discussions with the Agencies, US EPA representatives from Headquarters concurred that the US DOE methods were the acceptable established approach for the assessment. In a manner similar to the MADEP guidelines for chemical risk assessment, the US DOE approach includes a stepwise assessment, with the first step being a screening of radionuclides in soil or sediment to Biota Concentration Guidelines (BCGs) to determine whether an in-depth food web analysis would be required. In the case of radionuclides, the screening assessment indicated that all radionuclides were well below conservative BCGs, such that no food web analysis was needed.

The results of the ecological risk assessment are presented in terms of chemical Hazard Quotients and Hazard Indices for receptor species, which represent the calculated chemical intake or exposure relative to an acceptable intake, denoted as a Toxicity Reference Value (TRV). TRV values were selected from published literature based on No Observable Adverse Effects Levels (NOAELs) and Lowest Observable Adverse Effects Levels (LOAELs). A summary of the calculated Hazard Indices is provided below.

Summary of Environmental Risk Characterization				
Receptor	Hazard Index – Site		Hazard Index -- Background	
	NOAEL	LOAEL	NOAEL	LOAEL
Birds				
robin	7	1	4	<1
king fisher	<1	<1	<1	<1
Bald eagle	<1	<1	<1	<1
Mammals				
shrew	3	1	1	<1
cottontail	1	1	<1	<1
raccoon	<1	<1	<1	<1
fox	<1	<1	<1	<1

None of the LOAEL-based Hazard Indices for ecological receptors exposed *via* the food web exceed 1.0, the Agency benchmark commonly used to evaluate the potential for adverse ecological impact. The NOAEL-based Hazard Indices are above one (1) for the robin and shrew, but in all cases below 10, a threshold above which ecological risks cannot be ruled out. In addition, the background HI for the robin similarly exceeds one (1) based on exposure to background concentrations of COPCs. Based on these results, there is no indication of potential significant ecological risk involving the food web at the site.

In addition to the food web analysis, COPCs were compared to published ecological benchmarks. The ratio of chemical concentrations in sediment, soil, and surface water relative to their respective benchmarks was expressed as a Benchmark Quotient. Benchmark Quotients less than one (<1) indicate no ecological concerns are expected; quotients above one do not necessarily imply significant risk, but instead indicate that possible risks cannot be ruled out without further lines of evidence. Although Benchmark Quotients for several metal COPCs at the site exceed benchmarks for benthic macroinvertebrates (summarized below), this is not necessarily an indication of overt adverse risk. For example, organisms can exist in areas with naturally high background metal concentrations by means of modified physiology that results in the acclimation of exposed individuals or even through genetic modification of the population that results in adaptation and increased tolerance. Benchmark values based on laboratory toxicity tests conducted with organisms acclimated to low standard metal concentrations would not represent conditions at sites with naturally high background metal

concentrations (US EPA, 2004). Thus, there is little, if any environmental significance that can be associated with the isolated samples that exceed sediment benchmarks at the site.

Summary of Benchmark Quotients				
	Site		Background	
	Mean ^[a]	Max ^[a]	Mean	Max
Benthic Macroinvertebrates				
mercury	<1	11.7 (TEC) 2.6 (PEC)	<1	1.1
PCBs	7.9 (TEC) <1 (PEC)	56.9 (TEC) 5.0 (PEC)	<1	<1
PAHs ^[b]	18.4 (TEC) 1.2 (PEC)	151 (TEC) 11.1 (PEC)	6.8 (TEC)	7.2 (TEC)
Soil invertebrates	<1	2.6 (zinc)	<1	<1
Plants	3.2 (selenium)	13 (selenium)	1.6 (selenium)	2.6 (selenium)
	1.3 (zinc)	10.4 (zinc)	1.1 (zinc)	1.5 (zinc)
Amphibians	--	<1	--	<1

[a] Site mean and maximum benchmark quotients are the largest values in any of the study areas.

[b] TEC-based benchmark ratios skewed by single sample (SD-303) in the West Storm Ditch.

Mercury exceeds its benthic benchmark (TEC) on average by 2.6-fold in Sherman Reservoir sediments in the cooling water discharge area, however the average mercury concentration (0.47 mg/kg) is below the PEC benchmark (1.06 mg/kg). Given its small area, proximity to the Sherman intake structure, the lack of food web impacts for mercury, and the fact that mercury is on average below its PEC benchmark, this exceedance of the TEC on average in the Cooling Water Discharge area is not considered an indication of potentially significant adverse environmental impacts.

The Aroclor 1254 benchmark quotient for Sherman sediments in the ESD embayment is on average 4.7, with a maximum quotient of 56.9 (TEC basis). The average Aroclor 1254 concentration is below the PEC benchmark in all of the Sherman Reservoir study areas. Furthermore, the fact that PCBs in fish from Sherman Reservoir were no different than PCBs in fish from the Harriman Reservoir, and the lack of any calculated food web impact due to PCBs, provide further evidence that PCB bioaccumulation (e.g., sediments, to macroinvertebrates, to higher order organisms) is not a significant concern at the site.

As discussed earlier, several PAHs exceed their TEC-based sediment benchmarks on average, but the majority are below their respective PEC benchmarks, and none of the PAHs exceed their respective PEC benchmarks on average in any study areas.

With the exception of the isolated measurements of several COPCs that exceed sediment or soil benchmarks, the results of the ecological assessment indicate the site-related impacts, if any, are not significantly different from background. Based on these results, the site-related residual constituents do not contribute to a significant risk of harm to the environment.

7.0 References

Baes, CF; Sharp, RD; Sjoreen, AL; Shor, RW. 1984. "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture." Report to US EPA, Office of Radiation Programs. ORNL-5786. 148p., September.

Bean, JR; Hudson, RH. 1976. "Acute oral toxicity and tissue residues of thallium sulfate in golden eagles, *Aquila crysaetos*." *Bull. Environ. Contam. Toxicol.* 15(1):118-121.

Bechtel Jacobs Company LLC (Bechtel/Jacobs). 1998a. "Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation." Prepared for the US Dept. of Energy. August.

Bechtel Jacobs Company LLC (Bechtel/Jacobs). 1998b. "Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants." Prepared for the US Dept. of Energy. September.

Beyer, WN; Conner, E; Gerould, S. 1994. "Estimates of soil on gestation by wildlife." *J. Wildl. Manage.* 58:375-382.

Blaylock, BG; Frank, ML; O'Neal, BR. 1993. "Methodology for estimating radiation dose rates to freshwater biota exposed to radionuclides in the environment." Lockheed Martin Energy Systems, Inc. Report to US Dept. of Energy. ES/ER/TM-78.

Bursian, SJ; Aulerich, RJ; Yamini, B; Tillitt, DE. 2003. "Dietary Exposure of Mink to Fish from the Housatonic River: Effects on Reproduction and Survival." Report to Weston Solutions, Inc., West Chester, PA. 106p., June 10.

Damron, BL; Wilson, HR. 1975. "Lead toxicity of Bobwhite quail." *Bull. Environ. Contam. Res.* 14(4):489-496.

Efroymsen, R; Will, M; Suter, G. 1997a. "Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision." ES/ER/TM-126/R2. Oak Ridge National Laboratory.

Efroymsen, R; Will, M; Suter, G; Wooten, A. 1997b. "Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision." ES/ER/TM-95/R4. Oak Ridge National Laboratory.

Efroymsen, RA; Suter, II GW; Sample, BE; Jones, DS. 1997c. "Preliminary Remediation Goals for Ecological Endpoints." Office of Environmental Management, Oak Ridge National Laboratories, Oak Ridge, TN.

Environmental Resources Management (ERM). 2004. "Baseline Environmental Report: Yankee Nuclear Power Station Site Closure Project Rowe, Massachusetts." Boston, MA. April 30.

Environmental Resources Management (ERM). 2006a. "Phase I Environmental Site Assessment. Rowe and Monroe Parcels. Yankee Nuclear Power Station Site Closure Project, Rowe, Massachusetts." February 22.

Environmental Resources Management (ERM). 2006b. "TSCA Sediment Final Report, Yankee Nuclear Power Station, Site Closure Project, Rowe, Massachusetts." Report to Yankee Atomic Electric Co., Rowe, MA.

Environmental Resources Management (ERM). 2006c. "Supplemental Phase II Comprehensive Site Assessment Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." RTN 1-13411. September 21.

Formigli, L; Scelsi, R; Poggi, P; Gregotti, C; Di Nucci, A; Sabbioni, E; Gottardi, L; Manzo, L. 1986. "Thallium-induced testicular toxicity in the rat." *Environ. Res.* 40(2):531-539.

Hazardous Substances Data Base (HSDB). 2004. Accessed at <http://toxnet.nlm.nih.gov>.

Hill, EF; Camardese, MD. 1986. "Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to Coturnix." US Fish and Wildlife Service Technical Report 2. 147 pp.

Hough, JL; Baird, MB; Sfeir, GT; Pacini, CS; Darrow, D; Wheelock, C. 1993. "Benzo(a)pyrene enhances atherosclerosis in white carneau and show racer pigeons." *Arteriosclerosis Thrombosis* 13(12):1721-1727.

Jarvinen, AW; Ankley, GT. 1999. *Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals*. SETAC.

Jones, DS; Suter, GW; Hull, RN. November 6, 1997. "Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision." Report to US Dept. of Energy. ES/ER/TM-95/R4. 48p.

MacDonald, DD; Ingersoll, CG; Berger, TA. 2000. "Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems." *Arch. Environ. Contam. Toxicol.* 39 :20-31.

Massachusetts Department of Environmental Protection (MADEP). 1995. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim final policy)." Bureau of Waste Site Cleanup and Office of Research and Standards. BWSC/ORS-95-141. July.

Massachusetts Department of Environmental Protection (MADEP). 1996. "MCP Environmental Risk Characterization Guidelines." WSC/ORS-95-141. April.

Massachusetts Department of Environmental Protection (MADEP). 2002a. "Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil." Bureau of Waste Site Cleanup and Office of Research and Standards. May.

Massachusetts Department of Environmental Protection (MADEP). 2002b. "Freshwater sediment screening benchmarks for use under the Massachusetts Contingency Plan." Office of Research and Standards.

Massachusetts Department of Environmental Protection (MADEP). 2002c. "Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach." Bureau of Waste Site Cleanup. Policy #WSC-02-411. October 31.

Massachusetts Department of Environmental Protection (MADEP). 2006a. Massachusetts Contingency Plan. MCP 310 CMR 40.0006

Massachusetts Department of Environmental Protection (MADEP). 2006b. "Spreadsheets Detailing the Development of MCP Numerical Standards." <http://mass.gov/dep/cleanup/laws/pubnot04.htm>

Massachusetts Department of Environmental Protection (MADEP). 2006c. "Technical Update: Revised sediment screening values." Office of Research and Standards.

Matuk, Y; Ghosh, M; McCulloch, C. 1981. "Distribution of silver in the eyes and plasma proteins of the albino rat." *Can. J. Opthamol.* 16:145-150.

Menzie, C; Cura, J; Freshman, J; Svirsky, S. 1993. "Evaluating ecological risks and developing remedial objectives at forested wetland systems in New England, in Application of Ecological Risk Assessment to Hazardous Waste Site Remediation." Water Environmental Federation, Alexandria, VA.

Mineau, P; Collins, B; Baril, A. 1996. "On the use of scaling factors to improve interspecies extrapolation of acute toxicity in birds." *Reg. Toxicol. Phamacol.* 24:24-29.

National Research Council (NRC). 1983. *Risk Assessment in the Federal Government: Managing the Process*. National Research Council, National Academy of Sciences. National Academy Press, Washington, DC.

New York State Department of Environmental Conservation (NYDEC). 1998. "Technical Guidance for Screening Contaminated Sediments." Division of Fish, Wildlife and Marine Resources.

National Oceanic and Atmospheric Organization (NOAA). 1999. "Sediment quality guidelines developed for the National Status and Trends Program." National Ocean Service, Office of Response and Restoration. Accessed on November 12, 2000 at <http://response.restoration.noaa.gov/cpt/sediments/SQGs.html>. June 12.

Persaud, D; Jaagumagi, R; Hayton, A. 1993. "Guidelines for the protection and management of aquatic sediment quality in Ontario." Ontario Ministry of Environment and Energy. August.

Peterson, RP; Jensen, LS. 1975. "Interrelationship of dietary silver with copper in the chick." *Poultry Sci.* 54(3):771-775.

Sample, BE; Alpin, MS; Efroymson, RA; Suter, GW; Welsh, CJE. 1997. "Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants." ORNL/TM-13391. Prepared for the US Dept. of Energy. October.

Sample, BE; Arenal, C. 1999. "Allometric models for interspecies extrapolation of wildlife toxicity data." *Bull. Environ. Contam. Toxicol.* 62:653-663.

Sample, BE; Beauchamp, JJ; Efroymson, RA; Suter, GW. 1998a. "Development and Validation of Bioaccumulation Models for Small Mammals." ES/ER/TM-219. Prepared for the US Dept. of Energy. February.

Sample, BE; Beauchamp, JJ; Efrogmson, RA; Suter, GW; Ashwood, T. 1998b. "Development and Validation of Bioaccumulation Models for Small Earthworms." ES/ER/TM-220. Prepared for the US Dept. of Energy. February.

Sample, BE; Opresko, DM; Suter, GW. 1996. "Toxicological Benchmarks for Wildlife: 1996 Revision." ES/ER/TM-86/R3. Prepared for the US Dept. of Energy, Office of Environmental Management. Oak Ridge, TN. June.

Suter, G. and C. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory.

Thomann, RV; Connolly, JP. [Manhattan College (Bronx, NY)]. 1984. "Model of PCB in the Lake Michigan Lake Trout Food Chain." *Environ. Sci. Technol.* 18 (2) :65 (7)

Travis, CC; Arms, AD. 1988. "Bioconcentration of Organics in Beef, Milk, and Vegetation." *Environ. Sci. Technol.* 22(3):271(4).

US Dept. of Energy (US DOE). 2002. "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota." DOE-STD-1153-2002.

US Dept. of Energy (US DOE). 2004. *RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation. Interagency Steering Committee on Radiation Standards.* DOE/EH-0676.

US Environmental Protection Agency (US EPA). 1989a. "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference." Environmental Research Laboratory. EPA 600-3-89-013.

US Environmental Protection Agency (US EPA). 1989b. *Risk Assessment Guidance for Superfund. Volume 2. Environmental Evaluation Manual. Interim Final.* Office of Emergency and Remedial Response. EPA/540-1-89-001.

US Environmental Protection Agency (US EPA). 1991. "Ecological Assessment of Superfund Sites: An Overview. Eco Update 1(2)." Office of Solid Waste and Emergency Response. Publication 9345.0-05I.

US Environmental Protection Agency (US EPA). 1992a. "Developing a Work Scope for Ecological Assessments. Eco Update 1(4)." Office of Solid Waste and Emergency Response. Publication 9345.0-05I.

US Environmental Protection Agency (US EPA). 1992b. "Framework for Ecological Risk Assessment." EPA 630/R-92-001. Risk Assessment Forum, Washington, DC.

US Environmental Protection Agency (US EPA). 1993. "Wildlife Exposure Factors Handbook. Volume 1." EPA/600/R-93/187a. Office of Research and Development, Washington, DC.

US EPA, 1996a. National Health and Environmental Effects Research Laboratory (Corvallis, OR); Schuytema, GS; Nebeker, AV. August "Amphibian Toxicity Data for Water Quality Criteria Chemicals." National Health and Environmental Effects Research Laboratory (Corvallis, OR); Schuytema, GS; Nebeker, AV. August Report to US EPA, Office of Research and Development (Corvallis, OR) National Technical Information Service (NTIS) (Springfield, VA) NTIS PB97-109458 ; EPA/600/R-96/124. 215p.

US Environmental Protection Agency (US EPA). 1996b. "Eco Update – Ecotox Thresholds." Office of Emergency and Remedial Response. Intermittent Bulletin Volume 3, Number 2.

US Environmental Protection Agency (US EPA). 1997. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final." EPA 540-R-97-006. Solid Waste and Emergency Response, Edison, NJ.

US Environmental Protection Agency (US EPA). 1998. "Guidelines for Ecological Risk Assessment." EPA/630/R-95/002F. Risk Assessment Forum, Washington DC.

US Environmental Protection Agency (US EPA). 1999. "Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities." Solid Waste and Emergency Response. EPA 530-D-99-001.

US Environmental Protection Agency (US EPA). 2000. "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories."

US Environmental Protection Agency (US EPA). 2002. "National recommended water quality criteria: 2002." Office of Water. EPA-822-R-02-047.

US EPA. 2005. "Integrated Risk Information System (IRIS) Online database." Office of Health and Environmental Assessment, Cincinnati, OH.

US Environmental Protection Agency (US EPA). 2006. *ECOTOX Database*. Accessed on 10/13/2005 at http://www.epa.gov/cgi-bin/ecotox_quick_search.

US Environmental Protection Agency (US EPA). 2007. *Ecological Soil Screening Values*. Accessed at <http://www.epa.gov/ecotox/ecossl/>.

US Environmental Protection Agency (US EPA). 2003. "Toxicity Reference Values (TRVs) for Mammals and Birds on Selected Aroclors." Region 5. March 6.

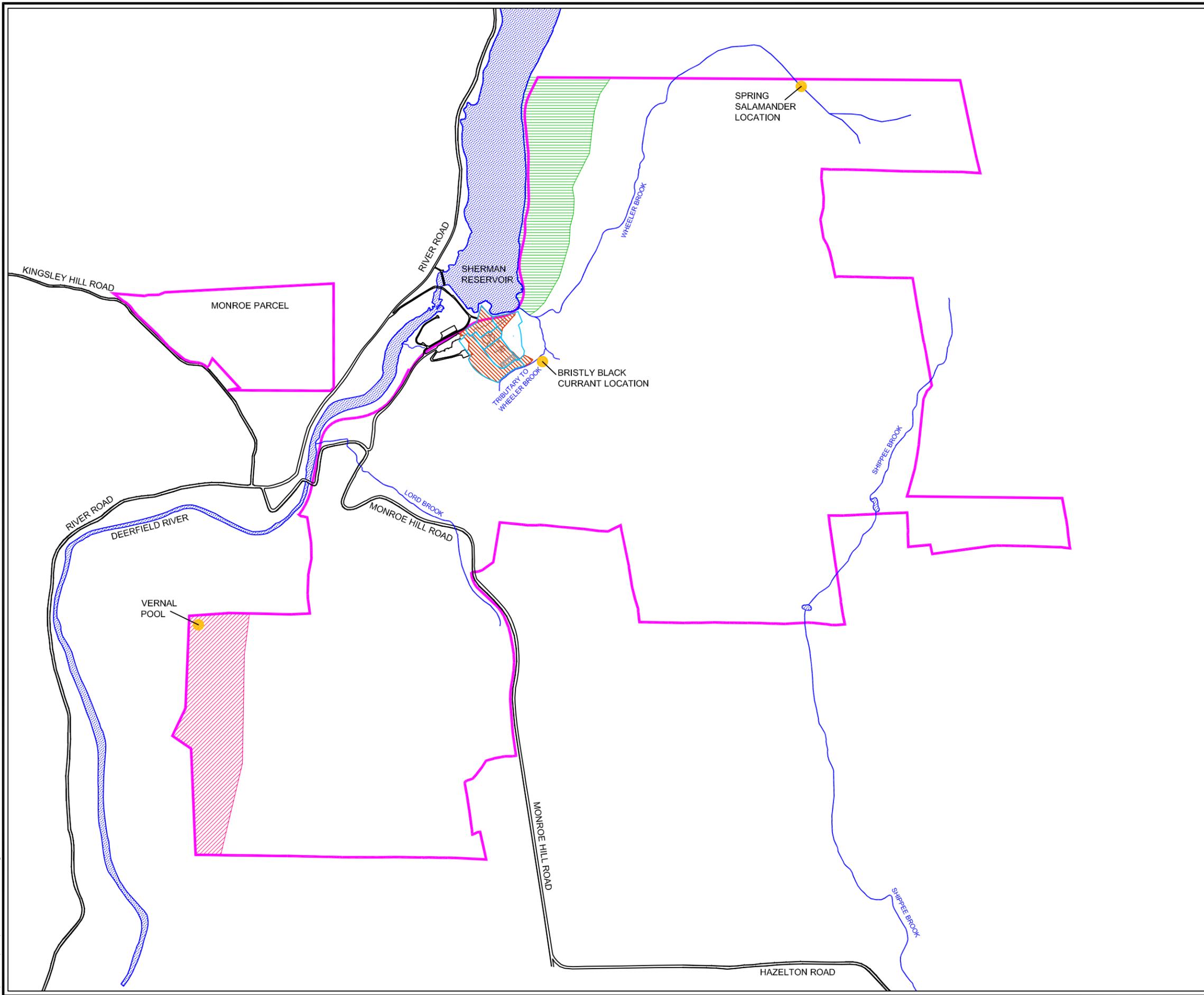
US Environmental Protection Agency (US EPA). 2004. "Framework for Inorganic Metals Risk Assessment." EPA/630/P-04/068B. Peer Review Draft.

US EPA. 2005. *Integrated Risk Information System (IRIS) Online Database*. Office of Health and Environmental Assessment, Cincinnati, OH.

Woodlot Alternatives, Inc. (Woodlot). 2004. "Natural resources inventory and management plan, Yankee Rowe Nuclear Power Station, Rowe and Monroe, Massachusetts." Report to Yankee Rowe Nuclear Power Station, Rowe, MA. April.

Zeiner, D.C., W.F. Laudenslayer, K.E. Mayer, and M. White. 1990. California's Wildlife. Volume III. Mammals. California Department of Fish and Game, Sacramento, California.

Figures



L E G E N D

-  PROPERTY BOUNDARY
-  ROADS
-  BODY OF WATER
-  STREAM OR BROOK
-  LOCATIONS OF INTEREST
-  BALD EAGLE HABITAT
-  NHESP BIOMAP CORE HABITAT
-  FORMER YNPS INDUSTRIAL AREA



Map Source: USGS; Woodlot Associates; Yankee Atomic Power Company - 02-036 Aerial Mapping.dwg.

Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617) 395-5000

FIGURE 1-1

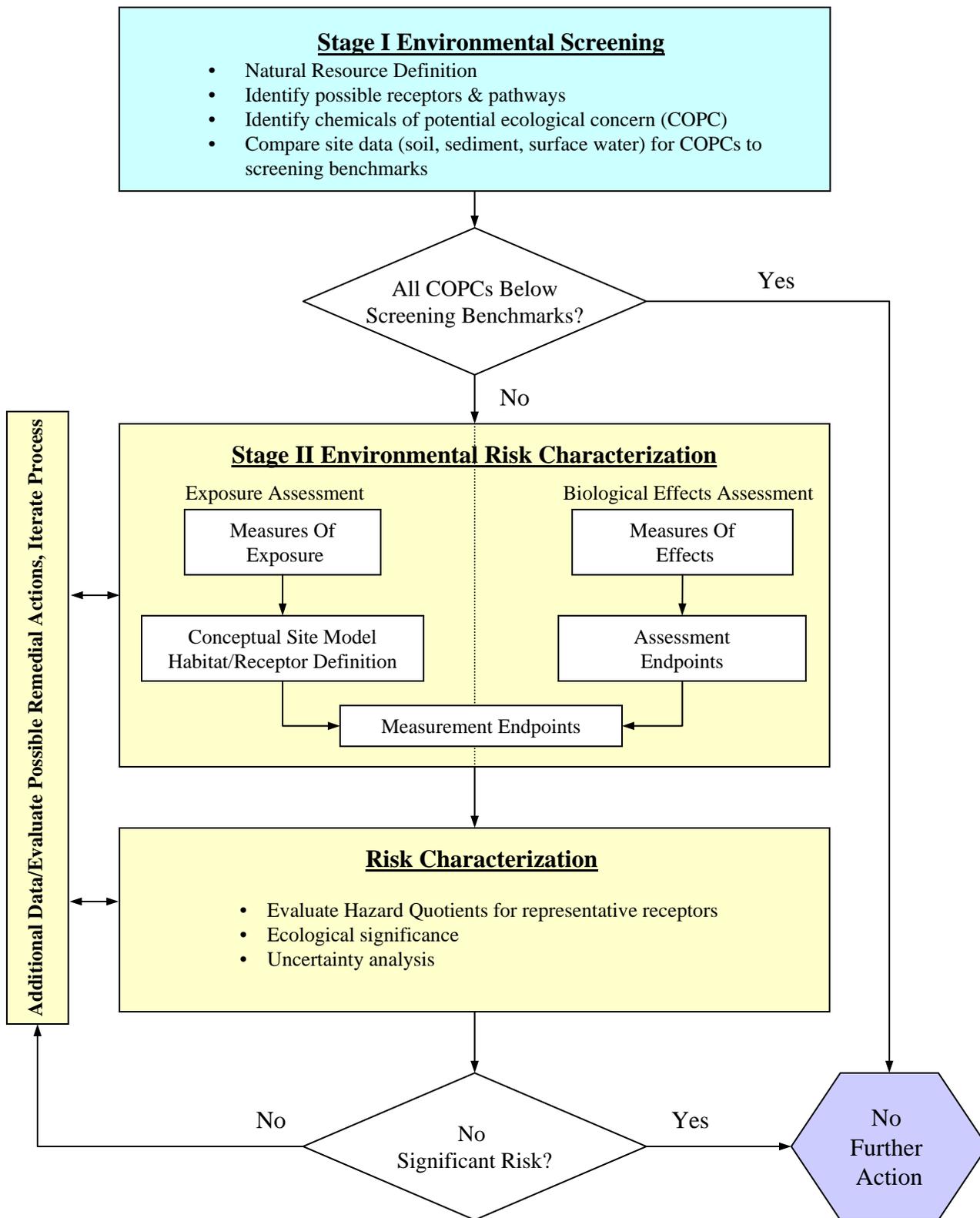
Yankee Property Boundaries
and Site Features

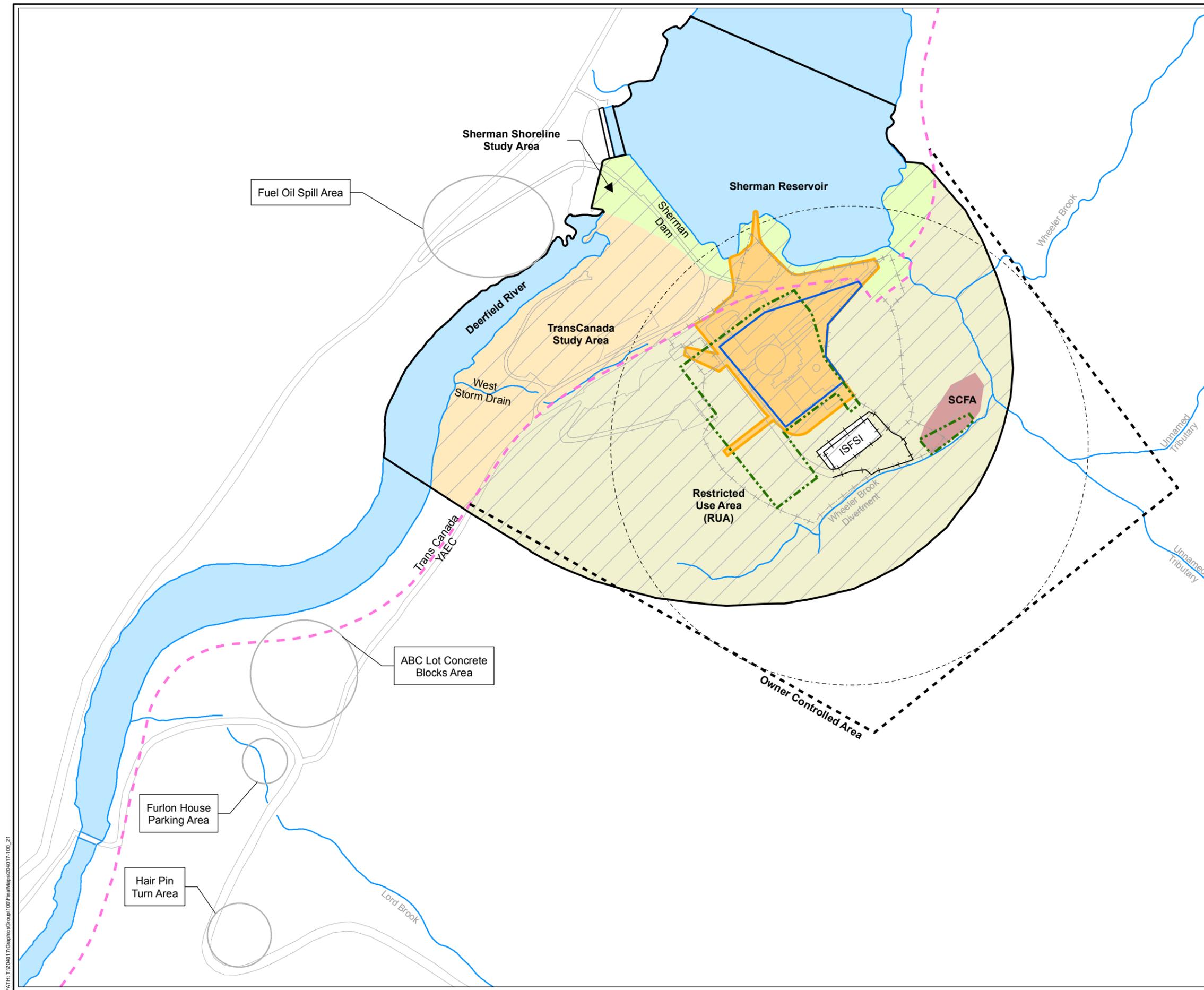
Yankee Nuclear Power Station
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	03/16/07	Date:	03/16/07	File:	204017-100_01

T:\204017\100\204017-100_01.dwg

**Figure 1-2
YNPS Environmental Assessment Approach**





- LEGEND**
- Combined Study Areas
 - TSCA Deed Restricted Areas
 - C&A Area
 - Property Boundary
 - ISFSI Fence
 - BUD Area
 - 300 Meter Buffer Around ISFSI
 - Restricted Use Areas (RUA)

Note : Former structures and plant features shown for reference. These no longer exist.



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-1
YNPS Study Areas and Restricted Areas

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/18/07	Date:	06/18/07	File:	204017-100_21.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_21

Note : Sample locations shown are for PCB samples.



Gradient CORPORATION

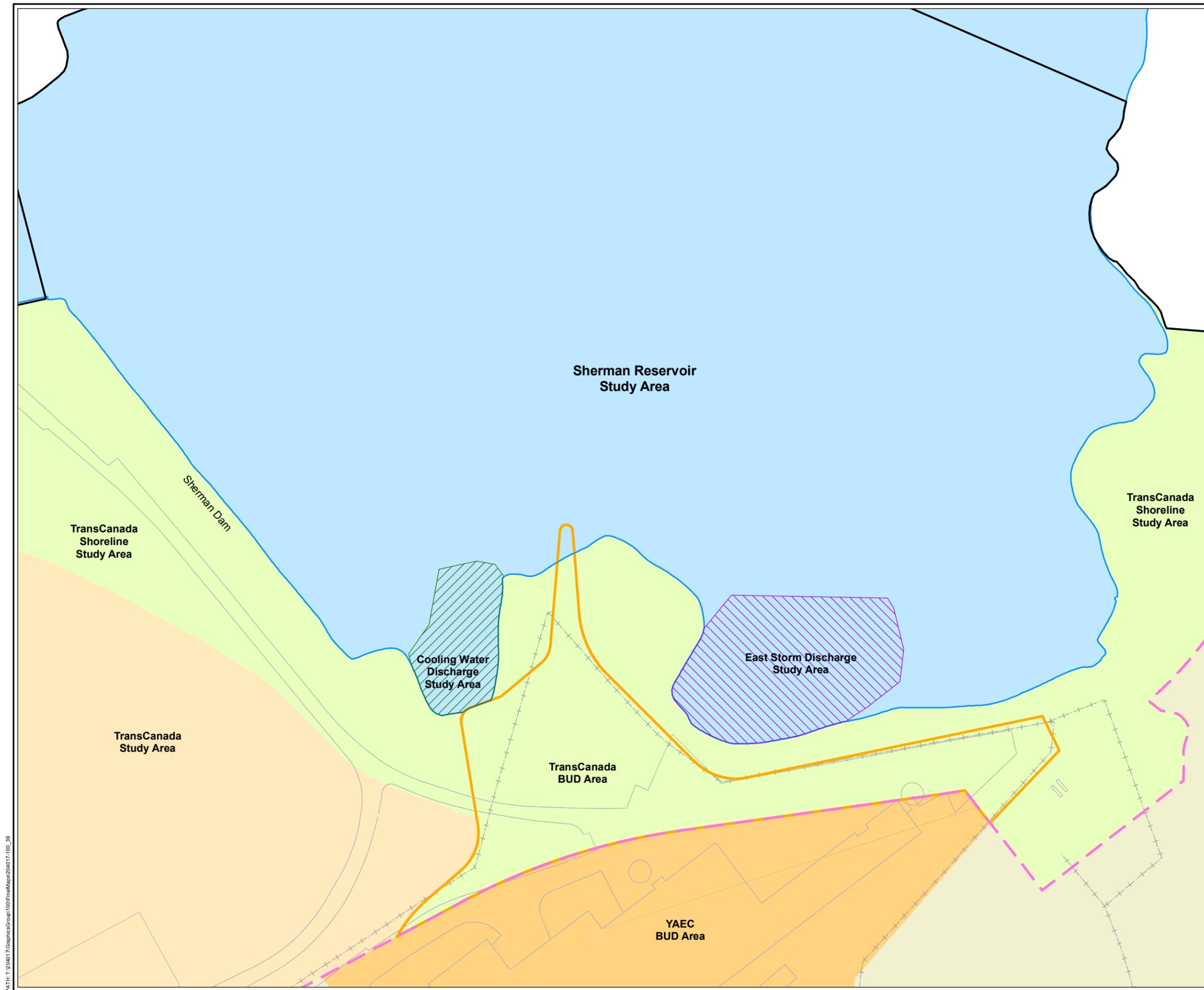
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-2

**Subareas of Sherman Reservoir
Sediment Sample Locations**

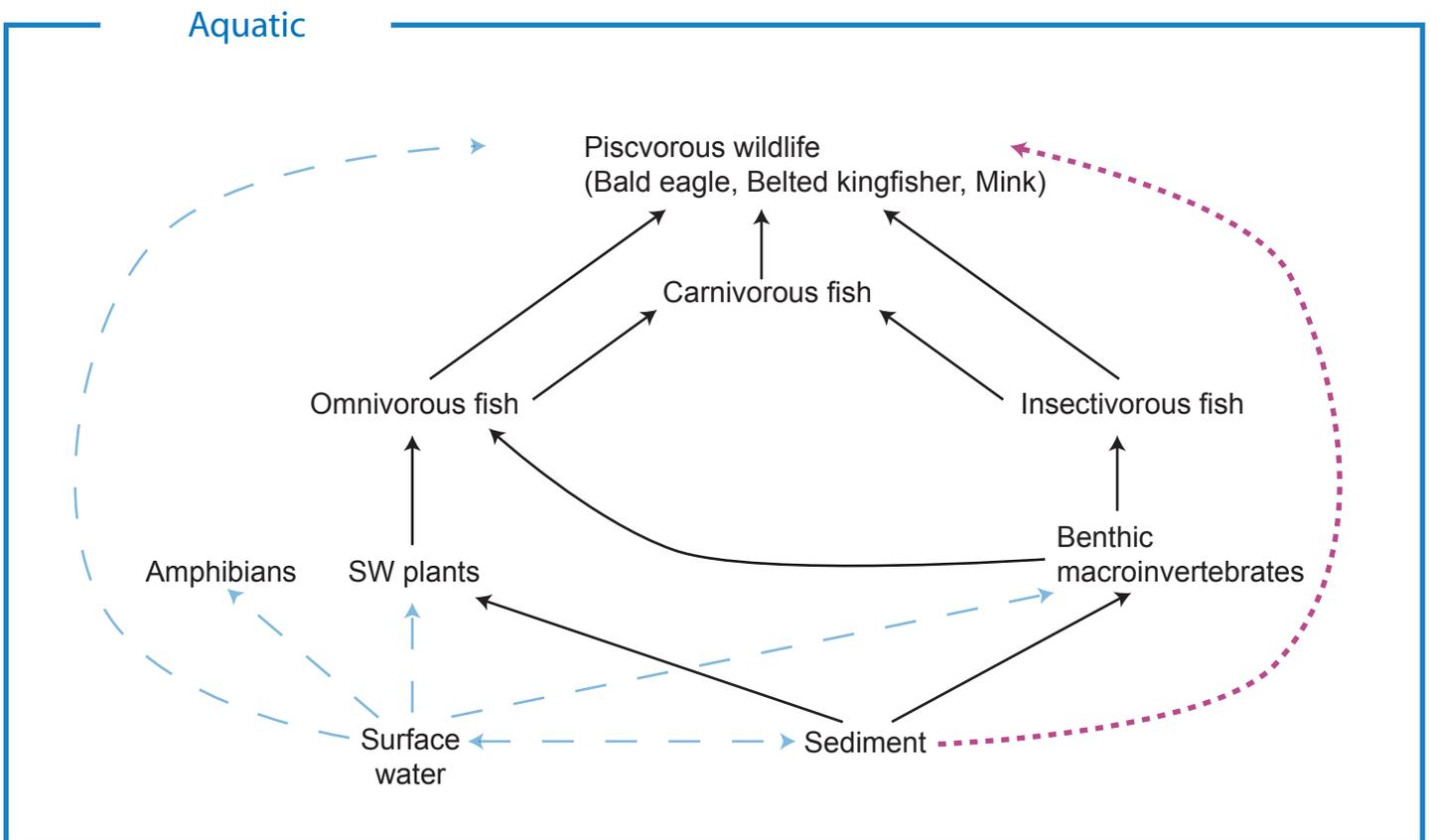
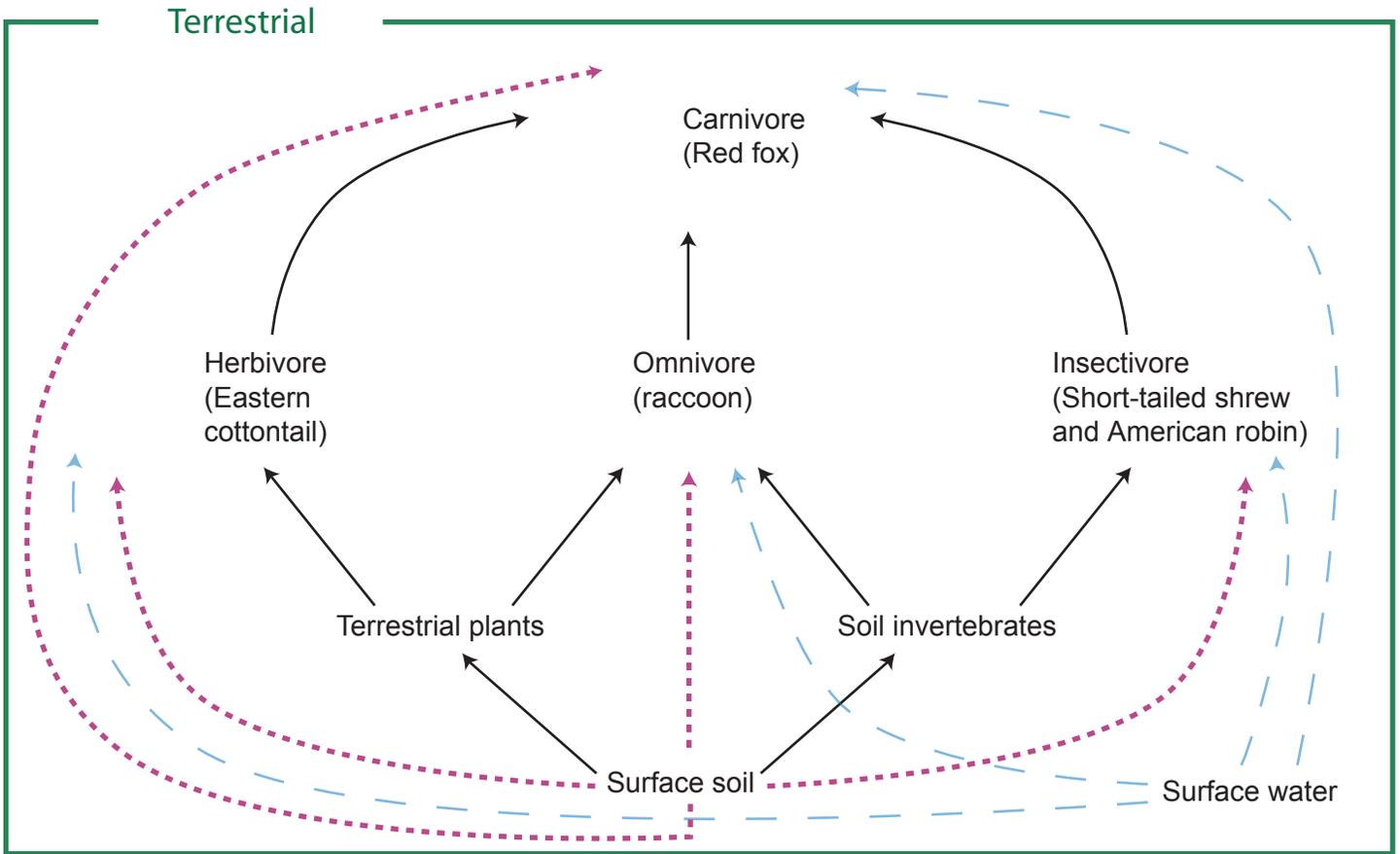
Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/20/07	Date:	06/20/07	File:	204017-100_39.mxd



PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_39

Figure 3-1
Food Web and Exposure Pathways



——— direct route of exposure/direct exposure pathway
 - - - - - de minimus pathway due to limited COPCs in surface water
 ······ incidental route of exposure/exposure pathway

Note : Sample locations shown are for PCB samples.



Gradient CORPORATION

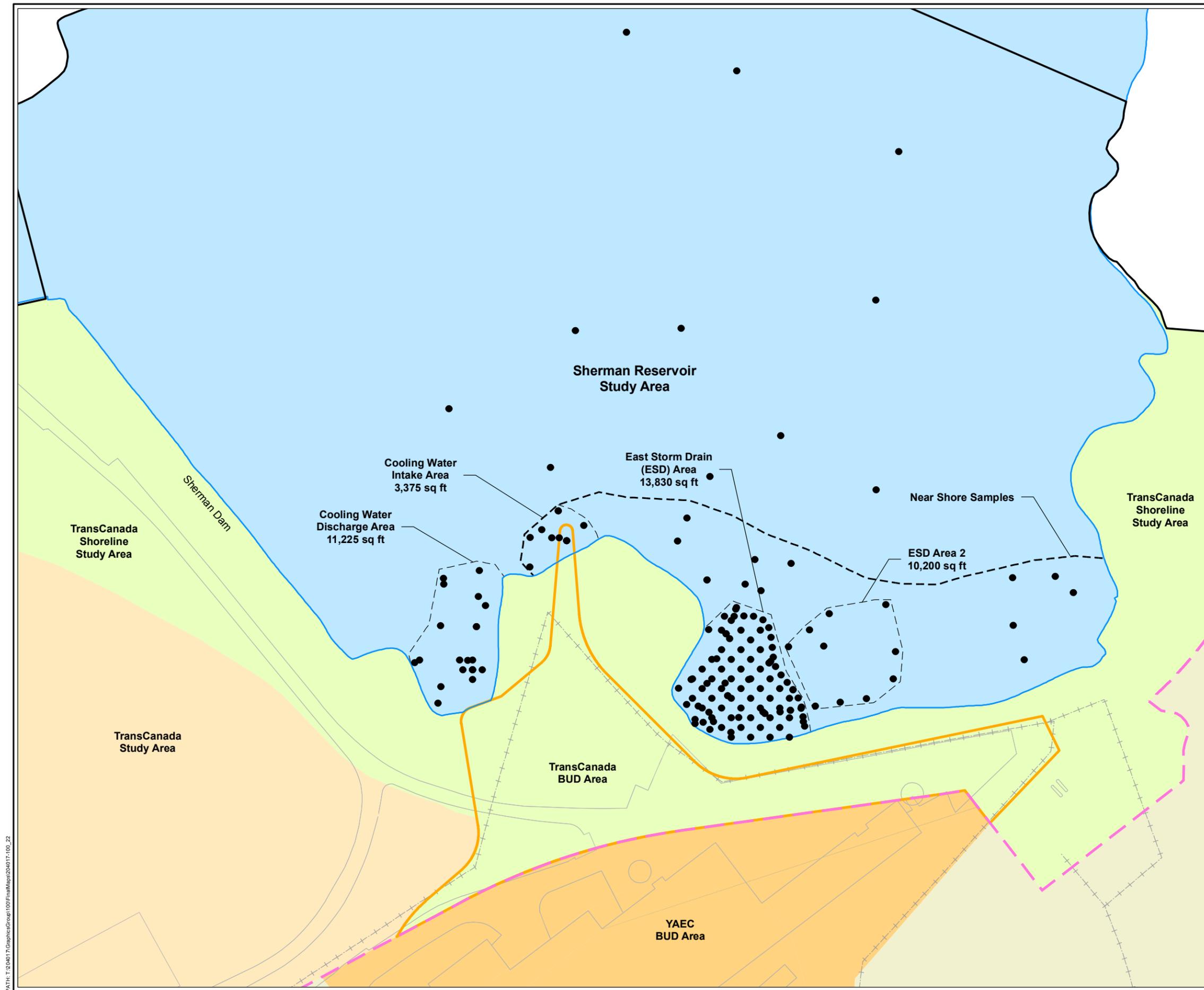
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 3-2

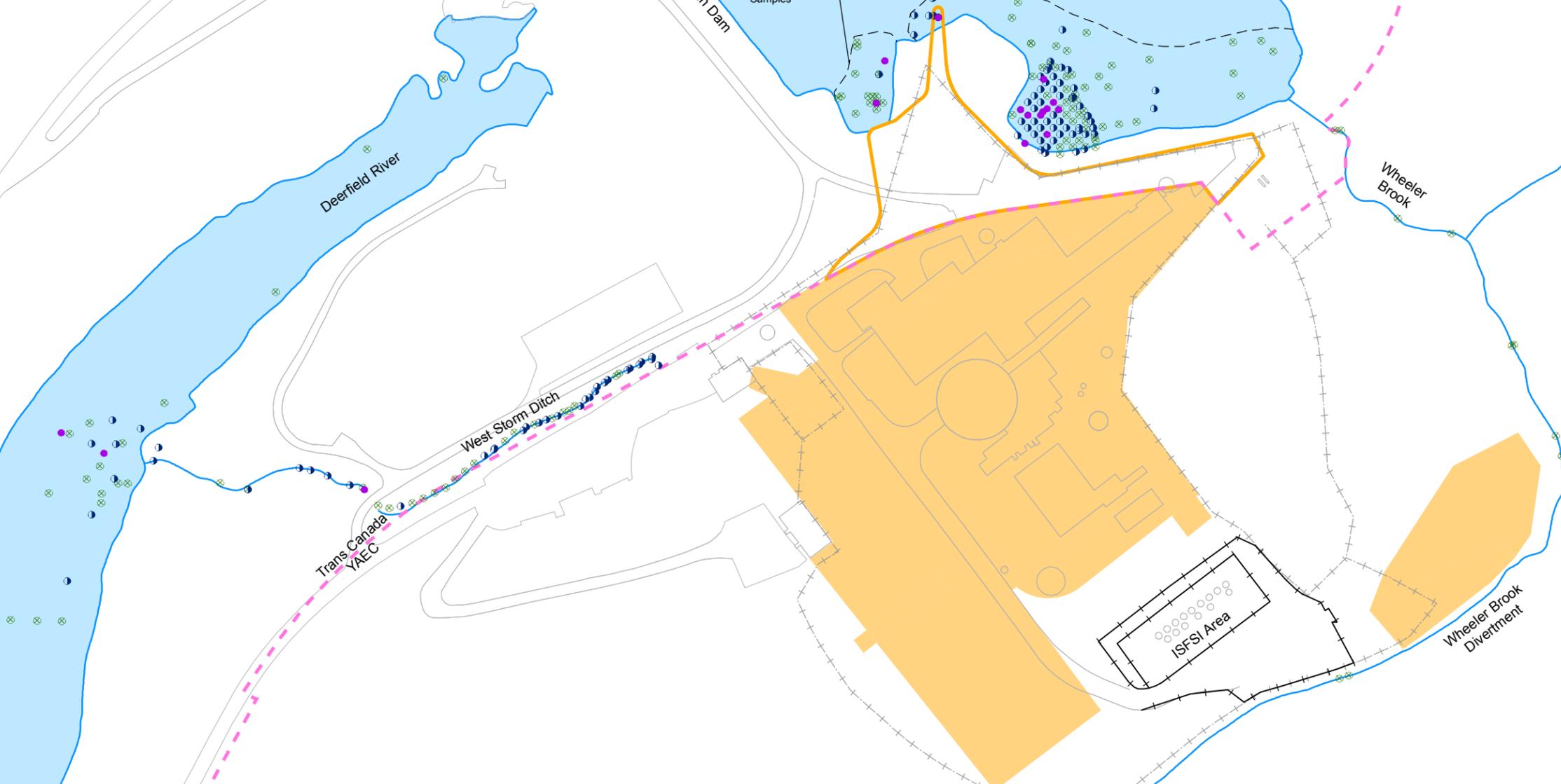
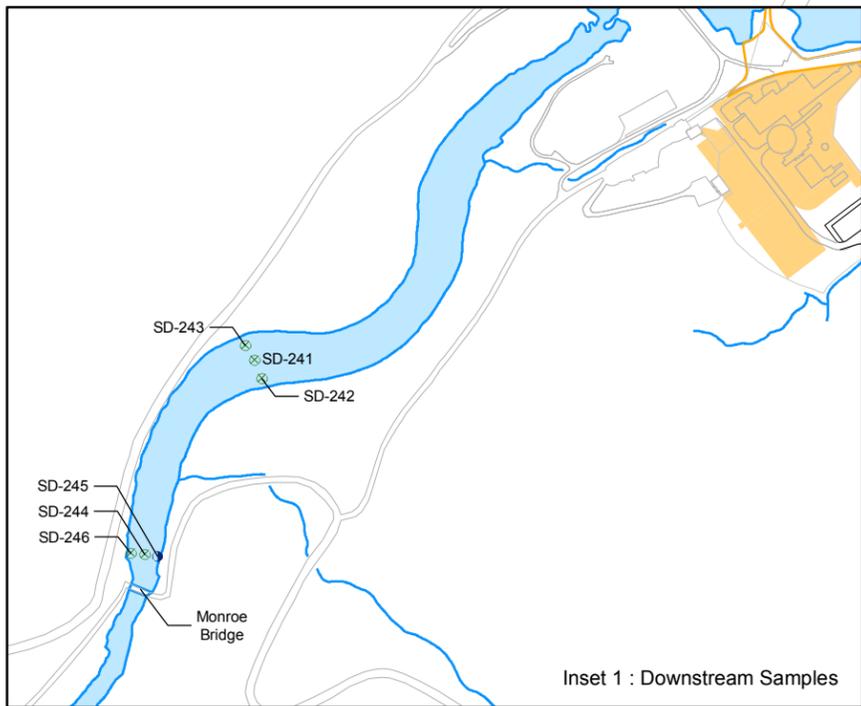
Sherman Reservoir Sediment Averaging Areas For Benchmark Comparisons

Yankee Nuclear Power Station, Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/20/07	Date:	06/20/07	File:	204017-100_22.mxd



PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_22



- LEGEND**
- >676 µg/kg (PEC)
 - >59.8 - 676 µg/kg
 - ⊗ <59.8 µg/kg (TEC)

Note : Former structures and plant features shown for reference. These no longer exist.

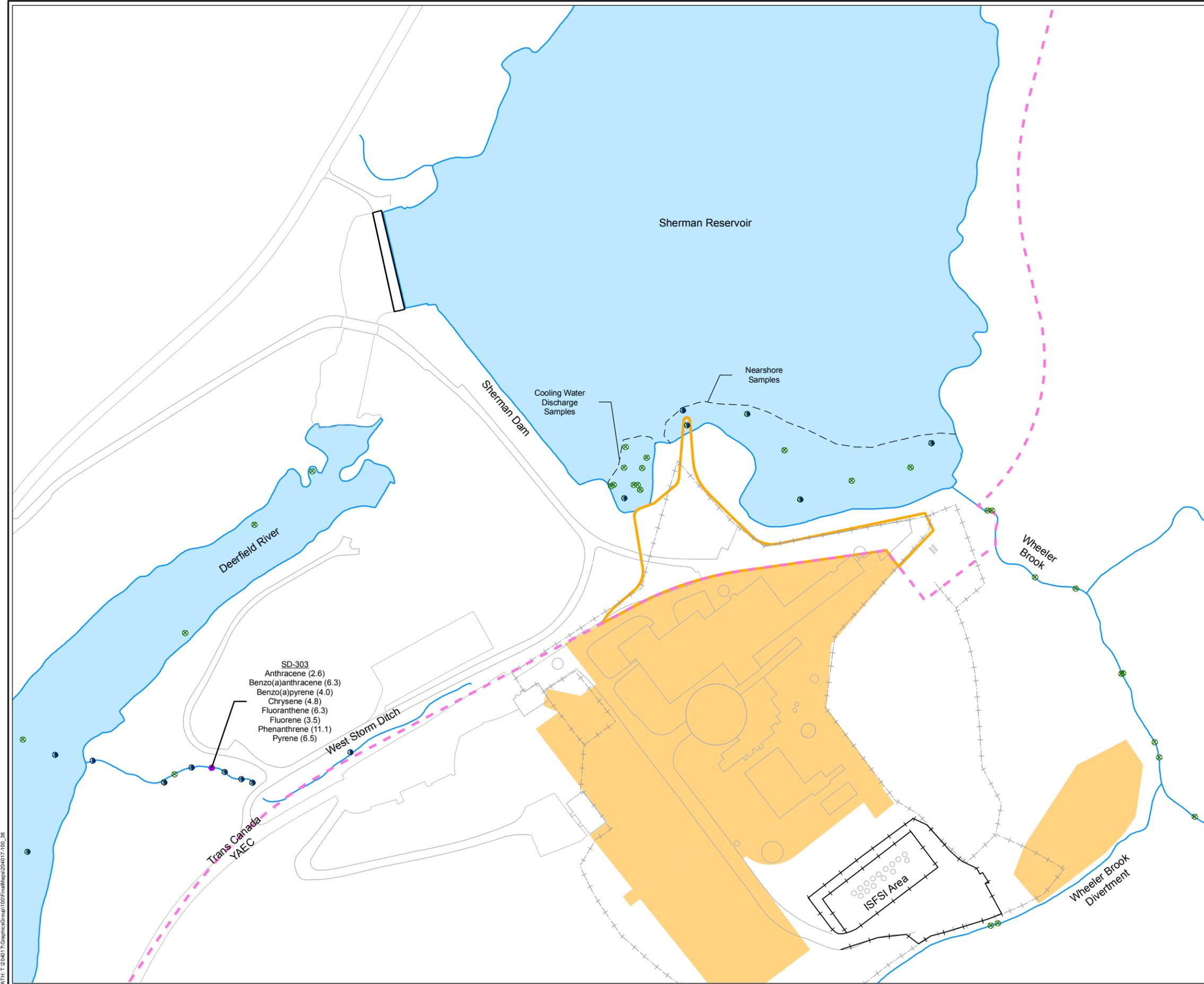


Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 3-3
 Sediment Benthic Macroinvertebrate
 Benchmark Comparisons for PCBs
 Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	05/08/07	Date:	05/08/07	File:	204017-100_30.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_30



BENCHMARK QUOTIENT

- ⊗ 0 to 0.1
- >0.1 to 1.5
- >1.5 to 12.0

Note : Former structures and plant features shown for reference. These no longer exist.

Chemical	PEC Benchmark (ug/kg)
Anthracene	845
Benzo(a)anthracene	1050
Benzo(a)pyrene	1450
Chrysene	1290
Fluoranthene	2230
Fluorene	536
Naphthalene	561
Phenanthrene	1170
Pyrene	1520

SD-303
 Anthracene (2.6)
 Benzo(a)anthracene (6.3)
 Benzo(a)pyrene (4.0)
 Chrysene (4.8)
 Fluoranthene (6.3)
 Fluorene (3.5)
 Phenanthrene (11.1)
 Pyrene (6.5)

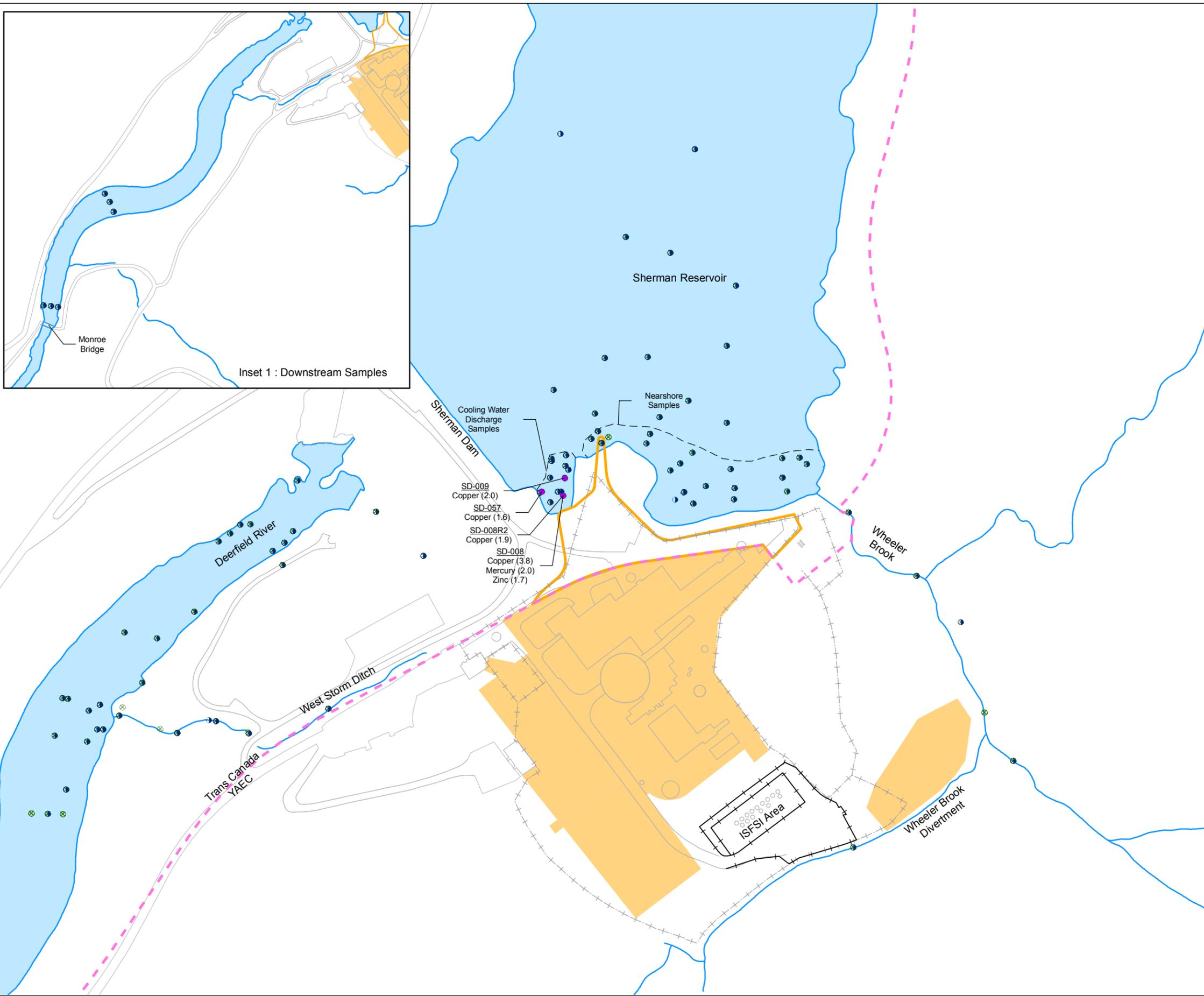
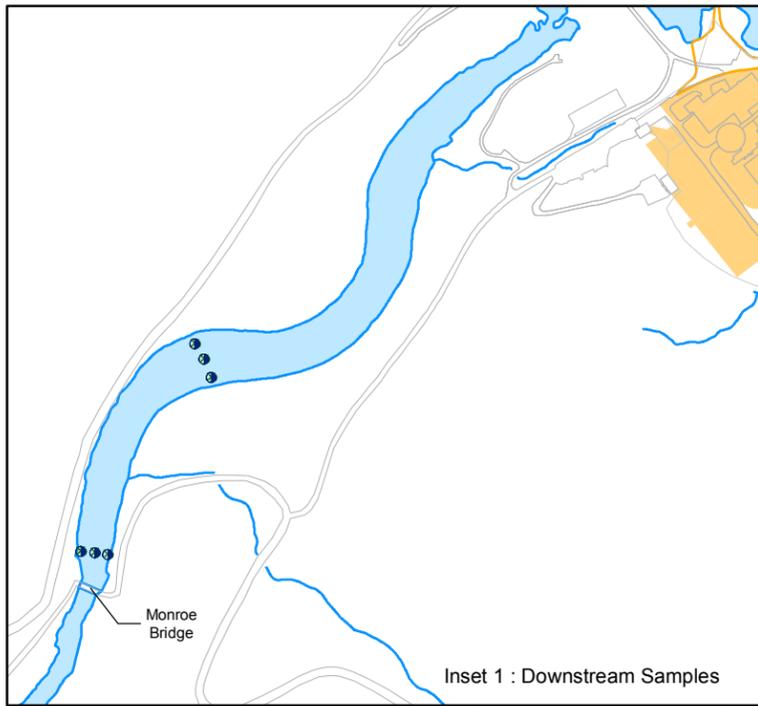


Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 3-4
Sediment Benthic Macroinvertebrate Benchmark Quotients -- PAHs
 Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	05/22/07	Date:	05/22/07	File:	204017-100_36.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_36



BENCHMARK QUOTIENT

- ⊗ 0 to 0.1
- >0.1 to 1.5
- >1.5 to 4.0

Note : Former structures and plant features shown for reference. These no longer exist.

Chemical	Benchmark (mg/kg)
Antimony	64*
Arsenic	33
Cadmium	5
Chromium	110
Copper	150
Lead	130
Mercury	1.06
Nickel	49
Silver	4.5*
Zinc	460

*Apparent Effects Threshold (AET). All other benchmarks are PEC values.



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

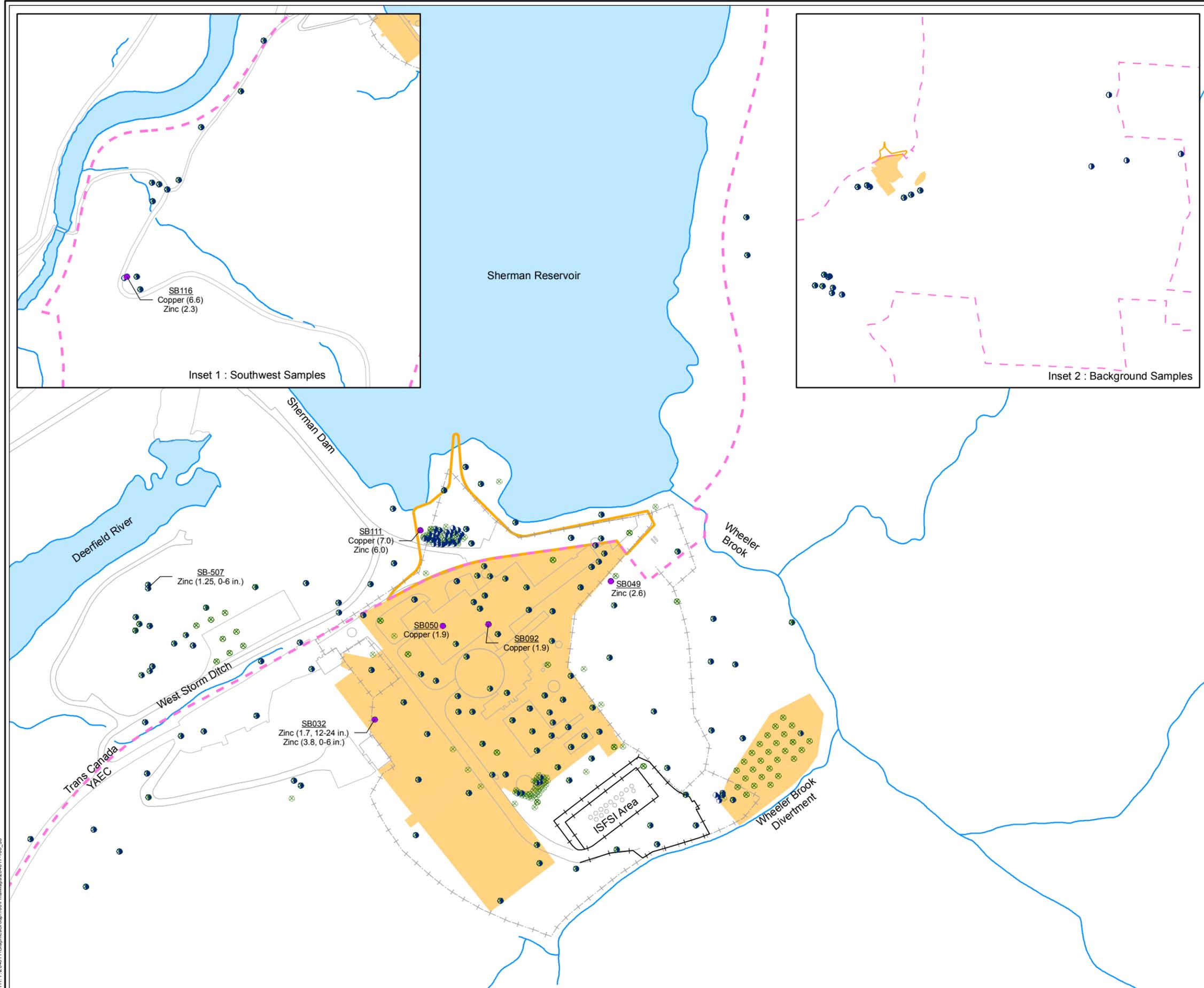
FIGURE 3-5

Sediment Benthic Macroinvertebrate Benchmark Quotients -- Inorganics

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	05/08/07	Date:	05/08/07	File:	204017-100_37.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_37



Inset 1 : Southwest Samples

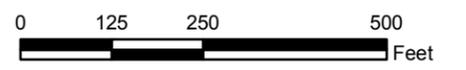
Inset 2 : Background Samples

BENCHMARK QUOTIENT

- ⊗ 0 to 0.1
- >0.1 to 1.5
- >1.5 to 15.0

Note : Former structures and plant features shown for reference. These no longer exist.

Chemical	Benchmark (mg/kg)
Arsenic	60
Copper	50
Lead	500
Nickel	200
Selenium	70
Zinc	200



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 3-6

**Soil Invertebrate (Earthworms)
 Benchmark Quotients -- Inorganics**

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/26/07	Date:	06/26/07	File:	204017-100_38.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_38

Tables

**Table 2-1
Chemicals Detected in Surface Soil (0-3 ft bgs) -- Background Areas
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Materials	Background Samples						Detected > 5% ?	MADEP Background ²
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		
Dioxin/Furans (pg/g)								
Dioxin/Furan TEQ	1	2	50%	0.36	0.07	0.44	Yes	--
Extractable Petroleum Hydrocarbons (mg/kg)								
Acenaphthylene - EPH	1	7	14%	0.13	0.14	0.14	Yes	--
Benzo(b)fluoranthene - EPH	2	7	29%	0.10	0.13	0.034	Yes	--
Chrysene - EPH	3	7	43%	0.08	0.08	0.046	Yes	--
Fluoranthene	6	7	86%	0.05	0.05	0.082	Yes	--
Inorganics (mg/Kg)								
Antimony	1	7	14%	1.73	1.32	4.75	Yes	1
Arsenic	26	27	96%	2.40	1.80	5.61	Yes	20
Beryllium	4	27	15%	0.46	0.49	0.48	Yes	0.4
Boron	2	2	100%	18.50	18.50	19	Yes	--
Cadmium	5	26	19%	0.49	0.50	0.79	Yes	2
Chromium	27	27	100%	15.16	15.00	34	Yes	30
Copper	22	27	81%	6.97	6.40	18.7	Yes	40
Lead	26	26	100%	16.33	3.60	101	Yes	100
Lithium	2	2	100%	24.50	24.50	26	Yes	--
Mercury	8	27	30%	0.33	0.36	0.32	Yes	0.3
Nickel	27	27	100%	10.57	8.90	29	Yes	20
Selenium	4	27	15%	1.61	1.55	2.45	Yes	0.5
Silver	4	25	16%	0.53	0.17	3.22	Yes	0.6
Thallium	3	26	12%	0.60	0.42	0.73	Yes	0.6
Zinc	27	27	100%	53.47	54.00	75.8	Yes	100
Semivolatile Organic Compounds (ug/Kg)								
Acenaphthylene	1	13	8%	182.85	205.00	96.5	Yes	500
Anthracene	1	13	8%	179.12	205.00	48	Yes	1000
Benzo(a)anthracene	1	13	8%	193.27	214.50	232	Yes	2000
Benzo(a)pyrene	2	13	15%	185.92	205.00	219	Yes	2000
Benzo(b)fluoranthene	2	13	15%	229.46	215.00	533	Yes	2000
Benzo(g,h,i)perylene	2	13	15%	172.52	200.00	105	Yes	1000
Benzo(k)fluoranthene	2	13	15%	185.85	205.00	217	Yes	1000
Benzoic acid	2	13	15%	941.19	950.00	3500	Yes	--
Chrysene	3	13	23%	190.30	200.00	337	Yes	2000
Fluoranthene	6	13	46%	216.37	215.00	552	Yes	4000
Indeno(1,2,3-cd)pyrene	1	13	8%	184.58	205.00	119	Yes	1000
Phenanthrene	4	13	31%	210.41	215.00	357	Yes	3000
Pyrene	4	13	31%	251.66	215.00	773	Yes	4000
Volatile Petroleum Hydrocarbons (mg/kg)								
Adjusted C5-C8 Aliphatics	1	8	13%	2.10	1.65	4.95	Yes	--
Adjusted C9-C10 Aromatics	7	8	88%	16.43	4.71	89	Yes	--
Adjusted C9-C12 Aliphatics	8	8	100%	7.77	2.99	35.3	Yes	--
Toluene - VPH	1	7	14%	0.22	0.11	0.839	Yes	--
Unadjusted C5-C8 Aliphatics	8	8	100%	2.89	2.71	4.95	Yes	--
Unadjusted C9-C12 Aliphatics	8	8	100%	24.17	7.65	124	Yes	--

Notes:

-- No criterion available

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) MADEP Background Soil Concentrations from Non-urban Locations (MADEP, 2002a).

Table 2-2
Chemicals Detected in Sediment -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Background Samples						Detected > 5% ?	Criteria ²
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		
Extractable Petroleum Hydrocarbons (mg/kg)								
Acenaphthylene - EPH	4	6	67%	0.12	0.11	0.17	Yes	0.15
Anthracene - EPH	2	6	33%	0.088	0.088	0.082	Yes	0.0572
Benzo(a)anthracene - EPH	1	6	17%	0.10	0.10	0.085	Yes	0.11
Benzo(a)pyrene - EPH	2	6	33%	0.09	0.10	0.11	Yes	0.15
Benzo(b)fluoranthene - EPH	4	6	67%	0.058	0.065	0.073	Yes	0.037
Benzo(g,h,i)perylene - EPH	1	6	17%	0.10	0.10	0.080	Yes	0.15
Benzo(k)fluoranthene - EPH	1	6	17%	0.11	0.10	0.13	Yes	0.037
Chrysene - EPH	3	6	50%	0.091	0.088	0.15	Yes	0.17
Fluoranthene - EPH	3	6	50%	0.13	0.10	0.32	Yes	0.423
Indeno(1,2,3-cd)pyrene - EPH	1	6	17%	0.10	0.10	0.066	Yes	0.03
Phenanthrene - EPH	2	6	33%	0.091	0.089	0.084	Yes	0.204
Pyrene - EPH	2	6	33%	0.13	0.10	0.265	Yes	0.2
Inorganics (mg/Kg)								
Arsenic	5	12	42%	1.11	0.76	2.8	Yes	33
Beryllium	6	12	50%	0.49	0.42	0.36	Yes	--
Boron	6	6	100%	2.98	2.69	4.91	Yes	--
Cadmium	6	12	50%	0.51	0.54	0.63	Yes	5
Chromium	12	12	100%	9.95	7.62	21	Yes	110
Copper	12	12	100%	19.18	11.24	45	Yes	150
Lead	12	12	100%	5.20	4.21	19.6	Yes	130
Lithium	6	6	100%	6.72	5.89	12.1	Yes	--
Mercury	6	12	50%	0.06	0.04	0.21	Yes	0.18
Nickel	12	12	100%	12.14	9.76	28	Yes	49
Selenium	2	11	18%	1.99	1.33	4.9	Yes	--
Silver	1	12	8%	0.45	0.46	0.4	Yes	4.5
Uranium	10	12	83%	1.56	1.55	2.9	Yes	--
Zinc	12	12	100%	108.39	63.50	270	Yes	460
Polychlorinated Biphenyls (ug/kg)								
Aroclor-1260	1	24	4%	76.04	5.50	6.97	No	60
Semivolatile Organic Compounds (ug/kg)								
1-Methylnaphthalene	1	6	17%	149.43	145.75	35.1	Yes	150
2-Methylnaphthalene	1	12	8%	252.70	247.50	20.9	Yes	150
2-Methylphenol	1	12	8%	249.92	183.75	150	Yes	--
3+4-Methylphenol	2	12	17%	234.07	222.50	230	Yes	--
Acenaphthene	1	12	8%	252.75	247.50	21.5	Yes	150
Acenaphthylene	1	12	8%	255.88	247.50	59.1	Yes	150
Anthracene	3	12	25%	230.20	183.75	124	Yes	57.2
Benzo(a)anthracene	7	12	58%	170.73	169.00	200	Yes	110
Benzo(a)pyrene	6	12	50%	196.62	206.00	230	Yes	150
Benzo(b)fluoranthene	2	12	17%	251.63	244.00	268	Yes	37
Benzo(g,h,i)perylene	3	12	25%	228.38	183.75	101	Yes	150
Benzo(k)fluoranthene	6	12	50%	190.36	183.75	220	Yes	37
Carbazole	1	12	8%	257.63	247.50	80	Yes	--
Chrysene	8	12	67%	168.19	185.00	273	Yes	170
Dibenzo(a,h)anthracene	1	12	8%	253.01	247.50	24.6	Yes	33
Dibenzofuran	1	12	8%	253.98	247.50	36.3	Yes	--
Di-n-butyl phthalate	1	12	8%	252.70	247.50	20.9	Yes	--
Di-n-octyl phthalate	3	12	25%	221.46	183.75	37.4	Yes	--
Fluoranthene	10	12	83%	236.59	242.50	651	Yes	423
Fluorene	1	12	8%	255.01	247.50	48.6	Yes	77.4
Indeno(1,2,3-cd)pyrene	3	12	25%	228.80	183.75	106	Yes	30
Phenanthrene	6	12	50%	262.74	233.75	777	Yes	204
Pyrene	9	12	75%	226.97	216.25	592	Yes	200

Table 2-2
Chemicals Detected in Sediment -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Background Samples						Detected > 5% ?	Criteria ²
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		
Total Petroleum Hydrocarbons (mg/kg)								
TPH-DRO	5	6	83%	31.75	25.50	80	Yes	--
Volatile Organic Compounds (ug/kg)								
1,1-Dichloroethene	5	12	42%	14.51	15.75	24	Yes	5900
2-Butanone	6	7	86%	37.69	30.00	91.3	Yes	27000
Acetone	6	12	50%	220.33	187.25	943	Yes	57.1
Dimethyl sulfide	1	1	100%	43.50	43.50	43.5	Yes	--
Toluene	6	12	50%	16.13	15.25	31	Yes	130000
Volatile Petroleum Hydrocarbons (mg/kg)								
Adjusted C9-C10 Aromatics	1	5	20%	0.15	0.10	0.35	Yes	--
Adjusted C9-C12 Aliphatics	2	5	40%	0.12	0.10	0.18	Yes	--
Ethylbenzene - VPH	1	5	20%	0.03	0.02	0.064	Yes	--
m+p-Xylenes - VPH	1	5	20%	0.05	0.04	0.11	Yes	--
Naphthalene - VPH	1	5	20%	0.03	0.02	0.060	Yes	0.176
Toluene - VPH	1	5	20%	0.03	0.02	0.056	Yes	130

Notes:

-- No criterion available

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.

Table 2-3
Chemicals Detected in Surface Water -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Background Samples						Detected > 5% ?	Criteria ¹
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		
<i>Inorganics (mg/L)</i>								
Boron	3	3	100%	0.0038	0.0039	0.0040	Yes	0.75
Cadmium	1	3	33%	0.000042	0.000020	0.000090	Yes	0.00025
Lead	1	3	33%	0.0012	0.0007	0.0022	Yes	0.0025
Silver	2	3	67%	0.0011	0.0008	0.0023	Yes	0.00012

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) MADEP (2006b) surface water criteria where available. See Table 3-7 for complete listing of sources.

Table 2-4
Chemical COPCs in Surface Soil (0-3 ft bgs) -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Combined Study Area Samples						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
Dioxin/Furans (pg/g)											
Dioxin/Furan TEQ	27	27	100%	1.19	0.50	7.38	Yes	0.36	0.40	Yes	
Extractable Petroleum Hydrocarbons (mg/Kg)											
2-Methylnaphthalene - EPH	6	60	10%	0.09	0.07	0.44	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Acenaphthene - EPH	7	60	12%	0.09	0.07	0.52	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Acenaphthylene - EPH	1	60	2%	0.08	0.07	0.06	No	0.14	0.14	No	Detected <5%
Adjusted C11-C22 Aromatics	9	37	24%	36.36	15.15	389.00	Yes	ND	ND	Yes	
Adjusted TPH	20	60	33%	76.45	15.33	1080.00	Yes	ND	ND	No-d	Analyzed by EPH/VPH
Anthracene - EPH	14	60	23%	0.11	0.07	0.92	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Benzo(a)anthracene - EPH	9	60	15%	0.17	0.08	3.21	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Benzo(a)pyrene - EPH	13	60	22%	0.15	0.07	2.04	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Benzo(b)fluoranthene - EPH	15	60	25%	0.12	0.07	1.69	Yes	0.13	0.03	No-c	Analyzed by SVOC/VOC
Benzo(g,h,i)perylene - EPH	10	60	17%	0.11	0.07	0.75	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Benzo(k)fluoranthene - EPH	14	60	23%	0.15	0.07	2.23	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Chrysene - EPH	16	60	27%	0.17	0.07	3.18	Yes	0.08	0.05	No-c	Analyzed by SVOC/VOC
Dibenzo(a,h)anthracene - EPH	3	60	5%	0.09	0.07	0.29	No	ND	ND	No	Detected <5%
Fluoranthene - EPH	22	60	37%	0.28	0.08	5.31	Yes	0.05	0.08	No-c	Analyzed by SVOC/VOC
Fluorene - EPH	7	60	12%	0.09	0.07	0.54	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Indeno(1,2,3-cd)pyrene - EPH	6	60	10%	0.11	0.07	0.82	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Naphthalene - EPH	1	60	2%	0.08	0.07	0.09	No	ND	ND	No	Detected <5%
Phenanthrene - EPH	17	60	28%	0.19	0.08	2.39	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Pyrene - EPH	19	60	32%	0.24	0.08	4.34	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Unadjusted C11-C22 Aromatics	53	171	31%	37.38	13.80	788.00	Yes	ND	ND	No-d	Analyzed by EPH/VPH
Unadjusted C19-C36 Aliphatics	55	171	32%	36.26	14.10	1010.00	Yes	ND	ND	No-d	Analyzed by EPH/VPH
Unadjusted C9-C18 Aliphatics	18	171	11%	22.32	3.97	562.00	Yes	ND	ND	No-d	Analyzed by EPH/VPH
Unadjusted TPH	21	60	35%	77.38	15.43	1080.00	Yes	ND	ND	No-d	Analyzed by EPH/VPH
Inorganics (mg/kg)											
Antimony	2	45	4%	2.04	2.50	0.83	No	1.32	4.75	No	Detected <5%
Arsenic	192	207	93%	2.67	1.9	27	Yes	1.80	5.61	No-e	Comparable to background
Beryllium	4	242	2%	0.35	0.37	2	No	0.49	0.48	No	Detected <5%
Boron	2	4	50%	97.50	72.5	240	Yes	18.50	19.00	Yes	
Cadmium	3	222	1%	0.97	0.46	6.2	No	0.50	0.79	No	Detected <5%
Chromium	211	216	98%	13.22	12	49	Yes	15.00	34.00	No-a	Comparable to background
Copper	169	222	76%	14.53	12	350	Yes	6.40	18.70	Yes	
Lead	324	328	99%	26.75	5.95	299	Yes	3.60	101.00	Yes	
Lithium	4	4	100%	14.00	13	18	Yes	24.50	26.00	No-b	Comparable to background
Mercury	17	222	8%	0.26	0.25	0.73	Yes	0.36	0.32	Yes	
Nickel	170	216	79%	13.93	11	230	Yes	8.90	29.00	Yes	
Selenium	29	222	13%	3.75	5	13	Yes	1.55	2.45	Yes	
Silver	1	222	0%	0.30	0.15	0.81	No	0.17	3.22	No	Detected <5%
Thallium	1	197	1%	1.08	0.34	0.82	No	0.42	0.73	No	Detected <5%
Zinc	134	213	63%	81.06	71	1200	Yes	54.00	75.80	Yes	

Table 2-4
Chemical COPCs in Surface Soil (0-3 ft bgs) -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Combined Study Area Samples						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
<i>Polychlorinated Biphenyls (ug/kg)</i>											
Aroclor-1016	14	1201	1%	11.25	5.2	83.8	No			No	Detected <5%
Aroclor-1248	22	1201	2%	12.35	5.2	440	No			No	Detected <5%
Aroclor-1254	934	1201	78%	301.33	106	5400	Yes			Yes	
Aroclor-1260	773	1201	64%	139.38	31.6	3590	Yes			Yes	
<i>Semivolatile Organic Compounds (ug/kg)</i>											
1-Methylnaphthalene	1	20	5%	120.48	100.75	185.00	No	ND	ND	No	Detected <5%
2-Methylnaphthalene	2	110	2%	209.40	180.00	348.00	No	ND	ND	No	Detected <5%
Acenaphthene	10	110	9%	210.64	180.00	530.00	Yes	ND	ND	Yes	
Acenaphthylene	16	110	15%	229.13	182.50	822.00	Yes	205.00	96.50	Yes	
Anthracene	23	110	21%	246.92	180.00	1500.00	Yes	205.00	48.00	Yes	
Benzidine	2	55	4%	1720.20	1800.00	234.00	No	ND	ND	No	Detected <5%
Benzo(a)anthracene	34	110	31%	363.32	185.00	2790.00	Yes	214.50	232.00	Yes	
Benzo(a)pyrene	31	110	28%	330.34	185.00	2830.00	Yes	205.00	219.00	Yes	
Benzo(b)fluoranthene	29	110	26%	358.92	185.00	3210.00	Yes	215.00	533.00	Yes	
Benzo(g,h,i)perylene	24	110	22%	254.23	180.00	1230.00	Yes	200.00	105.00	Yes	
Benzo(k)fluoranthene	29	110	26%	341.77	185.00	2850.00	Yes	205.00	217.00	Yes	
Benzoic acid	1	93	1%	975.38	900.00	150.00	No	950.00	3500.00	No	Detected <5%
Bis(2-ethylhexyl)phthalate	1	102	1%	217.68	180.00	448.00	No	ND	ND	No	Detected <5%
Butyl benzyl phthalate	1	102	1%	217.50	180.00	500.00	No	ND	ND	No	Detected <5%
Carbazole	7	102	7%	220.17	180.00	810.00	Yes	ND	ND	Yes	
Chrysene	33	110	30%	391.64	185.00	2850.00	Yes	200.00	337.00	Yes	
Dibenzo(a,h)anthracene	9	110	8%	206.47	180.00	400.00	Yes	ND	ND	Yes	
Dibenzofuran	3	102	3%	219.50	180.00	450.00	No	ND	ND	No	Detected <5%
Fluoranthene	44	110	40%	577.74	185.00	5860.00	Yes	215.00	552.00	Yes	
Fluorene	6	110	5%	212.87	180.00	750.00	Yes	ND	ND	Yes	
Indeno(1,2,3-cd)pyrene	20	110	18%	253.99	180.00	1440.00	Yes	205.00	119.00	Yes	
Isophorone	1	102	1%	214.36	180.00	135.00	No	ND	ND	No	Detected <5%
Naphthalene	4	110	4%	209.38	180.00	420.00	No	ND	ND	No	Detected <5%
Phenanthrene	25	109	23%	347.33	185.00	4000.00	Yes	215.00	357.00	Yes	
Pyrene	41	110	37%	527.70	185.00	5200.00	Yes	215.00	773.00	Yes	
<i>Total Petroleum Hydrocarbons (mg/kg)</i>											
TPH-DRO	107	134	80%	18.77	6.5	320	Yes			No-d	Analyzed by EPH/VPH
TPH-GRO	2	39	5%	5.20	1.25	150	Yes			No-d	Analyzed by EPH/VPH

Table 2-4
Chemical COPCs in Surface Soil (0-3 ft bgs) -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Combined Study Area Samples						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
Volatile Organic Compounds (ug/kg)											
1,2-Dichloroethane	1	53	2%	14.36	2.50	9.30	No			No	Detected <5%
2-Butanone	14	51	27%	129.22	5.30	6.60	Yes			Yes	
2-Hexanone	1	53	2%	122.95	2.50	1.00	No			No	Detected <5%
4-Isopropyltoluene	1	53	2%	15.56	2.50	73.00	No			No	Detected <5%
4-Methyl-2-Pentanone	3	53	6%	123.60	2.75	9.00	Yes			Yes	
Acetone	11	52	21%	77.78	6.45	86.00	Yes			Yes	
Carbon Disulfide	1	53	2%	62.53	2.50	0.50	No			No	Detected <5%
Dichlorodifluoromethane	2	53	4%	26.38	2.50	6.70	No			No	Detected <5%
m+p-Xylenes	2	53	4%	26.32	2.70	2.70	No			No	Detected <5%
n-Butylbenzene	1	53	2%	14.84	2.50	35.00	No			No	Detected <5%
o-Xylene	1	53	2%	14.22	2.50	1.80	No			No	Detected <5%
Toluene	17	53	32%	130.47	2.50	5740.00	Yes			Yes	
Trichlorofluoromethane	4	53	8%	14.23	2.50	5.20	Yes			Yes	
Volatile Petroleum Hydrocarbons (mg/kg)											
Adjusted C9-C10 Aromatics	8	33	24%	2.75	0.14	42.5	Yes	4.71	89.00	No	Comparable to background
Adjusted C9-C12 Aliphatics	13	24	54%	1.20	0.12	10.3	Yes	2.99	35.30	No	Comparable to background
Ethylbenzene - VPH	2	33	6%	0.948	0.026	0.036	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
m+p-Xylenes - VPH	6	33	18%	1.899	0.049	0.140	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Naphthalene - VPH	6	33	18%	1.02	0.026	0.99	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
o-Xylene - VPH	3	33	9%	0.950	0.026	0.066	Yes	ND	ND	No-c	Analyzed by SVOC/VOC
Toluene - VPH	7	33	21%	1.106	0.026	4.84	Yes	0.11	0.84	No-c	Analyzed by SVOC/VOC
Unadjusted C5-C8 Aliphatics	28	67	42%	2.85	1.92	19.3	Yes	2.71	4.95	No-d	Analyzed by EPH/VPH
Unadjusted C9-C12 Aliphatics	27	67	40%	4.87	2.83	94.9	Yes	7.65	124.00	No	Comparable to background

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

ND - Not Detected

Blank - Not analyzed

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

c - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods..

d - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

e - Site median is comparable to background median. Although site maximum exceeds background maximum, it is below the MADEP background for Non-urban Locations (MADEP, 2002d).

Table 2-5
Chemical COPCs in Surface Soil (0-3 ft bgs) -- YAEC Non-BUD/TSCA
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	YAEC Non-BUD/TSCA Samples						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
Dioxin/Furans (pg/g)											
Dioxin/Furan TEQ	2	2	100%	0.53	0.53	0.80	Yes	0.36	0.40	Yes	
Extractable Petroleum Hydrocarbons (mg/Kg)											
Unadjusted C11-C22 Aromatics	5	17	29%	32.99	4.28	226	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Unadjusted C19-C36 Aliphatics	5	17	29%	31.66	4.28	163	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Inorganics (mg/Kg)											
Antimony	2	8	25%	1.52	1.67	0.83	Yes	1.32	4.75	No-a	Comparable to background
Arsenic	58	61	95%	2.56	1.7	12	Yes	1.8	5.61	No-d	Comparable to background
Beryllium	1	73	1%	0.39	0.4	1	No	0.49	0.48	No	Detected <5%
Chromium	63	63	100%	13.52	13	28	Yes	15	34	No	Comparable to background
Copper	42	63	67%	9.38	9.5	25	Yes	6.4	18.7	Yes	
Lead	78	78	100%	16.99	4.5	160	Yes	3.6	101	Yes	
Mercury	2	63	3%	0.29	0.30	0.008	No	0.36	0.32	No	Detected <5%
Nickel	53	63	84%	11.88	11	78	Yes	8.9	29	Yes	
Selenium	10	63	16%	3.38	1.45	12	Yes	1.55	2.45	Yes	
Zinc	46	63	73%	64.80	56	520	Yes	54	75.8	Yes	
Polychlorinated Biphenyls (µg/Kg)											
Aroclor-1016	14	241	6%	14.09	5.5	83.8	Yes			Yes	
Aroclor-1248	15	241	6%	18.87	5.5	440	Yes			Yes	
Aroclor-1254	201	241	83%	132.36	87	826	Yes			Yes	
Aroclor-1260	175	241	73%	53.51	24.7	617	Yes			Yes	
Semivolatile Organic Compounds (µg/Kg)											
Fluoranthene	1	17	6%	265.88	200	400	Yes	215	552	No	Comparable to background
Pyrene	1	17	6%	265.88	200	400	Yes	215	773	No	Comparable to background
Total Petroleum Hydrocarbons (mg/Kg)											
TPH-DRO	42	49	86%	31.13	7.9	320	Yes			No-c	Analyzed by EPH/VPH
TPH-GRO	1	13	8%	1.63	1.25	4.6	Yes			No-c	Analyzed by EPH/VPH
Volatile Petroleum Hydrocarbons (mg/Kg)											
Adjusted C9-C12 Aliphatics	2	3	67%	0.15	0.13	0.209	Yes	2.99	35.3	No	Comparable to background
m+p-Xylenes - VPH	1	3	33%	0.053	0.058	0.028	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Toluene - VPH	1	3	33%	0.051	0.036	0.087	Yes	0.114	0.839	No	Comparable to background
Unadjusted C5-C8 Aliphatics	3	7	43%	3.46	3.57	0.34	Yes	2.71	4.95	No-a	Comparable to background
Unadjusted C9-C12 Aliphatics	3	7	43%	3.47	3.57	0.31	Yes	7.65	124.00	No	Comparable to background

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

a - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

c - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

d - Site median is comparable to background median. Although site maximum exceeds background maximum, it is below the MADEP background for Non-urban Locations (MADEP, 2002d).

ND - Not Detected
Blank - Not analyzed

Table 2-6
Chemical COPCs in Surface Soil (0-3 ft bgs) -- TransCanada Study Area*
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	TransCanada Property Samples*						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
Extractable Petroleum Hydrocarbons (mg/kg)											
2-Methylnaphthalene	2	7	29%	0.15	0.08	0.44	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Adjusted C11-C22 Aromatics	3	6	50%	47.71	23.85	117	Yes	ND	ND	Yes	
Adjusted TPH	3	7	43%	130.25	15.80	437	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Anthracene	1	7	14%	0.084	0.074	0.022	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Phenanthrene	2	7	29%	0.10	0.08	0.10	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Unadjusted C11-C22 Aromatics	4	9	44%	38.62	20.10	117	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Unadjusted C19-C36 Aliphatics	2	9	22%	31.51	15.80	98.8	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Unadjusted C9-C18 Aliphatics	3	9	33%	55.02	15.80	221	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Unadjusted TPH	3	7	43%	130.25	15.80	437	Yes	ND	ND	No-c	Analyzed by EPH/VPH
Inorganics (mg/Kg)											
Arsenic	43	44	98%	2.04	1.80	4.6	Yes	1.8	5.61	No-a	Comparable to background
Cadmium	1	44	2%	0.54	0.38	6.2	No	0.50	0.79	No	Detected <5%
Chromium	43	44	98%	13.14	12.00	28	Yes	15	34	No	Comparable to background
Copper	43	44	98%	16.13	15.50	33	Yes	6.4	18.7	Yes	
Lead	52	52	100%	7.81	2.05	230	Yes	3.6	101	Yes	
Mercury	1	44	2%	0.31	0.29	0.73	No	0.36	0.32	No	Detected <5%
Nickel	44	44	100%	15.62	12.00	98	Yes	8.9	29	Yes	
Selenium	8	44	18%	2.91	1.20	13	Yes	1.55	2.45	Yes	
Silver	1	44	2%	0.16	0.12	0.81	No	0.17	3.22	No	Detected <5%
Thallium	1	44	2%	0.40	0.28	0.82	No	0.42	0.73	No	Detected <5%
Zinc	43	44	98%	62.18	56.50	250	Yes	54	75.8	Yes	
Polychlorinated Biphenyls (ug/kg)											
Aroclor-1248	1	99	1%	10.31	5.10	9.36	No			No	Detected <5%
Aroclor-1254	56	99	57%	55.40	19.30	892	Yes			Yes	
Aroclor-1260	31	99	31%	23.06	16.50	580	Yes			Yes	
Semivolatile Organic Compounds (ug/kg)											
Acenaphthene	2	30	7%	169.67	180.00	359	Yes	ND	ND	Yes	
Acenaphthylene	6	30	20%	184.47	180.00	356	Yes	205	96.5	Yes	
Anthracene	6	30	20%	196.63	180.00	791	Yes	205	48	Yes	
Benzo(a)anthracene	8	30	27%	340.17	180.00	2790	Yes	214.5	232	Yes	
Benzo(a)pyrene	7	30	23%	283.20	180.00	2570	Yes	205	219	Yes	
Benzo(b)fluoranthene	7	30	23%	310.47	180.00	2370	Yes	215	533	Yes	
Benzo(g,h,i)perylene	7	30	23%	230.11	180.00	1230	Yes	200	105	Yes	
Benzo(k)fluoranthene	7	30	23%	288.17	180.00	2430	Yes	205	217	Yes	
Benzoic acid	1	22	5%	881.82	900.00	150	No	950	3500	No	Detected <5%
Butyl benzyl phthalate	1	22	5%	201.59	180.00	500	No	ND	ND	No	Detected <5%
Carbazole	1	22	5%	189.77	180.00	350	No	ND	ND	No	Detected <5%
Chrysene	8	30	27%	343.70	180.00	2850	Yes	200	337	Yes	

Table 2-6
Chemical COPCs in Surface Soil (0-3 ft bgs) -- TransCanada Study Area*
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	TransCanada Property Samples*						Detected > 5% ?	Background		COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹		
Dibenzo(a,h)anthracene	2	30	7%	173.34	180.00	400	Yes	ND	ND	Yes	
Fluoranthene	10	30	33%	543.03	180.00	5860	Yes	215	552	Yes	
Fluorene	1	30	3%	165.67	180.00	150	No	ND	ND	No	Detected <5%
Indeno(1,2,3-cd)pyrene	5	30	17%	231.49	180.00	1440	Yes	205	119	Yes	
Phenanthrene	7	30	23%	279.89	180.00	2430	Yes	215	357	Yes	
Pyrene	9	30	30%	491.57	180.00	5200	Yes	215	773	Yes	
Total Petroleum Hydrocarbons (mg/kg)											
TPH-DRO	33	44	75%	8.60	5.95	46	Yes			No-c	Analyzed by EPH/VPH
Volatile Organic Compounds (ug/kg)											
2-Butanone	1	3	33%	5.47	6.00	1.4	Yes			Yes	
4-Isopropyltoluene	1	3	33%	26.83	4.50	73	Yes			Yes	
Acetone	1	3	33%	22.17	9.00	49	Yes			Yes	
m+p-Xylenes	1	3	33%	3.40	3.00	2.7	Yes			Yes	
Toluene	2	3	67%	21.30	16.00	46	Yes			Yes	
Volatile Petroleum Hydrocarbons (mg/kg)											
Adjusted C9-C10 Aromatics	3	6	50%	2.64	1.62	7.12	Yes	4.71	89	No	Comparable to background
Adjusted C9-C12 Aliphatics	4	6	67%	2.58	1.84	7.7	Yes	2.99	35.3	No	Comparable to background
Ethylbenzene - VPH	2	6	33%	0.02	0.02	0.0358	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
m+p-Xylenes - VPH	3	6	50%	0.06	0.04	0.14	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Naphthalene - VPH	3	6	50%	0.13	0.08	0.318	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
o-Xylene - VPH	2	6	33%	0.03	0.02	0.0663	Yes	ND	ND	No-b	Analyzed by SVOC/VOC
Toluene - VPH	2	6	33%	0.03	0.02	0.0481	Yes	0.11	0.84	No-c	Comparable to background
Unadjusted C5-C8 Aliphatics	6	8	75%	2.33	0.83	1.92	Yes	2.71	4.95	No-c	Comparable to background
Unadjusted C9-C12 Aliphatics	6	8	75%	5.59	5.46	14.8	Yes	7.65	124	No-c	Comparable to background

Notes:

* Samples collected from Inside the BUD on the TransCanada Property were not included because they have been covered by clean fill material.

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

a - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

c - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

ND - Not Detected

Blank - Not analyzed

Table 2-7
Chemical COPCs in Sediment -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Combined Study Area Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Extractable Petroleum Hydrocarbons (mg/Kg)</i>												
Anthracene - EPH	1	12	8%	0.22	0.10	0.060	Yes	0.09	0.082	0.06	No-b	Comparable to background
Benzo(a)anthracene - EPH	1	12	8%	0.22	0.11	0.14	Yes	0.10	0.085	0.11	No-c	Analyzed by SVOC/VOC
Benzo(a)pyrene - EPH	1	12	8%	0.22	0.10	0.098	Yes	0.10	0.11	0.15	No-b	Comparable to background
Benzo(b)fluoranthene - EPH	3	12	25%	0.15	0.10	0.11	Yes	0.07	0.073	0.037	No-c	Analyzed by SVOC/VOC
Benzo(k)fluoranthene - EPH	1	12	8%	0.22	0.11	0.12	Yes	0.10	0.13	0.037	No-b	Comparable to background
Chrysene - EPH	4	12	33%	0.16	0.11	0.20	Yes	0.09	0.15	0.17	No-c	Analyzed by SVOC/VOC
Fluoranthene - EPH	6	12	50%	0.18	0.11	0.44	Yes	0.10	0.32	0.42	No-c	Analyzed by SVOC/VOC
Phenanthrene - EPH	1	12	8%	0.22	0.11	0.15	Yes	0.09	0.084	0.20	No-c	Analyzed by SVOC/VOC
Pyrene - EPH	3	12	25%	0.24	0.11	0.35	Yes	0.10	0.27	0.2	No-c	Analyzed by SVOC/VOC
<i>Inorganics (mg/Kg)</i>												
Antimony	4	53	8%	0.83	0.54	3.9	Yes	ND	ND	64	Yes	
Arsenic	65	90	72%	2.17	1.435	24.5	Yes	0.76	2.8	33	Yes	
Beryllium	35	91	38%	0.65	0.55	1.55	Yes	0.42	0.358	--	Yes	
Boron	11	40	28%	4.95	3.7875	10.9	Yes	2.69	4.91	--	Yes	
Cadmium	35	90	39%	0.90	0.58	6.7	Yes	0.54	0.633	5	Yes	
Chromium	96	97	99%	12.03	9.76	34	Yes	7.62	21	110	Yes	
Copper	89	96	93%	50.12	20	570	Yes	11.24	45	150	Yes	
Lead	90	99	91%	11.43	4.85	80.8	Yes	4.21	19.6	130	Yes	
Lithium	40	40	100%	12.94	11	29.2	Yes	5.89	12.1	--	Yes	
Mercury	36	96	38%	0.11	0.037	2.1	Yes	0.04	0.21	0.18	Yes	
Nickel	94	96	98%	16.02	11	55	Yes	9.76	28	49	Yes	
Selenium	12	89	13%	2.04	1.7	6.4	Yes	1.33	4.9	--	Yes	
Silver	8	89	9%	0.54	0.31	2.22	Yes	0.46	0.4	4.5	Yes	
Thallium	6	89	7%	0.79	0.55	6.06	Yes	ND	ND	--	Yes	
Uranium	7	34	21%	1.80	1.405	3.9	Yes	1.55	2.9	--	No-a	Comparable to background
Zinc	89	96	93%	122.73	80.5	790	Yes	63.50	270	460	Yes	
<i>Polychlorinated Biphenyls (µg/Kg)</i>												
Aroclor-1248	1	284	0.4%	37.06	20	171	No	ND	ND	60	No	Detected <5%
Aroclor-1254	151	287	53%	190.77	84	3400	Yes	ND	ND	60	Yes	
Aroclor-1260	31	284	11%	44.57	21.5	382	Yes	5.50	6.97	60	Yes	
<i>Semivolatile Organic Compounds (µg/Kg)</i>												
2,6-Dinitrotoluene	1	55	2%	261.38	215	25.4	No	ND	ND	--	No	Detected <5%
2-Methylnaphthalene	1	55	2%	265.79	215	280	No	247.50	20.9	150	No	Detected <5%
3+4-Methylphenol	1	55	2%	265.94	215	698	No	222.50	230	--	No	Detected <5%
Acenaphthene	5	55	9%	287.46	215	1800	Yes	247.50	21.5	150	Yes	
Anthracene	7	55	13%	292.84	215	2200	Yes	183.75	124	57.2	Yes	

Table 2-7
Chemical COPCs in Sediment -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Combined Study Area Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Benzo(a)anthracene	14	55	25%	384.31	215	6600	Yes	169.00	200	110	Yes	
Benzo(a)pyrene	14	55	25%	369.96	230	5800	Yes	206.00	230	150	Yes	
Benzo(b)fluoranthene	9	55	16%	365.34	215	5600	Yes	244.00	268	37	Yes	
Benzo(g,h,i)perylene	9	55	16%	312.05	215	2900	Yes	183.75	101	150	Yes	
Benzo(k)fluoranthene	11	55	20%	344.26	215	4600	Yes	183.75	220	37	Yes	
Benzoic acid	1	55	2%	1182.70	1050	130	No	ND	ND	--	No	Detected <5%
bis(2-Ethylhexyl)phthalate	9	55	16%	290.99	215	200	Yes	ND	ND	13300	Yes	
Carbazole	1	55	2%	300.70	215	2200	No	247.50	80	--	No	Detected <5%
Chrysene	18	55	33%	361.67	215	6200	Yes	185.00	273	170	Yes	
Dibenzo(a,h)anthracene	1	55	2%	274.70	215	770	No	247.50	24.6	33	No	Detected <5%
Dibenzofuran	2	55	4%	282.88	215	1300	No	247.50	36.3	--	No	Detected <5%
Di-n-octyl phthalate	1	55	2%	266.52	215	320	No	183.75	37.4	--	No	Detected <5%
Fluoranthene	26	55	47%	554.01	230	14000	Yes	242.50	651	423	Yes	
Fluorene	5	55	9%	285.01	215	1900	Yes	247.50	48.6	77.4	Yes	
Indeno(1,2,3-cd)pyrene	9	55	16%	309.22	215	2900	Yes	183.75	106	30	Yes	
Naphthalene	1	55	2%	269.25	215	470	No	ND	ND	176	No	Detected <5%
Phenanthrene	15	55	27%	525.80	230	13000	Yes	233.75	777	204	Yes	
Pyrene	19	55	35%	471.90	230	9900	Yes	216.25	592	200	Yes	
Total Petroleum Hydrocarbon (mg/Kg)												
TPH-DRO	42	58	72%	37.44	24.5	250	Yes	25.50	80	--	No-d	Analyzed by EPH/VPH
Volatile Organic Compounds (µg/Kg)												
1,1-Dichloroethene	11	31	35%	9.43	4.3	40	Yes	15.75	24	5900	Yes	
1,2,4-Trimethylbenzene	1	31	3%	2.75	2.5	4.2	No	ND	ND	--	No	Detected <5%
2-Butanone	13	31	42%	16.75	5	140	Yes	30.00	91.3	27000	Yes	
4-Isopropyltoluene	1	31	3%	2.68	2.5	2	No	ND	ND	--	No	Detected <5%
4-Methyl-2-Pentanone	1	31	3%	2.70	2.5	2.8	No	ND	ND	--	No	Detected <5%
Acetone	14	32	44%	53.55	15.75	270	Yes	187.25	943	57.1	Yes	
Carbon Disulfide	2	31	6%	2.92	2.5	8.8	Yes	ND	ND	--	Yes	
Chloromethane	1	31	3%	2.59	2.5	1.2	No	ND	ND	--	No	Detected <5%
Methylene Chloride	1	31	3%	8.49	7.5	1.1	No	ND	ND	7200	No	Detected <5%
Naphthalene - VOC	1	29	3%	2.68	2.5	5.7	No	ND	ND	176	No	Detected <5%
Toluene	6	31	19%	8.46	2.5	52	Yes	15.25	31	130000	Yes	
Volatile Petroleum Hydrocarbon (mg/Kg)												
Adjusted C9-C10 Aromatics	3	12	25%	0.35	0.095	1.19	Yes	0.10	0.35	--	Yes	
Adjusted C9-C12 Aliphatics	4	9	44%	0.11	0.086	0.12	Yes	0.10	0.18	--	Yes	
m+p-Xylenes - VPH	2	12	17%	0.12	0.038	0.33	Yes	0.04	0.11	--	No-c	Analyzed by SVOC/VOC
Methyl-t-butyl ether - VPH	1	12	8%	0.07	0.019	0.12	Yes	ND	ND	--	No-c	Analyzed by SVOC/VOC

**Table 2-7
Chemical COPCs in Sediment -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Combined Study Area Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Naphthalene - VPH	4	12	33%	0.08	0.028	0.36	Yes	0.02	0.060	0.176	No-c	Analyzed by SVOC/VOC
Toluene - VPH	1	12	8%	0.08	0.019	0.20	Yes	0.02	0.056	130	No-c	Analyzed by SVOC/VOC
Unadjusted C5-C8 Aliphatics	13	13	100%	1.68	0.51	6.44	Yes			--	No-d	Analyzed by EPH/VPH
Unadjusted C9-C12 Aliphatics	13	13	100%	0.58	0.17	1.98	Yes			--	No-d	Analyzed by EPH/VPH

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

Does not include samples collected from Deerfield River downstream of site.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

c - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

d - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

ND - Not Detected

-- No criterion available

Blank - Not analyzed

Table 2-8
Chemical COPCs in Sediment -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Extractable Petroleum Hydrocarbons (mg/Kg)												
Anthracene - EPH	1	12	8%	0.23	0.10	0.060	Yes	0.088	0.082	0.0572	No-b	Comparable to background
Benzo(a)anthracene - EPH	1	11	9%	0.24	0.12	0.14	Yes	0.096	0.085	0.11	No-c	Analyzed by SVOC/VOC
Benzo(a)pyrene - EPH	1	11	9%	0.23	0.10	0.098	Yes	0.096	0.11	0.15	No-b	Comparable to background
Benzo(b)fluoranthene - EPH	3	11	27%	0.15	0.10	0.11	Yes	0.065	0.073	0.037	No-c	Analyzed by SVOC/VOC
Benzo(k)fluoranthene - EPH	1	11	9%	0.23	0.12	0.12	Yes	0.10	0.13	0.037	No-b	Comparable to background
Chrysene - EPH	4	11	36%	0.17	0.12	0.20	Yes	0.088	0.15	0.17	No-c	Analyzed by SVOC/VOC
Fluoranthene - EPH	6	11	55%	0.19	0.12	0.44	Yes	0.10	0.32	0.423	No-c	Analyzed by SVOC/VOC
Phenanthrene - EPH	1	11	9%	0.24	0.12	0.15	Yes	0.089	0.084	0.204	No-c	Analyzed by SVOC/VOC
Pyrene - EPH	3	11	27%	0.25	0.12	0.35	Yes	0.10	0.265	0.2	No-c	Analyzed by SVOC/VOC
Inorganics (mg/Kg)												
Antimony	3	27	11%	1.03	0.535	3.9	Yes	ND	ND	64	Yes	
Arsenic	40	54	74%	2.27	1.5	17.2	Yes	0.76	2.8	33	Yes	
Beryllium	16	53	30%	0.77	0.7	1.55	Yes	0.42	0.36	--	Yes	
Boron	5	19	26%	6.75	3.87	10.9	Yes	2.69	4.91	--	Yes	
Cadmium	14	53	26%	1.16	0.75	6.7	Yes	0.54	0.63	5	Yes	
Chromium	57	58	98%	14.60	12	34	Yes	7.62	21	110	Yes	
Copper	56	58	97%	71.24	35	570	Yes	11.24	45	150	Yes	
Lead	52	57	91%	15.05	3.8	80.8	Yes	4.21	19.6	130	Yes	
Lithium	19	19	100%	15.74	15.8	29.2	Yes	5.89	12.1	--	Yes	
Mercury	26	58	45%	0.16	0.043	2.1	Yes	0.038	0.21	0.18	Yes	
Nickel	57	58	98%	20.83	18.15	55	Yes	9.76	28	49	Yes	
Selenium	8	52	15%	2.31	2	6.4	Yes	1.33	4.9	--	Yes	
Silver	5	52	10%	0.54	0.28	2.22	Yes	0.46	0.4	4.5	Yes	
Thallium	4	52	8%	0.91	0.52	6.06	Yes	ND	ND	--	Yes	
Uranium	2	13	15%	1.79	1.52	2.5	Yes	1.55	2.9	--	No	Comparable to background
Zinc	56	58	97%	162.13	115	790	Yes	63.50	270	460	Yes	
Polychlorinated Biphenyls (µg/Kg)												
Aroclor-1248	1	174	1%	42.29	23	171	No	ND	ND	60	No	Detected <5%
Aroclor-1254	91	177	51%	228.91	100	3400	Yes	ND	ND	60	Yes	
Aroclor-1260	11	174	6%	46.65	25.65	382	Yes	5.500	6.97	60	Yes	
Semivolatile Organic Compounds (µg/Kg)												
2,6-Dinitrotoluene	1	26	4%	291.78	222.5	25.4	No	ND	ND	--	No	Detected <5%
3+4-Methylphenol	1	26	4%	301.42	222.5	698	No	222.50	230	--	No	Detected <5%
Acenaphthene	2	26	8%	292.42	222.5	160	Yes	247.50	21.5	150	Yes	
Anthracene	3	26	12%	287.38	222.5	240	Yes	183.75	124	57.2	Yes	
Benzo(a)anthracene	5	26	19%	282.79	215	320	Yes	169.00	200	110	Yes	
Benzo(a)pyrene	3	26	12%	294.25	230	270	Yes	206.00	230	150	Yes	
Benzo(g,h,i)perylene	2	26	8%	293.40	222.5	120	Yes	183.75	101	150	Yes	
Benzo(k)fluoranthene	2	26	8%	291.47	222.5	86	Yes	183.75	220	37	No-b	Comparable to background

Table 2-8
Chemical COPCs in Sediment -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Bis(2-ethylhexyl)phthalate	2	26	8%	293.42	222.5	140	Yes	ND	ND	13300	Yes	
Chrysene	6	26	23%	259.38	207.5	290	Yes	185.00	273	170	Yes	
Dibenzofuran	1	26	4%	295.54	222.5	120	No	247.50	36.3	--	No	Detected <5%
Di-n-octyl phthalate	1	26	4%	302.65	230	320	No	183.75	37.4	--	No	Detected <5%
Fluoranthene	12	26	46%	259.62	200	700	Yes	242.50	651	423	No-a	Comparable to background
Fluorene	3	26	12%	280.82	215	180	Yes	247.50	48.6	77.4	Yes	
Indeno(1,2,3-cd)pyrene	2	26	8%	293.07	222.5	110	Yes	183.75	106	30	Yes	
Phenanthrene	5	26	19%	300.94	222.5	740	Yes	233.75	777	204	No	Comparable to background
Pyrene	8	26	31%	280.76	195	520	Yes	216.25	592	200	No	Comparable to background
Total Petroleum Hydrocarbon (mg/Kg)												
TPH-DRO	31	41	76%	45.96	32	250	Yes	25.50	80	--	No-d	Analyzed by EPH/VPH
Volatile Organic Compounds (µg/Kg)												
1,1-Dichloroethene	8	15	53%	10.00	4.3	40	Yes	15.75	24	5900	Yes	
1,2,4-Trimethylbenzene	1	15	7%	2.98	2.5	4.2	Yes	ND	ND	--	Yes	
2-Butanone	10	15	67%	28.27	5.4	140	Yes	30.00	91.3	27000	Yes	
4-Methyl-2-Pentanone	1	15	7%	2.89	2.5	2.8	Yes	ND	ND	--	Yes	
Acetone	11	15	73%	86.43	35	270	Yes	187.25	943	57.1	No	Comparable to background
Carbon Disulfide	2	15	13%	3.33	2.5	8.8	Yes	ND	ND	--	Yes	
Toluene	6	15	40%	14.56	6.5	52	Yes	15.25	31	130000	Yes	
Volatile Petroleum Hydrocarbon (mg/Kg)												
Adjusted C9-C10 Aromatics	3	11	27%	0.37	0.097	1.19	Yes	0.10	0.35	--	Yes	
Adjusted C9-C12 Aliphatics	4	8	50%	0.12	0.084	0.12	Yes	0.097	0.18	--	No	Comparable to background
m+p-Xylenes - VPH	2	11	18%	0.12	0.039	0.33	Yes	0.039	0.11	--	No-c	Analyzed by SVOC/VOC
Methyl-t-butyl ether - VPH	1	11	9%	0.07	0.019	0.119	Yes	ND	ND	--	No-c	Analyzed by SVOC/VOC
Naphthalene - VPH	3	11	27%	0.09	0.036	0.362	Yes	0.019	0.060	0.176	No-c	Analyzed by SVOC/VOC
Toluene - VPH	1	11	9%	0.08	0.019	0.204	Yes	0.019	0.056	130	No-c	Analyzed by SVOC/VOC
Unadjusted C5-C8 Aliphatics	3	3	100%	1.79	3.67	6.44	Yes			--	No-d	Analyzed by EPH/VPH
Unadjusted C9-C12 Aliphatics	3	3	100%	0.62	1.58	1.98	Yes			--	No-d	Analyzed by EPH/VPH

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

c - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

d - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

ND - Not Detected

-- No criterion available

Blank - Not analyzed

**Table 2-9
Chemical COPCs in Sediment -- Deerfield River Adjacent to the Site
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Deerfield River Adjacent to Site Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Inorganics (mg/kg)</i>												
Arsenic	19	27	70%	2.36	1.4	24.5	Yes	1.41	2.8	33	Yes	
Beryllium	19	27	70%	0.28	0.26	0.49	Yes	0.42	0.36	--	No-a	Comparable to background
Boron	6	20	30%	3.11	3.65	5.53	Yes	2.69	4.91	--	Yes	
Cadmium	20	26	77%	0.38	0.39	0.59	Yes	0.54	0.63	5	No	Comparable to background
Chromium	27	27	100%	8.72	7.87	18.4	Yes	7.62	21	110	No-b	Comparable to background
Copper	27	27	100%	19.40	11	150	Yes	11.24	45	150	Yes	
Lead	26	27	96%	6.93	6.76	14	Yes	4.21	19.6	130	Yes	
Lithium	20	20	100%	10.47	9.85	17.4	Yes	5.89	12.1	--	Yes	
Mercury	10	27	37%	0.05	0.04	0.2	Yes	0.04	0.21	0.18	No-b	Comparable to background
Nickel	26	26	100%	9.11	9.35	17	Yes	9.76	28	49	No	Comparable to background
Selenium	4	26	15%	1.17	0.93	3.5	Yes	1.33	4.9	--	No	Comparable to background
Silver	3	26	12%	0.62	0.58	2.22	Yes	0.46	0.4	4.5	Yes	
Thallium	2	26	8%	0.75	0.84	0.44	Yes	ND	ND	--	Yes	
Uranium	4	15	27%	1.75	0.64	3.9	Yes	1.55	2.9	--	No-a	Comparable to background
Zinc	27	27	100%	57.23	40.3	210	Yes	63.50	270	460	No	Comparable to background
<i>Polychlorinated Biphenyls (ug/kg)</i>												
Aroclor-1254	15	31	48%	107.04	20	820	Yes	ND	ND	60	Yes	
Aroclor-1260	4	31	13%	33.28	19	200	Yes	5.50	6.97	60	Yes	
<i>Semivolatile Organic Compounds (ug/kg)</i>												
Benzo(a)anthracene	1	6	17%	234.17	207.5	330	Yes	169.00	200	110	Yes	
Benzo(a)pyrene	3	6	50%	186.33	190	320	Yes	206.00	230	150	No-a	Comparable to background
Benzo(b)fluoranthene	3	6	50%	185.67	190	310	Yes	244.00	268	37	No-a	Comparable to background
Benzo(g,h,i)perylene	1	6	17%	214.17	205	210	Yes	183.75	101	150	Yes	
Benzo(k)fluoranthene	2	6	33%	213.83	207.5	330	Yes	183.75	220	37	Yes	
Bis(2-ethylhexyl)phthalate	1	6	17%	199.17	200	120	Yes	ND	ND	13300	Yes	
Chrysene	3	6	50%	197.50	190	380	Yes	185.00	273	170	Yes	
Fluoranthene	3	6	50%	269.17	200	670	Yes	242.50	651	423	No-a	Comparable to background
Indeno(1,2,3-cd)pyrene	1	6	17%	212.50	200	200	Yes	183.75	106	30	Yes	
Phenanthrene	2	6	33%	215.83	207.5	340	Yes	233.75	777	204	No	Comparable to background
Pyrene	3	6	50%	237.50	190	540	Yes	216.25	592	200	No	Comparable to background
<i>Total Petroleum Hydrocarbons (mg/kg)</i>												
TPH-DRO	5	6	83%	22.40	10	62	Yes	25.50	80	--	No	Comparable to background
<i>Volatile Organic Compounds (ug/kg)</i>												
2-Butanone	1	6	17%	6.50	5.5	12	Yes	30.00	91.3	27000	No	Comparable to background
4-Isopropyltoluene	1	6	17%	2.50	2.5	2	Yes	ND	ND	--	Yes	
Acetone	1	6	17%	23.33	5	76	Yes	187.25	943	57.1	No	Comparable to background
Chloromethane	1	6	17%	2.05	2.5	1.2	Yes	ND	ND	--	Yes	

Notes: Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

ND - Not Detected

-- No criterion available

Blank - Not analyzed

Table 2-10
Chemical COPCs in Sediment -- Wheeler Brook
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Wheeler Brook Samples						Detected > 5% ?	Background		Criteria ¹	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Median	Maximum			
<i>Inorganics (mg/kg)</i>												
Chromium	6	6	100%	7.53	7.45	9.8	Yes	7.62	21	110	No	Comparable to background
Lead	2	5	40%	0.57	0.44	1.1	Yes	4.21	19.6	130	No	Comparable to background
Nickel	5	6	83%	6.66	6.35	12	Yes	9.76	28	49	No	Comparable to background
<i>Total Petroleum Hydrocarbons (mg/kg)</i>												
TPH-DRO	4	6	67%	10.33	3.05	45	Yes	25.50	80	--	No	Comparable to background
<i>Volatile Organic Compounds (ug/kg)</i>												
1,1-Dichloroethene	1	5	20%	2.66	2.5	3.3	Yes	15.75	24	5900	No	Comparable to background
2-Butanone	2	5	40%	6.28	5	14	Yes	54.60	91.3	27000	No	Comparable to background
Acetone	2	6	33%	42.00	16.25	190	Yes	187.25	943	57.1	No	Comparable to background

Notes:

-- No criterion available

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.

Table 2-11
Chemical COPCs in Sediment -- TransCanada West Storm Ditch (WSD)
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	TransCanada West Storm Ditch Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Inorganics (mg/kg)</i>												
Antimony	1	6	17%	0.49	0.31	1.6	Yes	ND	ND	64	Yes	
Arsenic	6	6	100%	1.40	1.45	1.7	Yes	0.763	2.8	33	Yes	
Cadmium	1	6	17%	0.92	0.825	0.239	Yes	0.544	0.633	5	No	Comparable to background
Chromium	6	6	100%	6.62	5.25	13	Yes	7.62	21	110	No	Comparable to background
Copper	6	6	100%	24.27	19	58	Yes	11.24	45	150	Yes	
Lead	10	10	100%	8.32	4.23	30	Yes	4.21	19.6	130	Yes	
Lithium	1	1	100%	9.21	9.21	9.21	Yes	5.89	12.1	--	Yes	
Nickel	6	6	100%	8.94	7.05	20	Yes	9.76	28	49	No	Comparable to background
Uranium	1	1	100%	3.10	3.1	3.1	Yes	1.55	2.9	--	No	Comparable to background
Zinc	6	6	100%	119.33	84.5	310	Yes	63.50	270	460	Yes	
<i>Polychlorinated Biphenyl (ug/kg)</i>												
Aroclor-1254	39	57	68%	139.83	72	950	Yes	ND	ND	60	Yes	
Aroclor-1260	15	57	26%	34.60	16.7	240	Yes	5.50	6.97	60	Yes	
<i>Semivolatile Organic Compounds (ug/kg)</i>												
2-Methylnaphthalene	1	12	8%	205.38	200	280	Yes	247.50	20.9	150	Yes	
Acenaphthene	3	12	25%	318.13	200	1800	Yes	247.50	21.5	150	Yes	
Anthracene	4	12	33%	353.71	200	2200	Yes	183.75	124	57.2	Yes	
Benzo(a)anthracene	8	12	67%	773.29	200	6600	Yes	169.00	200	110	Yes	
Benzo(a)pyrene	8	12	67%	706.63	200	5800	Yes	206.00	230	150	Yes	
Benzo(b)fluoranthene	6	12	50%	679.13	200	5600	Yes	244.00	268	37	Yes	
Benzo(g,h,i)perylene	6	12	50%	429.13	197.5	2900	Yes	183.75	101	150	Yes	
Benzo(k)fluoranthene	7	12	58%	581.09	200	4600	Yes	183.75	220	37	Yes	
Benzoic acid	1	12	8%	850.79	950	130	Yes	ND	ND	--	Yes	
Bis(2-ethylhexyl)phthalate	6	12	50%	175.46	190	200	Yes	ND	ND	13300	Yes	
Carbazole	1	12	8%	365.38	200	2200	Yes	247.50	80	--	Yes	
Chrysene	9	12	75%	738.59	200	6200	Yes	185.00	273	170	Yes	
Dibenzo(a,h)anthracene	1	12	8%	246.21	200	770	Yes	247.50	24.6	33	Yes	
Dibenzofuran	1	12	8%	290.38	200	1300	Yes	247.50	36.3	--	Yes	
Fluoranthene	11	12	92%	1583.81	375	14000	Yes	242.50	651	423	Yes	
Fluorene	2	12	17%	332.04	200	1900	Yes	247.50	48.6	77.4	Yes	
Indeno(1,2,3-cd)pyrene	6	12	50%	417.71	197.5	2900	Yes	183.75	106	30	Yes	
Naphthalene	1	12	8%	221.21	200	470	Yes	ND	ND	176	Yes	
Phenanthrene	8	12	67%	1391.63	240	13000	Yes	233.75	777	204	Yes	
Pyrene	8	12	67%	1177.46	250	9900	Yes	216.25	592	200	Yes	
<i>Total Petroleum Hydrocarbons (mg/kg)</i>												
TPH-DRO	2	5	40%	18.20	12	30	Yes	25.50	80	--	No	Comparable to background
<i>Volatile Organic Compounds (ug/kg)</i>												
1,1-Dichloroethene	2	5	40%	7.90	2.5	21	Yes	15.75	24	5900	No	Comparable to background
Methylene Chloride	1	5	20%	6.22	7.5	1.1	Yes	ND	ND	7200	Yes	
Naphthalene - VOC	1	5	20%	3.14	2.5	5.7	Yes	ND	ND	176	No-b	Analyzed by SVOC/VOC

Table 2-11
Chemical COPCs in Sediment -- TransCanada West Storm Ditch (WSD)
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	TransCanada West Storm Ditch Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>												
Naphthalene - VPH	1	1	100%	0.02	0.0191	0.0191	Yes	0.02	0.0597	0.176	No	Comparable to background
Unadjusted C5-C8 Aliphatics	1	1	100%	0.40	0.395	0.395	Yes			0.176	No-c	Analyzed by EPH/VPH
Unadjusted C9-C12 Aliphatics	1	1	100%	0.13	0.128	0.128	Yes			--	No-c	Analyzed by EPH/VPH

Notes: ND - Not Detected
Only analytes detected in at least one sample are presented. -- No criterion available
Averages and medians calculated using those detected and 1/2 the detection limit of those not detected. Blank - Not analyzed
1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.
2) MADEP (2006c) sediment criteria where available. See Table 3-7 for complete listing of sources.
a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).
b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.
c - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

Table 2-12
Chemical COPCs in Surface Water -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Combined Study Areas Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Extractable Petroleum Hydrocarbons (µg/L)												
Adjusted TPH	1	15	7%	106.67	100	200	Yes	ND	ND	--	No-a	Analyzed by EPH/VPH
Anthracene - EPH	1	15	7%	2.49	2.66	0.202	Yes	ND	ND	17	No-b	Analyzed by SVOC/VOC
Chrysene - EPH	3	15	20%	2.17	2.66	0.21	Yes	ND	ND	17	No-b	Analyzed by SVOC/VOC
Fluoranthene - EPH	2	15	13%	2.34	2.66	0.26	Yes	ND	ND	39.8	No-b	Analyzed by SVOC/VOC
Unadjusted TPH	1	15	7%	106.67	100	200	Yes	ND	ND	--	No-a	Analyzed by EPH/VPH
Inorganics (mg/L)												
Antimony	5	39	13%	0.0035	0.003	0.0031	Yes	ND	ND	0.3	Yes	
Arsenic	2	44	5%	0.0029	0.002	0.0026	No	ND	ND	0.15	No	Detected <5%
Barium	25	25	100%	0.018	0.017	0.039	Yes			41	Yes	
Boron	11	19	58%	0.025	0.0249	0.044	Yes	0.0039	0.0040	0.75	Yes	
Cadmium	19	44	43%	0.00052	0.00008	0.0002	Yes	0.00002	0.00009	0.00008	Yes	
Chromium	1	44	2%	0.0029	0.0025	0.0008	No	ND	ND	0.011	No	Detected <5%
Copper	16	44	36%	0.0063	0.0025	0.03	Yes	ND	ND	0.0023	Yes	
Iron	25	25	100%	1.98	0.63	16	Yes			1	Yes	
Lead	11	44	25%	0.0014	0.00088	0.0038	Yes	0.00065	0.0022	0.0004	Yes	
Manganese	24	25	96%	0.20	0.086	0.82	Yes			--	Yes	
Mercury	11	44	25%	0.00010	0.0001	0.00032	Yes	ND	ND	0.00077	Yes	
Nickel	1	39	3%	0.0029	0.0025	0.00080	No	ND	ND	0.0133	No	Detected <5%
Selenium	12	44	27%	0.0070	0.00025	0.0002	Yes	ND	ND	0.005	Yes	
Silver	11	44	25%	0.0014	0.00145	0.0021	Yes	0.0008	0.0023	0.00012	Yes	
Thallium	8	39	21%	0.0019	0.00063	0.003	Yes	ND	ND	0.11	Yes	
Zinc	16	44	36%	0.012	0.0085	0.0261	Yes	ND	ND	0.0302	Yes	
Semivolatile Organic Compounds (µg/L)												
Benzo(g,h,i)perylene	1	9	11%	0.096	0.10	0.060	Yes	ND	ND	17	Yes	
Fluoranthene	1	9	11%	0.094	0.10	0.042	Yes	ND	ND	39.8	Yes	
Phenanthrene	1	9	11%	0.094	0.10	0.042	Yes	ND	ND	17	Yes	
Pyrene	2	9	22%	0.084	0.10	0.032	Yes	ND	ND	17	Yes	
Volatile Organic Compounds (µg/L)												
2-Hexanone	1	40	3%	4.27	5.00	0.80	No	ND	ND	--	No	Detected <5%
4-Methyl-2-Pentanone	2	40	5%	4.160	5.00	0.80	No	ND	ND	--	Yes	
Acetone	6	26	23%	5.49	5.00	14.00	Yes	ND	ND	1500	Yes	
Carbon disulfide	2	40	5%	2.41	2.50	0.83	No	ND	ND	--	Yes	
Chloromethane	4	40	10%	1.26	1.00	3.70	Yes	ND	ND	--	Yes	
Methylene chloride	5	40	13%	3.99	5.00	0.95	Yes	ND	ND	1930	Yes	
tert-Butyl Alcohol	1	16	6%	5.16	5.00	7.60	Yes	ND	ND	--	Yes	
Toluene	1	40	3%	1.15	0.50	6.60	No	ND	ND	175	No	Detected <5%

Notes: Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

ND - Not Detected

Does not include samples collected from Deerfield River downstream of site.

-- No criterion available

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

Blank - Not analyzed

2) See Table 3-7 for complete listing of sources.

a - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

Table 2-13
Chemical COPCs in Surface Water -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Extractable Petroleum Hydrocarbons (ug/L)</i>												
Anthracene - EPH	1	3	33%	1.84	2.66	0.20	Yes	ND	ND	17	No-b	Analyzed by SVOC/VOC
<i>Inorganics (mg/L)</i>												
Boron	2	3	67%	0.0042	0.0042	0.0042	Yes	0.0039	0.0040	0.75	Yes	
Cadmium	3	3	100%	0.000067	0.000060	0.000090	Yes	0.000020	0.000090	0.00008	Yes	
Silver	1	3	33%	0.00019	0.00005	0.00050	Yes	0.00080	0.0023	0.00012	No	Comparable to background
Zinc	1	3	33%	0.015	0.011	0.026	Yes	ND	ND	0.0302	Yes	

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

ND - Not Detected

-- No criterion available

Table 2-14
Chemical COPCs in Surface Water -- Deerfield River
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Deerfield River Adjacent to Site Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
Extractable Petroleum Hydrocarbons (ug/L)												
Chrysene - EPH	3	5	60%	1.16	0.21	0.21	Yes	ND	ND	17	No-b	Analyzed by SVOC/VOC
Fluoranthene - EPH	2	5	40%	1.67	2.63	0.26	Yes	ND	ND	39.8	No-b	Analyzed by SVOC/VOC
Inorganics (mg/L)												
Antimony	1	9	11%	0.0047	0.0031	0.0031	Yes	ND	ND	0.3	Yes	
Arsenic	2	9	22%	0.0021	0.0020	0.0026	Yes	ND	ND	0.15	Yes	
Boron	8	9	89%	0.016	0.0066	0.044	Yes	0.0039	0.0040	0.75	Yes	
Cadmium	1	9	11%	0.00004	0.00003	0.0001	Yes	0.000020	0.000090	0.00008	No-a	Comparable to background
Copper	1	9	11%	0.0021	0.0024	0.0024	Yes	ND	ND	0.0023	Yes	
Selenium	4	9	44%	0.00020	0.0001	0.0002	Yes	ND	ND	0.005	Yes	
Silver	5	9	56%	0.00074	0.0004	0.0021	Yes	0.00080	0.0023	0.00012	No	Comparable to background
Thallium	1	9	11%	0.0032	0.0039	0.003	Yes	ND	ND	0.0302	Yes	
Semivolatile Organic Compounds (ug/L)												
Benzo(g,h,i)perylene	1	5	20%	0.092	0.10	0.060	Yes	ND	ND	17	Yes	
Fluoranthene	1	5	20%	0.088	0.10	0.042	Yes	ND	ND	39.8	Yes	
Phenanthrene	1	5	20%	0.088	0.10	0.042	Yes	ND	ND	17	Yes	
Pyrene	2	5	40%	0.070	0.10	0.032	Yes	ND	ND	17	Yes	

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if median < background median AND maximum < 1.5 x background maximum (MADEP, 1995).

b - SVOCs and VOCs detected by EPH/VPH methods are analyzed by SVOCs and VOCs Methods.

ND - Not Detected

-- No criterion available

Table 2-15
Chemical COPCs in Surface Water -- Wheeler Brook
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Wheeler Brook Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Median	Maximum ¹			
<i>Extractable Petroleum Hydrocarbons (ug/L)</i>												
Adjusted TPH	1	6	17%	116.67	100	200	Yes	ND	ND	--	No-b	Analyzed by EPH/VPH
Unadjusted TPH	1	6	17%	116.67	100	200	Yes	ND	ND	--	No-b	Analyzed by EPH/VPH
<i>Inorganics (mg/L)</i>												
Antimony	4	26	15%	0.0031	0.0025	0.0017	Yes	ND	ND	0.3	Yes	
Barium	25	25	100%	0.018	0.017	0.039	Yes	ND	ND	41	Yes	
Cadmium	14	31	45%	0.00072	0.00060	0.00020	Yes	0.000020	0.000090	0.00008	Yes	
Chromium	1	31	3%	0.0031	0.0025	0.0008	No	ND	ND	0.011	No	Detected <5%
Copper	15	31	48%	0.0082	0.0025	0.030	Yes	ND	ND	0.0023	Yes	
Lead	11	31	35%	0.0018	0.0019	0.0038	Yes	0.0007	0.0022	0.0004	Yes	
Manganese	24	25	96%	0.20	0.09	0.82	Yes			--	Yes	
Mercury	11	31	35%	0.00011	0.00010	0.00032	Yes	ND	ND	0.00077	Yes	
Nickel	1	26	4%	0.0032	0.0025	0.00080	No	ND	ND	0.0133	No	Detected <5%
Selenium	8	31	26%	0.010	0.0038	0.00020	Yes	ND	ND	0.005	Yes	
Silver	5	31	16%	0.0017	0.0025	0.0013	Yes	0.00080	0.0023	0.00012	Yes	
Thallium	7	26	27%	0.0018	0.0006	0.0018	Yes	ND	ND	0.11	Yes	
Zinc	15	31	48%	0.013	0.009	0.0116	Yes	ND	ND	0.0302	Yes	
<i>Volatile Organic Compounds (ug/L)</i>												
2-Hexanone	1	31	3%	4.06	5.0	0.8	No	ND	ND	--	No	Detected <5%
4-Methyl-2-Pentanone	2	31	6%	3.92	5.0	0.8	Yes	ND	ND	--	Yes	
Acetone	6	25	24%	5.51	5.0	14	Yes	ND	ND	1500	Yes	
Carbon disulfide	1	31	3%	2.45	2.5	0.83	No	ND	ND	--	No	Detected <5%
Chloromethane	4	31	13%	1.34	1.00	3.7	Yes	ND	ND	--	Yes	
Methylene chloride	5	31	16%	3.70	5.00	0.95	Yes	ND	ND	1930	Yes	
tert-Butyl Alcohol	1	15	7%	5.17	5.00	7.6	Yes	ND	ND	--	Yes	
Toluene	1	31	3%	1.34	0.5	6.6	No	ND	ND	175	No	Detected <5%

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

b - Detected TPH and Unadjusted carbon fractions detected by EPH/VPH methods are analyzed as the individual EPH/VPH analytes.

ND - Not Detected
 -- No criterion available

Table 2-16
Chemical COPCs in Surface Water -- TransCanada West Storm Ditch (WSD)
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	TransCanada West Storm Ditch Samples						Detected > 5% ?	Background		Criteria ²	COPC?	Comment
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Median	Maximum ¹			
<i>Inorganics (mg/L)</i>												
Boron	1	1	17%	0.0094	0.0094	0.0094	Yes	0.0039	0.0040	0.75	Yes	
Cadmium	1	1	17%	0.00005	0.00005	0.00005	Yes	0.000020	0.000090	0.00008	No-a	Comparable to background
<i>Volatile Organic Compounds (ug/L)</i>												
Carbon disulfide	1	1	17%	0.60	0.6	0.6	Yes	ND	ND	--	Yes	

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits

2) See Table 3-7 for complete listing of sources.

a - Site data is comparable with background if maximum < background maximum AND median < 1.5 x background median (MADEP, 1995).

ND - Not Detected

-- No criterion available

Table 2-17
Fish Sample Results -- OHM
Yankee Nuclear Power Station, Rowe, MA

Sampling Year	2002 Samples																
Sample Location	Sherman (East Storm Drain)				Sherman Reservoir (Upstream of YNPS)						Harriman Reservoir (Background)						
Sample ID	FAE1	FAE2	FAE3	FBE2	FAN1	FAN2	FAN3	FBN1	FBN2	FBN3	FAH1	FAH2	FAH3	FBH1	FBH2	FBH3	
Date	11/2/02, 11/3/02	11/3/02	11/3/02, 11/5/02	11/2/02, 11/13/02	11/1/02, 11/2/02	11/2/02	11/2/02	11/2/02	11/2/02	11/2/02	11/3/02, 11/5/02	11/2/02	11/2/02	11/2/02	11/2/02	11/2/02	11/2/02, 11/3/02
Fish Species	YP	YP	YP	WS	YP	YP	YP	WS	WS	WS	YP	YP	YP	WS	WS	WS	
Sample Type	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	
% Lipid	0.2	0.2	0.3	1.4	0.6	0.4	0.4	1.7	1.7	1.2	1.0	1.0	0.7	1.5	1.4	0.8	
OHM	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	
Polychlorinated Biphenyls (ug/kg)																	
Aroclor 1254	10	<10	67	37	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	
Aroclor 1260	<10	<10	<10	17	<10	<10	<10	<10	12	<10	<10	<10	<10	<10	<10	<10	
Congener Analysis (ug/kg)																	
Total PCBs	8.85	9.76	81.82	53.03	7.03	<1	<1	<1	19.67	<1	4.34	<1	<1	11.77	<1	<1	

Sampling Year	2006 Samples															
Sample Location	Sherman Reservoir								Deerfield River				Harriman Reservoir (Background)			
Sample ID	FH-11	FH-11	FH-11/12	FH-11/12	FH-FD-12	FH-FD-12	FH-FD-12	FH-FD-12	FH-21/22	FH-21/22	FH-22	FH-01	FH-01	FH-01/02	FH-01/02	
Date	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/30/06	11/27/06	11/30/06	11/30/06	11/30/06	11/30/06	
Fish Species	BT	YP	BT	YP	BT	BT	YP	YP	BT	BT		RT	YP	RT	YP	
Sample Type	Fillet	Fillet	Composite	Composite	Composite	Fillet	Composite	Fillet	Fillet	Offal	Composite	Fillet	Fillet	Composite	Composite	
OHM	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	
Inorganics (mg/kg)																
Antimony	<0.381	<0.396	<0.4	<0.381	<0.391	<0.381	<0.398	<0.398	0.14	<0.388		<0.4	<0.39	<0.381	<0.393	
Arsenic	0.31	<0.99	<1	<0.952	<0.978	<0.952	<0.996	<0.996	<0.957	<0.969		<1	<0.975	<0.952	<0.982	
Beryllium	<0.0952	<0.099	<0.1	<0.0952	<0.0978	<0.0952	<0.0996	<0.0996	<0.0957	<0.0969		<0.1	<0.0975	<0.0952	<0.0982	
Boron	<2.86	<2.97	<3	<2.86	<2.94	<2.86	<2.99	<2.99	<2.87	<2.91		<3	<2.92	<2.86	<2.95	
Cadmium	<0.19	<0.198	0.029	0.074	0.05	0.035	0.03	<0.199	<0.191	0.075		<0.2	<0.195	0.062	0.13	
Chromium	0.43	0.34	0.44	0.409	0.69	0.72	0.52	0.33	0.29	0.31		0.31	0.33	0.96	0.49	
Copper	0.42	0.18	1.2	0.452	2.3	0.44	0.3	0.18	0.58	2		0.29	0.36	0.91	1.3	
Lead	<0.381	<0.396	<0.4	<0.381	<0.391	<0.381	<0.398	<0.398	<0.383	<0.388		<0.4	<0.39	<0.381	<0.393	
Lithium	<1.9	<1.98	<2	<1.9	<1.96	<1.9	<1.99	<1.99	<1.91	<1.94		<2	<1.95	<1.9	<1.96	
Mercury	0.058	0.27	0.184	0.136	0.1	0.0808	0.103	0.152	0.117	0.349		0.13	0.681	0.0871	0.177	
Nickel	<0.381	<0.396	0.14	0.352	0.78	0.24	0.46	<0.398	<0.383	<0.388		<0.4	<0.39	0.93	0.28	
Selenium	<0.952	0.55	<1	<0.952	<0.978	<0.952	<0.996	<0.996	<0.957	<0.969		<1	<0.975	<0.952	0.51	
Silver	<0.19	<0.198	<0.2	<0.19	0.066	<0.19	<0.199	<0.199	<0.191	<0.194		<0.2	<0.195	0.054	<0.196	
Thallium	<0.19	<0.198	<0.2	<0.19	<0.196	<0.19	<0.199	<0.199	<0.191	<0.194		<0.2	<0.195	<0.19	<0.196	
Uranium	<0.0381	<0.0396	<0.04	<0.0381	<0.0391	<0.0381	<0.0398	<0.0398	<0.0383	0.07		<0.04	<0.039	<0.0381	<0.0393	
Zinc	6.01	7.7	11.6	31.3	48.9	6.8	17.2	6.8	7	27.5		7.2	8.4	24.7	28.6	
Polychlorinated Biphenyls (ug/kg)																
Aroclor 1254	14	<10	12	15			12		<10		10	<10		<10		
Aroclor 1260	<10	<10	17	16			11		<10		10	<10		<10		
Congener Analysis (ug/kg)																
Total PCBs	8.01	21.53	86.08	63.89			63.49		26.84		54.15	29.42		38.22		

Notes: OHM - Oil or Hazardous Materials

Blank - Not analyzed

< Reporting limit = Not detected, or detected below reporting limit.

Fish Species: YP - Yellow Perch; WS - White Sucker; BT - Brown Trout; RT - Rainbow Trout.

Table 2-18
OHM Constituents of Potential Concern
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material (OHM)	Soil	Sediment ¹	Surface Water ¹	Fish ²
	Combined Study Areas			
<i>Dioxin/Furans</i>				
Dioxin/Furan TEQ	Yes			
<i>Extractable Petroleum Hydrocarbons</i>				
Adjusted C11-C22 Aromatics	Yes			
<i>Inorganics</i>				
Antimony	No	Yes	Yes	
Arsenic	No	Yes	No	
Barium			Yes	
Beryllium	No	Yes		
Boron	Yes	Yes	Yes	
Cadmium	No	Yes	Yes	No
Chromium	No	Yes	No	Yes
Copper	Yes	Yes	Yes	Yes
Iron			Yes	
Lead	Yes	Yes	Yes	
Lithium	No	Yes		
Manganese			Yes	
Mercury	Yes	Yes	Yes	Yes
Nickel	Yes	Yes	No	Yes
Selenium	Yes	Yes	Yes	
Silver	No	Yes	Yes	Yes
Thallium	No	Yes	Yes	
Uranium		No		
Zinc	Yes	Yes	Yes	Yes
<i>Polychlorinated Biphenyls</i>				
Aroclor-1016	No			
Aroclor-1221				
Aroclor-1232				
Aroclor-1242				
Aroclor-1248	No	No		
Aroclor-1254	Yes	Yes		No
Aroclor-1260	Yes	Yes		No
Aroclor-1262				
Aroclor-1268				
Total PCBs				Yes
<i>Semivolatile Organic Compounds</i>				
1-Methylnaphthalene	No			
2-Methylnaphthalene	No	No		
2,4-Dimethylphenol				
2,6-Dinitrotoluene		No		
2-Methylnaphthalene	No	No		
3+4-Methylphenol		No		
Acenaphthene	Yes	Yes		
Acenaphthylene	Yes			
Anthracene	Yes	Yes		
Benzdine	No			
Benzo(a)anthracene	Yes	Yes		
Benzo(a)pyrene	Yes	Yes		
Benzo(b)fluoranthene	Yes	Yes		
Benzo(g,h,i)perylene	Yes	Yes	Yes	
Benzo(k)fluoranthene	Yes	Yes		
Benzoic acid	No	No		
Bis(2-ethylhexyl)phthalate	No	Yes		
Butyl benzyl phthalate	No			

Table 2-18
OHM Constituents of Potential Concern
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material (OHM)	Soil	Sediment ¹	Surface Water ¹	Fish ²
	Combined Study Areas			
Carbazole	Yes	No		
Chrysene	Yes	Yes		
Dibenzo(a,h)anthracene	Yes	No		
Dibenzofuran	No	No		
Di-n-butyl phthalate				
Di-n-octyl phthalate		No		
Fluoranthene	Yes	Yes	Yes	
Fluorene	Yes	Yes		
Indeno(1,2,3-cd)pyrene	Yes	Yes		
Isophorone	No			
Naphthalene	No	No		
N-Nitrosodimethylamine				
Pentachlorophenol				
Phenanthrene	Yes	Yes	Yes	
Pyrene	Yes	Yes	Yes	
Total Petroleum Hydrocarbons				
TPH-DRO	No	No		
TPH-GRO	No			
Volatile Organic Compounds				
1,2,4-Trimethylbenzene		No		
1,3,5-Trimethylbenzene				
1,1-Dichloroethane				
1,1-Dichloroethene		Yes		
1,2-Dichloroethane	No			
2-Butanone	Yes	Yes		
2-Hexanone	No		No	
4-Isopropyltoluene	No	No		
4-Methyl-2-Pentanone	Yes	No	Yes	
Acetone	Yes	Yes	Yes	
Benzene				
Bromomethane				
Carbon Disulfide	No	Yes	Yes	
Chloromethane		No	Yes	
Dichlorodifluoromethane	No			
Diethyl Ether				
Ethylbenzene				
Methylene Chloride		No	Yes	
Methyl-t-butyl ether				
n-Butylbenzene	No			
o-Xylene	No			
t-Amyl methyl ether				
m+p-Xylenes	No			
tert-Butyl Alcohol			Yes	
Toluene	Yes	Yes	No	
Trichlorofluoromethane	Yes			
Volatile Petroleum Hydrocarbons				
Adjusted C5-C8 Aliphatics				
Adjusted C9-C10 Aromatics	No	Yes		
Adjusted C9-C12 Aliphatics	No	Yes		

Notes:

1) Does not include samples collected from areas farther downstream from the site (Monroe Bridge, Bear Swamp and No. 4 Dam).

2) Fish samples were collected from Sherman Reservoir and the Deerfield River adjacent to the site.

OHM analytes detected in at least one sample (regardless of media).

Table 2-19
Radionuclide Biota Concentration Guideline (BCG)
Yankee Nuclear Power Station, Rowe, MA

Radionuclide COPC	Soil DCGL ¹ (pCi/g)	Sediment BCG				Soil BCG			
		Aquatic Animals (pCi/g)		Riparian Animals (pCi/g)		Terrestrial Plants (pCi/g)		Terrestrial Animals (pCi/g)	
			Source		Source		Source		Source
Ag-108m	2.5	24,000	b	2,300	b	9,900	b	1,100	b
Am-241	10	704,000	a	5,150	a	21,500	a	3,890	a
C-14	1.9	789,000	a	59,000	a	60,700	a	4,760	a
Cm-243	11	150,000	b	3,800	b	35,000	b	2,600	b
Cm-244	11	4,010,000	a	5,190	a	153,000	a	4,060	a
Co-60	1.4	14,900	a	1,460	a	6,130	a	695	a
Cs-134	1.7	22,800	a	1,480	a	1,090	a	11	a
Cs-137	3	49,300	a	3,120	a	2,210	a	21	a
Eu-152	3.5	25,900	a	3,040	a	14,700	a	1,520	a
Eu-154	3.3	318,000	a	2,570	a	12,500	a	1,290	a
Eu-155	140	300,000	a	31,600	a	153,000	a	15,800	a
Fe-55	10,000	6,600,000	b	660,000	b	3,000,000	b	331,000	b
H-3	130	7,040,000	a	374,000	a	1,680,000	a	174,000	a
Nb-94	2.5	23,000	b	2,200	b	11,000	b	1,100	b
Ni-63	280	2,300,000	b	220,000	b	1,000,000	b	162,000	b
Pu-238	11	3,950,000	a	5,730	a	17,500	a	5,270	a
Pu-239	10	7,040,000	a	5,860	a	12,700	a	6,110	a
Pu-240	340	3,900,000	b	5,800	b	18,000	b	5,900	b
Pu-241	340	7,500,000	b	740,000	b	22,500	b	370,000	b
Sb-125	11	70,400	a	7,030	a	34,900	a	3,520	a
Sr-90	0.6	35,200	a	582	a	3,580	a	23	a
Tc-99	5	469,000	a	42,200	a	21,900	a	4,490	a

Notes:

1) DCGL = Derived Concentration Guideline Level (based on achieving dose limit of 10 mrem/yr) -- shown for information only.

Sources:

a - Calculated using US DOE (2004) RESRAD-Biota Software.

b - Calculated using BCG equations in US DOE (2002), with parameters in Table 2-3 (BCGs not available in RESRAD-Biota software).

Table 2-20a
Radionuclide COPCs in Surface Soil -- Combined Study Areas
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Combined Study Area Samples ¹				Detected > 5%	Background ²	Maximum > Background Maximum	Soil BCG ³	COPC	Comment
	Number Detected	Number Sampled	Percent Detected	Maximum (pCi/g)		Maximum (pCi/g)				
Ag-108m	25	1679	1%	0.34	No	ND	Yes	1,100 b	No	<5% detected / Less than Soil BCG.
Am-241	0	1678	0%	ND	No	ND	No	3,890 a	No	Not detected
Co-60	196	1679	12%	15.15	Yes	ND	Yes	695 a	No	Less than Soil BCG
Cs-134	27	1669	2%	0.045	No	ND	Yes	11 a	No	<5% detected / Less than Soil BCG.
Cs-137	762	1679	45%	9.597	Yes	2.16	Yes	21 a	No	Less than Soil BCG
Eu-152	11	1673	1%	0.228	No	ND	Yes	1,520 a	No	<5% detected / Less than Soil BCG.
Eu-154	11	1677	1%	0.299	No	ND	Yes	1,290 a	No	<5% detected / Less than Soil BCG.
Eu-155	37	1667	2%	0.335	No	ND	Yes	15,800 a	No	<5% detected / Less than Soil BCG.
Mn-54	7	1678	0.4%	0.068	No	ND	Yes		No	<5% detected
Nb-94	0	1678	0%	ND	No	ND	No	1,100 b	No	Not detected
Sb-125	228	1616	14%	0.540	Yes	ND	Yes	3,520 a	No	Less than Soil BCG
C-14	29	230	13%	4.86	Yes		Yes	4,760 a	No	Less than Soil BCG
Cm-243	2	177	1%	0.216	No		Yes	2,600 b	No	<5% detected / Less than Soil BCG.
Fe-55	4	179	2%	69.600	No		Yes	331,000 b	No	<5% detected / Less than Soil BCG.
H-3	11	230	4.8%	43.500	No		Yes	174,000 a	No	<5% detected / Less than Soil BCG.
Ni-63	4	179	2%	7.840	No		Yes	162,000 b	No	<5% detected / Less than Soil BCG.
Pu-238	0	178	0%	ND	No		No	5,270 a	No	Not detected
Pu-239	2	178	1%	0.187	No		Yes	6,110 a	No	<5% detected / Less than Soil BCG.
Pu-241	3	175	2%	126	No		Yes	370,000 b	No	<5% detected / Less than Soil BCG.
Sr-90	33	206	16%	0.978	Yes	1.14	No	23 a	No	Less than Soil BCG / Similar to background
Tc-99	8	179	4%	0.953	No		Yes	4,490 a	No	<5% detected / Less than Soil BCG.

Notes:

1) Soils from TransCanada property including BUD and shoreline, and YAEC property (all areas studied).

2) Soil background maxima from Pelham Lake area soil samples (blanks indicate not analyzed). See Risk Characterization Table 3-4.

3) BCGs from Table 2-19.

Mean and standard deviation use 1/2 detection limit (MDC) for non-detects.

Negative activities as reported by the lab are an artifact of adjusting for instrument background interferences.

ND = Not Detected

Table 2-20b
Radionuclide COPCs in Surface Soil -- TransCanada Property
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	TransCanada Property ¹				Detected > 5%	Background ²	Maximum > Background Maximum	Soil BCG ³	COPC	Comment
	Number Detected	Number Sampled	Percent Detected	Maximum (pCi/g)		Maximum (pCi/g)				
Ag-108m	12	499	2%	0.21	No	ND	Yes	1,100 b	No	<5% detected / Less than Soil BCG.
Am-241	0	499	0%	ND	No	ND	No	3,890 a	No	Not detected
Co-60	27	499	5.4%	1.782	Yes	ND	Yes	695 a	No	Less than Soil BCG
Cs-134	5	498	1%	0.031	No	ND	Yes	11 a	No	<5% detected / Less than Soil BCG.
Cs-137	231	499	46%	9.597	Yes	2.16	Yes	21 a	No	Less than Soil BCG
Eu-152	3	498	1%	0.187	No	ND	Yes	1,520 a	No	<5% detected / Less than Soil BCG.
Eu-154	7	498	1%	0.171	No	ND	Yes	1,290 a	No	<5% detected / Less than Soil BCG.
Eu-155	16	497	3%	0.335	No	ND	Yes	15,800 a	No	<5% detected / Less than Soil BCG.
Mn-54	4	499	1%	0.068	No	ND	Yes		No	<5% detected
Nb-94	0	499	0%	ND	No	ND	No	1,100 b	No	Not detected
Sb-125	76	490	16%	0.540	Yes	ND	Yes	3,520 a	No	Less than Soil BCG
C-14	0	41	0%	ND	No		No	4,760 a	No	Not detected
Cm-243	1	41	2%	0.145	No		Yes	2,600 b	No	<5% detected / Less than Soil BCG.
Fe-55	4	41	10%	69.6	Yes		Yes	331,000 b	No	Less than Soil BCG
H-3	0	59	0%	ND	No		No	174,000 a	No	Not detected
Ni-63	1	41	2%	2.350	No		Yes	162,000 b	No	<5% detected / Less than Soil BCG.
Pu-238	0	41	0%	ND	No		No	5,270 a	No	Not detected
Pu-239	0	41	0%	ND	No		No	6,110 a	No	Not detected
Pu-241	1	38	3%	25.5	No		Yes	370,000 b	No	<5% detected / Less than Soil BCG.
Sr-90	8	48	17%	0.333	Yes	1.14	No	23 a	No	Less than Soil BCG / Similar to background
Tc-99	2	41	4.9%	0.909	No		Yes	4,490 a	No	<5% detected / Less than Soil BCG.

Notes:

1) Soils from TransCanada property including BUD and shoreline areas.

2) Soil background maxima from Pelham Lake area soil samples (blanks indicate not analyzed). See Risk Characterization Table 3-4.

3) BCGs from Table 2-19.

Mean and standard deviation use 1/2 detection limit (MDC) for non-detects.

Negative activities as reported by the lab are an artifact of adjusting for instrument background interferences.

ND = Not Detected

Table 2-21
Radionuclide COPCs in Sediment -- Sherman Reservoir and Deerfield River
Yankee Nuclear Power Station, Rowe, MA

Radionuclide	Combined Study Area Samples ¹					Detected > 5%	Background Samples ²			Sediment BCG ³	COPC	Comment	
	Number Detected	Number Sampled	Percent Detected	Mean (pCi/g)	Maximum (pCi/g)		Mean (pCi/g)	Standard Deviation (pCi/g)	Maximum (pCi/g)				
Ag-108m	0	145	0%	ND	ND	No	ND			2,300	b	No	Not detected
Am-241	1	145	1%	-0.018	0.24	No	ND			5,150	a	No	<5% detected
Co-60	46	145	32%	0.118	1.29	Yes	ND			1,460	a	No	Less than Sediment BCG
Cs-134	4	145	3%	0.006	0.10	No	ND			1,480	a	No	<5% detected
Cs-137	139	145	96%	0.399	1.46	Yes	0.42	0.44	1.650	3,120	a	No	Comparable to background
Eu-152	0	145	0%	ND	ND	No	ND			3,040	a	No	Not detected
Eu-154	0	145	0%	ND	ND	No	ND			2,570	a	No	Not detected
Eu-155	10	143	7%	0.066	0.62	Yes	ND			31,600	a	No	Less than Sediment BCG
Mn-54	1	145	1%	0.002	0.041	No	ND					No	<5% detected
Nb-94	0	145	0%	ND	ND	No	ND			2,200	b	No	Not detected
Sb-125	34	142	24%	0.091	0.84	Yes	ND			7,030	a	No	Less than Sediment BCG
C-14	11	132	8%	0.017	0.45	Yes	0.019	0.043	0.171	59,000	a	No	Less than Sediment BCG
Cm-243	0	30	0%	ND	ND	No	ND			3,800	b	No	Not detected
Fe-55	0	31	0%	ND	ND	No	--	--	323 *	660,000	b	No	Not detected
H-3	0	30	0%	ND	ND	No	ND			374,000	a	No	Not detected
Ni-63	1	31	3%	0.588	8.65	No	ND			220,000	b	No	<5% detected
Pu-238	0	30	0%	ND	ND	No	0.19	0.29	0.611	5,730	a	No	Not detected
Pu-239	1	30	3%	0.002	0.086	No	ND			5,860	a	No	<5% detected
Pu-241	0	27	0%	ND	ND	No	ND			740,000	b	No	Not detected
Sr-90	18	130	14%	0.037	0.90	Yes	0.017	0.024	0.090	582	a	No	Less than Sediment BCG
Tc-99	2	30	7%	0.042	0.36	Yes	ND			42,200	a	No	Less than Sediment BCG

Notes:

1) FSS Data from Sherman Reservoir and Phase II Data from Deerfield River adjacent to the site.

*Anomalous sample result.

2) FSS and Phase II Data. (See Risk Characterization Table 3-5.)

3) BCGs from Table 2-19.

Mean and standard deviation use 1/2 detection limit for non-detects.

Negative activities as reported by the lab are an artifact of adjusting for instrument background interferences.

ND = Not Detected

Table 3-1
Wildlife Exposure Parameters
Yankee Nuclear Power Station, Rowe, MA

Receptor	Parameter	Value	Basis	Reference
American Robin (<i>Turdus migratorius</i>)	Incidental soil ingestion rate	0.003 kg/d	Assume 10% soil in diet based on food ingestion rate of 0.032 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.10 kg/d wet weight	Average: 1.2 g/g-day multiplying by body weight	US EPA, 1993
	Plant Ingestion Rate	0.045 kg/d weight weight	Assumes 45% of robin's diet is plant matter	US EPA, 1993
	Terrestrial Invertebrate Rate	0.055 kg/d wet weight	Assumes 55% of robin's diet is invertebrates	US EPA, 1993
	Water Ingestion Rate	0.011 L/d	0.14 g/g-day and multiplying by body weight	US EPA, 1993
	Life Span	1.35 yr	Average: 1.3 - 1.4 yr, range up to 9 yrs	US EPA, 1993
	Body Weight	0.081 kg	Average: range 77.3 to 86.2 g	US EPA, 1993
	Home Range	39 acre	Average: range 0.12 to 0.84 ha	US EPA, 1993
Short-tailed Shrew (<i>Blarina brevicauda</i>)	Incidental soil ingestion rate	0.00017 kg/d	Assume 5.9% soil in diet based on food ingestion rate of 0.0029 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.01 kg/d wet weight	Average: 0.53 g/g-day and multiplying by body weight	US EPA, 1993
	Plant Ingestion Rate	0.015 kg/d wet weight	Assume 15% of diet of shrew is plant matter	US EPA, 1993
	Terrestrial Invertebrate Rate	0.0085 kg/d wet weight	Assume 85% of diet of shrew is invertebrates	US EPA, 1993
	Water Ingestion Rate	0.004 L/d	0.223 g/g-day and multiplying by body weight	US EPA, 1993
	Life Span	0.375 yr	Average: range 4.4 - 4.6 months, maximum: 20 months	US EPA, 1993
	Body Weight	0.017 kg	Average: range 15 to 19.2 g	US EPA, 1993
	Home Range	1 acre	Average: range 0.07 to 2.2 ha	US EPA, 1993
Eastern Cottontail (<i>Sylvilagus floridanus</i>)	Incidental soil ingestion rate	0.002 kg/d	Assume 2% soil in diet based on food ingestion rate of 0.101 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.273 kg/weight weight	Estimated using dietary composition and water content	US EPA, 1993
	Terrestrial Plant Ingestion Rate	0.273 kg/weight weight	Assumes 100% diet of terrestrial plants	US EPA, 1993
	Water Ingestion Rate	0.118 L/d	0.097g/g-day and multiplying body weight	US EPA, 1993
	Life Span	1.25 yr	Average	US EPA, 1993
	Body Weight	1.22 kg	Average: range of 1.13 to 1.33 kg	US EPA, 1993
	Home Range	8 acres	Average: range of 1.5 to 4 ha	US EPA, 1993
	Raccoon (<i>Procyon lotor</i>)	Incidental soil ingestion rate	0.02661 kg/d	Assume 9.4% soil in diet based on food ingestion rate of 0.283 kg/d dry weight	Beyer et al., 1994
Daily Food Ingestion Rate		1.1 kg/d wet weight	Regression equation for mammals: $0.0687 (BW)^{0.822}$	US EPA, 1993
Plant Ingestion Rate		0.495 kg/d wet weight	Assume 45% plant in total diet	US EPA, 1993
Invertebrate Ingestion Rate		0.495 kg/d wet weight	Assume 45% invertebrate in total diet	US EPA, 1993
Small Mammal Ingestion Rate		0.11 kg/d wet weight	Assume 10% small mammal in total diet	US EPA, 1993
Water Ingestion Rate		0.46 L/d	0.083 g/g-day and multiply by body weight	US EPA, 1993
Life Span		2.45 yr	Average: range of 1.8 to 3.1 yrs	US EPA, 1993
Body Weight		5.6 kg	Average: range of 3.67 to 7.6 kg	US EPA, 1993
Home Range		1550 acres	Average: range of 96 to 806 ha	US EPA, 1993

Table 3-1
Wildlife Exposure Parameters
Yankee Nuclear Power Station, Rowe, MA

Receptor	Parameter	Value	Basis	Reference
Red Fox (<i>Vulpes vulpes</i>)	Incidental soil ingestion rate	0.00492 kg/d	Assume 3% soil in diet based on food ingestion rate of 0.164 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.51 kg/d	0.1123 g/g-day and multiplying by body weight	US EPA, 1993
	Plant Ingestion Rate	0.051 kg/d wet weight	Assume 10% of diet of fox is plant matter	US EPA, 1993
	Invertebrate Ingestion Rate	0.02 kg/d wet weight	Assume 4% of diet of fox is invertebrates	US EPA, 1993
	Small Mammal Ingestion Rate	0.44 kg/d wet weight	Assume 86% of diet of fox is small mammals	US EPA, 1993
	Water Ingestion Rate	0.380 L/d	Regression equation for mammals: 0.099 (BW) ^{0.9}	US EPA, 1993
	Life Span	1.5 years	Mean: 1.5 years, Range up to 6 years	US EPA, 1993
	Body Weight	4.5 kg	Average: range of 3.94 to 5.25 kg	US EPA, 1993
	Home Range	2560 acres	Average: range of 96 to 1976 ha	Zeiner <i>et al.</i> , 1990
Mink (<i>Mustela vison</i>)	Incidental sediment ingestion rate	0.0022 kg/d	Assume 5% in diet based on food ingestion rate of 0.044 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.158 kg/d	Average: 0.1575 g/g-day multiplying by body weight	US EPA, 1993
	Fish Ingestion Rate	0.158 kg/d wet weight	Assume 100% of diet of mink is fish	US EPA, 1993
	Water Ingestion Rate	0.079 L/d	Average: 0.079 g/g-day multiplying by body weight	US EPA, 1993
	Life Span	5 yr	Range: up to 5 years	US EPA, 1993
	Body Weight	1 kg	Average: range 550 - 1,233 g	US EPA, 1993
	Home Range	700 acres	Average: range 259 - 770 ha	US EPA, 1993
Belted Kingfisher (<i>Megaceryle alcyon</i>)	Incidental sediment ingestion rate	0.0034 kg/d	Assume 2% in diet based on food ingestion rate of 0.17 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.075 kg/d	0.50 g/g-day multiplying by body weight	US EPA, 1993
	Invertebrate Ingestion Rate	0.015 kg/d wet weight	Assume: 20% of diet of kingfisher is invertebrates	US EPA, 1993
	Fish Ingestion Rate	0.06 kg/d wet weight	Assume: 80% of diet of kingfisher is fish	US EPA, 1993
	Water Ingestion Rate	0.0165 L/d	0.11 g/g-day multiplying by body weight	US EPA, 1993
	Life Span	0.58 yr	Lifespan Equation: 1.02*(Body Weight ^{0.3})	
	Body Weight	0.15 kg	Average: range 136 - 158g	US EPA, 1993
	Home Range	351 acres	Average: range 0.39 - 2.19 km shoreline	US EPA, 1993
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Incidental sediment ingestion rate	0.0065 kg/d	Assume 5% in diet based on food ingestion rate of 0.13 kg/d dry weight	Beyer <i>et al.</i> , 1994
	Daily Food Ingestion Rate	0.48 kg/d	0.12 g/g-day multiplying by body weight	US EPA, 1993
	Fish Ingestion Rate	0.48 kg/d wet weight	Assume 100% of diet of Bald Eagle is fish	US EPA, 1993
	Water Ingestion Rate	0.15 L/d	0.036 g/g-day multiplying by body weight	US EPA, 1993
	Life Span	50 yrs	Range: up to 50 years	US EPA, 1993
	Body Weight	4.2 kg	Average: range 3 - 4.5 kg	US EPA, 1993
	Home Range	5800 acres	Average: range 1830 - 3494 ha	US EPA, 1993

Table 3-2
Exposure Point Concentrations for COPCs in Soil, Sediment, Surface Water, and Fish
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Combined Study Areas			
	Surface Soil (0-3 ft bgs) (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)
<i>Dioxin/Furans (pg/g)</i>				
Dioxin/Furan TEQ	1.19E-06			
<i>Extractable Petroleum Hydrocarbons</i>				
Adjusted C11-C22 Aromatics	3.64E+01			
<i>Inorganics</i>				
Antimony		8.29E-01	3.10E-03	
Arsenic		2.17E+00		
Barium			1.80E-02	
Beryllium		6.48E-01		
Boron	9.75E+01	4.95E+00	2.45E-02	
Cadmium		9.05E-01	2.00E-04	
Chromium		1.20E+01		5.15E-01
Copper	1.45E+01	5.01E+01	6.29E-03	1.06E+00
Iron			1.98E+00	
Lead	2.67E+01	1.14E+01	1.40E-03	
Lithium		1.29E+01		
Manganese			1.96E-01	
Mercury	2.62E-01	1.13E-01	1.05E-04	1.31E-01
Nickel	1.39E+01	1.60E+01		4.33E-01
Selenium	3.75E+00	2.04E+00	2.00E-04	
Silver		5.39E-01	1.39E-03	9.01E-02
Thallium		7.95E-01	1.95E-03	
Zinc	8.11E+01	1.23E+02	1.18E-02	2.73E+01
<i>Polychlorinated Biphenyls</i>				
Aroclor-1254	3.01E-01	1.91E-01		
Aroclor-1260	1.39E-01	4.46E-02		
Total PCBs				6.69E-02
<i>Semivolatile Organic Compounds</i>				
Acenaphthene	2.11E-01	2.87E-01		
Acenaphthylene	2.29E-01			
Anthracene	2.47E-01	2.93E-01		
Benzo(a)anthracene	3.63E-01	3.84E-01		
Benzo(a)pyrene	3.30E-01	3.70E-01		
Benzo(b)fluoranthene	3.59E-01	3.65E-01		
Benzo(g,h,i)perylene	2.54E-01	3.12E-01	6.00E-05	
Benzo(k)fluoranthene	3.42E-01	3.44E-01		
Bis(2-ethylhexyl)phthalate		2.00E-01		
Chrysene	3.92E-01	3.62E-01		
Dibenzo(a,h)anthracene	2.06E-01			
Fluoranthene	5.78E-01	5.54E-01	4.20E-05	
Fluorene	2.13E-01	2.85E-01		
Indeno(1,2,3-cd)pyrene	2.54E-01	3.09E-01		
Phenanthrene	3.47E-01	5.26E-01	4.20E-05	
Pyrene	5.28E-01	4.72E-01	3.20E-05	
<i>Volatile Organic Compounds</i>				
1,1-Dichloroethene		9.43E-03		
2-Butanone	6.60E-03	1.68E-02		
4-Methyl-2-Pentanone	9.00E-03		8.00E-04	
Acetone	7.78E-02	5.35E-02	5.49E-03	
Carbon Disulfide		2.92E-03	8.30E-04	
Chloromethane			1.26E-03	
Methylene Chloride			9.50E-04	
tert-Butyl Alcohol			5.16E-03	
Toluene	1.30E-01	8.46E-03		
Trichlorofluoromethane	5.20E-03			

Table 3-2
Exposure Point Concentrations for COPCs in Soil, Sediment, Surface Water, and Fish
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Combined Study Areas			
	Surface Soil (0-3 ft bgs) (mg/kg)	Sediment (mg/kg)	Surface Water (mg/L)	Fish (mg/kg)
<i>Volatile Petroleum Hydrocarbons</i>				
Adjusted C9-C10 Aromatics		3.50E-01		
Adjusted C9-C12 Aliphatics		1.15E-01		

Notes:

Blank - Not detected/not analyzed

In cases where the average exceeds the maximum concentration, the maximum concentration was used as the EPC.

Analytes considered a COPC in the Study Area (regardless of media) are presented.

Table 3-3
Estimated Chemical Concentrations in Terrestrial Plants
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Soil (0-3 ft bgs) EPCs (mg/kg) Combined Study Areas	Linear Uptake Model						Regression Model			Terrestrial Plant EPCs (mg/kg) Combined Study Areas
		LogK _{ow}	Koc	Kbw	Kd	UF	Ref	Intercept	Slope	Ref	
Dioxin/Furans											
Dioxin/Furan TEQ	1.19E-06	NA	NA	NA	NA	5.6E-03	3	NA	NA		2.5E-09
Extractable Petroleum Hydrocarbons											
Adjusted C11-C22 Aromatics	3.64E+01	NA	NA	NA	NA	1	5	NA	NA		1.3E+01
Inorganics											
Boron	9.75E+01	NA	NA	NA	NA	1	5	NA	NA		3.6E+01
Copper	1.45E+01	NA	NA	NA	NA	NA		0.669	0.394	1	2.1E+00
Lead	2.67E+01	NA	NA	NA	NA	NA		-1.328	0.561	1	6.2E-01
Mercury	2.62E-01	NA	NA	NA	NA	NA		-4.186	0.641	1	2.4E-03
Nickel	1.39E+01	NA	NA	NA	NA	NA		-2.224	0.748	1	2.9E-01
Selenium	3.75E+00	NA	NA	NA	NA	NA		-8.936	0.984	1	1.8E-04
Zinc	8.11E+01	NA	NA	NA	NA	NA		0.571	-0.128	1	3.7E-01
Polychlorinated Biphenyls											
Aroclor-1254	3.01E-01	NA	NA	NA	NA	0.01	3	NA	NA		1.1E-03
Aroclor-1260	1.39E-01	NA	NA	NA	NA	0.01	3	NA	NA		5.2E-04
Semivolatile Organic Compounds											
Acenaphthene	2.11E-01	NA	NA	NA	NA	0.020	3a	NA	NA		1.6E-03
Acenaphthylene	2.29E-01	NA	NA	NA	NA	0.020	3a	NA	NA		1.7E-03
Anthracene	2.47E-01	4.45	NA	NA	NA	0.020	3a	NA	NA		1.8E-03
Benzo(a)anthracene	3.63E-01	5.52	NA	NA	NA	0.020	3	NA	NA		2.7E-03
Benzo(a)pyrene	3.30E-01	NA	NA	NA	NA	0.020	3a	NA	NA		2.5E-03
Benzo(b)fluoranthene	3.59E-01	NA	NA	NA	NA	0.010	3	NA	NA		1.3E-03
Benzo(g,h,i)perylene	2.54E-01	NA	NA	NA	NA	0.020	3a	NA	NA		1.9E-03
Benzo(k)fluoranthene	3.42E-01	NA	NA	NA	NA	0.010	3	NA	NA		1.3E-03
Chrysene	3.92E-01	5.61	NA	NA	NA	0.019	3	NA	NA		2.7E-03
Dibenzo(a,h)anthracene	2.06E-01	NA	NA	NA	NA	0.006	3				
Fluoranthene	5.78E-01	5.2	NA	NA	NA	0.020	3a	NA	NA		4.3E-03
Fluorene	2.13E-01	NA	NA	NA	NA	0.020	3a	NA	NA		1.6E-03
Indeno(1,2,3-cd)pyrene	2.54E-01	NA	NA	NA	NA	0.004	3	NA	NA		3.7E-04
Phenanthrene	3.47E-01	4.35	NA	NA	NA	0.020	3a	NA	NA		2.6E-03
Pyrene	5.28E-01	5.18	NA	NA	NA	0.020	3a	NA	NA		3.9E-03
Volatile Organic Compounds											
2-Butanone	6.60E-03	0.26	NA	NA	NA	27.40	4	NA	NA		6.7E-02
4-Methyl-2-Pentanone	9.00E-03	1.31	NA	NA	NA	6.77	4	NA	NA		2.3E-02
Acetone	7.78E-02	-0.24	NA	NA	NA	53.30	4	NA	NA		1.5E+00
Toluene	1.30E-01	2.54	NA	NA	NA	1.32	4	NA	NA		6.4E-02
Trichlorofluoromethane	5.20E-03	2.13	NA	NA	NA	2.27	4	NA	NA		4.4E-03

Notes:

NA - Not Applicable

1) Bechtel Jacobs, 1998b.

2) Baes et al., 1984.

3) US EPA, 1999.

a - Uptake factor (UF) for Benzo(a)anthracene used in the absence of specific PAH UFs.

4) Unknown organic UFs calculated using Log K_{ow} & an equation from Sample et al. (1997) and Travis and Arms (1998). See Attachment A for models.

Log K_{ow} taken from Sample et al. (1997) and <http://www.epa.gov/oppt/exposure/docs/episuitedl.htm>. HENRYWIN

5) Uptake value of 1 used in the absence of analyte specific values.

Chemical concentrations in plants are reported as wet weight (assume 63% water content in terrestrial plants) (Sample et al., 1997).

Table 3-4
Estimated Chemical Concentrations in Terrestrial Invertebrates
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Soil (0-3 ft bgs) EPCs (mg/kg) Combined Study Areas	Linear Uptake Model						Regression Models			Terrestrial Invertebrate EPCs (mg/kg) Combined Study Areas
		LogK _{ow}	Koc	Kbw	Kd	UF	Ref	Intercept	Slope	Ref	
Dioxin/Furans											
Dioxin/Furan TEQ	1.19E-06	NA	NA	NA	NA	1.3E+00	2	NA	NA		4.4E-07
Extractable Petroleum Hydrocarbons											
Adjusted C11-C22 Aromatics	3.64E+01	NA	NA	NA	NA	1	4	NA	NA		1.1E+01
Inorganics											
Boron	9.75E+01	NA	NA	NA	NA	0.22	2	NA	NA		6.2E+00
Copper	1.45E+01	NA	NA	NA	NA	NA		1.81	0.24	1	3.4E+00
Lead	2.67E+01	NA	NA	NA	NA	NA		0.075	0.76	1	3.8E+00
Mercury	2.62E-01	NA	NA	NA	NA	NA		-0.684	0.12	1	1.2E-01
Nickel	1.39E+01	NA	NA	NA	NA	0.032	2	NA	NA		1.3E-01
Selenium	3.75E+00	NA	NA	NA	NA	0.22	2	NA	NA		2.4E-01
Zinc	8.11E+01	NA	NA	NA	NA	0.56	2	NA	NA		1.3E+01
Polychlorinated Biphenyls											
Aroclor-1254	3.01E-01	NA	NA	NA	NA	NA		1.41	1.36	1	2.3E-01
Aroclor-1260	1.39E-01	NA	NA	NA	NA	NA		1.79	1.29	1	1.4E-01
Semivolatile Organic Compounds											
Acenaphthene	2.11E-01	NA	NA	NA	NA	0.03	2a	NA	NA		1.8E-03
Acenaphthylene	2.29E-01	NA	NA	NA	NA	0.03	2a	NA	NA		2.0E-03
Anthracene	2.47E-01	4.45	NA	NA	NA	0.03	2a	NA	NA		2.1E-03
Benzo(a)anthracene	3.63E-01	5.52	NA	NA	NA	0.03	2	NA	NA		3.2E-03
Benzo(a)pyrene	3.30E-01	NA	NA	NA	NA	0.03	2a	NA	NA		2.9E-03
Benzo(b)fluoranthene	3.59E-01	NA	NA	NA	NA	0.03	2a	NA	NA		3.1E-03
Benzo(g,h,i)perylene	2.54E-01	NA	NA	NA	NA	0.03	2a	NA	NA		2.2E-03
Benzo(k)fluoranthene	3.42E-01	NA	NA	NA	NA	0.03	2a	NA	NA		3.0E-03
Chrysene	3.92E-01	5.61	NA	NA	NA	0.04	2	NA	NA		4.5E-03
Dibenzo(a,h)anthracene	2.06E-01	NA	NA	NA	NA	0.07	2	NA	NA		4.2E-03
Fluoranthene	5.78E-01	5.2	NA	NA	NA	0.03	2a	NA	NA		5.0E-03
Fluorene	2.13E-01	NA	NA	NA	NA	0.03	2a	NA	NA		1.9E-03
Indeno(1,2,3-cd)pyrene	2.54E-01	NA	NA	NA	NA	0.03	2a	NA	NA		2.2E-03
Phenanthrene	3.47E-01	4.35	NA	NA	NA	0.03	2a	NA	NA		3.0E-03
Pyrene	5.28E-01	5.18	NA	NA	NA	0.03	2a	NA	NA		4.6E-03
Volatile Organic Compounds											
2-Butanone	6.60E-03	0.26	NA	NA	NA	0.12	3	NA	NA		2.2E-04
4-Methyl-2-Pentanone	9.00E-03	1.31	10.91	5.13	0.44	0.85	3	NA	NA		2.2E-03
Acetone	7.78E-02	-0.24	NA	NA	NA	0.05	2	NA	NA		1.1E-03
Toluene	1.30E-01	2.54	NA	NA	NA	8.60	3	NA	NA		3.3E-01
Trichlorofluoromethane	5.20E-03	2.13	NA	NA	NA	3.97	3	NA	NA		6.0E-03

Notes:

NA - Not Applicable

Chemical concentrations in earthworms reported as wet weight (assume 71% water content in earthworms) (Sample et al., 1997).

1) Sample et al., 1998b.

a - Uptake factor (UF) of Benzo(a)pyrene used in the absence of specific PAH UFs.

2) UFs from US EPA, 1999.

3) Unknown organic UFs calculated using Log K_{ow} & Sample et al. (1997) equations. See Attachment A for models.

Linear Uptake Model parameters taken from Sample et al. (1997) and <http://www.epa.gov/oppt/exposure/docs/episuitd.htm>. HENRYWIN

4) Uptake value of 1 used in the absence of analyte specific values.

Table 3-5
Estimated Chemical Concentrations in Benthic Invertebrates
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Sediment EPCs (mg/kg) Combined Study Areas	Linear Uptake Model						Regression Models			Benthic Invertebrate EPCs (mg/kg) Combined Study Areas
		LogK _{ow}	Koc	Kbw	Kd	UF	Ref	Intercept	Slope	Ref	
Inorganics											
Antimony	8.29E-01	NA	NA	NA	NA	0.9	2	NA	NA		1.57E-01
Arsenic	2.17E+00	NA	NA	NA	NA	NA		-0.29	0.75	1	1.92E-01
Beryllium	6.48E-01	NA	NA	NA	NA	0.9	2	NA	NA		1.22E-01
Boron	4.95E+00	NA	NA	NA	NA	1	5	NA	NA		1.04E+00
Cadmium	9.05E-01	NA	NA	NA	NA	NA		-0.314	0.513	1	9.68E-02
Chromium	1.20E+01	NA	NA	NA	NA	NA		0.21	0.37	1	8.43E-01
Copper	5.01E+01	NA	NA	NA	NA	NA		1.09	0.28	1	7.65E+00
Lead	1.14E+01	NA	NA	NA	NA	NA		-0.78	0.80	1	2.47E-01
Lithium	1.29E+01	NA	NA	NA	NA	0.083	4	NA	NA		2.26E-01
Mercury	1.13E-01	NA	NA	NA	NA	NA		-0.67	0.33	1	2.20E-02
Nickel	1.60E+01	NA	NA	NA	NA	NA		1.48	-0.43	1	1.95E+00
Selenium	2.04E+00	NA	NA	NA	NA	0.9	2	NA	NA		3.86E-01
Silver	5.39E-01	NA	NA	NA	NA	0.9	2	NA	NA		1.02E-01
Thallium	7.95E-01	NA	NA	NA	NA	0.9	2	NA	NA		1.50E-01
Zinc	1.23E+02	NA	NA	NA	NA	NA		1.89	0.13	1	2.99E+01
Polychlorinated Biphenyls											
Aroclor-1254	1.91E-01	NA	NA	NA	NA	NA		0.59	1.11	1	1.30E-01
Aroclor-1260	4.46E-02	NA	NA	NA	NA	NA		0.59	1.11	1	2.59E-02
Semivolatile Organic Compounds											
Acenaphthene	2.87E-01	3.92	7,139	2,089	286	7.32	3	NA	NA		4.42E-01
Anthracene	2.93E-01	4.54	29,047	8,710	1,162	7.50	3	NA	NA		4.61E-01
Benzo(a)anthracene	3.84E-01	5.61	327,273	102,329	13,091	7.82	3	NA	NA		6.31E-01
Benzo(a)pyrene	3.70E-01	6.25	1,393,253	446,684	55,730	8.02	3	NA	NA		6.23E-01
Benzo(b)fluoranthene	3.65E-01	6.06	906,275	288,403	36,251	7.96	3	NA	NA		6.10E-01
Benzo(g,h,i)perylene	3.12E-01	6.51	2,509,632	812,831	100,385	8.10	3	NA	NA		5.31E-01
Benzo(k)fluoranthene	3.44E-01	6.06	906,275	288,403	36,251	7.96	3	NA	NA		5.75E-01
Bis(2-ethylhexyl)phthalate	2.00E-01	5.11	105,538	32,359	4,222	7.67	3	NA	NA		3.22E-01
Chrysene	3.62E-01	5.61	327,273	102,329	13,091	7.82	3	NA	NA		5.94E-01
Fluoranthene	5.54E-01	5.2	129,384	39,811	5,175	7.69	3	NA	NA		8.95E-01
Fluorene	2.85E-01	4.18	12,859	3,802	514	7.39	3	NA	NA		4.42E-01
Indeno(1,2,3-cd)pyrene	3.09E-01	6.5	2,453,466	794,328	98,139	8.09	3	NA	NA		5.26E-01
Phenanthrene	5.26E-01	4.52	27,761	8,318	1,110	7.49	3	NA	NA		8.27E-01
Pyrene	4.72E-01	5.18	123,657	38,019	4,946	7.69	3	NA	NA		7.62E-01
Volatile Organic Compounds											
1,1-Dichloroethene	9.43E-03	2.13	124.19	33.88	4.97	6.82	3	NA	NA		1.35E-02
2-Butanone	1.68E-02	0.26	1.80	0.46	0.07	6.34	3	NA	NA		2.23E-02
Acetone	5.35E-02	-0.24	0.58	0.14	0.02	6.22	3	NA	NA		6.99E-02
Carbon Disulfide	2.92E-03	1.94	80.78	21.88	3.23	6.77	3	NA	NA		4.15E-03
Toluene	8.46E-03	2.54	314.12	87.10	12.56	6.93	3	NA	NA		1.23E-02
Volatile Petroleum Hydrocarbons											
Adjusted C9-C10 Aromatics	3.50E-01	NA	NA	NA	NA	1	5	NA	NA		7.34E-02
Adjusted C9-C12 Aliphatics	1.15E-01	NA	NA	NA	NA	1	5	NA	NA		2.41E-02

Notes:

NA - Not Applicable

- 1) Bechtel/Jacobs (1998a): Biota Sediment Accumulation Factors for Invertebrates.
- 2) US EPA (1999): Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities.
- 3) Unknown organic UFs calculated using Log K_{ow} & Sample et al. (1997) equations. See Attachment A for models.
 Log K_{ow} taken from Sample et al. (1997) and <http://www.epa.gov/oppt/exposure/docs/episuitd.htm>. HENRYWIN
- 4) Sample et al. (1998b): Development and Validation of Bioaccumulation Models for Earthworms.
- 5) BSAF of 1 used in the absence of analyte specific values (US EPA, 1997).

Table 3-6
Estimated Chemical Concentrations in Small Mammals and Birds
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Chemical Properties				Soil (0-3 ft bgs) EPCs (mg/kg)	Sediment EPCs (mg/kg)	Surface Water EPCs (mg/L)	Terrestrial Plants EPCs (mg/kg)	Terrestrial Invertebrate EPCs (mg/kg)	Benthic Invertebrate EPCs (mg/kg)	BCFs for the Short-tailed Shrew			Omnivore Mammal EPC (mg/kg)	BCFs for the American Robin			Insectivore Bird EPC (mg/kg)	BCFs for the Deermouse			Herbivore Mammal EPC (mg/kg)
	Log _{Kow}	FCM ₂	FCM ₃	FCM ₄							BCFs-a	BCFw-a	BCFp-a		Shrew	BCFs-a	BCFw-a		BCFp-a	Robin	BCFs-a		BCFw-a	BCFp-a	Deermouse
Dioxin/Furans																						
Dioxin/Furan TEQ	6.8	1	14	27	1.19E-06			2.47E-09	4.39E-07		7.41E-04	8.18E-03	3.37E-02 a	1.33E-10	4.92E+00	4.71E+01	1.53E+02 a	2.64E-06	7.81E-05	8.19E-03	3.25E-02 a	9.32E-11
Extractable Petroleum Hydrocarbons																						
Adjusted C11-C22 Aromatics	NA	NA	NA	NA	3.64E+01			1.35E+01	1.05E+01		1.00E+00	1.00E+00	2.90E-03 g	5.45E+00	8.00E-01	8.00E-01	2.56E-02 g	1.31E+01	1.00E+00	1.00E+00	1.69E-02 g	3.64E+01
Inorganics																						
Boron	0.23	1	1	1	9.75E+01	4.95E+00	2.45E-02	3.61E+01	6.22E+00	1.04E+00	4.27E-08	4.27E-08	1.24E-10 g	6.24E-07	3.41E-08	3.41E-08	1.09E-09 g	1.50E-06	4.27E-08	4.27E-08	7.21E-10 g	4.16E-06
Copper	-0.57	1	1	1	1.45E+01	5.01E+01	6.29E-03	2.07E+00	3.37E+00	7.65E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	0.73	1	1	1	2.67E+01	1.14E+01	1.40E-03	6.20E-01	3.82E+00	2.47E-01	4.09E-06	4.52E-05	1.86E-04	1.64E-05	NA	NA	NA	NA	4.32E-07	4.53E-05	1.80E-04	1.16E-05
Mercury	0.62	1	1	1	2.62E-01	1.13E-01	1.05E-04	2.38E-03	1.25E-01	2.20E-02	1.06E-05	1.18E-04	4.84E-04 c	4.16E-07	5.12E-05	4.90E-04	1.59E-03 c	6.04E-06	1.12E-06	1.18E-04	4.68E-04 c	2.93E-07
Nickel	-0.57	1	1	1	1.39E+01	1.60E+01		2.87E-01	1.29E-01	1.95E+00	8.18E-05	9.04E-04	3.72E-03	1.71E-04	NA	NA	NA	NA	8.63E-06	9.05E-04	3.60E-03	1.20E-04
Selenium	0.24	1	1	1	3.75E+00	2.04E+00	2.00E-04	1.79E-04	2.39E-01	3.86E-01	3.10E-05	3.42E-04	1.41E-03	1.74E-05	1.61E-02	1.55E-01	5.02E-01	2.72E-02	3.27E-06	3.42E-04	1.36E-03	1.23E-05
Zinc	-0.47	1	1	1	8.11E+01	1.23E+02	1.18E-02	3.73E-01	1.32E+01	2.99E+01	1.23E-06	1.36E-05	5.58E-05	1.50E-05	1.25E-04	1.20E-03	3.89E-03	4.56E-03	1.29E-07	1.36E-05	5.39E-05	1.05E-05
Polychlorinated Biphenyls																						
Aroclor-1254	6.29	1	13	22	3.01E-01	1.91E-01		1.11E-03	2.32E-01	1.30E-01	5.52E-04	6.10E-03	2.51E-02	2.50E-05	4.55E-04	4.38E-03	1.42E-02	6.17E-05	5.83E-05	6.11E-03	2.43E-02	1.76E-05
Aroclor-1260	6.29	1	13	22	1.39E-01	4.46E-02		5.16E-04	1.37E-01	2.59E-02	5.52E-04	6.10E-03	2.51E-02 d	1.15E-05	4.55E-04	4.38E-03	1.42E-02 d	2.85E-05	5.83E-05	6.11E-03	2.43E-02 d	8.13E-06
Semivolatile Organic Compounds																						
Acenaphthene	3.92	1	1.2	1.1	2.11E-01	2.87E-01		1.57E-03	1.83E-03	4.42E-01	4.61E-04	5.09E-03	2.10E-02 e	1.46E-05	3.81E-04	3.67E-03	1.19E-02 e	3.61E-05	4.86E-05	5.10E-03	2.03E-02 e	1.02E-05
Acenaphthylene	3.94	1	1.2	1.1	2.29E-01			1.71E-03	1.99E-03		4.61E-04	5.09E-03	2.10E-02 e	1.58E-05	3.81E-04	3.67E-03	1.19E-02 e	3.93E-05	4.86E-05	5.10E-03	2.03E-02 e	1.11E-05
Anthracene	4.45	1	1.8	1.3	2.47E-01	2.93E-01		1.85E-03	2.15E-03	4.61E-01	4.61E-04	5.09E-03	2.10E-02 e	1.71E-05	3.81E-04	3.67E-03	1.19E-02 e	4.23E-05	4.86E-05	5.10E-03	2.03E-02 e	1.20E-05
Benzo(a)anthracene	5.52	1	6.3	7.1	3.63E-01	3.84E-01		2.72E-03	3.16E-03	6.31E-01	1.64E-04	1.81E-03	7.44E-03	8.94E-06	1.35E-04	1.30E-03	4.20E-03	2.21E-05	1.73E-05	1.81E-03	7.19E-03	6.29E-06
Benzo(a)pyrene	6.25	1	13	22	3.30E-01	3.70E-01		2.47E-03	2.87E-03	6.23E-01	4.61E-04	5.09E-03	2.10E-02	2.28E-05	3.81E-04	3.67E-03	1.19E-02	5.66E-05	4.86E-05	5.10E-03	2.03E-02	1.61E-05
Benzo(b)fluoranthene	6.06	1	11	18	3.59E-01	3.65E-01		1.34E-03	3.12E-03	6.10E-01	5.46E-04	6.03E-03	2.48E-02	2.94E-05	4.50E-04	4.34E-03	1.40E-02	7.27E-05	5.75E-05	6.03E-03	2.40E-02	2.06E-05
Benzo(g,h,i)perylene	6.51	1	14	25	2.54E-01	3.12E-01	6.00E-05	1.90E-03	2.21E-03	5.31E-01	4.61E-04	5.09E-03	2.10E-02 e	1.76E-05	3.81E-04	3.67E-03	1.19E-02 e	4.36E-05	4.86E-05	5.10E-03	2.03E-02 e	1.24E-05
Benzo(k)fluoranthene	6.06	1	11	18	3.42E-01	3.44E-01		1.28E-03	2.97E-03	5.75E-01	5.43E-04	6.00E-03	2.47E-02	2.78E-05	4.48E-04	4.31E-03	1.39E-02	6.89E-05	5.73E-05	6.00E-03	2.39E-02	1.96E-05
Chrysene	5.61	1	7.1	8.6	3.92E-01	3.62E-01		2.71E-03	4.54E-03	5.94E-01	1.88E-04	2.08E-03	8.56E-03	1.10E-05	1.55E-04	1.50E-03	4.84E-03	2.73E-05	1.99E-05	2.08E-03	8.27E-03	7.79E-06
Dibenzo(a,h)anthracene	6.7	1	14	26	2.06E-01			4.32E-03	5.03E-03	8.95E-01	1.88E-04	2.08E-03	8.56E-03	5.82E-06	1.55E-04	1.50E-03	4.84E-03	1.44E-05	1.99E-05	2.08E-03	8.27E-03	4.11E-06
Fluoranthene	5.2	1	4.2	3.9	5.78E-01	5.54E-01	4.20E-05	4.32E-03	5.03E-03	8.95E-01	1.88E-04	2.08E-03	8.56E-03	1.63E-05	1.55E-04	1.50E-03	4.84E-03	4.03E-05	1.99E-05	2.08E-03	8.27E-03	1.15E-05
Fluorene	4.18	1	1.4	1.1	2.13E-01	2.85E-01		1.59E-03	1.85E-03	4.42E-01	4.61E-04	5.09E-03	2.10E-02 e	1.47E-05	3.81E-04	3.67E-03	1.19E-02 e	3.65E-05	4.86E-05	5.10E-03	2.03E-02 e	1.03E-05
Indeno(1,2,3-cd)pyrene	6.5	1	14	25	2.54E-01	3.09E-01		3.67E-04	2.21E-03	5.26E-01	2.82E-03	3.12E-02	1.28E-01	1.07E-04	2.32E-03	2.24E-02	7.24E-02	2.65E-04	2.98E-04	3.12E-02	1.24E-01	7.57E-05
Phenanthrene	4.35	1	1.6	1.2	3.47E-01	5.26E-01	4.20E-05	2.60E-03	3.02E-03	8.27E-01	4.61E-04	5.09E-03	2.10E-02 e	2.40E-05	3.81E-04	3.67E-03	1.19E-02 e	5.95E-05	4.86E-05	5.10E-03	2.03E-02 e	1.69E-05
Pyrene	5.18	1	4.2	3.9	5.28E-01	4.72E-01	3.20E-05	3.94E-03	4.59E-03	7.62E-01	4.61E-04	5.09E-03	2.10E-02 e	3.65E-05	3.81E-04	3.67E-03	1.19E-02 e	9.05E-05	4.86E-05	5.10E-03	2.03E-02 e	2.56E-05
Volatile Organic Compounds																						
2-Butanone	0.26	1	1	1	6.60E-03	1.68E-02		6.69E-02	2.23E-04	2.23E-02	4.57E-08	4.57E-08	1.33E-10 f	4.53E-11	3.66E-08	3.66E-08	1.17E-09 f	1.09E-10	4.57E-08	4.57E-08	7.72E-10 f	3.02E-10
4-Methyl-2-Pentanone	1.31	1	1	1	9.00E-03		8.00E-04	2.26E-02	2.21E-03		5.13E-07	5.13E-07	1.49E-09 f	6.92E-10	4.10E-07	4.10E-07	1.31E-08 f	1.66E-09	5.13E-07	5.13E-07	8.67E-09 f	4.62E-09
Acetone	-0.24	1	1	1	7.78E-02	5.35E-02	5.49E-03	1.53E+00	1.13E-03	6.99E-02	2.06E-10	2.28E-09	9.36E-09	2.40E-12	1.70E-10	1.63E-09	3.70E-10	5.95E-12	2.17E-11	2.28E-09	9.05E-09	1.69E-12
Toluene	2.54	1	1	1	1.30E-01	8.46E-03		6.36E-02	3.25E-01	1.23E-02	8.71E-06	8.71E-06	2.53E-08 f	1.70E-07	6.97E-06	6.97E-06	2.23E-07 f	4.09E-07	8.71E-06	8.71E-06	1.47E-07 f	1.14E-06
Trichlorofluoromethane	2.13	1	1	1	5.20E-03			4.38E-03	5.98E-03		3.39E-06	3.39E-06	9.83E-09 f	2.64E-09	2.71E-06	2.71E-06	8.67E-08 f	6.34E-09	3.39E-06	3.39E-06	5.73E-08 f	1.76E-08

Notes:

BCFs (Bioconcentration Factors) and FCMs (Food Chain Multipliers where i = trophic level) from US EPA (1999) unless otherwise noted.

$$EPC_a = (EPC_s \times BCF_{s-a} \times P_s) + (EPC_w \times BCF_{w-a} \times P_w) + (EPC_p \times BCF_{p-a} \times F_p \times P_p) + \sum_i (C_{F_i} \times BMF_{F_i} \times F_{F_i} \times P_{F_i})$$

where $BMF = (FCM_a / FCM_{prey})$. In cases where the FCM is unavailable, a BMF of 1 was used.

a - 2,3,7,8-TCDD used in the absence of specific BCF for TEQs

b - Hexavalent Chromium used in the absence of a specific BCF for chromium.

c - Methylmercury used in the absence of a specific BCF for mercury.

d - Aroclor 1254 used in the absence of a specific BCF for Aroclor 1260.

e - Benzo(a)pyrene used in the absence of specific BCF for PAHs.

f - BCF for food and media for organics calculated using equations presented in Attachment A.

g - In cases where the LogK_{ow} are unknown or BCFs are not available for metals, a BA of 1 was applied.

	Units	shrew	robin	deermouse	NA - Not Available
Average Ingestion Rate	kg/day - wwt	0.01	0.1	0.013	
Soil/Sediment Ingestion Rate	kg/day - dwt	0.0029	0.032	0.017	
Water Intake Rate	L/day	0.0038	0.011	0.009	
% of soil/sediment containing COPC	unitless	1	1	1	
% of water containing COPC		1	1	1	
Fraction of diet consisting of plants	Fp	15%	45%	100%	
Proportion of plants containing COPC	Pp	1	1	1	
Fraction of invertebrates item in diet	Fi	85%	55%	0%	
Proportion of invertebrates containing COPC	Pi	1	1	1	

Table 3-7

**Toxicity Reference Values (TRVs) for Terrestrial Plants, Terrestrial Invertebrates, Benthic Macroinvertebrates, and Freshwater Organisms
Yankee Nuclear Power Station, Rowe, MA**

Constituent of Potential Concern (COPC)	Terrestrial Plants (mg/Kg)		Terrestrial Invertebrates (mg/Kg)		Benthic Macroinvertebrates (mg/Kg)		Freshwater TRV Chronic (ug/L)	
Total Petroleum Hydrocarbon								
VPH - C9-C10 Aromatics	--		--		--		--	
EPH - C11-C22 Aromatics	--		--		--		--	
Volatile Organic Compounds								
1,1-Dichloroethene	--		--		5.9	j	303	f
2-Butanone	--		--		27	j	--	
4-Isopropyltoluene	--		--		--		--	
4-Methyl-2-pentanone	--		--		--		--	
Acetone	--		--		0.0571	c	1500	f
Carbon disulfide	--		--		0.23	j	--	
Chloromethane	--		--		--		--	
Methylene chloride	--		--		7.2	j	1930	f
Toluene	200	a	--		130	j	175	f
Semi-Volatile Organic Compounds								
Acenaphthene	20	a	30	3b	0.15 (TEC)	4d	23	f,k
Acenaphthylene	20	1a	30	3b	0.15 (TEC)	4d	17	2f
Anthracene	20	1a	30	3b	0.0572 (TEC)	d	17	2f
Benzo(a)anthracene	20	1a	30	3b	0.110 (TEC)	d	17	2f
Benzo(a)pyrene	20	1a	30	3b	0.15 (TEC)	d	17	2f
Benzo(b)fluoranthene	20	1a	30	3b	0.037 (ERL)	c	17	2f
Benzo(g,h,i)perylene	20	1a	30	3b	0.15 (TEC)	4d	17	2f
Benzo(k)fluoranthene	20	1a	30	3b	0.037 (ERL)	c	17	2f
Benzoic acid	--		--		--		42	f
bis(2-Ethylhexyl)phthalate	--		--		13.3	c	0.3	f
Chrysene	20	1a	30	3b	0.170 (TEC)	d	17	2f
Dibenzo(a,h)anthracene	20	1a	30	3b	0.033 (TEC)	d	17	2f
Dibenzofuran	--		--		5.1	g	--	
Fluoranthene	20	1a	30	3b	0.423 (TEC)	d	39.8	f
Fluorene	20	1a	30	b	0.0774 (TEC)	d	17	2f
Indeno(1,2,3-cd)pyrene	20	1a	30	3b	0.03 (ERL)	c	17	2f
Naphthalene	20	1a	30	3b	0.176 (TEC)	d	62	f
Phenanthrene	20	1a	30	3b	0.204 (TEC)	d	17	2f
Pyrene	20	1a	30	3b	0.2 (TEC)	d	17	2f
Polychlorinated Biphenyls								
Aroclor-1254	40	a	2.51	b	0.06 (TEC)	d	0.014	e
Aroclor-1260	40	a	2.51	b	0.06 (TEC)	d	0.014	e
Dioxin/Furan								
2,3,7,8-TCDD	--		500	c	0.00041	c	0.00001	g
Inorganics								
Antimony	5	a	--		64 (AET)	c	300	k
Arsenic	10	a	60	b	9.79 (LEL)	d	150	e
Barium	500	a	3000	2b	20	c	41,000	k
Beryllium	10	a	40	i	--		7.3	k
Boron	0.5	a	20	2b	--		750	f
Cadmium	4	a	20	b	5 (PEC)	d	0.08	e
Chromium	1	a	0.4	b	110 (PEC)	d	11 Cr(VI)	e
Copper	100	a	50	b	150 (PEC)	d	2.3	e
Iron	--		200	2b	2,000,000	h	1000	e
Lead	50	a	500	b	130 (PEC)	d	0.4	e
Lithium	2	a	10	2b	--		--	
Manganese	500	a	100	2b	630	g	--	
Mercury	0.3	a	0.1	b	0.18 (TEC)	d	0.77	e
Nickel	30	a	200	b	49 (PEC)	d	13.3	e
Selenium	1	a	70	b	0.1 (AET)	c	5	e
Silver	2	a	50	2b	4.5 (AET)	c	0.12	c
Thallium	1	a	--		--		110	k
Zinc	50	a	200	b	460 (PEC)	d	30.2	e

Notes:

1) Values for Acenaphthene are used in the absence of specific PAH TRVs.

2) Values protective of microbial processes are used in the absence of terrestrial invertebrate TRVs.

3) Values for Fluorene are used in the absence of specific PAH TRVs.

4) Values for Benzo(a)pyrene are used in the absence of specific PAH TRVs.

Sources:

a - Efroymson et al., 1997b

b - Efroymson et al., 1997a

c - US EPA, 1999

d - McDonald et al., 2000; MADEP, 2006c

f - Suter & Tsao, 1996

g - NOAA, 1999

h - Persaud et al., 1993

i - US EPA Eco SSLs, 2007

j - Jones et al., 1997

k - MADEP, 2006b (MCP GW.xls; Sheet SW Target)

-- No criterion available

TEC = Threshold Effects Concentration

PEC = Probable Effects Concentration

AET = Apparent Effects Threshold

ERL = Effects Range Low

LEL = Lowest Effects Level

(based on 20 mg/L hardness for hardness-dependent metals)

**Table 3-8
Toxicity Reference Values (TRVs) for Avian and Mammalian Receptors
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Avian		Ref	Short-tailed Shrew		Eastern Cottontail		Raccoon		Red Fox		Mink		Ref
	NOAEL (mg/kg-d)	LOAEL (mg/kg-d)		NOAEL (mg/kg-d)	LOAEL (mg/kg-d)									
<i>Dioxin/Furans</i>														
Dioxin/Furan TEQ	0.000014	0.00014		2.13E-06	2.13E-05	7.32E-07	7.32E-06	5.00E-07	5.00E-06	5.28E-07	5.28E-06	7.69E-07	7.69E-06	
<i>Extractable Petroleum Hydrocarbons</i>														
Adjusted C11-C22 Aromatics	--	--		15.3	45.8	5.2	16	3.6	10.8	3.8	11.4	5.5	16.5	2h5
<i>Inorganics</i>														
Antimony	840	2520	g	0.1	1.4	0.05	0.49	0.03	0.3	0.04	0.4	0.1	0.5	
Arsenic	5.14	12.8		0.1	1.5	0.05	0.50	0.03	0.3	0.04	0.4	0.1	0.5	
Barium	20.8	41.7		5.4	54.1	1.9	19	1.3	12.7	1.3	13.4	2.0	19.5	
Beryllium	--	--		1.4	4.2	0.5	1	0.3	1.0	0.3	1.0	0.5	1.5	2m
Boron	28.8	100		59.6	199.4	20.5	69	14.0	46.8	14.8	49.4	21.5	72.0	
Cadmium	1.45	20.0		2.1	21.3	0.7	7	0.5	5.0	0.5	5.3	0.8	7.7	
Chromium	1	5.0		5830.1	17490.4	2003.1	6009	1368.5	4105.5	1445.4	4336.2	2105.2	6315.6	2
Copper	47	61.7		32.4	41.9	11.1	14	7.6	9.8	8.0	10.4	11.7	15.1	
Iron	--	--		21.3	7.1	7.3	2	5.0	1.7	5.3	1.8	7.7	2.6	
Lead	1.13	11.3		17.0	170.4	5.9	59	4.0	40.0	4.2	42.2	6.2	61.5	
Lithium	28.35	85.1	j	20.0	40.0	6.9	14	4.7	9.4	5.0	9.9	7.2	14.5	
Manganese	977	9770		187.5	605.0	64.4	208	44.0	142.0	46.5	150.0	67.7	218.4	2
Mercury	0.45	0.9		0.1	0.3	0.02	0.12	0.02	0.1	0.02	0.1	0.02	0.1	
Nickel	77.4	107		85.2	170.4	29.3	59	20.0	40.0	21.1	42.2	30.8	61.5	
Selenium	0.44	1.5		0.4	0.7	0.1	0	0.1	0.2	0.1	0.2	0.2	0.3	
Silver	6.22	62.2	c	70.0	700.0	24.0	240	16.4	164.3	17.4	173.5	25.3	252.7	
Thallium	0.06	0.6	d	0.02	0.2	0.01	0.05	0.004	0.04	0.004	0.04	0.01	0.1	e
Zinc	14.5	130.9		340.8	681.6	117.1	234	80.0	160.0	84.5	169.0	123.1	246.1	
<i>Polychlorinated Biphenyls</i>														
Aroclor-1254	0.6	1.2	b	0.3	0.6	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	f
Aroclor-1260	1.18	2.4	4	0.5	1.2	0.2	0.4	0.1	0.3	0.1	0.3	0.2	0.4	f
Total PCBs	0.6	1.2	b	0.3	0.6	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	f
<i>Semivolatile Organic Compounds</i>														
Acenaphthene	--	--		201.7	403.4	69.3	139	47.3	94.7	50.0	100.0	72.8	145.7	i
Acenaphthylene	--	--		201.7	403.4	69.3	139	47.3	94.7	50.0	100.0	72.8	145.7	i
Anthracene	14.3	143	3	115.3	1152.6	39.6	396	27.1	270.5	28.6	285.7	41.6	416.2	3
Benzo(a)anthracene	1.43	14.3	3	11.5	115.3	4.0	40	2.7	27.1	2.9	28.6	4.2	41.6	3
Benzo(a)pyrene	0.143	1.43	a	1.2	11.5	0.4	4	0.3	2.7	0.3	2.9	0.4	4.2	3
Benzo(b)fluoranthene	1.43	14.3	3	11.5	115.3	4.0	40	2.7	27.1	2.9	28.6	4.2	41.6	3
Benzo(g,h,i)perylene	14.3	143	3	115.3	1152.6	39.6	396	27.1	270.5	28.6	285.7	41.6	416.2	3
Benzo(k)fluoranthene	14.3	143	3	115.3	1152.6	39.6	396	27.1	270.5	28.6	285.7	41.6	416.2	3
Bis(2-ethylhexyl)phthalate	1.1	11		21.1	210.9	7.2	72	5.0	49.5	5.2	52.3	7.6	76.2	
Chrysene	14.3	143	3	115.3	1152.6	39.6	396	27.1	270.5	28.6	285.7	41.6	416.2	3
Fluoranthene	--	--		15.2	152.1	5.2	52	3.6	35.7	3.8	37.7	5.5	54.9	i
Fluorene	--	--		14.4	28.8	4.9	10	3.4	6.8	3.6	7.1	5.2	10.4	i
Indeno(1,2,3-cd)pyrene	1.43	14.3	3	11.5	115.3	4.0	40	2.7	27.1	2.9	28.6	4.2	41.6	3

Table 3-8
Toxicity Reference Values (TRVs) for Avian and Mammalian Receptors
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Avian			Short-tailed Shrew		Eastern Cottontail		Raccoon		Red Fox		Mink		Ref
	NOAEL	LOAEL	Ref	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	
	(mg/kg-d)			(mg/kg-d)		(mg/kg-d)		(mg/kg-d)		(mg/kg-d)		(mg/kg-d)		
Phenanthrene	--	--		86.4	864.4	29.7	297	20.3	202.9	21.4	214.3	31.2	312.1	7
Pyrene	--	--		86.4	864.4	29.7	297	20.3	202.9	21.4	214.3	31.2	312.1	i
Volatile Organic Compounds														
1,1-Dichloroethene	--	--		63.9	191.7	22.0	66	15.0	45.0	15.8	47.5	23.1	69.2	2
2-Butanone	--	--		308.9	926.6	106.1	318	72.5	217.5	76.6	229.7	111.5	334.6	
4-Isopropyltoluene	--	--		505.9	1517.7	173.8	521	118.8	356.3	125.4	376.3	182.7	548.0	2h5
4-Methyl-2-Pentanone	--	--		53.3	159.8	18.3	55	12.5	37.5	13.2	39.6	19.2	57.7	2
Acetone	52000	156000	k	21.3	106.5	7.3	37	5.0	25.0	5.3	26.4	7.7	38.5	2k
Carbon Disulfide	--	--		32.0	96.0	11.0	33	7.5	22.5	7.9	23.8	11.6	34.7	i
Chloromethane	112.5	337.5	2j5	191.7	575.1	65.9	198	45.0	135.0	47.5	142.6	69.2	207.7	2h5
Methylene Chloride	--	--		12.5	106.5	4.3	37	2.9	25.0	3.1	26.4	4.5	38.5	
tert-Butyl Alcohol	--	--		--	--	--	--	--	--	--	--	--	--	
m+p-Xylenes	--	--		2.4	3.0	0.8	1	0.6	0.7	0.6	0.7	0.9	1.1	
Toluene	--	--		30.0	299.7	10.3	103	7.0	70.3	7.4	74.3	10.8	108.2	
Volatile Petroleum Hydrocarbons														
Adjusted C9-C10 Aromatics	--	--		4.2	12.5	1.4	4	1.0	2.9	1.0	3.1	1.5	4.5	2h6
Adjusted C9-C12 Aliphatics	--	--		4.2	12.5	1.4	4	1.0	2.9	1.0	3.1	1.5	4.5	2h6

Notes:

-- No criterion available

TRVs from Sample et al. (1996) unless otherwise noted.

- 1) TRV for Aroclor 1254 used for other PCBs.
- 2) No published LOAEL. LOAEL estimated as NOAEL x 3.
- 3) PAHs based benzo(a)pyrene and Toxicity Equivalency Factors.
- 4) PCBs are adjusted based on relative dioxin-like TEF ratio.
- 5) NOAEL is the LD50 divided by an uncertainty factor of 20.
- 6) The NOAEL for TPH used in the absence of specific benchmark.
- 7) TRVs for pyrene used for phenanthrene.

a - Hough et al., 1993

b - US EPA, 2003

c - Peterson & Jensen, 1975

d - Bean & Hudson, 1976

e - Formigli et al., 1986

f - Bursian et al., 2003

g - Damron & Wilson, 1975

h - HSDB, 2004

i - US EPA, 2005

j - US EPA ECOTOX, 2006

k - Hill & Camardese, 1986

m - US EPA, 1999

n - Matuk et al., 1981

Table 3-9
Sediment Benchmark Values -- Benthic Macroinvertebrates -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir Samples						Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹			Average ³	Maximum	
<i>Inorganics (mg/Kg)</i>											
Antimony	3	27	11%	1.03	0.54	3.9	64	b	<1	<1	
Arsenic	40	54	74%	2.27	1.5	17.2	33	a	<1	<1	
Beryllium	16	53	30%	0.77	0.7	1.55	--		--	--	
Boron	5	19	26%	6.75	3.87	10.9	--		--	--	
Cadmium	14	53	26%	1.16	0.75	6.7	5	a	<1	1.3	SD-008-00-04-I
Chromium	57	58	98%	14.60	12	34	110	a	<1	<1	
Copper	56	58	97%	71.24	35	570	150	a	<1	3.8	SD-008-00-04-I
Lead	52	57	91%	15.05	3.8	80.8	130	a	<1	<1	
Lithium	19	19	100%	15.74	15.8	29.2	--		--	--	
Mercury	26	58	45%	0.16	0.043	2.1	0.18	a	<1	11.7	SD-008-00-04-I
Nickel	57	58	98%	20.83	18.15	55	49	a	<1	1.1	SD-008-00-04-I
Selenium	8	52	15%	2.31	2	6.4	--		--	--	
Silver	5	52	10%	0.54	0.28	2.22	4.5	b	<1	<1	
Thallium	4	52	8%	0.91	0.52	6.06	--		--	--	
Zinc	56	58	97%	162.13	115	790	460	a	<1	1.7	SD-008-00-04-I
<i>Polychlorinated Biphenyls (µg/Kg)</i>											
Aroclor-1254	91	177	51%	228.91	100	3400	59.8		3.8	56.9	SD-626-00-03I
Aroclor-1260	11	174	6%	46.65	25.65	382	59.8		<1	6.4	SD-012R
<i>Semivolatile Organic Compounds (µg/Kg)</i>											
Acenaphthene	2	26	8%	292.42	222.5	160	150	d		1.1	SD-011-05-09-I
Anthracene	3	26	12%	287.38	222.5	240	57.2			4.2	SD-011-05-09-I
Benzo(a)anthracene	5	26	19%	282.79	215	320	110		2.6	2.9	SD-011-05-09-I
Benzo(a)pyrene	3	26	12%	294.25	230	270	150			1.8	SD-011-05-09-I
Benzo(g,h,i)perylene	2	26	8%	293.40	222.5	120	150	d		<1	
Bis(2-ethylhexyl)phthalate	2	26	8%	293.42	222.5	140	13300	b	<1	<1	
Chrysene	6	26	23%	259.38	207.5	290	170		1.5	1.7	SD-011-05-09-I
Fluorene	3	26	12%	280.82	215	180	77			2.3	SD-011-05-09-I
Indeno(1,2,3-cd)pyrene	2	26	8%	293.07	222.5	110	30	b		3.7	SD-011-05-09-I
<i>Volatile Organic Compounds (µg/Kg)</i>											
1,1-Dichloroethene	8	15	53%	10.00	4.3	40	31	c	<1	1.3	SD-017-00-04-I
1,2,4-Trimethylbenzene	1	15	7%	2.98	2.5	4.2	--		--	--	
2-Butanone	10	15	67%	28.27	5.4	140	270	c	<1	<1	
4-Methyl-2-Pentanone	1	15	7%	2.89	2.5	2.8	--		--	--	
Carbon Disulfide	2	15	13%	3.33	2.5	8.8	--		--	--	
Toluene	6	15	40%	14.56	6.5	52	670	e	<1	<1	
<i>Volatile Petroleum Hydrocarbon (mg/Kg)</i>											
Adjusted C9-C10 Aromatics	3	11	27%	0.37	0.097	1.19	--		--	--	

Notes: Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

-- No criterion available

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

d - Screening values for Benzo(a)pyrene used.

b - Freshwater Sediment Toxicity Reference Value (US EPA, 1999).

e - Sediment quality benchmarks (SQBs) by equilibrium partitioning. (US EPA, 1996b).

c - Secondary Chronic Value (SCV) from Efrogmson et al. (1997a).

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 3-10

**PCB and PAH Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Sherman Reservoir						Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹			Average	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>											
Aroclor-1254	91	177	51%	228.91	100.00	3400.00	676	a	<1	5.0	SD-626-00-03I
Aroclor-1260	11	174	6%	46.65	25.65	382.00	676	a	<1	<1	
<i>Semivolatile Organic Compounds (ug/kg)</i>											
Acenaphthene	1	26	4%	291.78	222.50	25.40	12040	c	<1	<1	
Anthracene	1	26	4%	301.42	222.50	698.00	845	a	<1	<1	
Benzo(a)anthracene	2	26	8%	292.42	222.50	160.00	1050	a	<1	<1	
Benzo(a)pyrene	3	26	12%	287.38	222.50	240.00	1450	a	<1	<1	
Benzo(g,h,i)perylene	5	26	19%	282.79	215.00	320.00	27520	b	<1	<1	
Chrysene	2	26	8%	291.47	222.50	86.00	1290	a	<1	<1	
Fluorene	6	26	23%	259.38	207.50	290.00	536	a	<1	<1	
Indeno(1,2,3-cd)pyrene	1	26	4%	295.54	222.50	120.00	27520	b	<1	<1	

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic Carbon Normalized benchmarks were converted to sediment based concentrations using mean Sherman Reservoir total organic carbon (TOC) value of 86,063 mg/kg (8.6%).

Table 3-11
Sediment Benchmark Values -- Benthic Macroinvertebrates -- Cooling Water Discharge Area
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir - Cooling Water Discharge Area					Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum ¹			Average ³	Maximum	
<i>Inorganics (mg/kg)</i>										
Antimony	1	13	8%	1.41	2.21	64	b	<1	<1	
Arsenic	13	15	87%	4.51	17.20	33	a	<1	<1	
Beryllium	11	15	73%	0.79	1.55	--		--	--	
Boron	3	14	21%	7.10	10.40	--		--	--	
Cadmium	11	15	73%	2.28	6.70	5	a	<1	1.3	SD-008-00-04-I
Chromium	15	15	100%	14.90	32.00	110	a	<1	<1	
Copper	15	15	100%	177.27	570.00	150	a	1.2	3.8	SD-008-00-04-I
Lead	15	15	100%	28.55	64.90	130	a	<1	<1	
Lithium	14	14	100%	16.26	29.20	--		--	--	
Mercury	13	15	87%	0.47	2.10	0.18	a	2.6	11.7	SD-008-00-04-I
Nickel	15	15	100%	28.89	55.00	49	a	<1	1.1	SD-008-00-04-I
Selenium	6	15	40%	2.30	4.60	--		--	--	
Silver	5	15	33%	1.20	2.22	4.5	b	<1	<1	
Thallium	4	15	27%	1.95	6.06	--		--	--	
Zinc	15	15	100%	269.10	790.00	460	a	<1	1.7	SD-008-00-04-I
<i>Polychlorinated Biphenyls (ug/Kg)</i>										
Aroclor-1254	5	18	28%	168.11	1660.00	59.8		2.8	27.8	SD-008R2
Aroclor-1260	4	18	22%	30.81	251.00	59.8		<1	4.2	SD-008R2
<i>Semivolatile Organic Compounds (ug/Kg)</i>										
Acenaphthene	1	10	10%	350.90	25.50	150	c		<1	
Anthracene	1	10	10%	334.77	57.70	57.2			1.0	SD-056
Benzo(a)anthracene	1	10	10%	334.91	59.10	110			<1	
Benzo(g,h,i)perylene	0	10	0%	ND	ND	150	c	ND	ND	
Bis(2-ethylhexyl)phthalate	0	10	0%	ND	ND	13300	b	ND	ND	
Chrysene	2	10	20%	277.89	65.80	170			<1	
Fluorene	2	10	20%	318.72	28.90	77			<1	
Indeno(1,2,3-cd)pyrene	0	10	0%	ND	ND	30	b	ND	ND	
<i>Volatile Organic Compounds (ug/Kg)</i>										
1,1-Dichloroethene	0	1	0%	ND	ND	31	e	ND	ND	
1,2,4-Trimethylbenzene	0	1	0%	ND	ND	--		ND	ND	
2-Butanone	0	1	0%	ND	ND	270	e	ND	ND	
4-Methyl-2-Pentanone	0	1	0%	ND	ND	--		ND	ND	
Carbon Disulfide	0	1	0%	ND	ND	0.85	e	ND	ND	
Toluene	1	1	100%	11.00	11.00	670	d	<1	<1	
<i>Volatile Petroleum Hydrocarbons (mg/Kg)</i>										
Adjusted C9-C10 Aromatics	3	9	33%	0.43	1.19	--		--	--	

Notes: Averages calculated using those detected and 1/2 the detection limit of those not detected.

-- No criterion available

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

ND - Not Detected

2) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

d - Sediment quality benchmarks (SQBs) by equilibrium partitioning (US EPA, 1996b).

b - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

e - Secondary Chronic Value (SCV) from Efrogmson et al. (1997a).

c - Screening values for Benzo(a)pyrene used.

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 3-12

**PCB and PAH Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- Cooling Water Discharge Area
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Sherman Reservoir - Cooling Water Discharge Area					Sediment Benchmark ²	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum ¹		Average ³	Maximum	
<i>Polychlorinated Biphenyls (ug/Kg)</i>									
Aroclor-1254	5	18	28%	168.11	1660.00	676 a	<1	2.5	SD-008R2
Aroclor-1260	4	18	22%	30.81	251.00	676 a	<1	<1	
<i>Semivolatile Organic Compounds (ug/Kg)</i>									
Acenaphthene	1	10	10%	350.90	25.50	12040 c	<1	<1	
Anthracene	1	10	10%	334.77	57.70	845 a	<1	<1	
Benzo(a)anthracene	1	10	10%	334.91	59.10	1050 a	<1	<1	
Benzo(a)pyrene	0	10	0%	ND	ND	1450 a	ND	ND	
Benzo(g,h,i)perylene	0	10	0%	ND	ND	27520 b	ND	ND	
Bis(2-ethylhexyl)phthalate	0	10	0%	ND	ND	17157 c	ND	ND	
Chrysene	2	10	20%	277.89	65.80	1290 a	<1	<1	
Fluorene	2	10	20%	318.72	28.90	536 a	<1	<1	
Indeno(1,2,3-cd)pyrene	0	10	0%	ND	ND	27520 b	ND	ND	

Notes:

ND - Not Detected

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic Carbon Normalized benchmarks were converted to sediment based concentrations using mean Sherman Reservoir total organic carbon (TOC) value of 86,063 mg/kg (8.6%).

Table 3-13
Sediment Benchmark Values -- Benthic Macroinvertebrates -- Sherman Reservoir Cooling Water Intake Area
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir - Cooling Water Intake Area					Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum ¹			Average ³	Maximum	
<i>Inorganics (mg/kg)</i>										
Antimony	0	6	0%	ND	ND	64	b	ND	ND	
Arsenic	5	7	71%	1.39	2.51	33	a	<1	<1	
Beryllium	4	7	57%	0.72	1.11	--		--	--	
Boron	1	4	25%	4.49	10.20	--		--	--	
Cadmium	2	7	29%	0.56	0.88	5	a	<1	<1	
Chromium	6	7	86%	7.05	11.50	110	a	<1	<1	
Copper	5	7	71%	42.47	105.00	150	a	<1	<1	
Lead	5	7	71%	29.80	80.80	130	a	<1	<1	
Lithium	4	4	100%	11.55	16.20	--		--	--	
Mercury	1	7	14%	0.03	0.05	0.18	a	<1	<1	
Nickel	6	7	86%	21.02	42.70	49	a	<1	<1	
Selenium	0	7	0%	ND	ND	--		ND	ND	
Silver	0	7	0%	ND	ND	4.5	b	ND	ND	
Thallium	0	7	0%	ND	ND	--		ND	ND	
Zinc	6	7	86%	192.11	459.00	460	a	<1	<1	
<i>Polychlorinated Biphenyls (ug/kg)</i>										
Aroclor-1254	10	10	100%	473.40	2200.00	59.8		7.9	36.8	SD-012R
Aroclor-1260	7	10	70%	68.63	382.00	59.8		1.1	6.4	SD-012R
<i>SemiVolatile Organic Compounds (ug/kg)</i>										
Acenaphthene	1	4	25%	166.00	160.00	150	c		1.1	SD-011-05-09-I
Anthracene	2	4	50%	173.55	240.00	57.2		3.0	4.2	SD-011-05-09-I
Benzo(a)anthracene	3	4	75%	168.38	320.00	110		1.5	2.9	SD-011-05-09-I
Benzo(a)pyrene	3	4	75%	147.63	270.00	150		<1	1.8	SD-011-05-09-I
Benzo(g,h,i)perylene	2	4	50%	142.08	120.00	150	c	<1	<1	
Bis(2-ethylhexyl)phthalate	2	4	50%	142.25	140.00	13300	b	<1	<1	
Chrysene	3	4	75%	161.23	290.00	170		<1	1.7	SD-011-05-09-I
Fluorene	1	4	25%	171.00	180.00	77		2.2	2.3	SD-011-05-09-I
Indeno(1,2,3-cd)pyrene	2	4	50%	139.93	110.00	30	b		3.7	SD-011-05-09-I
<i>Volatile Organic Compounds (ug/kg)</i>										
1,1-Dichloroethene	0	2	0%	ND	ND	31	e	ND	ND	
1,2,4-Trimethylbenzene	1	2	50%	3.35	4.20	--		--	--	
2-Butanone	2	2	100%	6.00	6.60	270	d	<1	<1	
4-Methyl-2-Pentanone	0	2	0%	ND	ND	--		ND	ND	
Carbon Disulfide	0	2	0%	ND	ND	0.85	e	ND	ND	
Toluene	0	2	0%	ND	ND	670	d	ND	ND	
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>										
Adjusted C9-C10 Aromatics	0	2	0%	ND	ND	--		ND	ND	

Notes: Averages calculated using those detected and 1/2 the detection limit of those not detected.

-- No criterion available

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

ND - Not Detected

2) Threshold Effects Concentration (TEC) values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) as recommended by MADEP (2006c).

b - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

c - Screening values for Benzo(a)pyrene used.

d - Sediment quality benchmarks (SQBs) by equilibrium partitioning (US EPA, 1996)

e - Secondary Chronic Value (SCV) from Efroymson et al. (1997a).

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 3-14

**PCB and PAH Probable Effects Concentration Sediment Benchmark Values --Benthic Macroinvertebrates -- Sherman Reservoir Cooling Water Intake Area
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Sherman Reservoir - Cooling Water Intake Area					Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum ¹			Average	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>										
Aroclor-1254	10	10	100%	473.40	2200.00	676	a	<1	3.3	SD-012R
Aroclor-1260	7	10	70%	68.63	382.00	676	a	<1	<1	
<i>SemiVolatile Organic Compounds (ug/kg)</i>										
Acenaphthene	1	4	25%	166.00	160.00	12040	c	<1	<1	
Anthracene	2	4	50%	173.55	240.00	845	a	<1	<1	
Benzo(a)anthracene	3	4	75%	168.38	320.00	1050	a	<1	<1	
Benzo(a)pyrene	3	4	75%	147.63	270.00	1450	a	<1	<1	
Benzo(g,h,i)perylene	2	4	50%	142.08	120.00	27520	b	<1	<1	
Bis(2-ethylhexyl)phthalate	2	4	50%	142.25	140.00	17157	c	<1	<1	
Chrysene	3	4	75%	161.23	290.00	1290	a	<1	<1	
Fluorene	1	4	25%	171.00	180.00	536	a	<1	<1	
Indeno(1,2,3-cd)pyrene	2	4	50%	139.93	110.00	27520	b	<1	<1	

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic carbon normalized benchmarks converted to sediment based concentrations using mean Sherman Reservoir total organic carbon value of 86,063 mg/kg (8.6%).

Table 3-15
Sediment Benchmark Values -- Benthic Macroinvertebrates -- East Storm Discharge Area
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir - East Storm Discharge Area					Sediment Benchmark ¹	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum		Average	Maximum	
<i>Inorganics (mg/kg)</i>									
Antimony									
Arsenic	4	4	100%	1.12	1.5	33 a	<1	<1	
Beryllium	0	4	0%	ND	ND	--	ND	ND	
Boron									
Cadmium	0	4	0%	ND	ND	5 a	ND	ND	
Chromium	4	4	100%	16.50	22.0	110 a	<1	<1	
Copper	4	4	100%	30.95	65.0	150 a	<1	<1	
Lead	5	5	100%	18.54	57.0	130 a	<1	<1	
Lithium									
Mercury	0	4	0%	ND	ND	0.18 a	ND	ND	
Nickel	4	4	100%	17.98	26.0	49 a	<1	<1	
Selenium	0	4	0%	ND	ND	--	ND	ND	
Silver	0	4	0%	ND	ND	4.5 d	ND	ND	
Thallium	0	4	0%	ND	ND	--	ND	ND	
Zinc	4	4	100%	123.00	220.0	460 a	<1	<1	
<i>Polychlorinated Biphenyls (ug/kg)</i>									
Aroclor-1254	68	98	69%	282.02	3400.0	59.8	4.7	56.9	SD-626-00-031
Aroclor-1260	0	98	0%	ND	ND	59.8	ND	ND	
<i>SemiVolatile Organic Compounds (ug/kg)</i>									
Acenaphthene	0	2	0%	ND	ND	150 e	ND	ND	
Anthracene	0	2	0%	ND	ND	57.2	ND	ND	
Benzo(a)anthracene	0	2	0%	ND	ND	110	ND	ND	
Benzo(a)pyrene	0	2	0%	ND	ND	150	ND	ND	
Benzo(g,h,i)perylene	0	2	0%	ND	ND	150 e	ND	ND	
Bis(2-ethylhexyl)phthalate	0	2	0%	ND	ND	13300 d	ND	ND	
Chrysene	0	2	0%	ND	ND	170	ND	ND	
Fluorene	0	2	0%	ND	ND	77	ND	ND	
Indeno(1,2,3-cd)pyrene	0	2	0%	ND	ND	30 d	ND	ND	
<i>Volatile Organic Compounds (ug/kg)</i>									
1,1-Dichloroethene	1	2	50%	13.25	24.0	31 b	<1	<1	
1,2,4-Trimethylbenzene	0	2	0%	ND	ND	--	ND	ND	
2-Butanone	2	2	100%	84.50	140.0	270 b	<1	<1	
4-Methyl-2-Pentanone	0	2	0%	ND	ND	--	ND	ND	
Carbon Disulfide	0	2	0%	ND	ND	0.85 b	ND	ND	
Toluene	1	2	50%	18.25	34.0	670 c	<1	<1	
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>									
Adjusted C9-C10 Aromatics									

Notes: Averages calculated using those detected and 1/2 the detection limit of those not detected.

-- No criterion available

1) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

ND - Not Detected

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

d - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

b - Secondary Chronic Value (SCV) from Efroymsen et al. (1997a).

e - Screening values for Benzo(a)pyrene used.

c - Sediment quality benchmarks (SQBs) by equilibrium partitioning (US EPA, 1996b).

Table 3-16

**PCB Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- East Storm Discharge Area
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Sherman Reservoir - East Storm Discharge Area					Sediment Benchmark ¹	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum		Average	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>									
Aroclor-1254	68	98	69%	282.02	3400.0	676 a	<1	5.0	SD-626-00-03I
Aroclor-1260	0	98	0%	ND	ND	676 a	ND	ND	
<i>SemiVolatile Organic Compounds (ug/kg)</i>									
Acenaphthene	0	2	0%	ND	ND	12040 c	ND	ND	
Anthracene	0	2	0%	ND	ND	845 a	ND	ND	
Benzo(a)anthracene	0	2	0%	ND	ND	1050 a	ND	ND	
Benzo(a)pyrene	0	2	0%	ND	ND	1450 a	ND	ND	
Benzo(g,h,i)perylene	0	2	0%	ND	ND	27520 b	ND	ND	
Bis(2-ethylhexyl)phthalate	0	2	0%	ND	ND	17157 c	ND	ND	
Chrysene	0	2	0%	ND	ND	1290 a	ND	ND	
Fluorene	0	2	0%	ND	ND	536 a	ND	ND	
Indeno(1,2,3-cd)pyrene	0	2	0%	ND	ND	27520 b	ND	ND	

Notes:

ND - Not Detected

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic carbon normalized benchmarks converted to sediment based concentrations using mean Sherman Reservoir total organic carbon value of 86,063 mg/kg (8.6%).

Table 3-17
Sediment Benchmark Values -- Benthic Macroinvertebrates -- East Storm Drain Area 2
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir East Storm Drain Areas 2 Samples					Sediment Benchmark ¹		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum			Average	Maximum	
<i>Inorganics (mg/kg)</i>										
Antimony										
Arsenic	1	5	20%	0.43	1.4	33	a	<1	<1	
Beryllium	0	5	0%	ND	ND	--		ND	ND	
Cadmium	0	5	0%	ND	ND	5	a	ND	ND	
Chromium	5	5	100%	17.40	22.0	110	a	<1	<1	
Copper	5	5	100%	28.40	44.0	150	a	<1	<1	
Lead	5	5	100%	1.27	2.2	130	a	<1	<1	
Lithium										
Mercury	2	5	40%	0.05	0.1	0.18	a	<1	<1	
Nickel	5	5	100%	19.40	24.0	49	a	<1	<1	
Selenium	1	5	20%	3.02	5.4	--		--	--	
Silver	0	5	0%	ND	ND	4.5	b	ND	ND	
Thallium	0	5	0%	ND	ND	--		ND	ND	
Zinc	5	5	100%	126.40	160.0	460	a	<1	<1	
<i>Polychlorinated Biphenyls (ug/kg)</i>										
Aroclor-1254	3	19	16%	108.68	430.0	59.8		1.8	7.2	SD-025-00-04-I
Aroclor-1260	0	19	0%	ND	ND	59.8		ND	ND	
<i>Semivolatile Organic Compounds (ug/kg)</i>										
Acenaphthene	0	2	0%	ND	ND	150	e	ND	ND	
Anthracene	0	2	0%	ND	ND	57.2		ND	ND	
Benzo(a)anthracene	0	2	0%	ND	ND	110		ND	ND	
Benzo(a)pyrene	0	2	0%	ND	ND	150		ND	ND	
Benzo(g,h,i)perylene	0	2	0%	ND	ND	150	e	ND	ND	
Bis(2-ethylhexyl)phthalate	0	2	0%	ND	ND	13300	b	ND	ND	
Chrysene	0	2	0%	ND	ND	170		ND	ND	
Fluorene	0	2	0%	ND	ND	77		ND	ND	
Indeno(1,2,3-cd)pyrene	0	2	0%	ND	ND	30	b	ND	ND	
<i>Volatile Organic Compounds (ug/kg)</i>										
1,1-Dichloroethene	2	2	100%	21.00	31.0	31	c	<1	1.0	SD-024-12-18-I
1,2,4-Trimethylbenzene	0	2	0%	ND	ND	--		ND	ND	
2-Butanone	2	2	100%	89.50	120.0	270	c	<1	<1	
4-Methyl-2-Pentanone	0	2	0%	ND	ND	--		ND	ND	
Carbon Disulfide	1	2	50%	4.85	5.2	--	c	--	--	
Toluene	2	2	100%	49.50	52.0	670	d	<1	<1	
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>										
Adjusted C9-C10 Aromatics										

Notes: Averages calculated using those detected and 1/2 the detection limit of those not detected.

-- No criterion available

1) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

ND - Not Detected

a - Possible Effects Concentrations used as recommended by MADEP (2006c).

d - Sediment quality benchmarks (SQBs) by equilibrium partitioning (US

b - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

e - Screening values for Benzo(a)pyrene used.

c - Secondary Chronic Value (SCV) from Efrogmson et al. (1997a).

Table 3-18

**PCB Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- East Storm Drain Area 2
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Sherman Reservoir East Storm Drain Areas 2 Samples					Sediment Benchmark ¹	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Maximum		Average	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>									
Aroclor-1254	3	19	16%	108.68	430.0	676 a	<1	<1	
Aroclor-1260	0	19	0%	ND	ND	676 a	ND	ND	
<i>Semivolatile Organic Compounds (ug/kg)</i>									
Acenaphthene	0	2	0%	ND	ND	12040 c	ND	ND	
Anthracene	0	2	0%	ND	ND	845 a	ND	ND	
Benzo(a)anthracene	0	2	0%	ND	ND	1050 a	ND	ND	
Benzo(a)pyrene	0	2	0%	ND	ND	1450 a	ND	ND	
Benzo(g,h,i)perylene	0	2	0%	ND	ND	27520 b	ND	ND	
Bis(2-ethylhexyl)phthalate	0	2	0%	ND	ND	17157 c	ND	ND	
Chrysene	0	2	0%	ND	ND	1290 a	ND	ND	
Fluorene	0	2	0%	ND	ND	536 a	ND	ND	
Indeno(1,2,3-cd)pyrene	0	2	0%	ND	ND	27520 b	ND	ND	

Notes:

ND - Not Detected

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic carbon normalized benchmarks converted to sediment based concentrations using mean Sherman Reservoir total organic carbon value of 86,063 mg/kg (8.6%).

Table 3-19
Sediment Benchmark Values -- Benthic Macroinvertebrates -- Deerfield River Adjacent to the Site
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Deerfield River Samples						Sediment Benchmark ²	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average ³	Maximum	
<i>Inorganics (mg/kg)</i>										
Arsenic	19	27	70%	2.36	1.4	24.5	33 a	<1	<1	
Boron	6	20	30%	3.11	3.65	5.53	--	--	--	
Copper	27	27	100%	19.40	11	150	150 a	<1	1.0	SD-204-00-04-I
Lead	26	27	96%	6.93	6.76	14	130 a	<1	<1	
Lithium	20	20	100%	10.47	9.85	17.4	--	--	--	
Silver	3	26	12%	0.62	0.58	2.22	4.5 b	<1	<1	
Thallium	2	26	8%	0.75	0.84	0.44	--	--	--	
<i>Polychlorinated Biphenyls (ug/kg)</i>										
Aroclor-1254	15	31	48%	107.04	20	820	59.8	1.8	13.7	SD-205-00-04-I
Aroclor-1260	4	31	13%	33.28	19	200	59.8	<1	3.3	SD-205-00-04-I
<i>Semivolatile Organic Compounds (ug/kg)</i>										
Benzo(a)anthracene	1	6	17%	234.17	207.5	330	110	2.1	3.0	SD-204-00-04-I
Benzo(g,h,i)perylene	1	6	17%	214.17	205	210	150 c	1.4	1.4	SD-204-00-04-I
Benzo(k)fluoranthene	2	6	33%	213.83	207.5	330	37 b	5.8	8.9	SD-204-00-04-I
Bis(2-ethylhexyl)phthalate	1	6	17%	199.17	200	120	13300 b	<1	<1	
Chrysene	3	6	50%	197.50	190	380	170	1.2	2.2	SD-204-00-04-I
Indeno(1,2,3-cd)pyrene	1	6	17%	212.50	200	200	30 b		6.7	SD-204-00-04-I
<i>Volatile Organic Compounds (ug/kg)</i>										
4-Isopropyltoluene	1	6	17%	2.50	2.5	2	--	--	--	
Chloromethane	1	6	17%	2.05	2.5	1.2	--	--	--	

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

b - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

c - Screening values for Benzo(a)pyrene used.

3) Blank - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 3-20

**PCB and PAH Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- Deerfield River Adjacent to the Site
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	Deerfield River Samples						Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹			Average ³	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>											
Aroclor-1254	15	31	48%	107.04	20	820	676	a	<1	1.2	SD-205-00-04-I
Aroclor-1260	4	31	13%	33.28	19	200	676	a	<1	<1	
<i>Semivolatile Organic Compounds (ug/kg)</i>											
Benzo(a)anthracene	1	6	17%	234.17	207.5	330	1050	a	<1	<1	
Benzo(g,h,i)perylene	1	6	17%	214.17	205	210	1152	b	<1	<1	
Benzo(k)fluoranthene	2	6	33%	213.83	207.5	330	4824	b	<1	<1	
Bis(2-ethylhexyl)phthalate	1	6	17%	199.17	200	120	718.2	c	<1	<1	
Chrysene	3	6	50%	197.50	190	380	1290	a	<1	<1	
Indeno(1,2,3-cd)pyrene	1	6	17%	212.50	200	200	1152	b	<1	<1	

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

Organic carbon normalized benchmarks converted to sediment based concentrations using mean Sherman Reservoir total organic carbon value of 86,063 mg/kg (8.6%).

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 3-21
Sediment Benchmark Values -- Benthic Macroinvertebrates -- West Storm Ditch (WSD)
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	TransCanada West Storm Ditch Samples						Sediment Benchmark ²	Benchmark Ratios		Location of Maximum Concentration	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum		
<i>Inorganics (mg/kg)</i>											
Antimony	1	6	17%	0.49	0.31	1.6	64	c	<1	<1	
Arsenic	6	6	100%	1.40	1.45	1.7	33	a	<1	<1	
Copper	6	6	100%	24.27	19	58	150	a	<1	<1	
Lead	10	10	100%	8.32	4.23	30	130	a	<1	<1	
Lithium	1	1	100%	9.21	9.21	9.21	--	--	--	--	
Zinc	6	6	100%	119.33	84.5	310	460	a	<1	<1	
<i>Polychlorinated Biphenyls (ug/kg)</i>											
Aroclor-1254	39	57	68%	139.83	72	950	59.8		2.3	15.9	SD-036-0004I
Aroclor-1260	15	57	26%	34.60	16.7	240	59.8		<1	4.0	SD-707-00-03I
<i>Semivolatile Organic Compounds (ug/kg)</i>											
2-Methylnaphthalene	1	12	8%	205	200	280	150	f	1.4	1.9	SD-303-00-04-I
Acenaphthene	3	12	25%	318	200	1800	150	f	2.1	12.0	SD-303-00-04-I
Anthracene	4	12	33%	354	200	2200	57.2		6.2	38.5	SD-303-00-04-I
Benzo(a)anthracene	8	12	67%	773	200	6600	110		7.0	60.0	SD-303-00-04-I
Benzo(a)pyrene	8	12	67%	707	200	5800	150		4.7	38.7	SD-303-00-04-I
Benzo(b)fluoranthene	6	12	50%	679	200	5600	37	e	18.4	151.4	SD-303-00-04-I
Benzo(g,h,i)perylene	6	12	50%	429	197.5	2900	150	f	2.9	19.3	SD-303-00-04-I
Benzo(k)fluoranthene	7	12	58%	581	200	4600	37	c	15.7	124.3	SD-303-00-04-I
Benzoic acid	1	12	8%	851	950	130	--	--	--	--	
Bis(2-ethylhexyl)phthalate	6	12	50%	175	190	200	13300	c	<1	<1	
Carbazole	1	12	8%	365	200	2200	--	--	--	--	
Chrysene	9	12	75%	739	200	6200	170		4.3	36.5	SD-303-00-04-I
Dibenzo(a,h)anthracene	1	12	8%	246	200	770	33		7.5	23.3	SD-303-00-04-I
Dibenzofuran	1	12	8%	290	200	1300	5100	b	<1	<1	
Fluoranthene	11	12	92%	1584	375	14000	420		3.8	33.3	SD-303-00-04-I
Fluorene	2	12	17%	332	200	1900	77		4.3	24.7	SD-303-00-04-I
Indeno(1,2,3-cd)pyrene	6	12	50%	418	197.5	2900	30	c	13.9	96.7	SD-303-00-04-I
Naphthalene	1	12	8%	221	200	470	180		1.2	2.6	SD-303-00-04-I
Phenanthrene	8	12	67%	1392	240	13000	200		7.0	65.0	SD-303-00-04-I
Pyrene	8	12	67%	1177	250	9900	200		5.9	49.5	SD-303-00-04-I
<i>Volatile Organic Compounds (ug/kg)</i>											
Methylene Chloride	1	5	20%	6.22	7.5	1.1	18000	d	<1	<1	

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

d - Lowest Chronic Value (LCV) from Efroymson et al. (1997a)

b - Upper Effects Threshold (UET) from NOAA (1999).

e - Secondary Chronic Value (SCV) from Efroymson et al. (1997c)

c - Freshwater Sediment Toxicity Reference Values (US EPA, 1999).

f - Screening values for Benzo(a)pyrene used.

Table 3-22

**PCB and PAH Probable Effects Concentration Sediment Benchmark Values -- Benthic Macroinvertebrates -- West Storm Drain (WSD)
Yankee Nuclear Power Station, Rowe, MA**

Oil or Hazardous Material	TransCanada West Storm Drain Samples						Sediment Benchmark ²		Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹			Average	Maximum	
<i>Polychlorinated Biphenyls (ug/kg)</i>											
Aroclor-1254	39	57	68%	139.83	72	950	676	a	<1	1.4	SD-302-00-04-I
Aroclor-1260	15	57	26%	34.60	16.7	240	676	a	<1	<1	
<i>Semivolatile Organic Compounds (ug/kg)</i>											
2-Methylnaphthalene	1	12	8%	205	200	280	561	d	<1	<1	
Acenaphthene	3	12	25%	318	200	1800	504	c	<1	3.6	SD-303-00-04-I
Anthracene	4	12	33%	354	200	2200	845	a	<1	2.6	SD-303-00-04-I
Benzo(a)anthracene	8	12	67%	773	200	6600	1050	a	<1	6.3	SD-303-00-04-I
Benzo(a)pyrene	8	12	67%	707	200	5800	1450	a	<1	4.0	SD-303-00-04-I
Benzo(b)fluoranthene	6	12	50%	679	200	5600	1450	e	<1	3.9	SD-303-00-04-I
Benzo(g,h,i)perylene	6	12	50%	429	197.5	2900	1152	b	<1	2.5	SD-303-00-04-I
Benzo(k)fluoranthene	7	12	58%	581	200	4600	4824	b	<1	<1	
Benzoic acid	1	12	8%	851	950	130	--		--	--	
Bis(2-ethylhexyl)phthalate	6	12	50%	175	190	200	718.2	c	<1	<1	
Carbazole	1	12	8%	365	200	2200	--		--	--	
Chrysene	9	12	75%	739	200	6200	1290	a	<1	4.8	SD-303-00-04-I
Dibenzo(a,h)anthracene	1	12	8%	246	200	770	468	b	<1	1.6	SD-303-00-04-I
Dibenzofuran	1	12	8%	290	200	1300	--		--	--	
Fluoranthene	11	12	92%	1584	375	14000	2230	a	<1	6.3	SD-303-00-04-I
Fluorene	2	12	17%	332	200	1900	536	a	<1	3.5	SD-303-00-04-I
Indeno(1,2,3-cd)pyrene	6	12	50%	418	197.5	2900	1152	b	<1	2.5	SD-303-00-04-I
Naphthalene	1	12	8%	221	200	470	561	a	<1	<1	
Phenanthrene	8	12	67%	1392	240	13000	1170	a	1.2	11.1	SD-303-00-04-I
Pyrene	8	12	67%	1177	250	9900	1520	a	<1	6.5	SD-303-00-04-I

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Sediment benchmark source:

a - Probable Effects Concentration (PEC) from MacDonald et al. (2000).

b - Organic carbon normalized Severe Effects Level from Persaud et al. (1993).

c - Organic carbon normalized Sediment Criteria from NYDEC (1998).

d - Benchmark value for Naphthalene used.

e - Benchmark value for Benzo(a)pyrene used.

Organic Carbon Normalized benchmarks were converted to sediment based concentrations using mean Deerfield River total organic carbon (TOC) value of 3,565 mg/kg (0.36%).

Table 3-23

Comparison of Whole-Body Fish Tissue Chemical Residue to TRVs
Yankee Nuclear Power Station, Rowe, MA

Location:		Harriman Reservoir		Sherman Pond				Tissue Residue of Representative Fish Species (mg/kg) ¹					
Sample ID:		FH-01/02	FH-01/02	FH-11/12	FH-11/12	FH-FD-12	FH-FD-12	Rainbow Trout	Brown Trout	Bass	Bullhead	Bluegill	Carp
Oil or Hazardous Materials	Units	Rainbow trout	Yellow perch	Brown Trout	Yellow perch	Brown Trout	Yellow perch						
<i>Inorganics</i>													
Cadmium	mg/kg	0.062	0.13	0.029	0.074	0.05	0.03	0.38	18.2	--	--	4.2 ^a	--
Chromium	mg/kg	0.96	0.49	0.44	0.409	0.69	0.52	1.98	--	--	--	--	--
Copper	mg/kg	0.91	1.3	1.2	0.452	2.3	0.3	34	3.4	--	2.0	2.4	--
Mercury	mg/kg	0.0871	0.177	0.184	0.136	0.1	0.103	0.7 ^{a,b}	2.9 ^b	--	--	6.5 ^a	0.28
Nickel	mg/kg	0.93	0.28	0.14	0.352	0.78	0.46	2.92	--	--	--	--	36.40
Silver	mg/kg	0.054	ND	ND	ND	0.066	ND	--	--	0.07 ^c	--	0.06	--
Zinc	mg/kg	24.7	28.6	11.6	31.3	48.9	17.2	60 ^b	60 ^b	--	--	--	--
<i>Polychlorinated Biphenyls</i>													
Aroclor-1254	mg/kg	0.012	ND	0.015		0.012		3.7	--	--	--	--	--
Aroclor-1260	mg/kg	0.017	ND	0.016		0.011		3.7	--	--	--	--	--
Total PCBs (Congener)	mg/kg	0.038		0.086		0.064		40.3	--	--	--	--	--

Notes:

-- No criterion available

Although all fish samples were analyzed for arsenic, antimony, beryllium, boron, lead, lithium, thallium and uranium, these analytes were not included because these were not detected in all samples.

ND = Not Detected

Only fillet and offal samples were collected from the Deerfield River and therefore not presented.

1) TRVs from Jarvinen and Ankley (1999) with endpoints focused on survival, growth and reproduction - no effects, with the following exceptions:

a - The endpoint is reduced survival.

b - Mercury and Zinc value based on a brook trout.

c - Silver value is based on a largemouth bass.

Bold - Concentration exceeds benchmark of same species or the lowest available benchmark if a benchmark value is not available for the same species.

Table 3-24
Surface Water Benchmark Values -- Amphibians -- Sherman Reservoir
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Sherman Reservoir Samples						Benchmark Protective of Amphibians ¹	Benchmark Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Average	Maximum
<i>Inorganics (mg/L)</i>									
Boron	2	3	67%	0.0042	0.0042	0.0042	25	<1	<1
Cadmium	3	3	100%	0.000067	0.000060	0.000090	0.24	<1	<1
Zinc	1	3	33%	0.015	0.011	0.026	0.1	<1	<1

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) - endpoints of mortality or reproductive impairment.

Table 3-25
Surface Water Benchmark Values -- Amphibians -- Deerfield River Adjacent to the Site
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Deerfield River Samples						Benchmark Protective of Amphibians ²	Benchmark Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum
<i>Inorganics (mg/L)</i>									
Antimony	1	9	11%	0.0047	0.0031	0.0031	0.3	<1	<1
Arsenic	2	9	22%	0.0021	0.002	0.0026	0.4	<1	<1
Boron	8	9	89%	0.016	0.0066	0.044	25	<1	<1
Copper	1	9	11%	0.0021	0.0024	0.0024	0.11	<1	<1
Selenium	4	9	44%	0.00020	0.0001	0.0002	0.09	<1	<1
Thallium	1	9	11%	0.0032	0.0039	0.003	0.011	<1	<1
<i>Semivolatile Organic Compounds (ug/L)</i>									
Benzo(g,h,i)perylene	1	5	20%	0.092	0.10	0.060	12.5 a	<1	<1
Fluoranthene	1	5	20%	0.088	0.10	0.042	12.5 a	<1	<1
Phenanthrene	1	5	20%	0.088	0.10	0.042	12.5 a	<1	<1
Pyrene	2	5	40%	0.070	0.10	0.032	12.5 a	<1	<1

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) - endpoints of mortality or reproductive impairment.

a - Screening value benzo(a)pyrene used in the absence of specific benchmark.

Table 3-26
Surface Water Benchmark Values -- Amphibians -- Wheeler Brook
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	Wheeler Brook						Surface Water Benchmark ²	Benchmark Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum
<i>Inorganics (mg/L)</i>									
Antimony	4	26	15%	0.0031	0.0025	0.0017	0.3	<1	<1
Barium	25	25	100%	0.018	0.017	0.039	--	--	--
Cadmium	14	31	45%	0.00072	0.00060	0.00020	0.24	<1	<1
Copper	15	31	48%	0.0082	0.0025	0.03	0.11	<1	<1
Lead	11	31	35%	0.0018	0.0019	0.0038	0.02	<1	<1
Manganese	24	25	96%	0.20	0.09	0.82	1.42	<1	<1
Mercury	11	31	35%	0.00011	0.00010	0.00032	0.001	<1	<1
Selenium	8	31	26%	0.010	0.0038	0.00020	0.09	<1	<1
Silver	5	31	16%	0.0017	0.0025	0.0013	0.0041	<1	<1
Thallium	7	26	27%	0.0018	0.00063	0.0018	0.011	<1	<1
<i>Volatile Organic Compounds (ug/L)</i>									
4-Methyl-2-Pentanone	2	26	8%	3.71	5.0	0.8	--	--	--
Acetone	6	26	23%	5.49	5.0	14	--	--	--
Chloromethane	4	26	15%	1.41	1.0	3.7	1070	<1	<1
Methylene chloride	5	26	19%	3.45	5.0	0.95	--	--	--
tert-Butyl Alcohol	1	16	6%	5.16	5.0	7.6	--	--	--

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) - endpoints of mortality or reproductive impairment.

Table 3-27
Surface Water Benchmark Values -- Amphibians -- TransCanada West Storm Ditch (WSD)
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Material	TransCanada West Storm Ditch						Surface Water Benchmark ¹	Benchmark Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Average	Maximum
<i>Inorganics (mg/L)</i>									
Boron	1	1	100%	0.0094	0.0094	0.0094	25	<1	<1
<i>Volatile Organic Compounds (ug/L)</i>									
Carbon disulfide	1	1	100%	0.60	0.60	0.60	--	--	--

Notes:

-- No criterion available

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) - endpoints of mortality or reproductive impairment.

Table 3-28
Soil Benchmark Values -- Earthworms -- YAEC Non-BUD/TSCA
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	YAEC Non-BUD/TSCA Samples						Soil Benchmark ¹	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Average	Maximum	
<i>Dioxin/Furans (pg/g)</i>										
Dioxin/Furan TEQ	2	2	100%	0.53	0.53	0.80	500000 a,b	<1	<1	
<i>Inorganics (mg/Kg)</i>										
Copper	42	63	67%	9.38	9.5	25	80 d	<1	<1	
Lead	78	78	100%	16.99	4.5	160	1700 d	<1	<1	
Nickel	53	63	84%	11.88	11	78	200	<1	<1	
Selenium	10	63	16%	3.38	1.45	12	70	<1	<1	
Zinc	46	63	73%	64.80	56	520	200	<1	2.6	SB0490006I
<i>Polychlorinated Biphenyls (µg/Kg)</i>										
Aroclor-1016	14	241	6%	14.09	5.5	83.8	2510 a,c	<1	<1	
Aroclor-1248	15	241	6%	18.87	5.5	440	2510 a,c	<1	<1	
Aroclor-1254	201	241	83%	132.36	87	826	2510	<1	<1	
Aroclor-1260	175	241	73%	53.51	24.7	617	2510 a,c	<1	<1	

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Benchmarks from Efrymson et al. (1997a) unless otherwise stated.

a - Soil Invertebrate Toxicity Reference Values from US EPA (1999).

b - Screening values for 2,3,7,8 - TCDD used in the absence of specific Dioxin/Furan TEQ TRV.

c - Screening values for Aroclor-1254 from used in the absence of specific PCB TRVs.

d - Screening values from US EPA Eco-SSLs (2007).

Table 3-29
Soil Benchmark Values -- Earthworms -- TransCanada Property*
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	TransCanada Property* Samples						Soil Benchmark ²	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum	
Extractable Petroleum Hydrocarbons (mg/kg)										
Adjusted C11-C22 Aromatics	3	6	50%	47.71	23.85	117	--	--	--	
Inorganics (mg/Kg)										
Copper	43	44	98%	16.13	15.50	33	80 d	<1	<1	
Lead	52	52	100%	7.81	2.05	230	1700 d	<1	<1	
Nickel	44	44	100%	15.62	12.00	98	200	<1	<1	
Selenium	8	44	18%	2.91	1.20	13	70	<1	<1	
Zinc	43	44	98%	62.18	56.50	250	200	<1	1.3	SB-507-0006I
Polychlorinated Biphenyls (ug/kg)										
Aroclor-1254	56	99	57%	55.40	19.30	892	2510	<1	<1	
Aroclor-1260	31	99	31%	23.06	16.50	580	2510 a,c	<1	<1	
Semivolatile Organic Compounds (ug/kg)										
Acenaphthene	2	30	7%	169.67	180.00	359	30000 a,b	<1	<1	
Acenaphthylene	6	30	20%	184.47	180.00	356	30000 a,b	<1	<1	
Anthracene	6	30	20%	196.63	180.00	791	30000 a,b	<1	<1	
Benzo(a)anthracene	8	30	27%	340.17	180.00	2790	25000 a,b	<1	<1	
Benzo(a)pyrene	7	30	23%	283.20	180.00	2570	25000 a	<1	<1	
Benzo(b)fluoranthene	7	30	23%	310.47	180.00	2370	30000 a,b	<1	<1	
Benzo(g,h,i)perylene	7	30	23%	230.11	180.00	1230	30000 a,b	<1	<1	
Benzo(k)fluoranthene	7	30	23%	288.17	180.00	2430	30000 a,b	<1	<1	
Chrysene	8	30	27%	343.70	180.00	2850	30000 a,b	<1	<1	
Dibenzo(a,h)anthracene	2	30	7%	173.34	180.00	400	30000 a,b	<1	<1	
Fluoranthene	10	30	33%	543.03	180.00	5860	30000 a,b	<1	<1	
Indeno(1,2,3-cd)pyrene	5	30	17%	231.49	180.00	1440	30000 a,b	<1	<1	
Phenanthrene	7	30	23%	279.89	180.00	2430	30000 a,b	<1	<1	
Pyrene	9	30	30%	491.57	180.00	5200	30000 a,b	<1	<1	
Volatile Organic Compounds (ug/kg)										
2-Butanone	1	3	33%	5.47	6.00	1.4	--	--	--	
4-Isopropyltoluene	1	3	33%	26.83	4.50	73	--	--	--	
Acetone	1	3	33%	22.17	9.00	49	--	--	--	
m+p-Xylenes	1	3	33%	3.40	3.00	2.7	--	--	--	
Toluene	2	3	67%	21.30	16.00	46	--	--	--	

Notes:

-- No criterion available

*Samples collected from Inside the BUD on the TransCanada Property were not included in this analysis because they have been covered by clean fill material.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Benchmarks from Efroymsen et al. (1997a) unless otherwise stated.

a - Soil Invertebrate Toxicity Reference Values from US EPA (1999).

b - Screening values for Benzo(a)pyrene used in the absence of specific PAH TRVs.

c - Screening values for Aroclor-1254 from used in the absence of specific PCB TRVs.

d - Values from US EPA Eco-SSLs (2007).

Table 3-30
Soil Benchmark Values -- Terrestrial Plants -- YAEC Non-BUD/TSCA
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	YAEC Non-BUD/TSCA Samples						Soil Benchmark ¹	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Average	Maximum	
<i>Dioxin/Furans (pg/g)</i>										
Dioxin/Furan TEQ	2	2	100%	0.53	0.53	0.80	600	<1	<1	
<i>Inorganics (mg/Kg)</i>										
Copper	42	63	67%	9.38	9.5	25	100	<1	<1	
Lead	78	78	100%	16.99	4.5	160	120 a	<1	1.3	SB1350203F
Nickel	53	63	84%	11.88	11	78	30	<1	2.6	SB-015 0203F
Selenium	10	63	16%	3.38	1.45	12	1	3.4	12.0	SB1460102F
Zinc	46	63	73%	64.80	56	520	50	1.3	10.4	SB0490006I
<i>Polychlorinated Biphenyls (µg/Kg)</i>										
Aroclor-1016	14	241	6%	14.09	5.5	83.8	40000 b	<1	<1	
Aroclor-1248	15	241	6%	18.87	5.5	440	40000 c	<1	<1	
Aroclor-1254	201	241	83%	132.36	87	826	40000 b	<1	<1	
Aroclor-1260	175	241	73%	53.51	24.7	617	40000 b	<1	<1	

Notes:

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1 - Efroymsen et al. *Toxicological Benchmarks for screening Potential Contaminants of Concern for Effects on Terrestrial Plants (1997b)* unless otherwise stated.

a - Screening values from US EPA Eco-SSLs (2007).

b - Screening values for PCBs used in the absence of specific Aroclor TRVs.

c - Screening values for Acenaphthene used in the absence of specific PAH TRVs.

Table 3-31
Soil Benchmark Values -- Terrestrial Plants -- TransCanada Property*
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	TransCanada Property* Samples						Soil Benchmark ²	Benchmark Ratios		Location of Maximum Concentration
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum	
Extractable Petroleum Hydrocarbons (mg/kg)										
Adjusted C11-C22 Aromatics	3	6	50%	47.71	23.85	117	--	--	--	
Inorganics (mg/Kg)										
Copper	43	44	98%	16.13	15.50	33	100	<1	<1	
Lead	52	52	100%	7.81	2.05	230	120 a	<1	1.9	SB1520006I
Nickel	44	44	100%	15.62	12.00	98	30	<1	3.3	SB-540-0006I
Selenium	8	44	18%	2.91	1.20	13	1	2.9	13.0	SB1390203F, SB1220203F
Zinc	43	44	98%	62.18	56.50	250	50	1.2	5.0	SB-507-0006I
Polychlorinated Biphenyls (ug/kg)										
Aroclor-1254	56	99	57%	55.40	19.30	892	40000 b	<1	<1	
Aroclor-1260	31	99	31%	23.06	16.50	580	40000 b	<1	<1	
Semivolatile Organic Compounds (ug/kg)										
Acenaphthene	2	30	7%	169.67	180.00	359	20000	<1	<1	
Acenaphthylene	6	30	20%	184.47	180.00	356	20000 c	<1	<1	
Anthracene	6	30	20%	196.63	180.00	791	20000 c	<1	<1	
Benzo(a)anthracene	8	30	27%	340.17	180.00	2790	20000 c	<1	<1	
Benzo(a)pyrene	7	30	23%	283.20	180.00	2570	20000 c	<1	<1	
Benzo(b)fluoranthene	7	30	23%	310.47	180.00	2370	20000 c	<1	<1	
Benzo(g,h,i)perylene	7	30	23%	230.11	180.00	1230	20000 c	<1	<1	
Benzo(k)fluoranthene	7	30	23%	288.17	180.00	2430	20000 c	<1	<1	
Chrysene	8	30	27%	343.70	180.00	2850	20000 c	<1	<1	
Dibenzo(a,h)anthracene	2	30	7%	173.34	180.00	400	20000 c	<1	<1	
Fluoranthene	10	30	33%	543.03	180.00	5860	20000 c	<1	<1	
Indeno(1,2,3-cd)pyrene	5	30	17%	231.49	180.00	1440	20000 c	<1	<1	
Phenanthrene	7	30	23%	279.89	180.00	2430	20000 c	<1	<1	
Pyrene	9	30	30%	491.57	180.00	5200	20000 c	<1	<1	
Volatile Organic Compounds (ug/kg)										
2-Butanone	1	3	33%	5.47	6.00	1.4	--	--	--	
4-Isopropyltoluene	1	3	33%	26.83	4.50	73	--	--	--	
Acetone	1	3	33%	22.17	9.00	49	--	--	--	
m+p-Xylenes	1	3	33%	3.40	3.00	2.7	--	--	--	
Toluene	2	3	67%	21.30	16.00	46	200000	<1	<1	

Notes:

-- No criterion available

*Samples collected from Inside the BUD on the TransCanada Property were not included in this analysis because they have been covered by clean fill material.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Froymson et al. Toxicological Benchmarks for screening Potential Contaminants of Concern for Effects on Terrestrial Plants (1997b) unless otherwise stated.

a - Screening values from US EPA Eco-SSLs (2007).

b - Screening values for PCBs used in the absence of specific Aroclor TRVs.

c - Screening values for Acenaphthene used in the absence of specific PAH TRVs.

Table 4-1
Summary of Benchmark Ratios
Yankee Nuclear Power Station, Rowe, MA

Benchmark Ratios (mean / maximum) For COPCs with Ratios > 1						
	YAEC Non-BUD/TSCA	TransCanada Property ^{1,2}	Sherman Reservoir	Deerfield River ³	Wheeler Brook	Background
Sediment -- Benthic Macroinvertebrates (PEC Benchmarks)	NA	Aroclor-1254 (<1 / 1.4) Acenaphthene (<1 / 3.6) Anthracene (<1 / 2.6) Benzo(a)anthracene (<1 / 6.3) Benzo(a)pyrene (<1 / 4.0) Benzo(b)fluoranthene (<1 / 3.9) Benzo(ghi)fluoranthene (<1 / 2.5) Chrysene (<1 / 4.8) Dibenzo(ah)anthracene (<1 / 1.6) Fluoranthene (<1 / 6.3) Fluorene (<1 / 3.5) Indeno(123-cd)pyrene (<1 / 2.5) Phenanthrene (1.2 / 11.1) Pyrene (<1 / 6.5)	ESD Discharge: Aroclor 1254 (<1 / 5.0) Cooling Water Intake: Aroclor 1254 (<1 / 2.5) Mercury (<1 / 2.6)	Aroclor-1254 (<1 / 1.2)	(no sediment COPCs)	Anthracene (2.2) ^a Benzo(a)anthracene (1.6 / 1.8) Benzo(a)pyrene (1.3 / 1.5) Benzo(b)fluoranthene (6.8 / 7.2) Chrysene (<1 / 1.6) Fluoranthene (<1 / 1.6) Indeno(1,2,3-cd)pyrene (3.5) ^a Phenanthrene (1.3 / 3.9) Pyrene (1.1 / 3.0)
Surface Water -- Amphibians	--	<1	<1	<1	<1	<1
Soil -- Earthworm	Zinc (<1 / 2.6)	Zinc (<1 / 1.3)	NA	NA	NA	Mercury (3.2) ^a
Soil -- Terrestrial Plants	Nickel (<1 / 2.6) Selenium (3.2 / 12.0) Zinc (1.3 / 10.4)	Lead (<1 / 1.9) Nickel (<1 / 3.3) Selenium (2.9 / 13.0) Zinc (1.2 / 5.0)	NA	NA	NA	Selenium (1.6 / 2.6) Zinc (1.1 / 1.5)

Notes:

NA - Not Applicable for this environmental medium.

- 1) Does not include the TransCanada BUD Area because it has been remediated and capped with clean soils.
 - 2) Sediment and surface water from the West Storm Ditch were evaluated in the benthic and amphibian benchmark screening.
 - 3) Deerfield River samples include Sherman Spring samples.
- ^a - Maximum benchmark quotient -- mean concentration exceeded the maximum due to elevated detection limits.

Table 4-2
Summary of Modeled Food Web Hazard Indices (HI)
Yankee Nuclear Power Station, Rowe, MA

Receptor	Combined Study Areas HI ¹		Background HI ²	
	NOAEL	LOAEL	NOAEL	LOAEL
Short-tailed Shrew	2.9	1.0	1.4	<1
American Robin	7.0	1.3	3.8	<1
Eastern Cottontail	1.3	<1	<1	<1
Raccoon	<1	<1	<1	<1
Red Fox	<1	<1	<1	<1
Mink	<1	<1	<1	<1
Belted Kingfisher	<1	<1	<1	<1
Bald Eagle	<1	<1	<1	<1

Notes:

- 1) Does not include the YAEC RUA because it has been remediated and restored with clean soil cover.
- 2) Area use factors applied to the Combined Study Areas calculations were applied to background calculations as well.

Table 5-2
Sediment Benchmark Values -- Benthic Invertebrates -- Background Area:
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Sediment Samples from Background Areas						Sediment Benchmark ²	Hazard Ratios		
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average ³	Maximum	
Extractable Petroleum Hydrocarbons (mg/kg)										
Acenaphthylene - EPH *	4	6	67%	0.12	0.11	0.17	--	--	--	
Anthracene - EPH *	2	6	33%	0.09	0.09	0.082	--	--	--	
Benzo(a)anthracene - EPH *	1	6	17%	0.10	0.10	0.085	--	--	--	
Benzo(a)pyrene - EPH *	2	6	33%	0.09	0.10	0.11	--	--	--	
Benzo(b)fluoranthene - EPH *	4	6	67%	0.06	0.07	0.073	--	--	--	
Benzo(g,h,i)perylene - EPH *	1	6	17%	0.10	0.10	0.080	--	--	--	
Benzo(k)fluoranthene - EPH *	1	6	17%	0.11	0.10	0.13	--	--	--	
Chrysene - EPH *	3	6	50%	0.09	0.09	0.15	--	--	--	
Fluoranthene - EPH *	3	6	50%	0.13	0.10	0.32	--	--	--	
Indeno(1,2,3-cd)pyrene - EPH *	1	6	17%	0.10	0.10	0.066	--	--	--	
Phenanthrene - EPH *	2	6	33%	0.09	0.09	0.084	--	--	--	
Pyrene - EPH *	2	6	33%	0.13	0.10	0.27	--	--	--	
Inorganics (mg/Kg)										
Arsenic	5	12	42%	1.11	0.76	2.8	33	a	<1	<1
Beryllium	6	12	50%	0.49	0.42	0.36	--	--	--	--
Boron	6	6	100%	2.98	2.69	4.91	--	--	--	--
Cadmium	6	12	50%	0.51	0.54	0.63	5	a	<1	<1
Chromium	12	12	100%	9.95	7.62	21	110	a	<1	<1
Copper	12	12	100%	19.18	11.24	45	150	a	<1	<1
Lead	12	12	100%	5.20	4.21	19.6	130	a	<1	<1
Lithium	6	6	100%	6.72	5.89	12.1	--	--	--	--
Mercury	6	12	50%	0.06	0.04	0.21	0.18	a	<1	1
Nickel	12	12	100%	12.14	9.76	28	49	a	<1	<1
Selenium	2	11	18%	1.99	1.33	4.9	--	--	--	--
Silver	1	12	8%	0.45	0.46	0.4	4.5	b	<1	<1
Uranium *	10	12	83%	1.56	1.55	2.9	--	--	--	--
Zinc	12	12	100%	108.39	63.50	270	460	a	<1	<1
Polychlorinated Biphenyls (ug/kg)										
Aroclor-1260	1	24	4%	76.04	5.50	6.97	59.8			<1
Semivolatile Organic Compounds (ug/kg)										
1-Methylnaphthalene *	1	6	17%	149.43	145.75	35.1	150	d	<1	<1
2-Methylnaphthalene	1	12	8%	252.70	247.50	20.9	150	d		<1
2-Methylphenol *	1	12	8%	249.92	183.75	150	--	--	--	--
3+4-Methylphenol *	2	12	17%	234.07	222.50	230	--	--	--	--
Acenaphthene	1	12	8%	252.75	247.50	21.5	150	d		<1
Acenaphthylene *	1	12	8%	255.88	247.50	59.1	150	d		<1
Anthracene	3	12	25%	230.20	183.75	124	57.2			2.2
Benzo(a)anthracene	7	12	58%	170.73	169.00	200	110		1.6	1.8
Benzo(a)pyrene	6	12	50%	196.62	206.00	230	150		1.3	1.5
Benzo(b)fluoranthene	2	12	17%	251.63	244.00	268	37	e	7	7

Table 5-2
Sediment Benchmark Values -- Benthic Invertebrates -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Sediment Samples from Background Areas						Sediment Benchmark ²		Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹			Average ³	Maximum
Benzo(g,h,i)perylene	3	12	25%	228.38	183.75	101	150	d		<1
Benzo(k)fluoranthene	6	12	50%	190.36	183.75	220	37	b	5.1	5.9
Carbazole	1	12	8%	257.63	247.50	80	--		--	--
Chrysene	8	12	67%	168.19	185.00	273	170		<1	1.6
Dibenzo(a,h)anthracene	1	12	8%	253.01	247.50	24.6	33			<1
Dibenzofuran	1	12	8%	253.98	247.50	36.3	5100	c	<1	<1
Di-n-butyl phthalate *	1	12	8%	252.70	247.50	20.9	1.16E+10	b	<1	<1
Di-n-octyl phthalate *	3	12	25%	221.46	183.75	37.4	1.16E+10	b	<1	<1
Fluoranthene	10	12	83%	236.59	242.50	651	420		<1	1.6
Fluorene	1	12	8%	255.01	247.50	48.6	77			<1
Indeno(1,2,3-cd)pyrene	3	12	25%	228.80	183.75	106	30	b		3.5
Phenanthrene	6	12	50%	262.74	233.75	777	200		1.3	3.9
Pyrene	9	12	75%	226.97	216.25	592	200		1.1	3.0
Total Petroleum Hydrocarbons (mg/kg)										
TPH-DRO *	5	6	83%	31.75	25.50	80	--		--	--
Volatile Organic Compounds (ug/kg)										
1,1-Dichloroethene	5	12	42%	14.51	15.75	24	31	e	<1	<1
2-Butanone	6	7	86%	37.69	30.00	91.3	270	e	<1	<1
Acetone *	6	12	50%	220.33	187.25	943	57.1	b	3.9	16.5
Dimethyl sulfide *	1	1	100%	43.50	43.50	43.5	--		--	--
Toluene	6	12	50%	16.13	15.25	31	670	f	<1	<1
Volatile Petroleum Hydrocarbons (mg/kg)										
Adjusted C9-C10 Aromatics	1	5	20%	0.15	0.10	0.35	--		--	--
Adjusted C9-C12 Aliphatics *	2	5	40%	0.12	0.10	0.18	--		--	--
Ethylbenzene - VPH *	1	5	20%	0.03	0.02	0.064	--		--	--
m+p-Xylenes - VPH *	1	5	20%	0.05	0.04	0.11	--		--	--
Naphthalene - VPH *	1	5	20%	0.03	0.02	0.060	--		--	--
Toluene - VPH *	1	5	20%	0.03	0.02	0.056	--		--	--

Notes:

Only analytes detected in at least one sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Threshold Effects Concentration values from MADEP (2006c) Revised Sediment Screening Values and McDonald et al. (2000) unless noted.

a - Probable Effects Concentration (PEC) values (MADEP, 2006c).

b - Freshwater Sediment Toxicity Reference Value (US EPA, 1999).

c - Upper Effects Threshold (UET) from NOAA (1999).

d - Values for Benzo(a)pyrene used in the absence of specific PAH TRVs.

e - Secondary Chronic Value (SCV) from Efroymsen et al. (1997c).

f - Sediment quality benchmarks (SQBs) by equilibrium partitioning (US EPA, 1996b).

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

-- No criterion available

* Not considered site-specific COPCs.

Table 5-3
Soil Benchmark Values -- Terrestrial Invertebrates -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Background Areas						Soil		Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹	Benchmark ²	Average ³	Maximum	
<i>Dioxin/Furans (pg/g)</i>										
Dioxin/Furan TEQ	1	2	50%	0.36	0.07	0.44	500000 a,b	<1	<1	
<i>Extractable Petroleum Hydrocabons (mg/kg)</i>										
Acenaphthylene - EPH *	1	7	14%	0.13	0.14	0.14	--	--	--	
Benzo(b)fluoranthene - EPH *	2	7	29%	0.10	0.13	0.034	--	--	--	
Chrysene - EPH *	3	7	43%	0.08	0.08	0.046	--	--	--	
Fluoranthene *	6	7	86%	0.05	0.05	0.082	30000 a,c	<1	<1	
<i>Inorganics (mg/Kg)</i>										
Antimony *	1	7	14%	1.73	1.32	4.75	78 d	<1	<1	
Arsenic *	26	27	96%	2.40	1.80	5.61	60	<1	<1	
Beryllium *	4	27	15%	0.46	0.49	0.48	40 d	<1	<1	
Boron *	2	2	100%	18.50	18.50	19	20	<1	<1	
Cadmium *	5	26	19%	0.49	0.50	0.79	140 d	<1	<1	
Chromium *	27	27	100%	15.16	15.00	34	0.4	37.9	85.0	
Copper	22	27	81%	6.97	6.40	18.7	80 d	<1	<1	
Lead	26	26	100%	16.33	3.60	101	1700 d	<1	<1	
Lithium *	2	2	100%	24.50	24.50	26	10	2.5	2.6	
Mercury *	8	27	30%	0.33	0.36	0.32	0.1		3.2	
Nickel	27	27	100%	10.57	8.90	29	200	<1	<1	
Selenium	4	27	15%	1.61	1.55	2.45	70	<1	<1	
Silver *	4	25	16%	0.53	0.17	3.22	50	<1	<1	
Thallium *	3	26	12%	0.60	0.42	0.73	--	--	--	
Zinc	27	27	100%	53.47	54.00	75.8	200	<1	<1	
<i>Semivolatile Organic Compounds (ug/Kg)</i>										
Acenaphthylene	1	13	8%	182.85	205.00	96.5	30000 a,c	<1	<1	
Anthracene	1	13	8%	179.12	205.00	48	30000 a,c	<1	<1	
Benzo(a)anthracene	1	13	8%	193.27	214.50	232	25000 a,c	<1	<1	
Benzo(a)pyrene	2	13	15%	185.92	205.00	219	25000 a	<1	<1	
Benzo(b)fluoranthene	2	13	15%	229.46	215.00	533	30000 a,c	<1	<1	
Benzo(g,h,i)perylene	2	13	15%	172.52	200.00	105	30000 a,c	<1	<1	
Benzo(k)fluoranthene	2	13	15%	185.85	205.00	217	30000 a,c	<1	<1	
Benzoic acid *	2	13	15%	941.19	950.00	3500	--	--	--	
Chrysene	3	13	23%	190.30	200.00	337	30000 a,c	<1	<1	
Fluoranthene	6	13	46%	216.37	215.00	552	30000 a,c	<1	<1	
Indeno(1,2,3-cd)pyrene	1	13	8%	184.58	205.00	119	30000 a,c	<1	<1	
Phenanthrene	4	13	31%	210.41	215.00	357	30000 a,c	<1	<1	
Pyrene	4	13	31%	251.66	215.00	773	30000 a,c	<1	<1	

Table 5-3
Soil Benchmark Values -- Terrestrial Invertebrates -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Background Areas						Soil Benchmark ²	Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average ³	Maximum
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>									
Adjusted C5-C8 Aliphatics *	1	8	13%	2.10	1.65	4.95	--	--	--
Adjusted C9-C10 Aromatics *	7	8	88%	16.43	4.71	89	--	--	--
Adjusted C9-C12 Aliphatics *	8	8	100%	7.77	2.99	35.3	--	--	--
Toluene - VPH *	1	7	14%	0.22	0.11	0.84	--	--	--
Unadjusted C5-C8 Aliphatics *	8	8	100%	2.89	2.71	4.95	--	--	--
Unadjusted C9-C12 Aliphatics *	8	8	100%	24.17	7.65	124	--	--	--

Notes:

-- No criterion available

Only analytes detected in at least one background sample are presented.

* Not considered site-specific COPCs.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Benchmarks from Efrogmson et al. (1997a) unless otherwise stated.

a - Soil Invertebrate Toxicity Reference Values from US EPA (1999).

b - Values for 2,3,7,8 - TCDD used in the absence of specific Dioxin/Furan TEQ TRV.

c - Values for Benzo(a)pyrene used in the absence of specific PAH TRVs.

d - Values from US EPA Eco-SSLs (2007).

3) Blanks - Average hazard ratios were not presented because mean concentrations are higher than maximum concentrations.

Table 5-4
Soil Benchmark Values -- Terrestrial Plants - Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Surface Soil Samples from Background Areas						Soil Benchmark ²	Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum
<i>Dioxin/Furans (pg/g)</i>									
Dioxin/Furan TEQ	1	2	50%	0.36	0.07	0.44	600	<1	<1
<i>Extractable Petroleum Hydrocarbons (mg/kg)</i>									
Acenaphthylene - EPH *	1	7	14%	0.13	0.14	0.14	--	--	--
Benzo(b)fluoranthene - EPH *	2	7	29%	0.10	0.13	0.034	--	--	--
Chrysene - EPH *	3	7	43%	0.08	0.08	0.046	--	--	--
Fluoranthene *	6	7	86%	0.05	0.05	0.082	20000 a	<1	<1
<i>Inorganics (mg/Kg)</i>									
Antimony *	1	7	14%	1.73	1.32	4.75	5	<1	<1
Arsenic *	26	27	96%	2.40	1.80	5.61	18 b	<1	<1
Beryllium *	4	27	15%	0.46	0.49	0.48	10	<1	<1
Boron *	2	2	100%	18.50	18.50	19	0.5	37.0	38.0
Cadmium *	5	26	19%	0.49	0.50	0.79	32 b	<1	<1
Chromium *	27	27	100%	15.16	15.00	34	1	15.2	34.0
Copper	22	27	81%	6.97	6.40	18.7	100	<1	<1
Lead	26	26	100%	16.33	3.60	101	120 b	<1	<1
Lithium *	2	2	100%	24.50	24.50	26	2	12.3	13.0
Mercury *	8	27	30%	0.33	0.36	0.32	0.3	1.1	1.1
Nickel	27	27	100%	10.57	8.90	29	30	<1	<1
Selenium	4	27	15%	1.61	1.55	2.45	1	1.6	2.5
Silver *	4	25	16%	0.53	0.17	3.22	560 b	<1	<1
Thallium *	3	26	12%	0.60	0.42	0.73	1	<1	<1
Zinc	27	27	100%	53.47	54.00	75.8	50	1.1	1.5
<i>Semivolatile Organic Compounds (ug/Kg)</i>									
Acenaphthylene	1	13	8%	182.85	205.00	96.5	20000 a	<1	<1
Anthracene	1	13	8%	179.12	205.00	48	20000 a	<1	<1
Benzo(a)anthracene	1	13	8%	193.27	214.50	232	20000 a	<1	<1
Benzo(a)pyrene	2	13	15%	185.92	205.00	219	20000 a	<1	<1
Benzo(b)fluoranthene	2	13	15%	229.46	215.00	533	20000 a	<1	<1
Benzo(g,h,i)perylene	2	13	15%	172.52	200.00	105	20000 a	<1	<1
Benzo(k)fluoranthene	2	13	15%	185.85	205.00	217	20000 a	<1	<1
Benzoic acid *	2	13	15%	941.19	950.00	3500	--	--	--
Chrysene	3	13	23%	190.30	200.00	337	20000 a	<1	<1
Fluoranthene	6	13	46%	216.37	215.00	552	20000 a	<1	<1
Indeno(1,2,3-cd)pyrene	1	13	8%	184.58	205.00	119	20000 a	<1	<1
Phenanthrene	4	13	31%	210.41	215.00	357	20000 a	<1	<1
Pyrene	4	13	31%	251.66	215.00	773	20000 a	<1	<1

Table 5-4
Soil Benchmark Values -- Terrestrial Plants - Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Surface Soil Samples from Background Areas						Soil Benchmark ²	Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum ¹		Average	Maximum
<i>Volatile Petroleum Hydrocarbons (mg/kg)</i>									
Adjusted C5-C8 Aliphatics *	1	8	13%	2.10	1.65	4.95	--	--	--
Adjusted C9-C10 Aromatics *	7	8	88%	16.43	4.71	89	--	--	--
Adjusted C9-C12 Aliphatics *	8	8	100%	7.77	2.99	35.3	--	--	--
Toluene - VPH *	1	7	14%	0.22	0.11	0.839	--	--	--
Unadjusted C5-C8 Aliphatics *	8	8	100%	2.89	2.71	4.95	--	--	--
Unadjusted C9-C12 Aliphatics *	8	8	100%	24.17	7.65	124	--	--	--

Notes:

-- No criterion available

Only analytes detected in at least one background sample are presented.

* Not considered site-specific COPCs.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) In cases where the average and/or median is higher than the maximum concentrations, it is due to high detection limits.

2) Efromson et al. Toxicological Benchmarks for screening Potential Contaminants of Concern for Effects on Terrestrial Plants (1997b) unless otherwise stated.

a - Values for Acenaphthene used in the absence of specific PAH TRVs.

b - Values from US EPA Eco-SSLs (2007).

Table 5-5
Surface Water Benchmark Values -- Amphibians -- Background Areas
Yankee Nuclear Power Station, Rowe, MA

Oil or Hazardous Materials	Surface Water Samples from Background Areas						Amphibian Benchmark ¹	Hazard Ratios	
	Number Detected	Number Sampled	Percent Detected	Average	Median	Maximum		Average	Maximum
<i>Inorganics (mg/L)</i>									
Boron	3	3	100%	0.0038	0.0039	0.0040	25	<1	<1
Cadmium	1	3	33%	0.000042	0.000020	0.000090	0.24	<1	<1
Lead	1	3	33%	0.0012	0.00065	0.0022	0.02	<1	<1
Silver	2	3	67%	0.0011	0.00080	0.0023	0.0041	<1	<1

Notes:

Only analytes detected in at least one background sample are presented.

Averages and medians calculated using those detected and 1/2 the detection limit of those not detected.

1) Amphibian Toxicity Data for Water Quality Criteria Chemicals (US EPA, 1996a) - endpoints of mortality or reproductive impairment.

Attachment A Estimation of COPC Uptake in Biota

Determination of Exposure Point Concentrations in Biota

In order to conduct the environmental risk characterization, it is necessary to estimate exposure point concentrations (EPCs) in biota such as aquatic and terrestrial plants, aquatic and terrestrial invertebrates, small mammals, and birds. With the exception of PCBs, inorganics and radionuclide monitoring data for fish, the EPCs in other biota will be estimated using the published approaches described below. Note that a variety of empirical approaches are described below. The particular approach will be selected depending on the availability of published uptake factors for particular compounds and receptors.

Linear biouptake factors represent the ratio of the chemical concentration in biological tissue to that in soil or sediment. These models (based on regression equations) assume that accumulation is linear and across all soil/sediment concentrations. Linear uptake factors of this form are often termed bioconcentration factors (BCFs), biota-sediment accumulation factors (BSAF), *etc.*

Log-linear regression uptake models have also been developed. These non-linear models predict decreasing bioaccumulation as chemical concentration in soil/sediment increases. Various soil/sediment properties, such as pH, clay content, calcium, and organic matter, can strongly affect the retention of contaminants in soil/sediment and the bioavailability of these contaminants for uptake by receptors, thus producing the observed non-linear relationships. These empirical regression models are "linearized" by performing the regressions in log-space. Because contaminant uptake is influenced by characteristics of the organism and by the properties of the chemical, separate uptake factors are recommended for each chemical and taxonomic group considered (Sample *et al.*, 1997).

Biota-sediment accumulation factors are commonly used to estimate the uptake of organic chemicals in fish. The primary exposure pathway for fish is the consumption of contaminated food. Sediments often act as a local sink for contaminants, which may increase the contaminant exposure for sediment-associated biota that ingest sediment particles while foraging. BSAFs are transfer coefficients that relate concentrations in biota to concentrations in sediment. They are calculated as the ratio of the concentration of organic chemical in fish tissue (normalized by lipid content) to the concentration of organic chemical in sediment (normalized by organic carbon content).

A.1 Plants

A.1.1 EPCs for COPCs in Plants

Chemical uptake in plants *via* the roots can be estimated as (US EPA, 1999):

$$C_p = C_s \times BCF_p \times (1 - F_{wc}) \quad (\text{A.1-1})$$

where:

C_p	=	concentration in plant (mg/kg-wet weight)
C_s	=	concentration in soil or sediment (mg/kg - dry weight)
BCF_p	=	soil/sediment-plant uptake factor (mg/kg plant dry wt./ mg/kg soil dry wt.)
F_{wc}	=	water content (g-water/g-fresh wt.)
		F_{wc} : 0.63 terrestrial plants (US EPA, 1993)

For organic compounds without sufficient data to develop empirical BCF_p values, estimated uptake factors can be estimated from the octanol-water partition coefficient using the following regression (Travis and Arms, 1988; US EPA, 1999):

$$\log_{10}(BCF_p) = 1.58 - 0.58 \log_{10}(K_{ow}) \quad (\text{A.1-2})$$

For inorganic compounds, empirically determined values for BCF_p have been reported by Baes *et al.* (1984) or chemical uptake in plants can be estimated using log-linear models (Bechtel Jacobs, 1998a).

A.1.2 EPCs for COPCs in Plants – Log-linear Regression Equation for Inorganics

Bechtel Jacobs (1998a) developed a non-linear regression equation relating chemical uptake in plants. The power model is of the form:

$$C_p = m(C_s)^b$$

The natural log-transformed linear regression model is then:

$$\text{LN}(C_p) = m' + b \text{LN}(C_s)$$

or

$$C_p = \exp[m' + b \text{LN}(C_s)] \quad (\text{A.1-3})$$

$$C_{p-ww} = C_p \times (1 - F_{wc})$$

where:

C_p	=	concentration in plant (mg/kg – dry wet)
C_{p-ww}	=	concentration in plant (mg/kg – wet weight)
m'	=	y-intercept of the regression line for log-transformed data
b	=	slope of the regression line for log-transformed data
C_s	=	concentration in soil or sediment (mg/kg – dry weight)
F_{wc}	=	water content (terrestrial = 0.63; aquatic = 0.78; US EPA, 1993)
$\exp()$	=	exponential function (e^x)
$\text{LN}()$	=	natural logarithm

Note that Bechtel Jacobs developed similar non-linear power models for chemical uptake in invertebrates (discussed below), but used base-10 logarithms for the regression models.

A.2 Invertebrates

Empirical relationships using linear and log-linear regression equations have been developed for chemical uptake in invertebrates relating the chemical concentration in the invertebrate to the chemical concentration in soil or sediment.

A.2.1 Linear Bio-Uptake Model:

Sample *et al.* (1997) published a model relating chemical concentrations in pore-water to the chemical concentration in earthworms, a representative soil invertebrate. The linear model is:

$$C_v = K_{bw} \times C_{pw} \quad (\text{A.2-1})$$

For non-ionic chemicals, the chemical concentration in pore-water is related to the chemical concentration adsorbed to soil/sediment according to:

$$C_{pw} = C_s / K_d \quad (\text{A.2-2})$$

Combining (A-3) and (A-4) gives:

$$C_v = \text{BCF}_v \times C_s \quad (\text{A.2-3})$$

where

$$BCF_v = \frac{K_{bw}}{K_d} \quad (A.2-4)$$

The conversion from dry-weight concentration to wet weight is simply:

$$C_{v-WW} = C_v \times (1 - F_{wc}) \quad (A.2-5)$$

where:

C_v	=	concentration in invertebrate (mg/kg-dry weight)
C_{v-WW}	=	concentration in invertebrate (mg/kg-wet weight)
C_{pw}	=	concentration in pore-water (mg/L)
C_s	=	concentration in soil/sediment (mg/kg – dry weight)
K_{bw}	=	biota-water partition coefficient (L/kg)
K_d	=	soil-water partition coefficient (L/kg)
BCF_v	=	soil-biota uptake factor (mg/kg-invert. dry wt.)/(mg/kg-dry soil)
F_{wc}	=	water content (mg-water/mg-fresh wt.)
		F_{wc} : 0.79 aquatic; 0.71 terrestrial (US EPA, 1993)

The biota-water partition coefficient can be estimated from the octanol-water partition coefficient (K_{ow}) from the following (Sample *et al.*, 1997):

$$\begin{aligned} \log_{10} K_{bw} &= \log_{10} K_{ow} - 0.6 \\ \text{or} \\ K_{bw} &= 10^{(\log K_{ow} - 0.6)} \end{aligned} \quad (A.2-6)$$

The soil-water partition coefficient is given by:

$$K_d = f_{oc} \times K_{oc} \quad (A.2-7)$$

where

f_{oc}	=	fraction of organic carbon (kg-OC/kg-soil)
K_{oc}	=	organic carbon-soil partition coefficient (L/kg)

If a value of K_{oc} is not available, it can be estimated from K_{ow} (Sample *et al.*, 1997):

$$\log_{10} K_{oc} = 0.983 \log_{10} K_{ow} + 0.00028 \quad (A.2-8)$$

The value of BCF_v can be estimated as K_{bw}/K_d using the above relationships, or alternatively US EPA (1999) provides the following empirical relationship (note this empirical equation is based on a wet weight basis for chemical concentration in invertebrate tissue):

$$\log \text{BCF}_{v\text{-WW}} = 0.819 \log K_{ow} - 1.146$$

where

$$\text{BCF}_{v\text{-WW}} = \text{soil-biota uptake factor (mg/kg-invert wet wt.)/(mg/kg-dry soil)}$$

For inorganic chemicals, uptake factors (BCF_v) are available from Sample *et al.* (1997), Sample *et al.* (1998b), or Bechtel Jacobs (1998a).

A.2.2 Log-Linear Regression Models

Power models have also been used to develop regression equations relating chemical uptake in invertebrates for metals and PCBs. The power model is of the form:

$$C_v = m(C_s)^b$$

Several authors have developed log-linear regression relationships from this model, using field data to develop the regression parameters. Bechtel Jacobs (1998a) developed log-regression parameters based on dry-weight sediment chemical concentration data for metals and organic-carbon normalized data for PCBs. The Bechtel Jacobs (1998a) regression equations predict the dry-weight metal concentration in invertebrates, whereas for PCBs the regressions were based on lipid-normalized data. Sample *et al.* (1998b) developed similar regression models, but used natural logarithm transformations, and did not use lipid or organic carbon adjusted values for PCBs.

Thus, the general form of the equations above translates into the following specific log-regression models:

Bechtel Jacobs (1998) -- Regression Model for Metals:

$$\text{Log}_{10}(C_v) = m' + b \text{Log}_{10}(C_s)$$

$$C_{v\text{-DW}} = 10^{(m'+b \log(C_s))}$$

(A.2-9)

$$C_{v\text{-WW}} = C_{v\text{-DW}} \times (1 - F_{wc})$$

Bechtel Jacobs (1998) – Log Regression for PCBs:

$$C_{v-LP} = 10^{(m'+b \log(C_{s-OC}))}$$

$$C_{s-OC} = C_s / OC \tag{A.2-10}$$

$$C_{v-WW} = C_{v-LP} \times LP_v$$

Sample et al. (1998) – Natural Log Regression for Metals and PCBs :

LN(C_{v-DW}) = $m' + b \text{LN}(C_s)$

or

$$C_{v-DW} = \exp[m' + b \text{LN}(C_s)] \tag{A.2-11}$$

$$C_{v-WW} = C_{v-DW} \times (1-F_{wc})$$

where:

- C_v = chemical concentration in invertebrates (mg/kg)
- C_{v-WW} = chemical concentration in invertebrates (mg/kg – wet wt.)
- C_{v-DW} = chemical concentration in invertebrates (mg/kg – dry wt.)
- C_{v-LP} = lipid-normalized PCB concentration in invertebrates (mg/kg-lipid)
- m' = y-intercept of the log-transformed regression model (mg/kg_{biota})
- b = slope of the log-transformed regression model (mg/kg_{biota} per mg/kg_{sed})
- C_s = chemical concentration in sediment (mg/kg – dry wt.)
- C_{s-OC} = chemical concentration in sediment - carbon normalized (mg/kg-OC dry wt.)
- LP_v = lipid content in invertebrates (kg-lipid/kg-tissue)
- OC = organic carbon content in sediment (kg-OC/kg-sediment)
- F_{wc} = water content (mg-water/mg-tissue)
 F_{wc} : 0.79 aquatic; 0.71 terrestrial (US EPA, 1993)
- Log() = base 10 logarithm
- LN() = natural logarithm
- exp() = exponential function (e^x)

Sample et al. (1997) report that 0.02 kg-lipid/kg-tissue is a typical lipid content of invertebrates (e.g., $LP_v = 0.02$).

A.3 Fish

Chemical concentrations for organic COPCs in fish can be estimated using one of two methods. One method involves a two-step process that combines (1) estimates of chemical concentrations in invertebrates (as discussed in previous Section), coupled with (2) the use of an assimilation of the

invertebrate diet into fish tissue. Alternatively, empirically derived biota sediment accumulation factors (BSAF) relating the chemical concentration in fish to the chemical concentration in sediment, can be used. The selection of the particular approach will be based on the availability of data or published values.

A.3.1 Assimilation Approach – Inorganics

In the absence of BSAF or BCF values for inorganics, the chemical concentration in fish tissue can be estimated as a function of the inorganic COPC concentration in food (invertebrates) and based on the food assimilation efficiency:

$$C_f = C_v \times \alpha \tag{A.3-1}$$

where

- C_f = chemical concentration in fish (mg/kg-wet weight)
- C_v = chemical concentration in invertebrate food source (mg/kg-wet weight)
- α = food assimilation efficiency (unitless fraction)

The assimilation efficiency of food is the fraction of food ingested that does not appear in the feces, *i.e.*, conservatively assumed to be incorporated into fish tissue. A food assimilation efficiency for lake trout of 0.8 is reported by Thomann and Connolly (1984). This approach assumes that 80% of food is assimilated by the fish, and 100% of the chemical in the assimilated food source is retained in fish with no further metabolism or depuration.

A.3.2 BSAF Approach – Organics

For the uptake of organic COPCs into fish for which measured data are unavailable, a biota-sediment accumulation factor (BSAF) can be used to estimate fish tissue concentrations (US EPA, 1997):

$$C_f = \text{BSAF} \times C_s \times \frac{\text{LP}}{\text{OC}} \tag{A.3-2}$$

where:

- C_f = chemical concentration in fish tissue (mg/kg)
- BSAF = biota sediment accumulation factor (mg-chem/kg-lipid per mg-chem/kg-OC)
- C_s = chemical concentration in sediment (mg/kg)
- LP = lipid content in fish whole body or filet (kg-lipid/kg-tissue)
- OC = organic carbon fraction in sediment (kg-OC/kg-sed)

A.4 COPCs in Herbivores, Omnivores, Carnivores

The measurement endpoints for herbivores, omnivores, and carnivores are based on chemical intake, so it is necessary to estimate the COPC concentration in food and environmental matrices ingested by these receptors. The concentration of COPCs in animal tissue (herbivores, omnivores, carnivores) can be estimated as a function of consumption of dietary items and incidental sediment/soil/water ingestion using the following model including bioconcentration factors and food chain multipliers for trophic transfer (US EPA, 1999):

$$C_a = (C_s \times BCF_{s-a} \times P_s) + (C_w \times BCF_{w-a} \times P_w) + (C_p \times BCF_{p-a} \times F_p \times P_p) + \sum_i (C_{FI,i} \times BMF_{FI,i} \times F_{FI,i} \times P_{FI,i}) \quad (A.4-1)$$

where:

C_a	=	COPC concentration in animal tissue (mg/kg)
C_s	=	COPC concentration in soil or sediment (mg/kg)
BCF_{s-a}	=	soil/sediment-animal biouptake factor (mg/kg-animal)/(mg/kg-soil/sed.)
P_s	=	proportion of soil/sediment containing COPC (unitless fraction)
C_w	=	COPC concentration in water (mg/L)
BCF_{w-a}	=	water-animal biouptake factor (mg/kg-animal)/(mg/L-water)
P_w	=	proportion of water containing COPC (unitless fraction)
C_p	=	COPC concentration in plants (mg/kg)
BCF_{p-a}	=	plant to animal biouptake factor (mg/kg-animal)/(mg/kg-plant)
F_p	=	fraction of diet consisting of plants (unitless fraction) (herbivore $F_p = 1.0$; carnivore $F_p = 0$)
P_p	=	proportion of plants containing COPC (unitless fraction)
$C_{FI,i}$	=	COPC concentration in i^{th} non-plant food item (mg/kg)
$F_{FI,i}$	=	fraction of i^{th} non-plant food item in diet (unitless decimal)
$P_{FI,i}$	=	proportion of non-plant food item containing COPC (unitless fraction)
$BMF_{FI,i}$	=	biomagnification multiplier (unitless)

In the absence of specific target receptors, representative dietary fractions for herbivore, omnivore, carnivore prey items (*e.g.*, food items) are given below.

Animal Type	Dietary Fraction
Herbivore (<i>e.g.</i> , rabbit)	$F_p = 1.0$ $F_{FI,i} = 0$ (<i>e.g.</i> , diet 100% plant)
Omnivore (mammal) (<i>e.g.</i> , raccoon)	$F_p = 0.45$ $F_{FI,1} = 0.45$ (invertebrates) $F_{FI,2} = 0.1$ (other omnivore/carnivore)
Omnivore (bird) (<i>e.g.</i> , robin)	$F_p = 0.5$ $F_{FI,1} = 0.5$ (invertebrates)
Carnivore (mammal) (<i>e.g.</i> , fox)	$F_p = 0$ $F_{FI,1} = 0.5$ (herbivore) $F_{FI,2} = 0.5$ (other omnivore/carnivore)

The BCF parameter (by medium) represents the ratio of chemical concentration in animal tissue to the chemical concentration in water, soil/sediment, or plant materials:

$$BCF = \frac{C_{\text{animal}} \text{ (mg – COPC/kg – animal)}}{C_{\text{media}} \text{ (mg – COPC/kg – media)}}$$

While this ratio is frequently viewed as a "unitless" proportion, the units must be carefully defined. The BCF factors can be defined in terms of either fresh-weight or dry-weight of biological tissues (*e.g.*, mg/kg-wet wt. or mg/kg-dry wt.). The chemical concentration in soil or sediment is typically reported on a dry-weight basis, but also can sometimes be reported on an organic-carbon normalized basis. Thus, it is important to determine the underlying units of measure when applying a reported BCF or when using a regression-derived BCF.

Estimates of the BCF_{s-a} and BCF_{w-a} are provided in US EPA (1999, Appendix D). Estimates of BCF_{p-a} for ingestion of food items is derived according to the following formula using biotransfer factors (Travis and Arms, 1988):

$$BCF_{p-a} = B_a \times IR \tag{A.4-2}$$

where:

$$BCF_{p-a} = \text{plant-animal biouptake factor (mg-COPC/kg-animal)/(mg-COPC/kg-plant)}$$

$$B_a = \text{biotransfer factor (day/kg-tissue ingested – wet weight)}$$

IR = average ingestion rate (kg/day – wet weight)

For organics (other than dioxins/furans) the following regression equation can be used to estimate B_a (US EPA, 1999)

$$\begin{aligned} \text{Mammals:} \quad \log_{10} B_{a,\text{mammal}} &= \log_{10} K_{ow} - 7.6 \\ \text{Birds:} \quad B_{a,\text{bird}} &= B_{a,\text{mammal}} \times 0.8 \end{aligned} \tag{A.4-3}$$

The biotransfer factor for birds is estimated from the biotransfer factor for mammals, adjusting for lipid content in birds of approximately 80% the lipid content in mammals (US EPA, 1999).

The biomagnification parameter (BMF) depends on the trophic level of the food item, relative to the trophic level of the animal and can be estimated as follows (US EPA, 1999).

$$\text{BMF} = \frac{\text{FCM}_{\text{TL-an}}}{\text{FCM}_{\text{TLi-prey}}} \tag{A.4-4}$$

where

$\text{FCM}_{\text{TL-an}}$ = food chain multiplier for the trophic level of the animal (unitless)
 $\text{FCM}_{\text{TLi-prey}}$ = food chain multiplier for the trophic level of the prey (unitless)

Estimates of FCM by trophic level, which varies depending on the chemical K_{ow} , are provided by US EPA (1999).

The proportion of the media or food intake that is contaminated with the COPC will depend on the environmental extent of contamination and the home range or foraging area for a particular receptor (US EPA, 1999). Thus, P_i can be estimated as (Sample *et al.*, 1997):

$$P_i = \frac{A_c}{A_f} \tag{A.4-5}$$

where

P_i = proportion of i^{th} media or food item containing COPC (unitless fraction)
 A_c = area containing COPC (acres)
 A_f = total foraging area of receptor (acres)

Dietary composition estimates (e.g., to estimate F_{FI}) for various bird and mammal species are published in Baes *et al.* (1984), Sample *et al.*,(1997), US EPA (1993), and US EPA (1999).

A.5 Estimation of Total Exposure to COPCs

Because many measurement endpoints are based on chemical intake (typically daily intake), rather than body burden, it is necessary to estimate the total COPC intake based on exposure from environmental media and food. Daily intake, ingestion rates, and species foraging ranges are published in US EPA (1993). The daily intake is given by the summation of intakes from all media of potential concern (US EPA,1999):

$$DI = \sum_i \frac{(C_i \times IR_i \times P_i)}{BW} \tag{A.5-1}$$

where:

- DI = daily intake of COPC (mg/kg/day)
- C_i = COPC concentration in i^{th} media or food item (mg/kg)
- IR_i = ingestion rate of i^{th} media (kg/day)
- P_i = proportion of i^{th} media or food item that is contaminated (unitless fraction)
- BW = body weight of receptor (kg)

Note that the proportion of the contaminated media or food occurs in Equation (A.5-1) as it does in Equation (A.4-1). This is not "double-counting" as each equation is based on different receptors. That is, the chemical intake of a carnivore, for example, calculated using Equation (A.5-1) would include the chemical concentration in food items calculated using Equation (A.4-1). The COPC concentration in these food items would depend in turn on the habitat/foraging range of these prey items, which is separate from the foraging range of the carnivore consuming them in this example. The " P_i " value for the carnivore chemical intake estimate would thus be different from the " P_i " value corresponding to the calculation of chemical body burden in the food items consumed by the carnivore. For prey with small foraging ranges, the value of " P_i " would tend toward a value of one (1.0).

Attachment A References

Baes, CF; Sharp, RD; Sjoreen, AL; Shor, RW. 1984. "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture." Report to US EPA, Office of Radiation Programs. Oak Ridge National Laboratory. ORNL-5786. 148p.

Bechtel Jacobs Co., LLC. 1998a. "Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation." Report to US Dept. of Energy. BJC/OR-112. 52p.

Bechtel Jacobs Co., LLC. 1998b. "Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants." Report to US Dept. of Energy, Office of Environmental Management. BJC/OR-133. 95p.

Sample, BE; Alpin, MS; Efroymson, RA; Suter, GW, Welsh, CJE. 1997. "Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants." ORNL/TM-13391. October.

Sample, BE; Beauchamp, JJ; Efroymson, RA; Suter, GW, Ashwood, TL. 1998b. "Development and Validation of Bioaccumulation Models for Earthworms." Prepared for the US Dept. of Energy. ES/ER/TM-220. February.

Thomann, RV; Connolly, JP. [Manhattan College (Bronx, NY)]. 1984. "Model of PCB in the Lake Michigan Lake Trout food chain." *Environ. Sci. Technol.* 18(2):65(7).

Travis, CC; Arms, AD. 1988. "Bioconcentration of organics in beef, milk, and vegetation." *Environ. Sci. Technol.* 22(3):271(4).

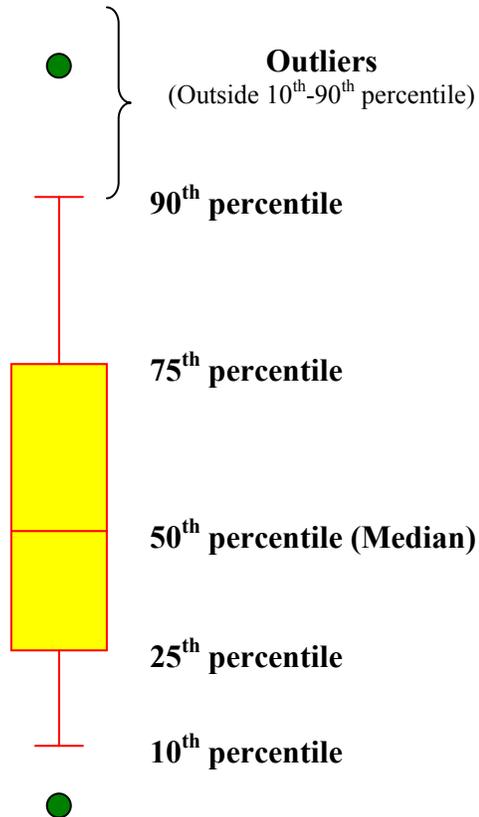
US Environmental Protection Agency (US EPA). 1993. *Wildlife Exposure Factors Handbook. Volume 1.* Office of Research and Development. EPA/600/R-93/187a.

US Environmental Protection Agency (US EPA). 1997. "The Incidence and Severity of Sediment Contamination in Surface Waters of the United States. Volume I: National Sediment Quality Survey."

US Environmental Protection Agency (US EPA). 1999. "Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities." Solid Waste and Emergency Response. EPA530-D-99-001A.

Appendix J
Box and Whisker Plots

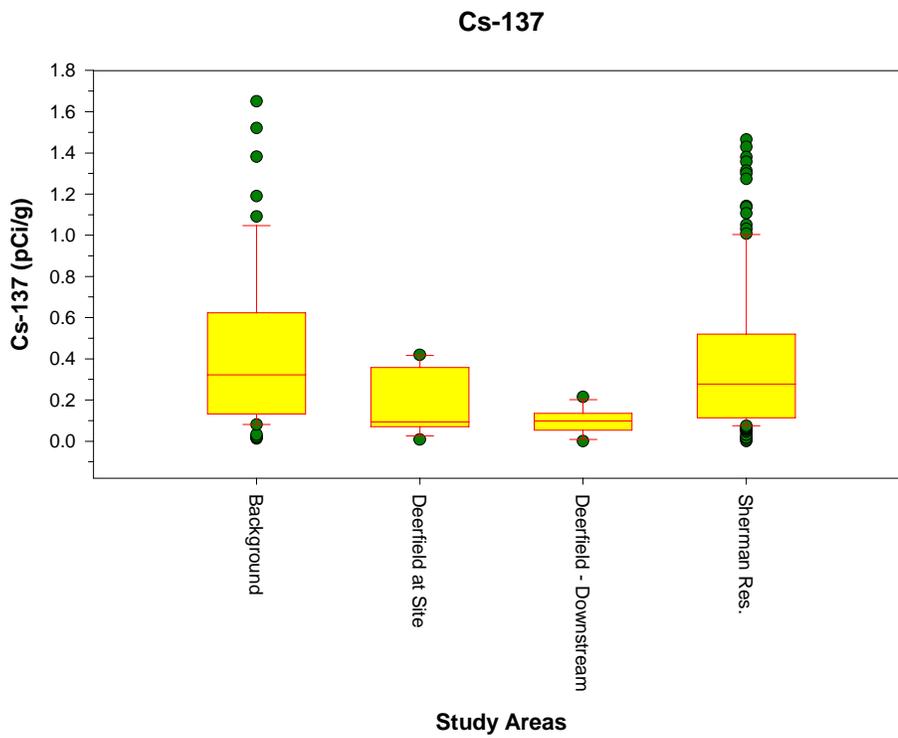
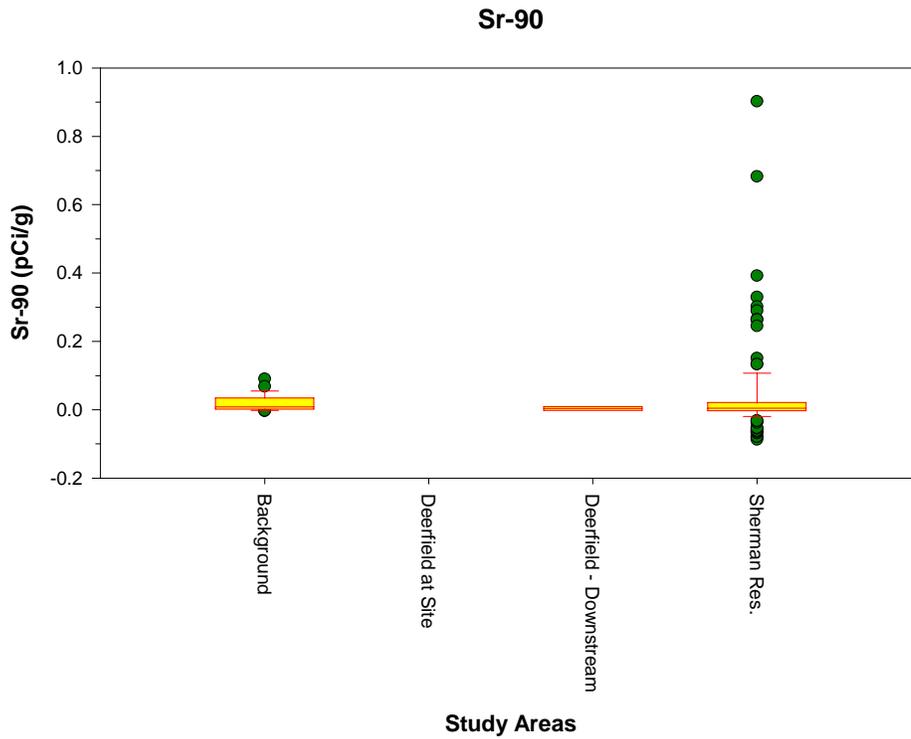
Box-Whisker Plot Definitions



Note:

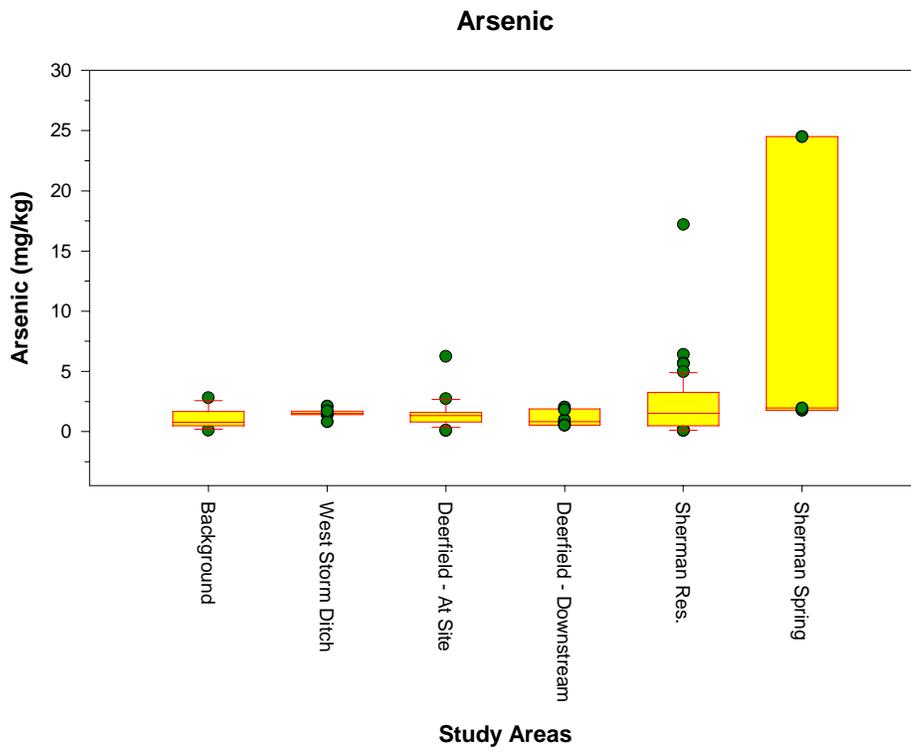
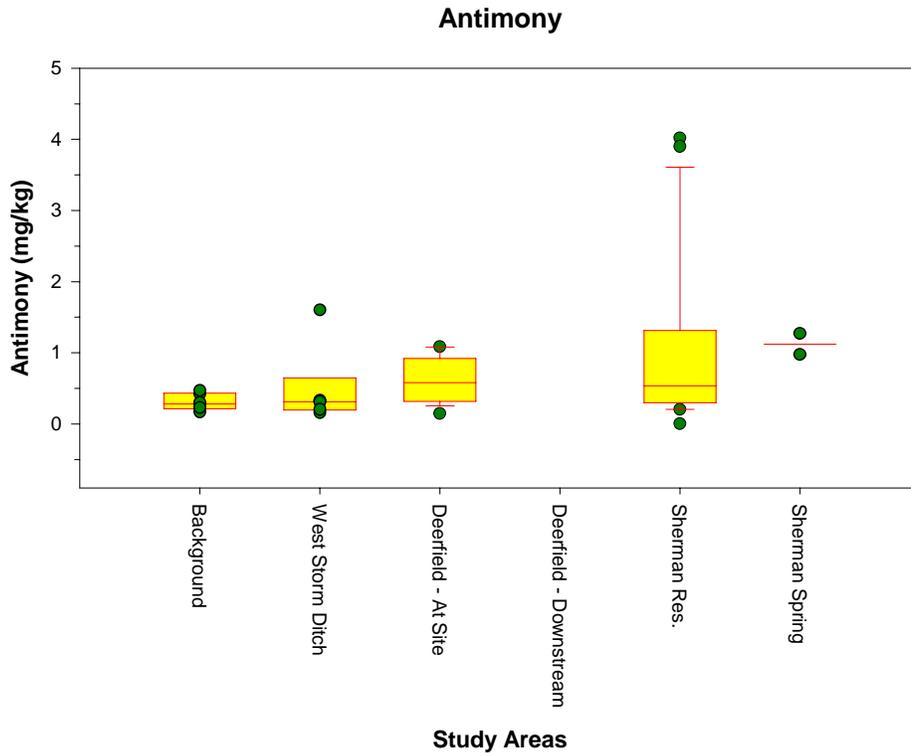
At least 3 data points are required to compute the 25th and 75th percentiles and at least 9 data points are required to compute the 10th and 90th percentiles. Plots with fewer than 9 data points plot all data points; plots with 9 or more data points only plot the outliers.

Box-Whisker Plots
Sediments – Sr-90 and Cs-137



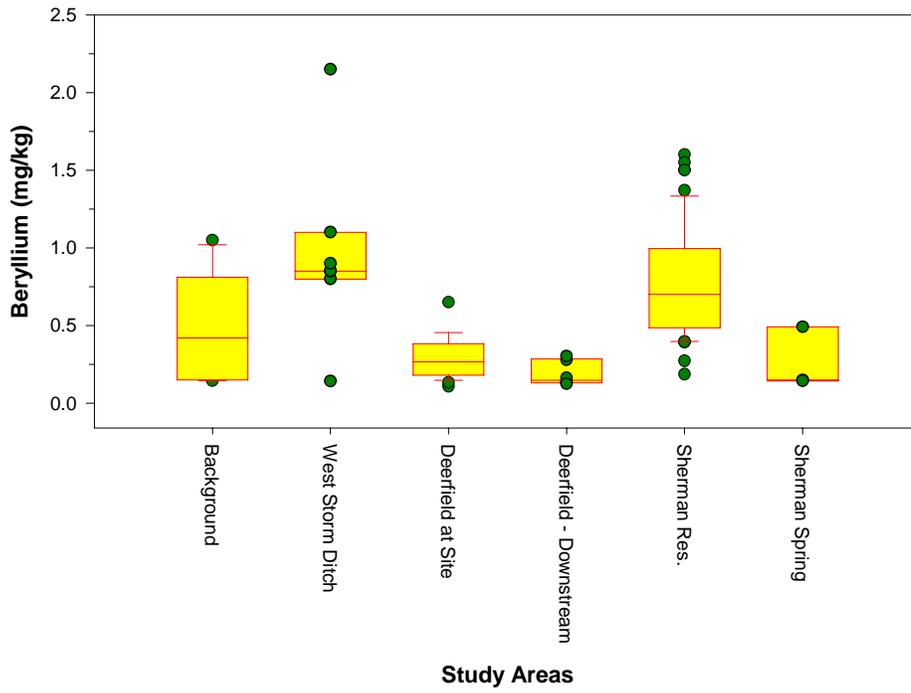
Non-Detects included at 1/2 sample detection limit.

**Box-Whisker Plots
Sediments – Inorganics**

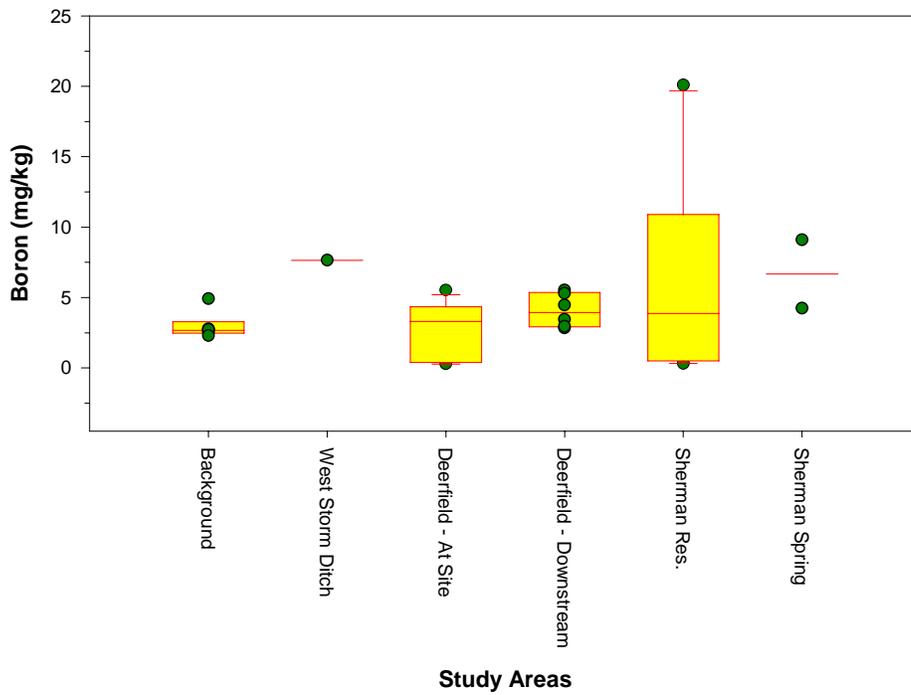


**Box-Whisker Plots
Sediments – Inorganics**

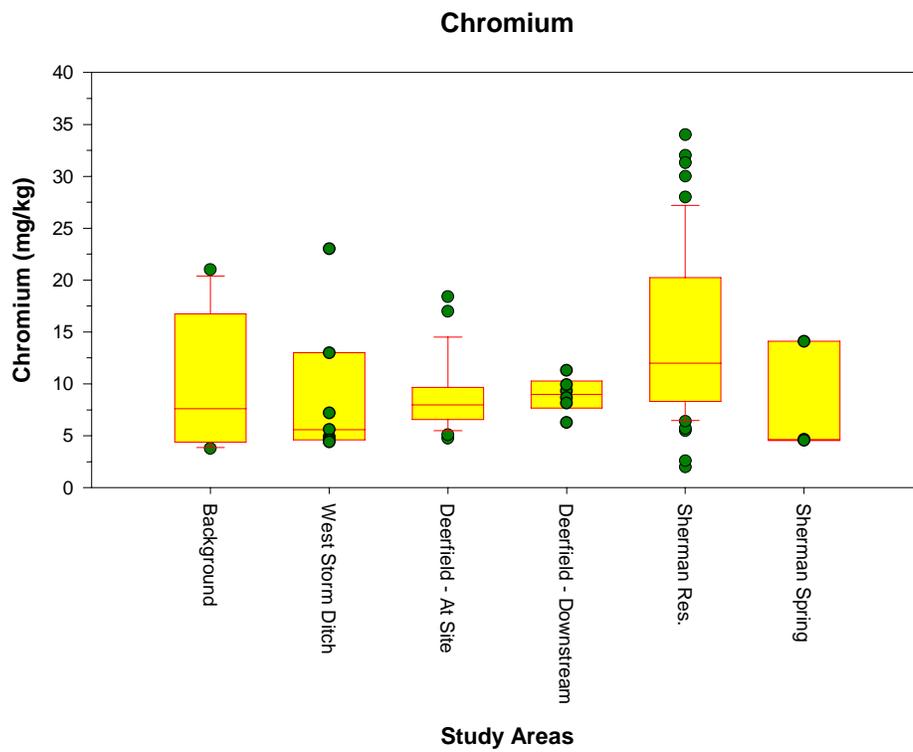
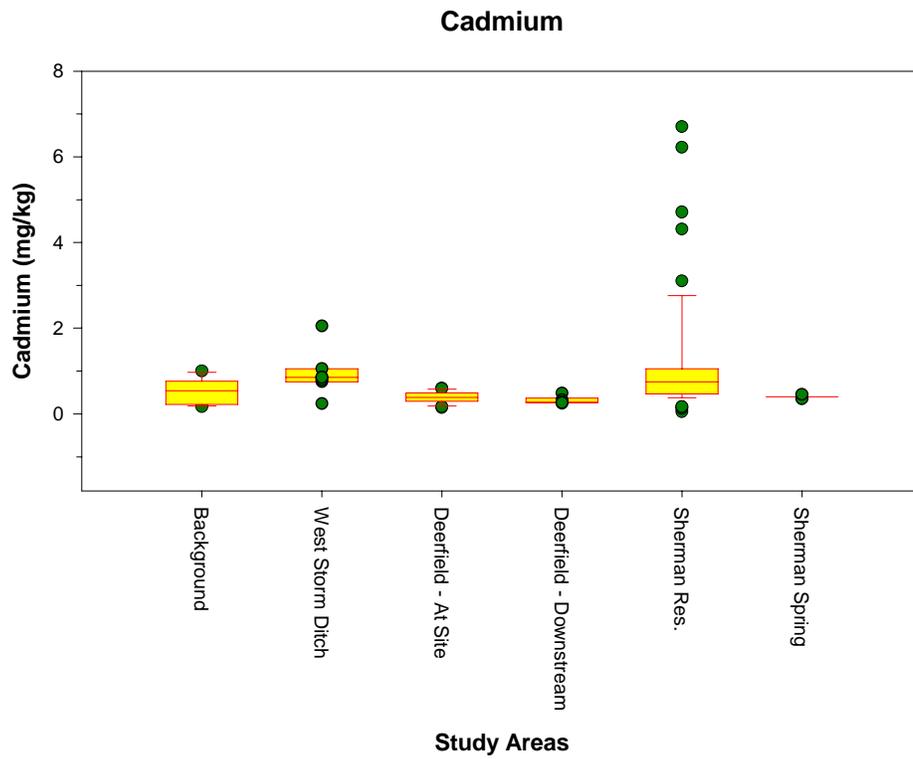
Beryllium



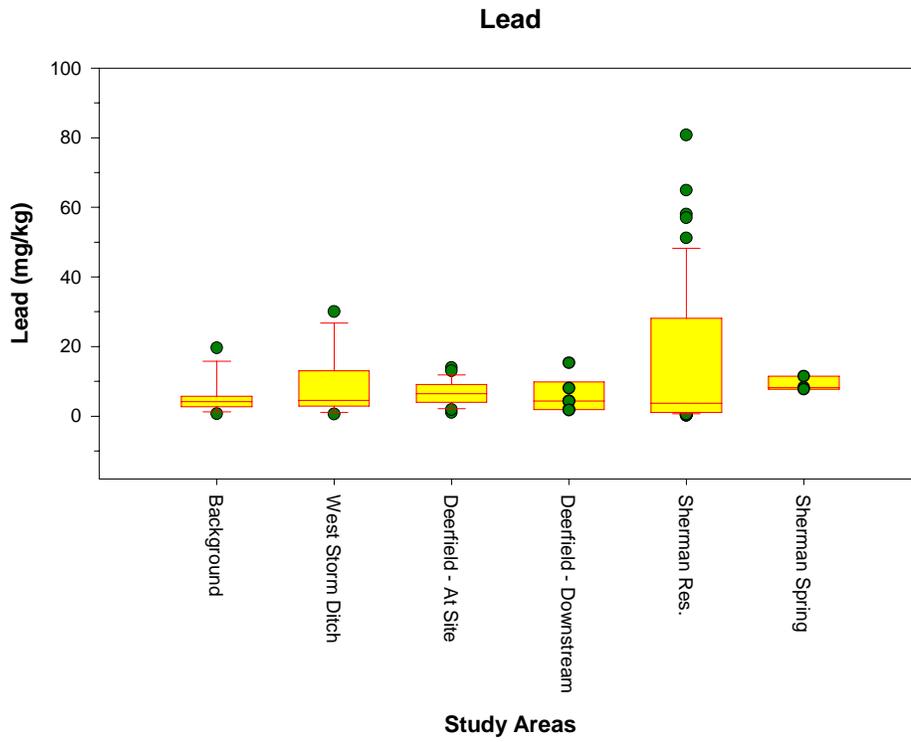
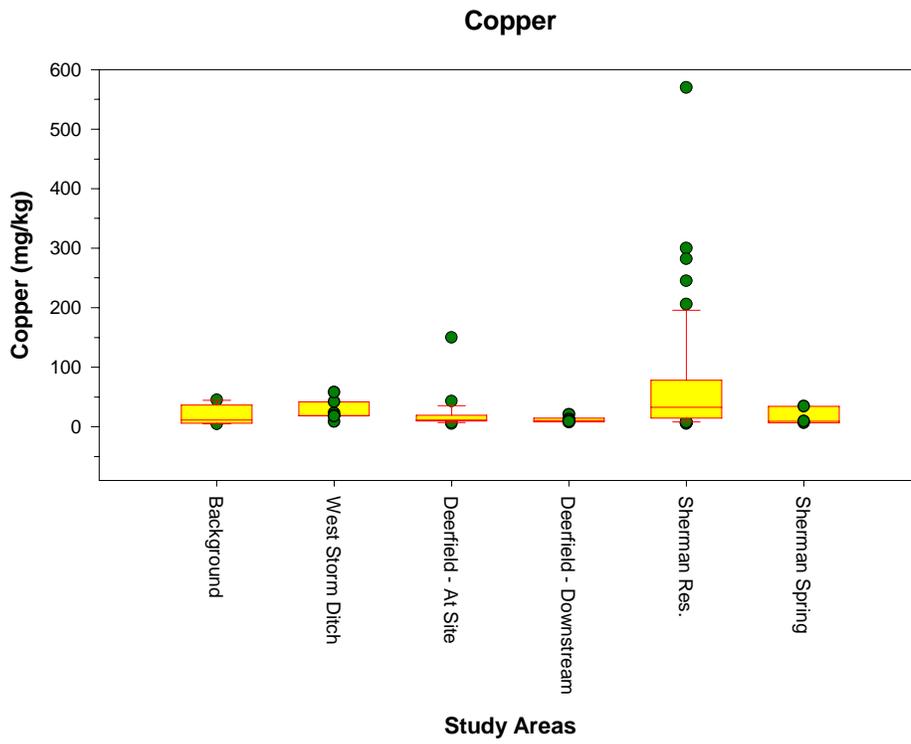
Boron



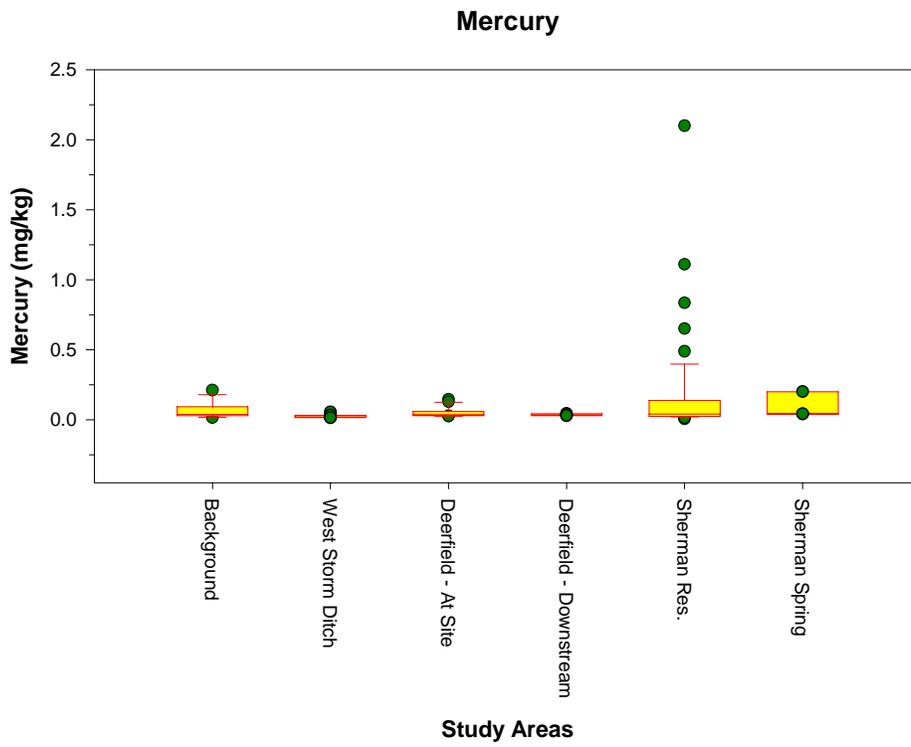
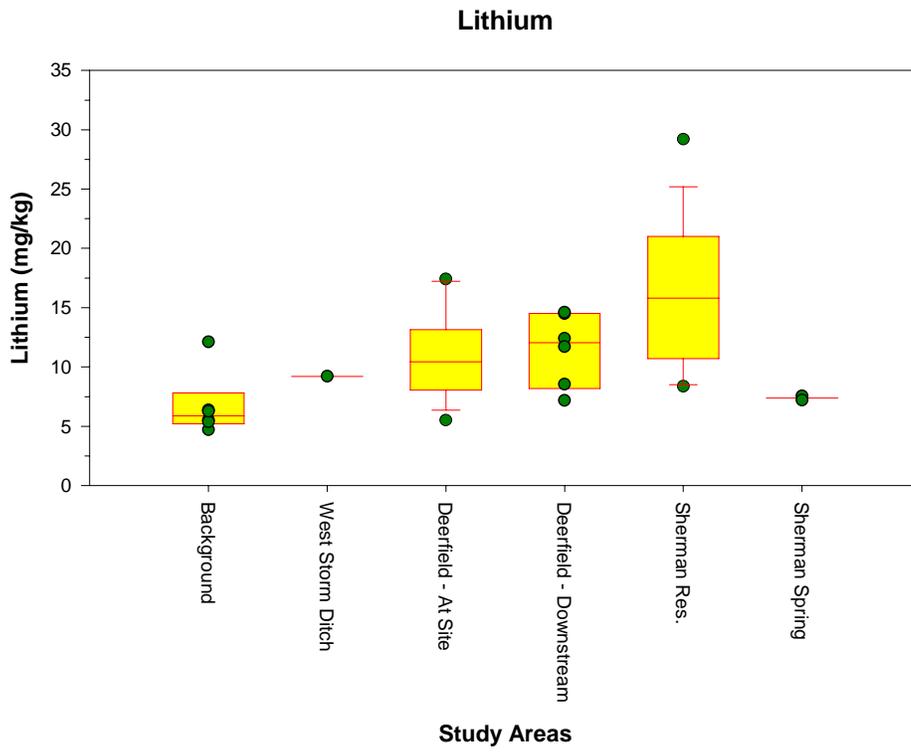
**Box-Whisker Plots
Sediments – Inorganics**



**Box-Whisker Plots
Sediments – Inorganics**

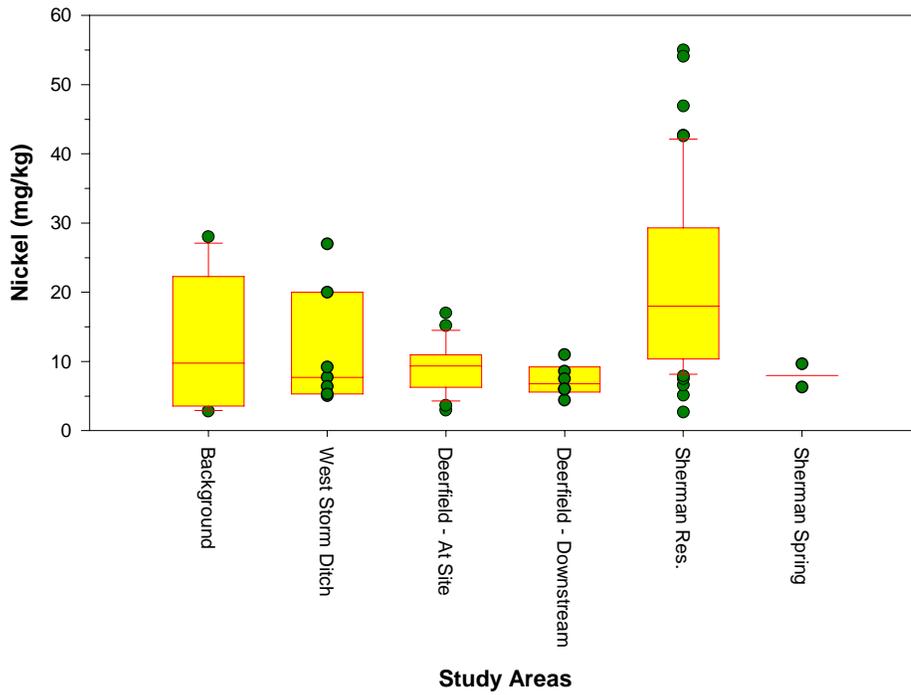


**Box-Whisker Plots
Sediments – Inorganics**

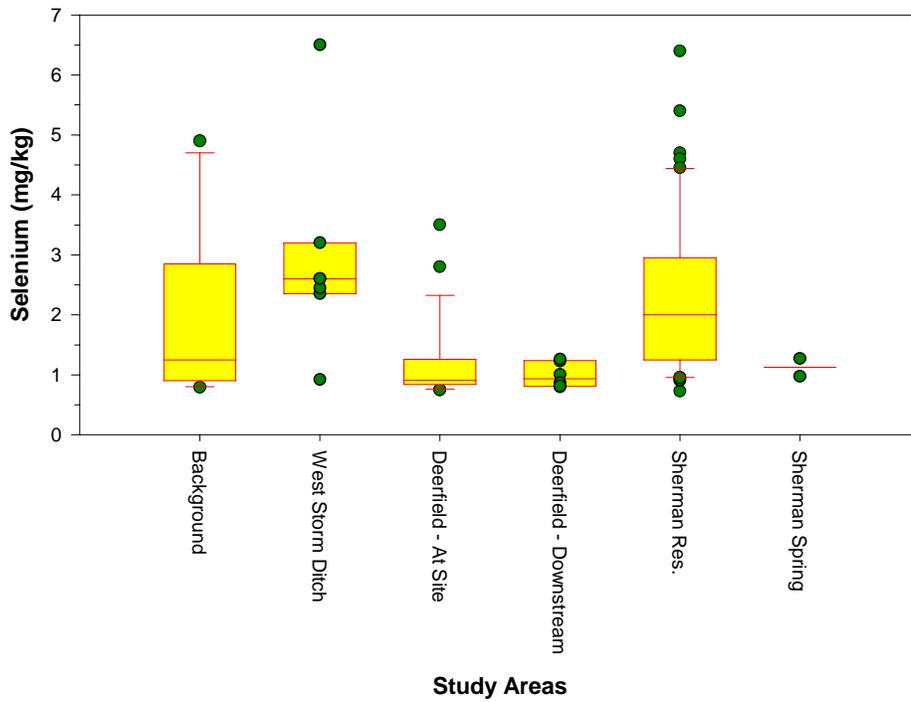


**Box-Whisker Plots
Sediments – Inorganics**

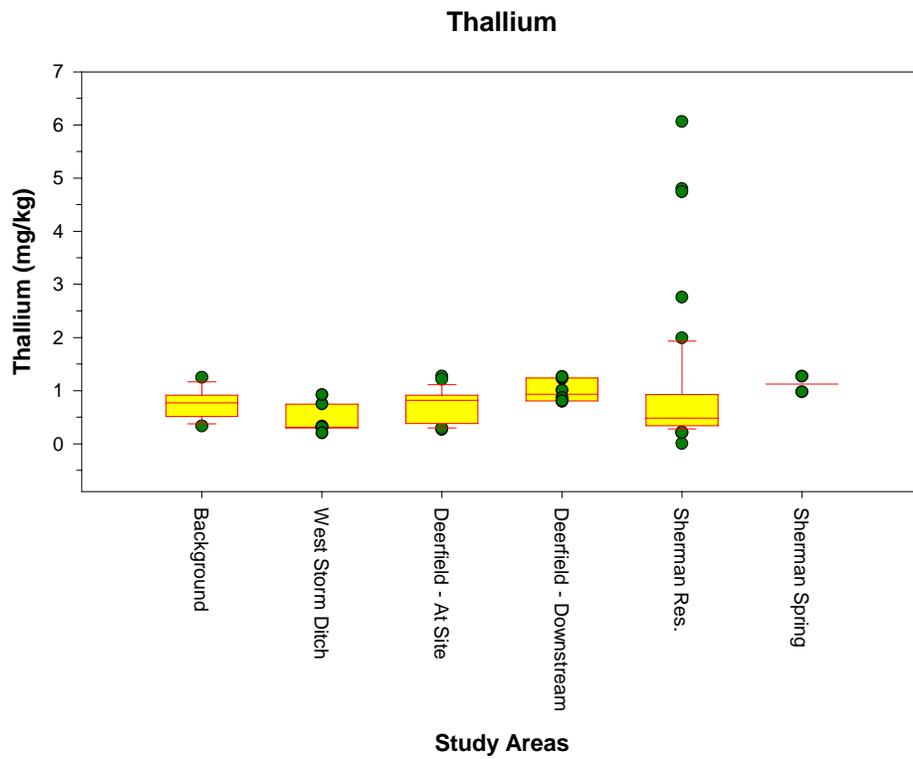
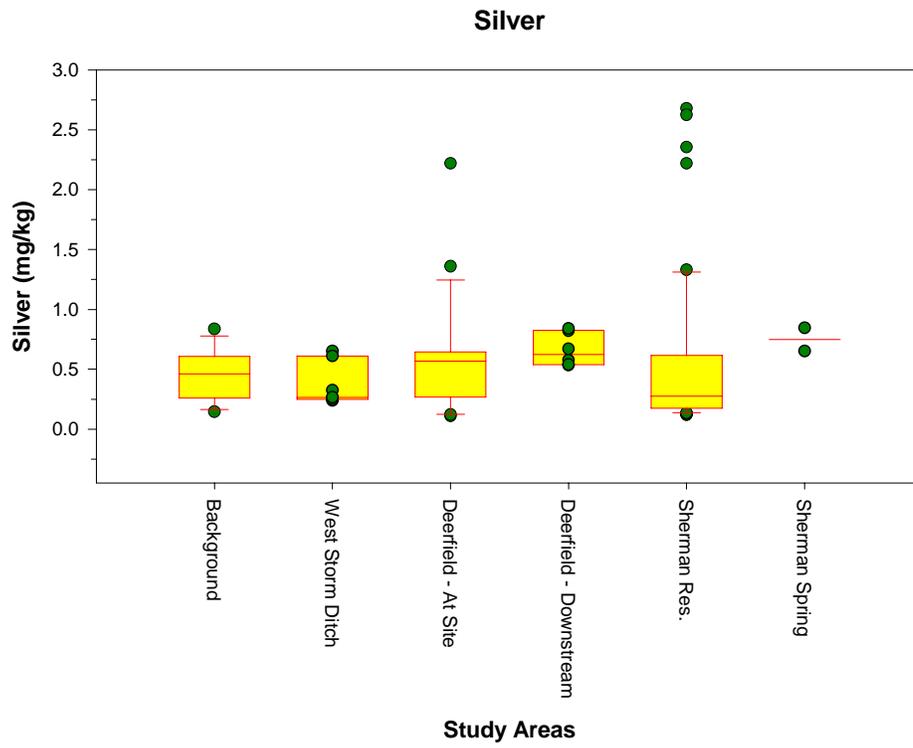
Nickel



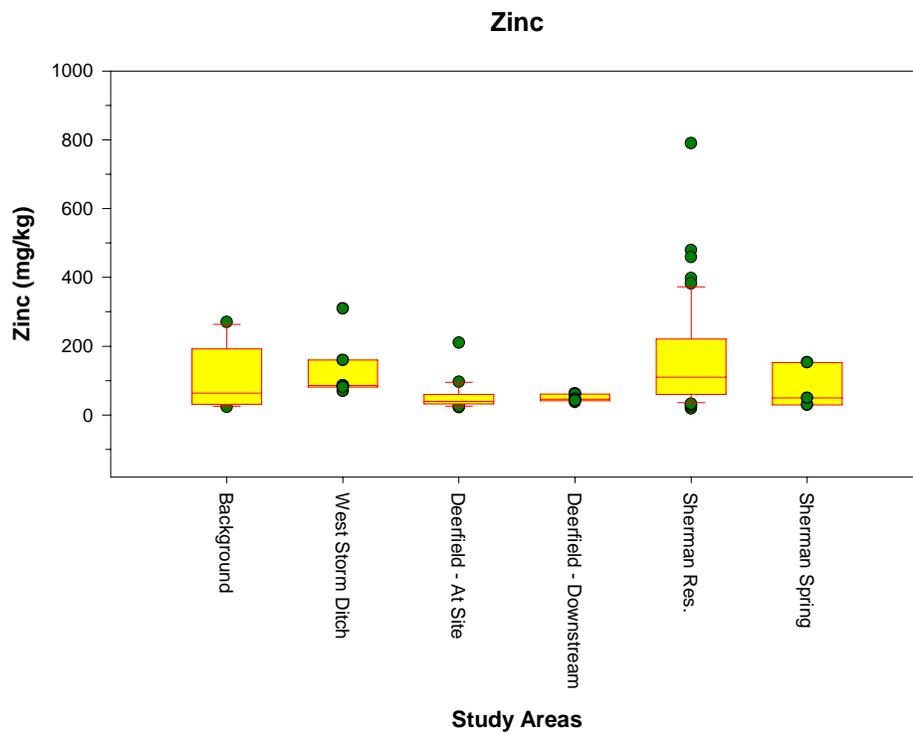
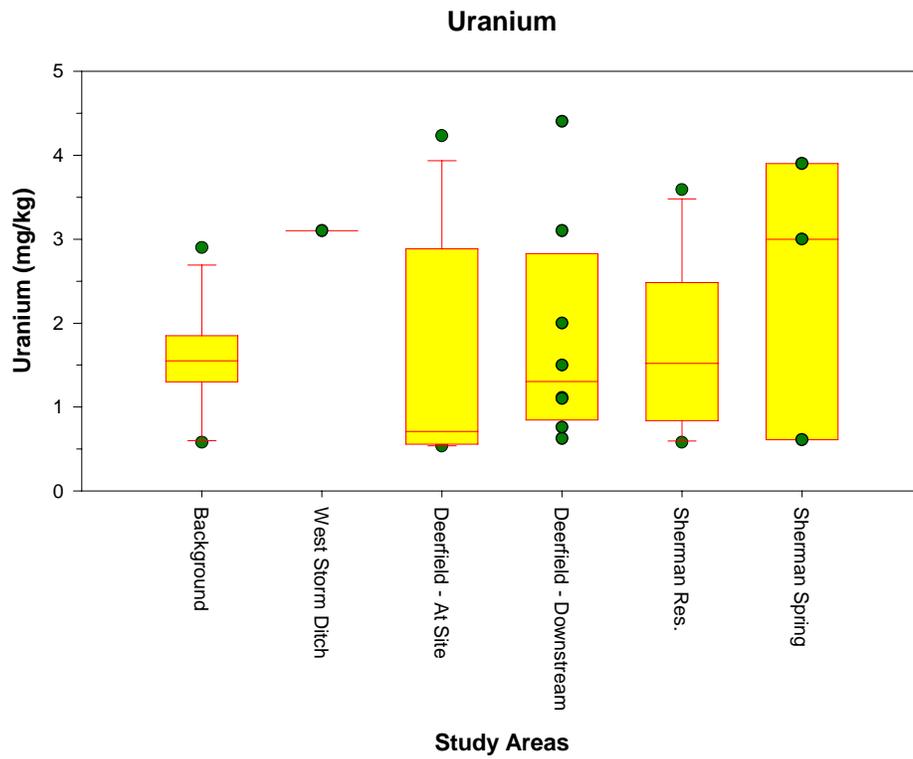
Selenium



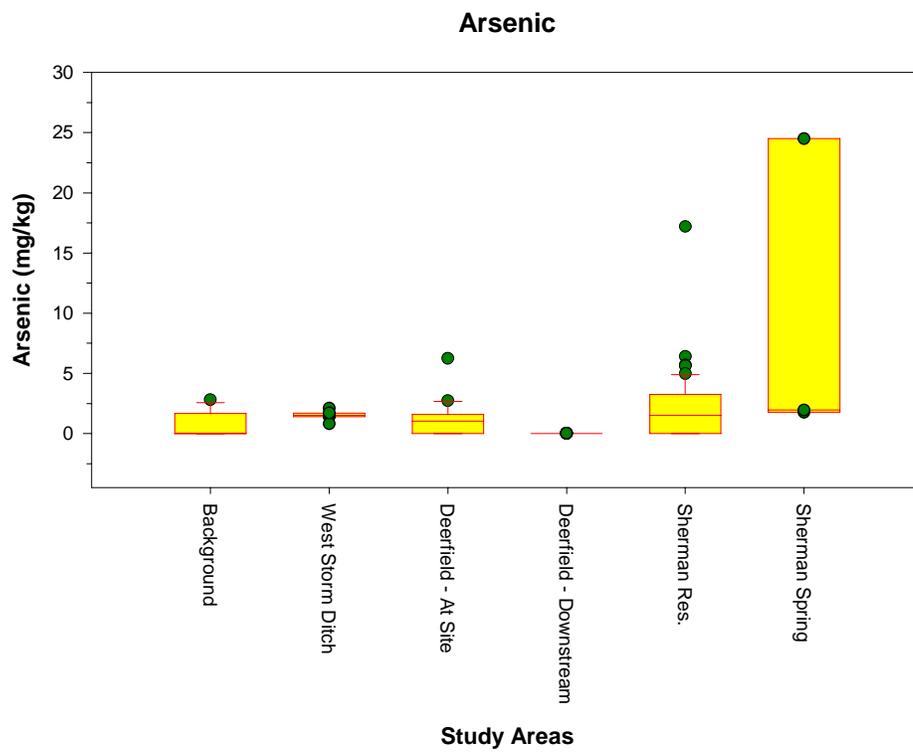
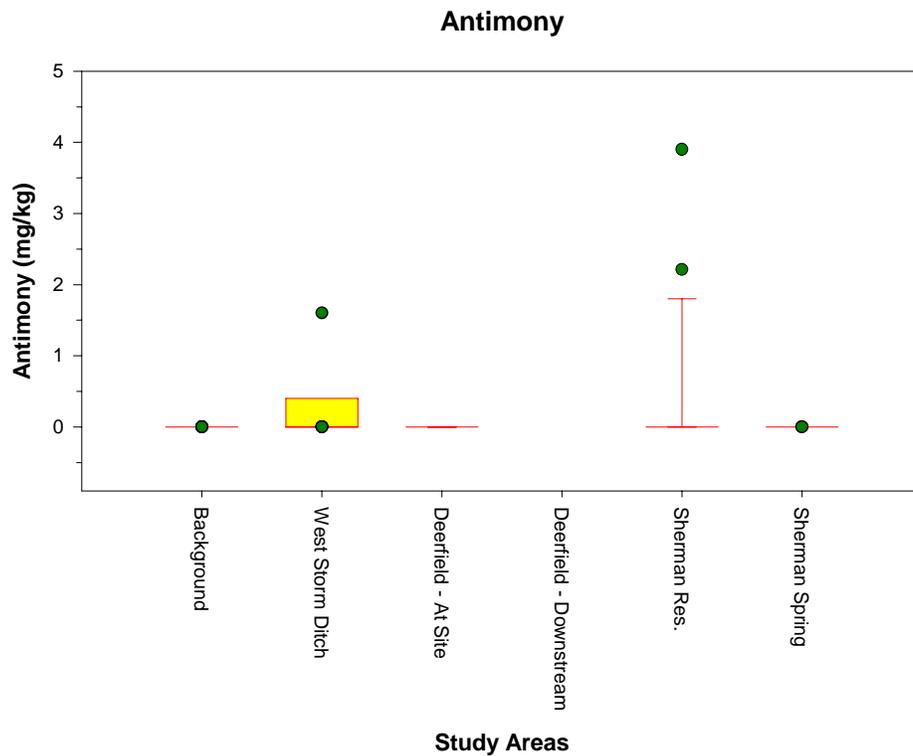
**Box-Whisker Plots
Sediments – Inorganics**



**Box-Whisker Plots
Sediments – Inorganics**



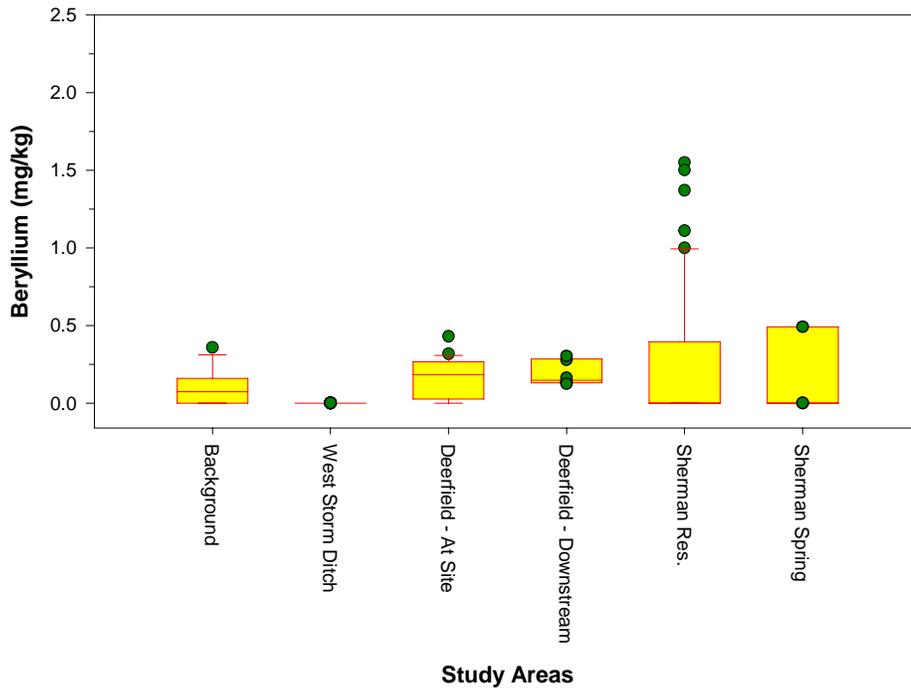
**Box-Whisker Plots
Sediments – Inorganics**



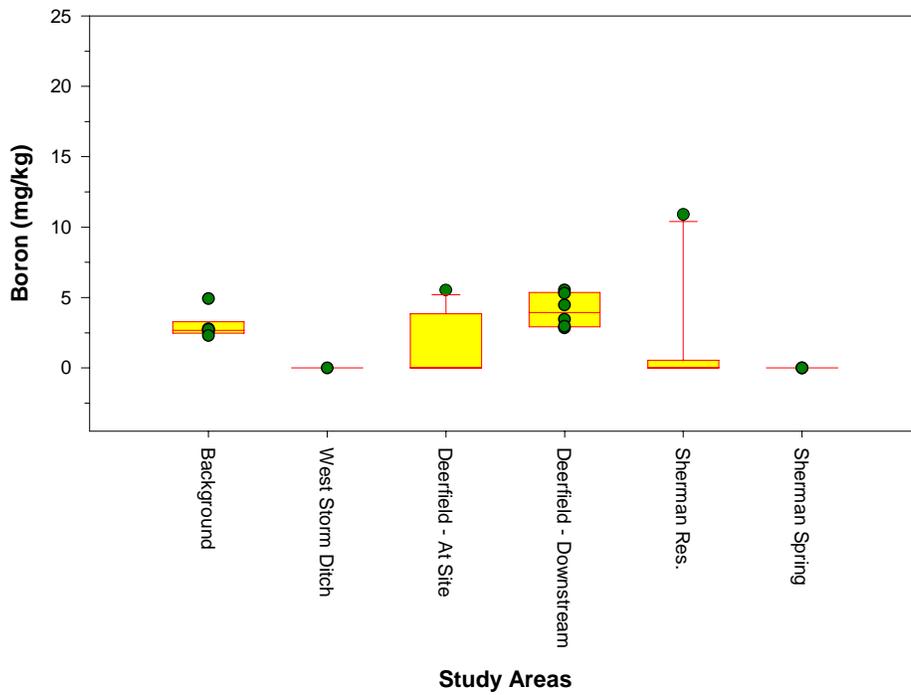
Non-Detects plotted at concentration = 0 mg/kg.

**Box-Whisker Plots
Sediments – Inorganics**

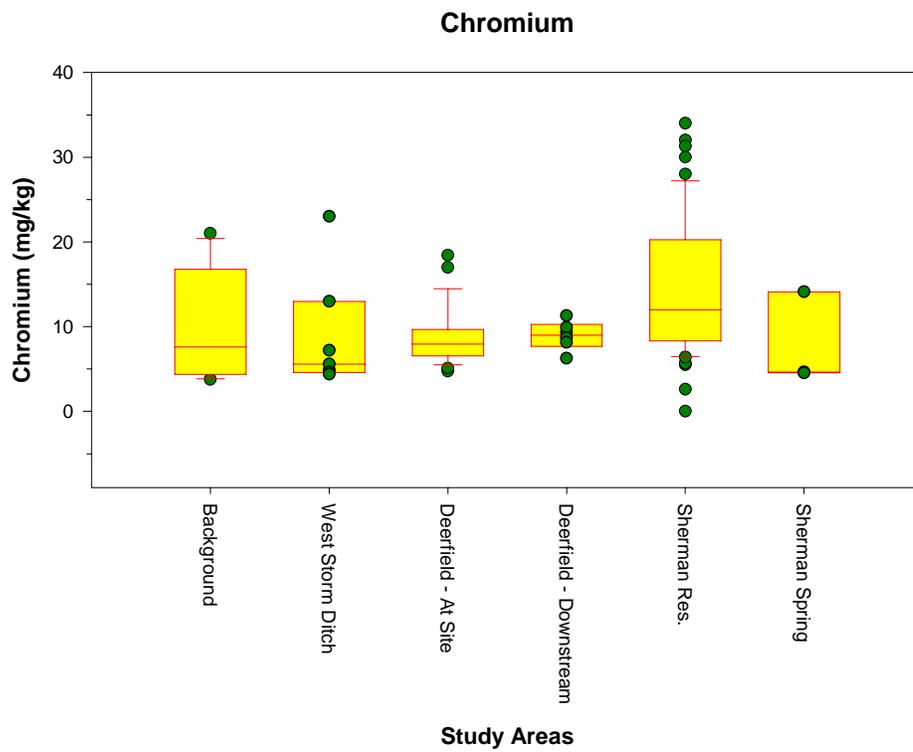
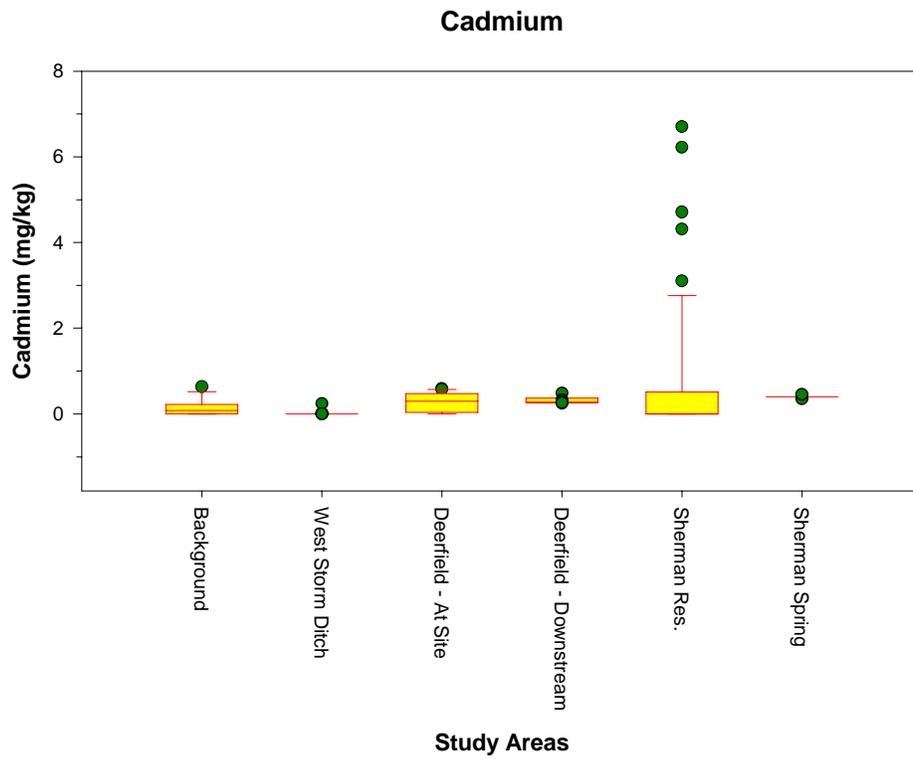
Beryllium



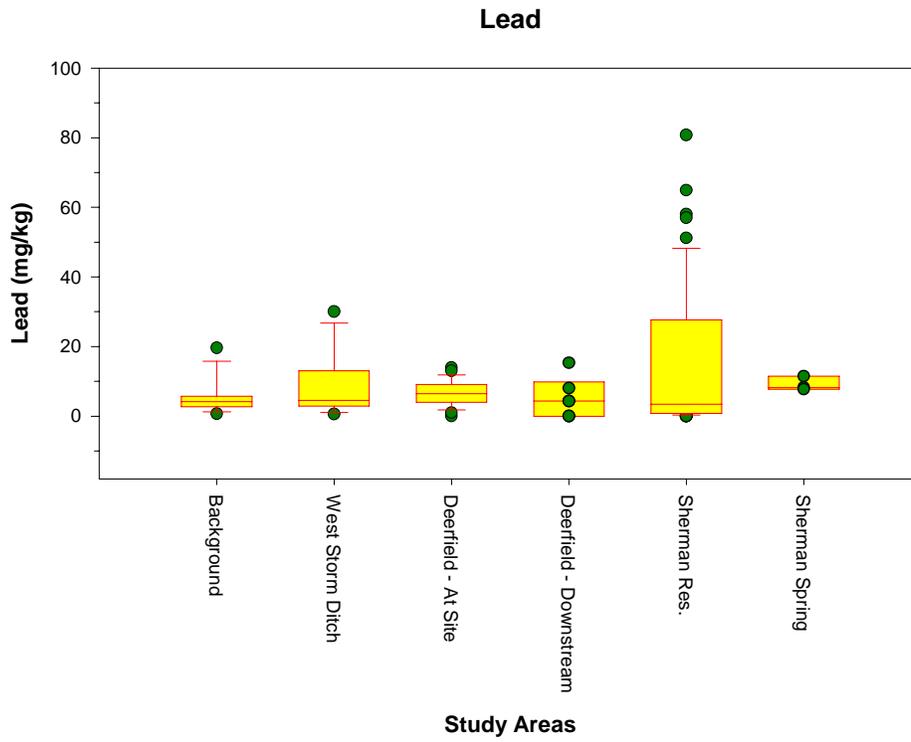
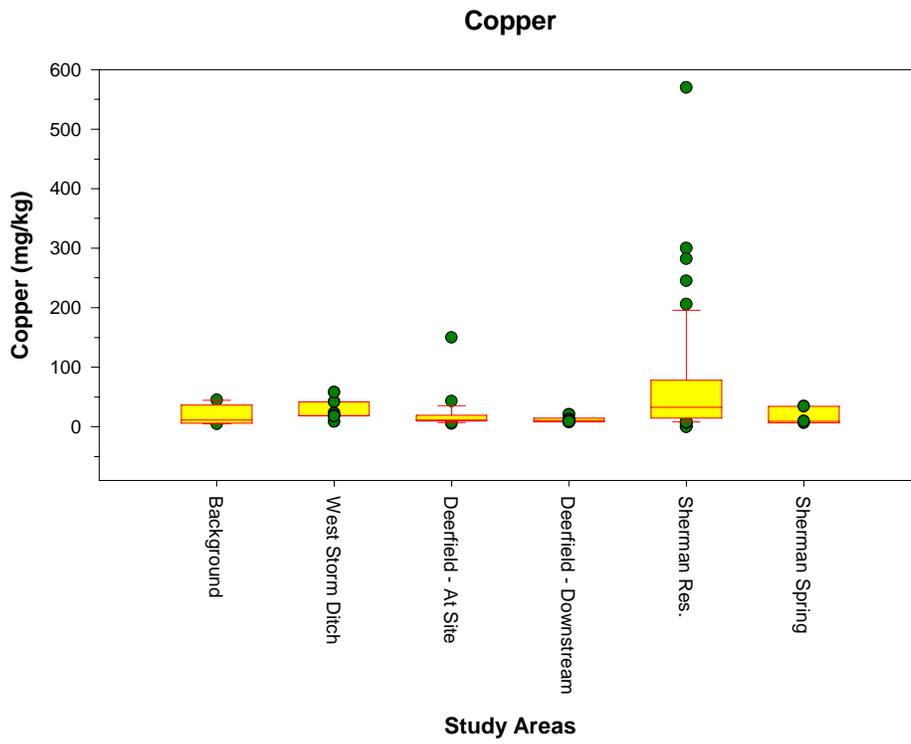
Boron



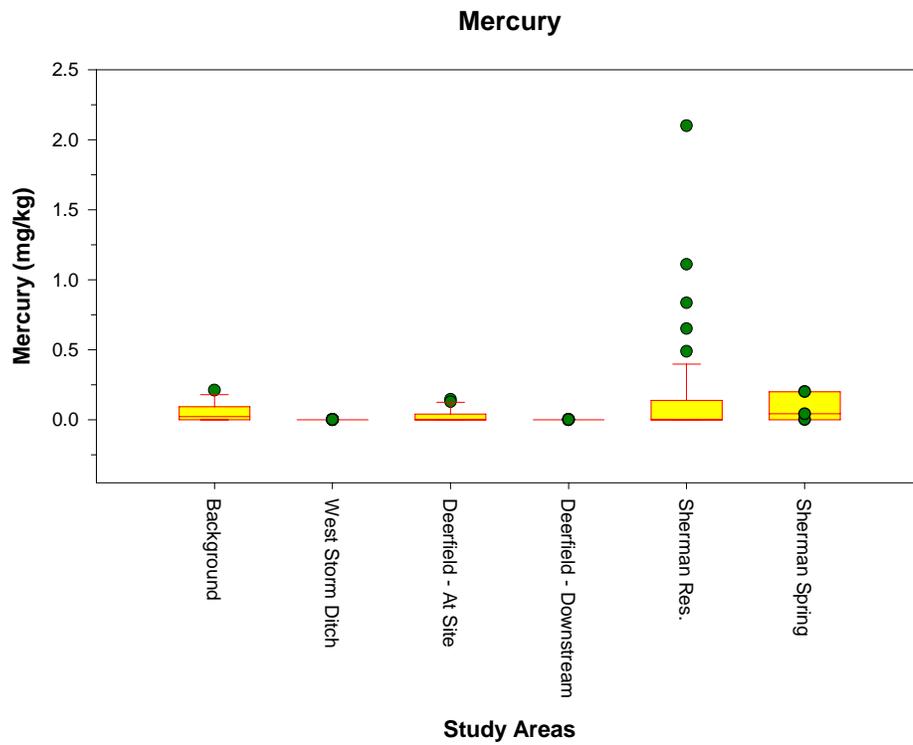
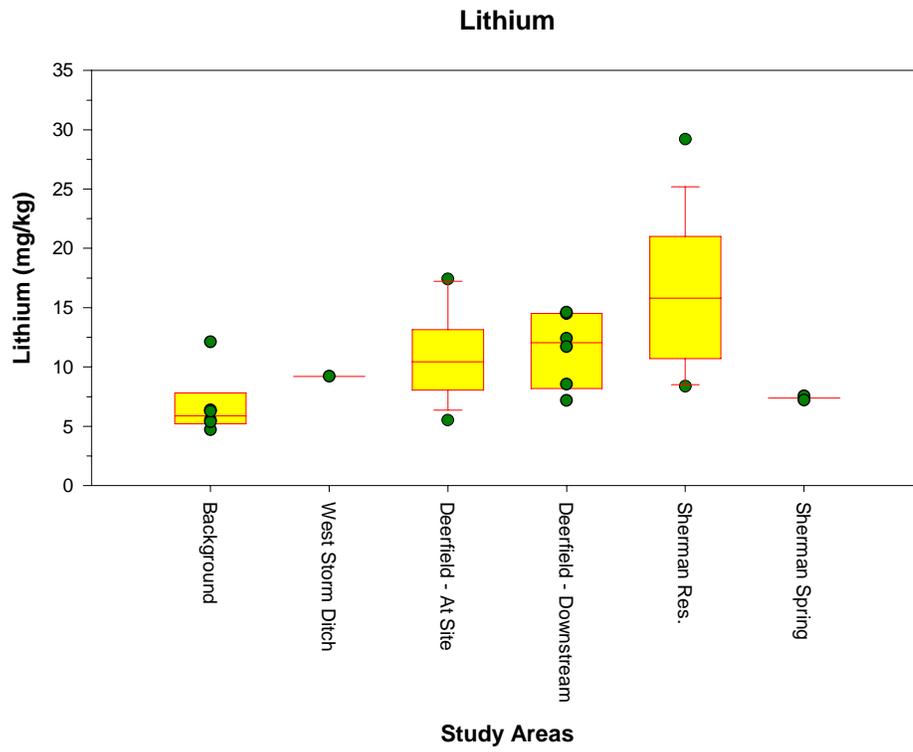
**Box-Whisker Plots
Sediments – Inorganics**



**Box-Whisker Plots
Sediments – Inorganics**

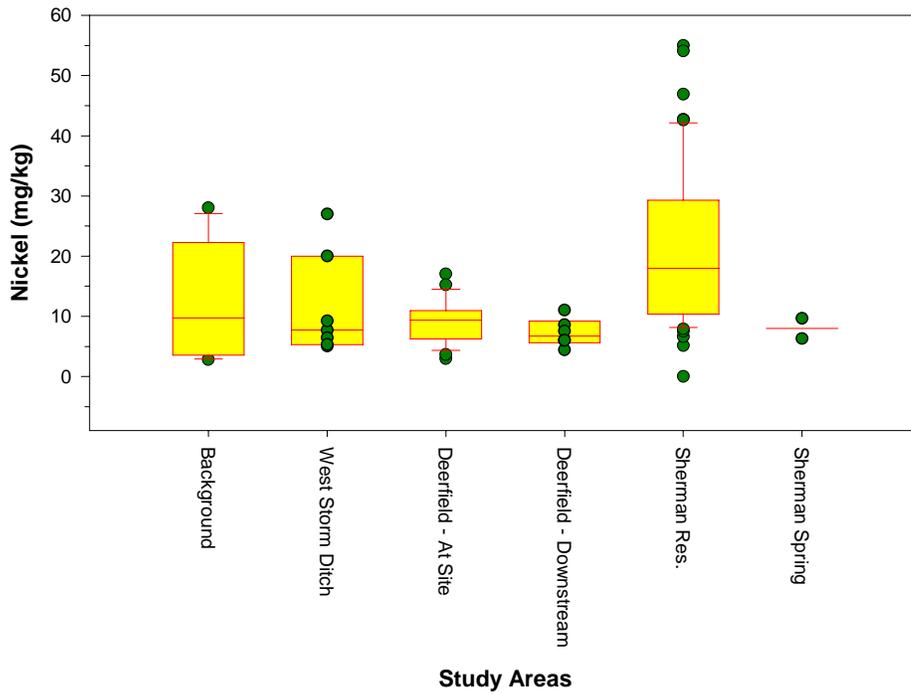


**Box-Whisker Plots
Sediments – Inorganics**

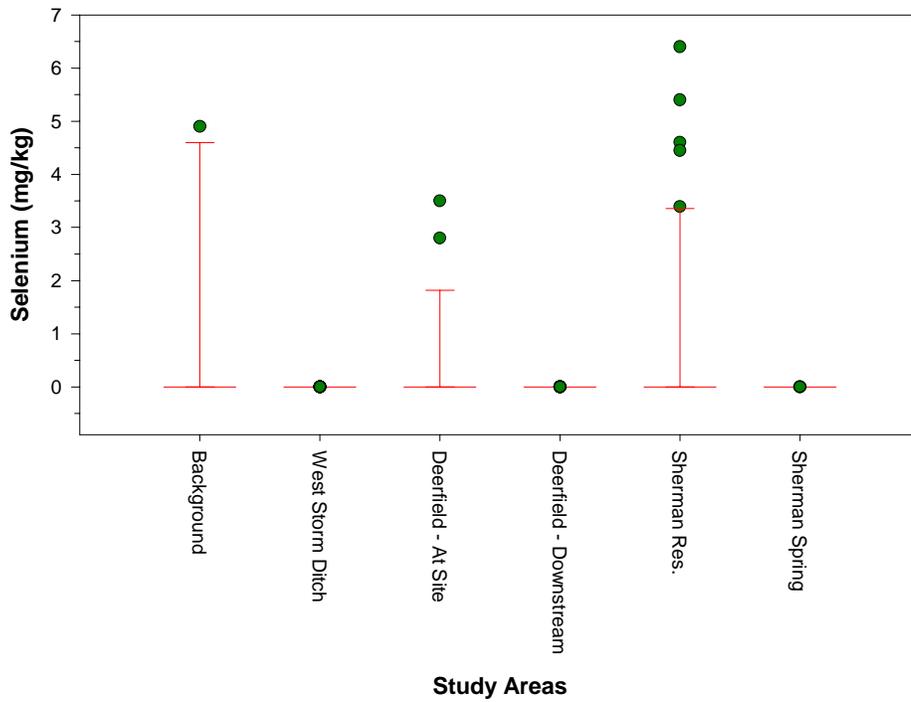


**Box-Whisker Plots
Sediments – Inorganics**

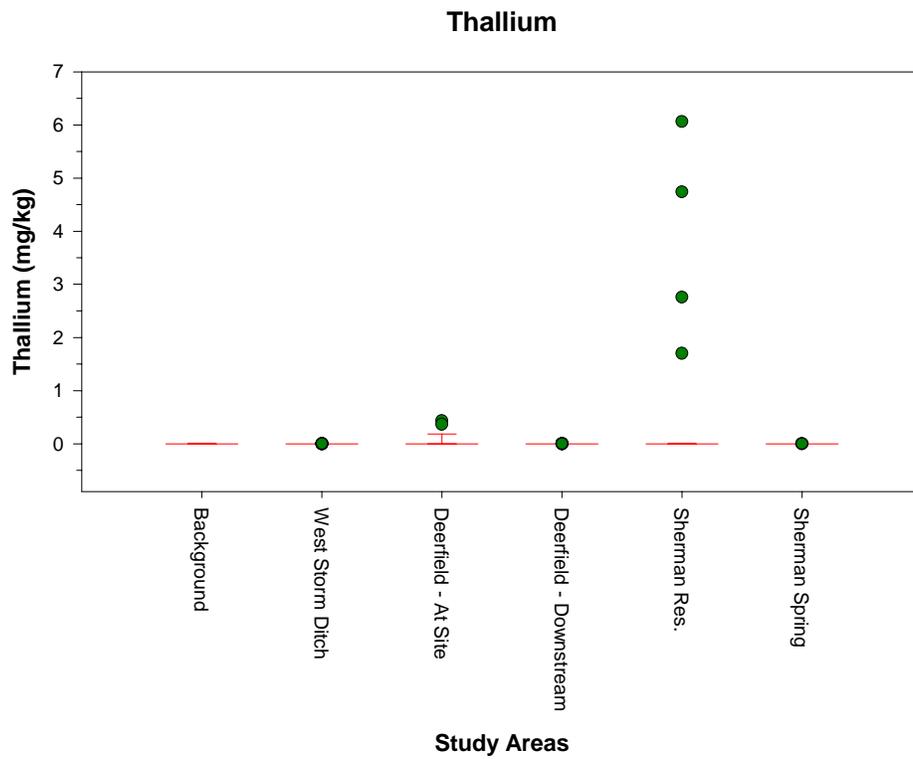
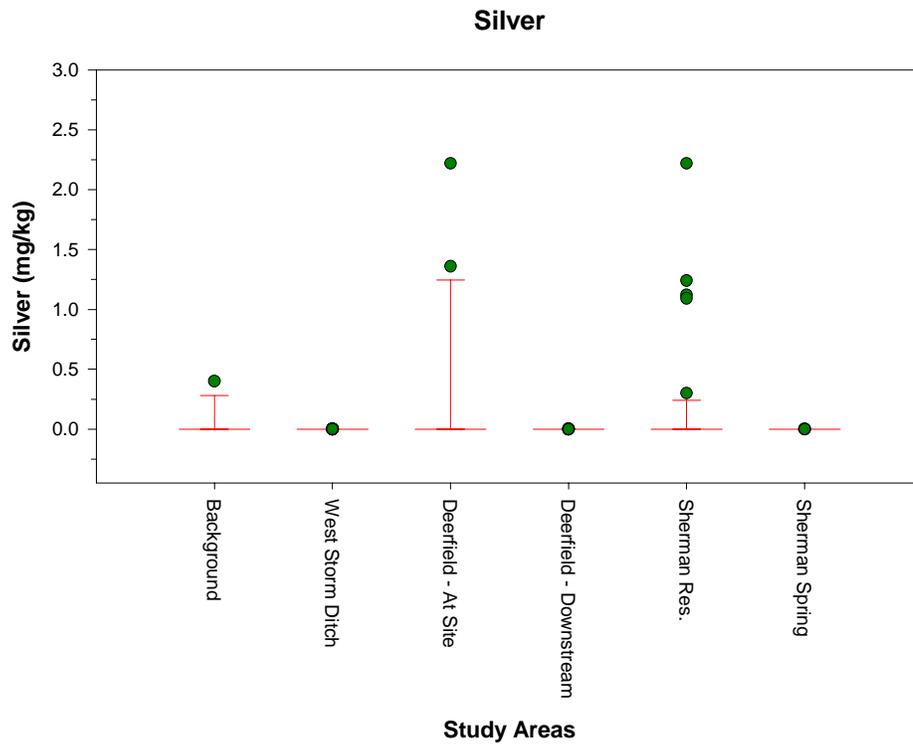
Nickel



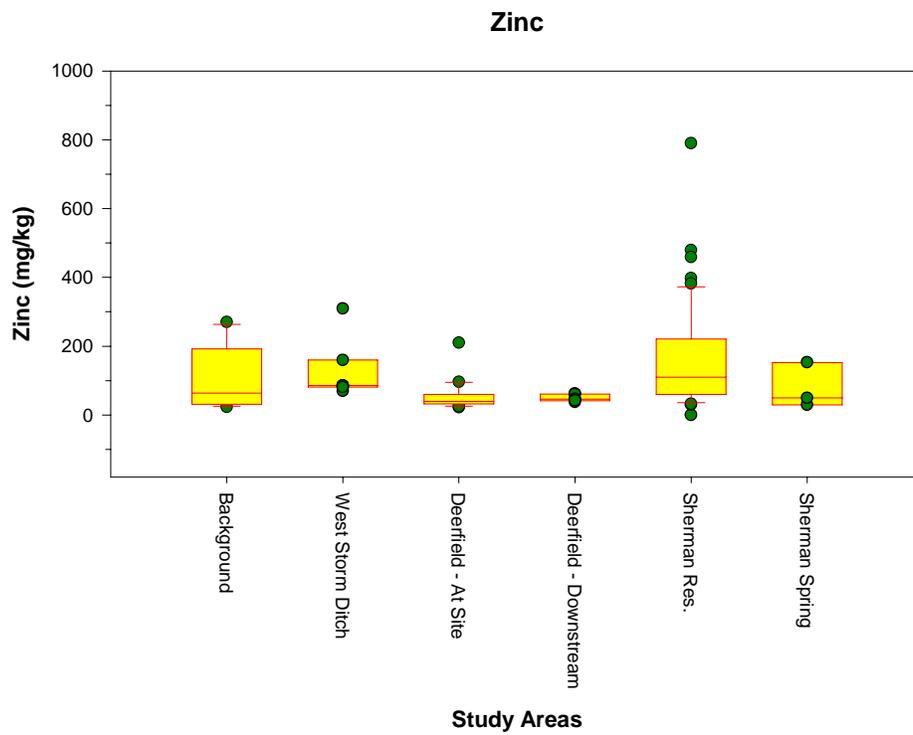
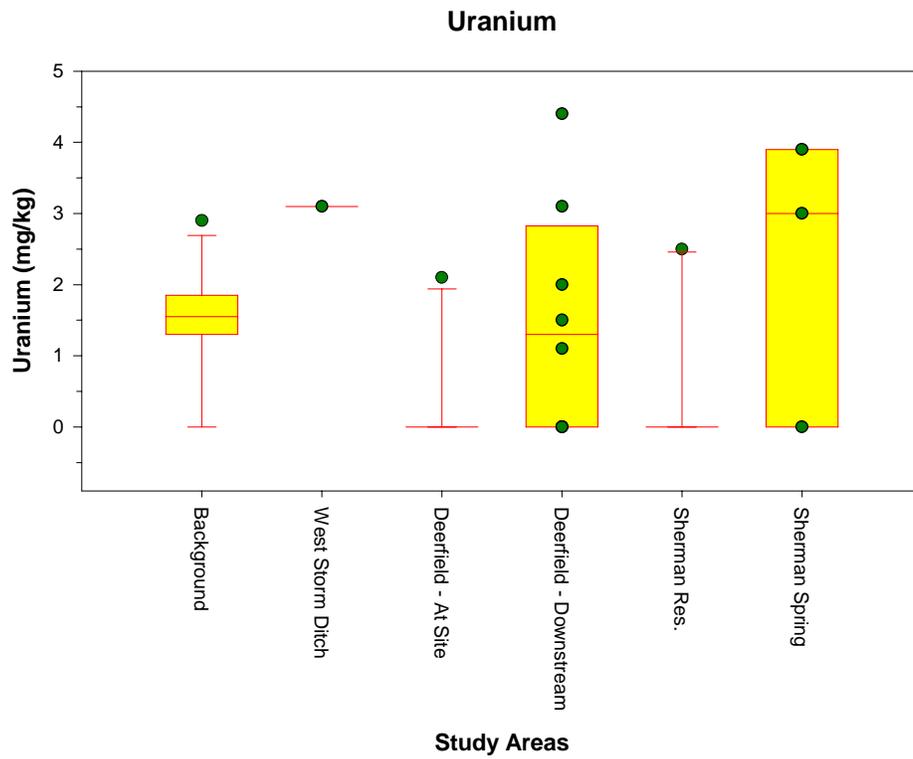
Selenium



**Box-Whisker Plots
Sediments – Inorganics**

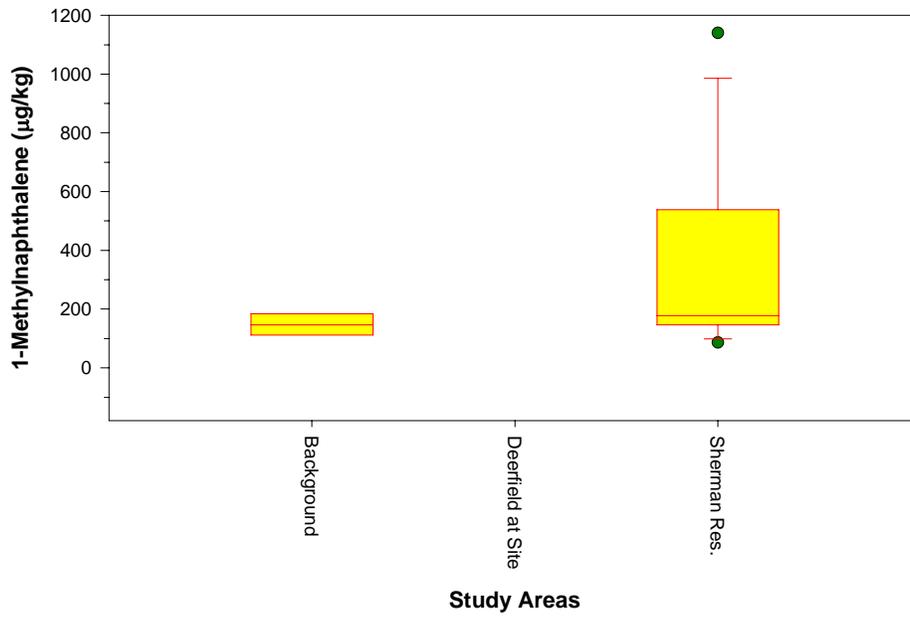


**Box-Whisker Plots
Sediments – Inorganics**

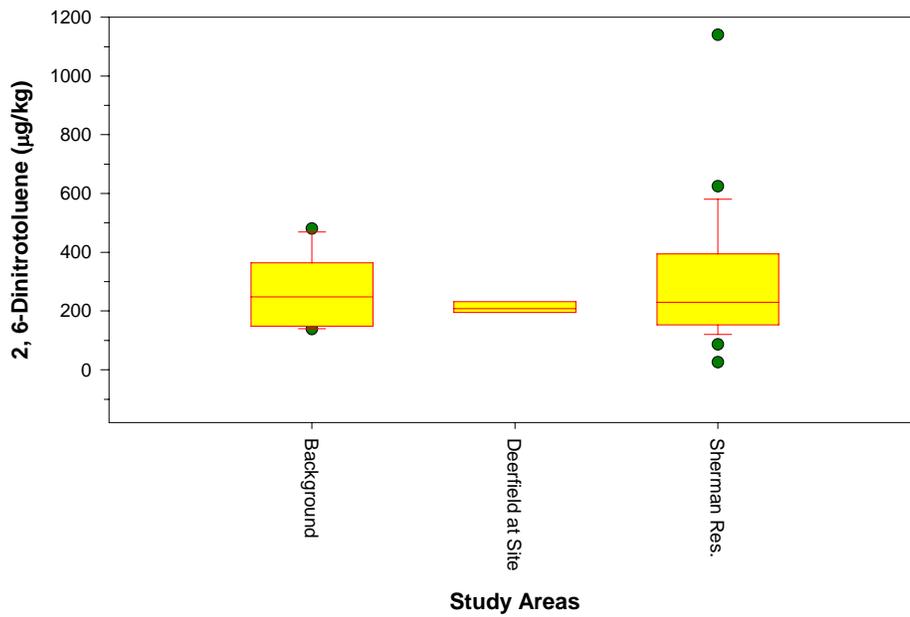


**Box-Whisker Plots
Sediments – SVOCs**

1-Methylnaphthalene



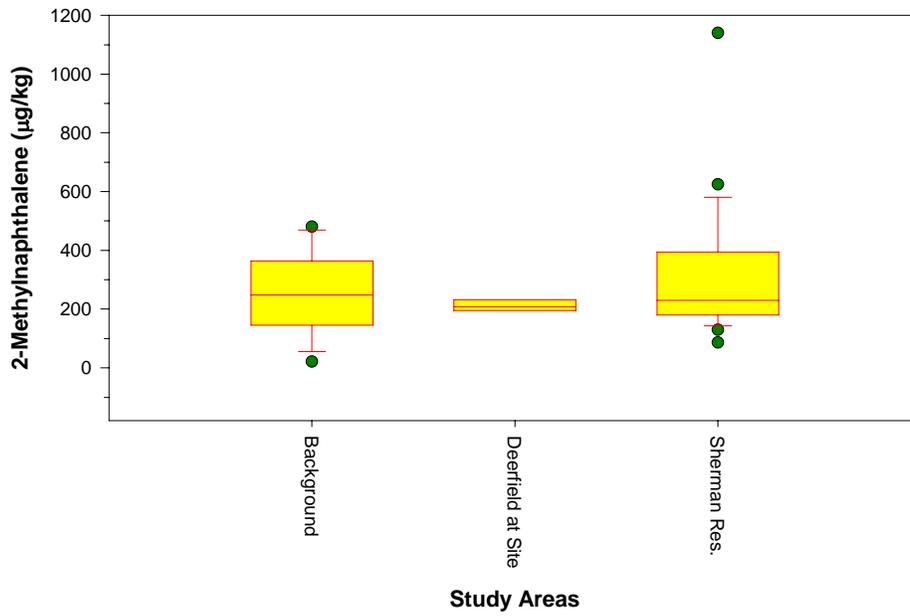
2, 6-Dinitrotoluene



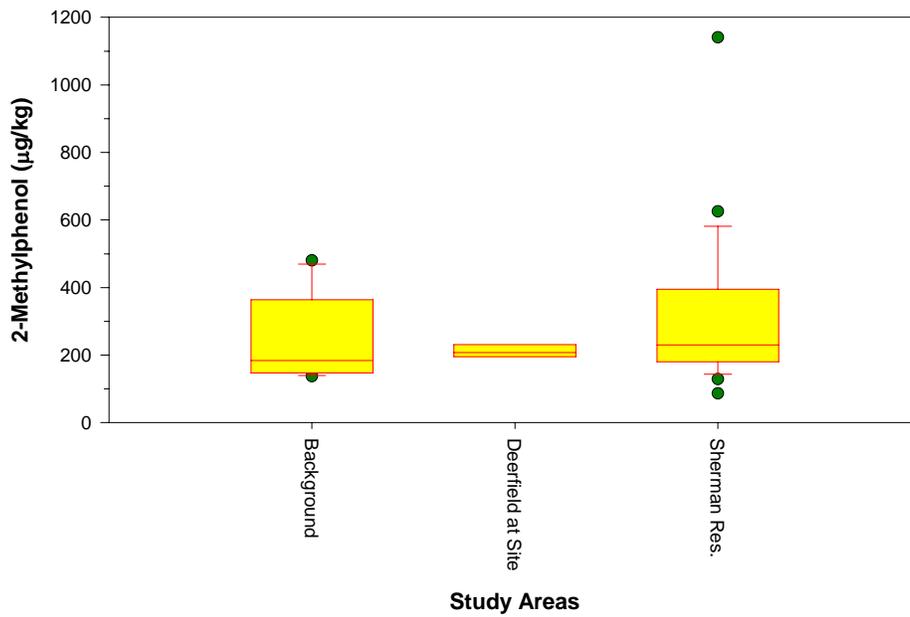
Non-Detects plotted at 1/2 sample detection limit.

**Box-Whisker Plots
Sediments – SVOCs**

2-Methylnaphthalene

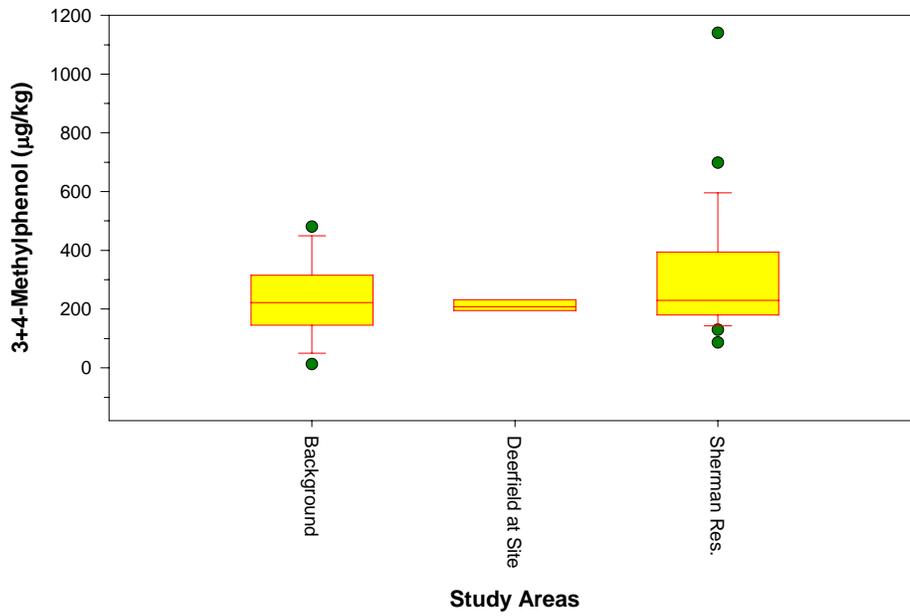


2-Methylphenol

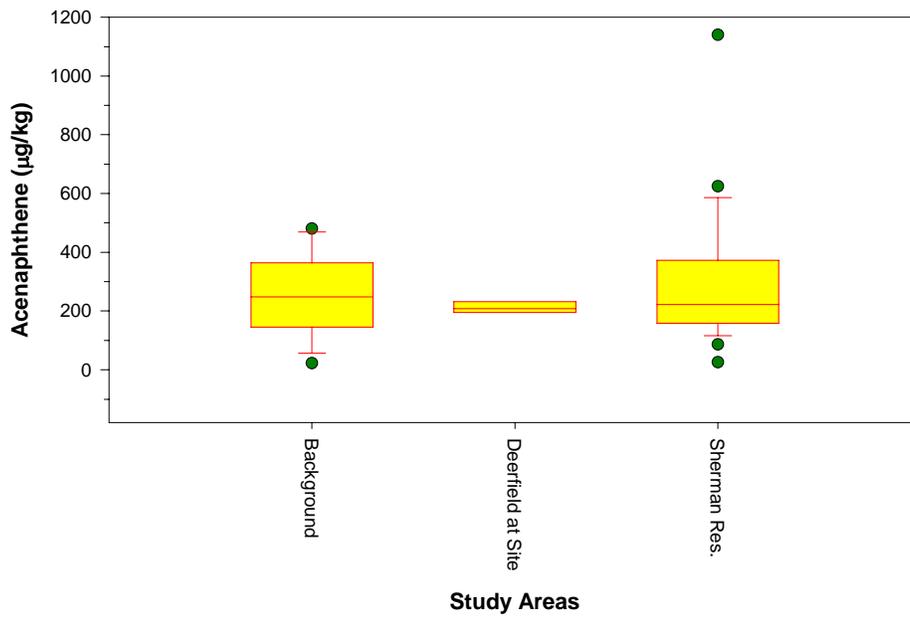


**Box-Whisker Plots
Sediments – SVOCs**

3+4-Methylphenol

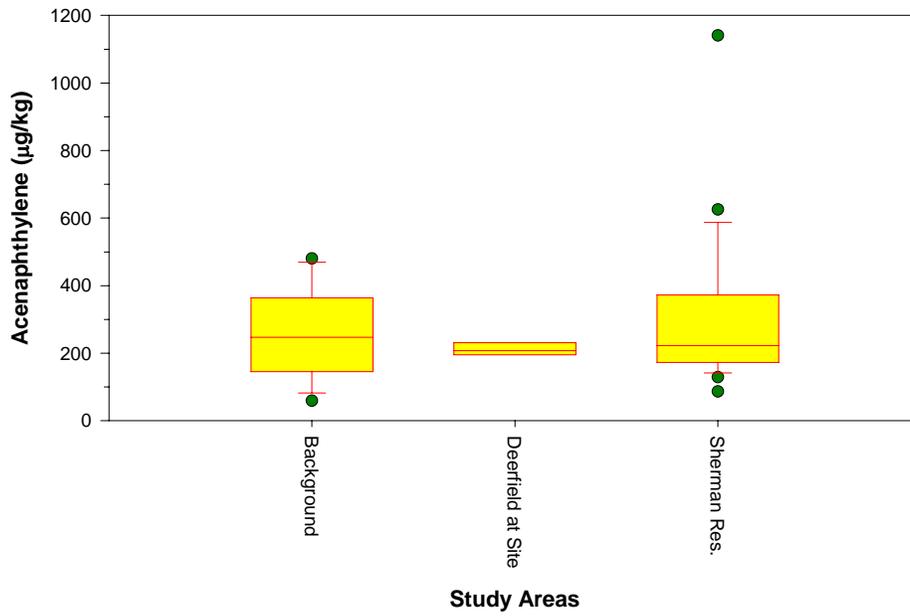


Acenaphthene

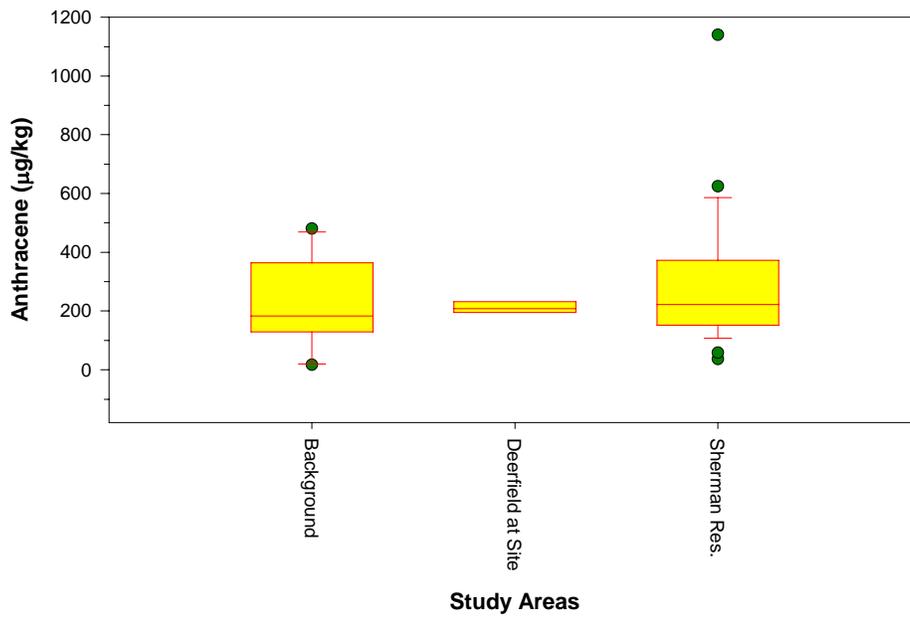


**Box-Whisker Plots
Sediments – SVOCs**

Acenaphthylene

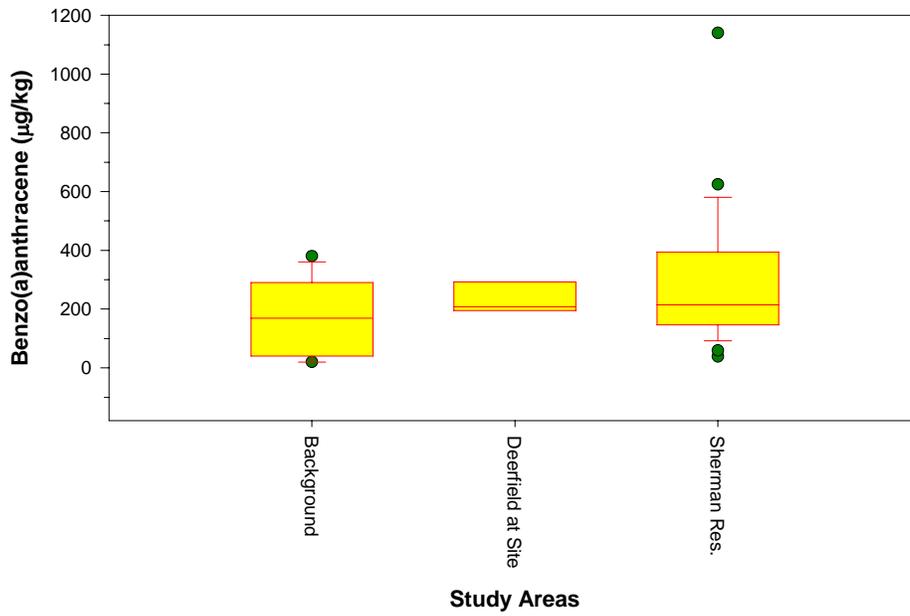


Anthracene

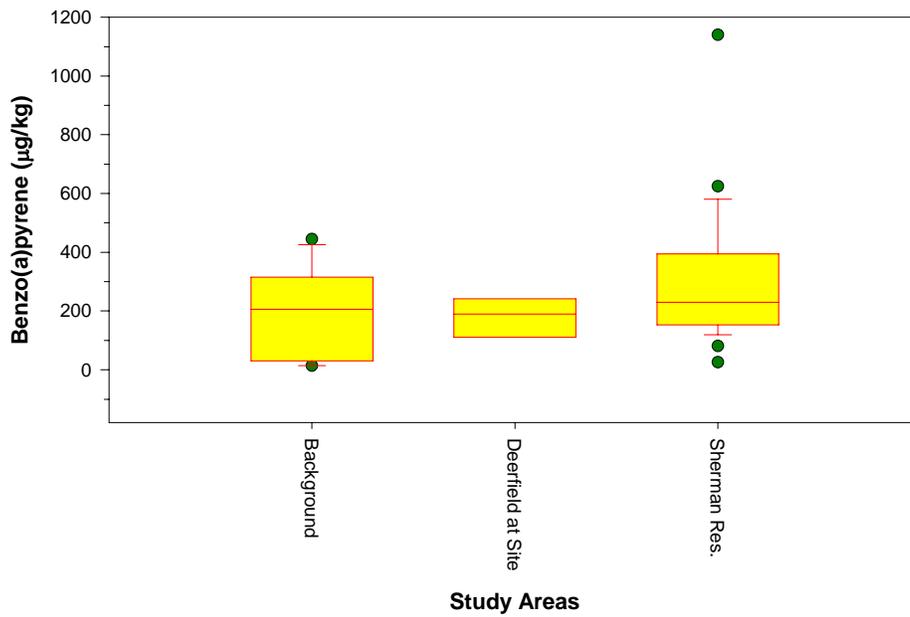


**Box-Whisker Plots
Sediments – SVOCs**

Benzo(a)anthracene

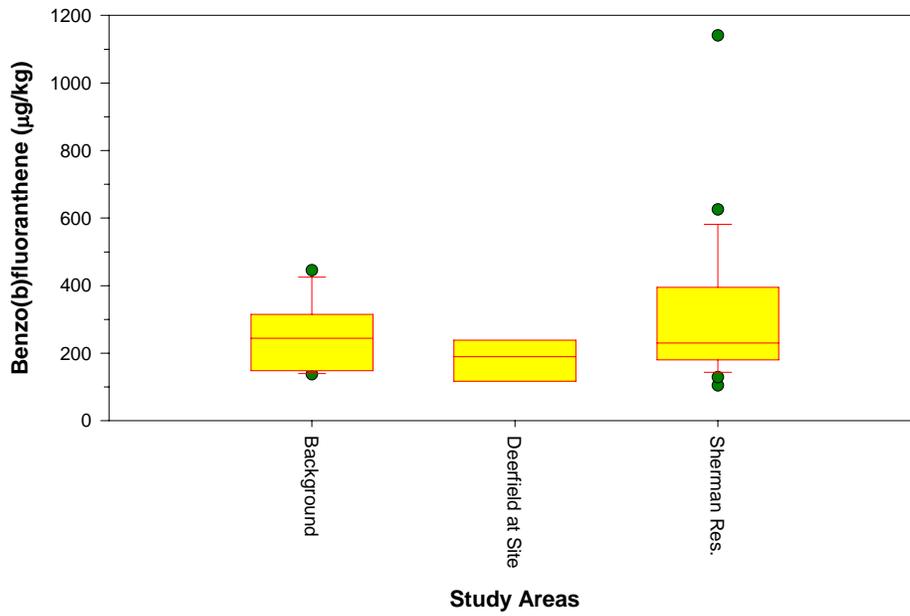


Benzo(a)pyrene

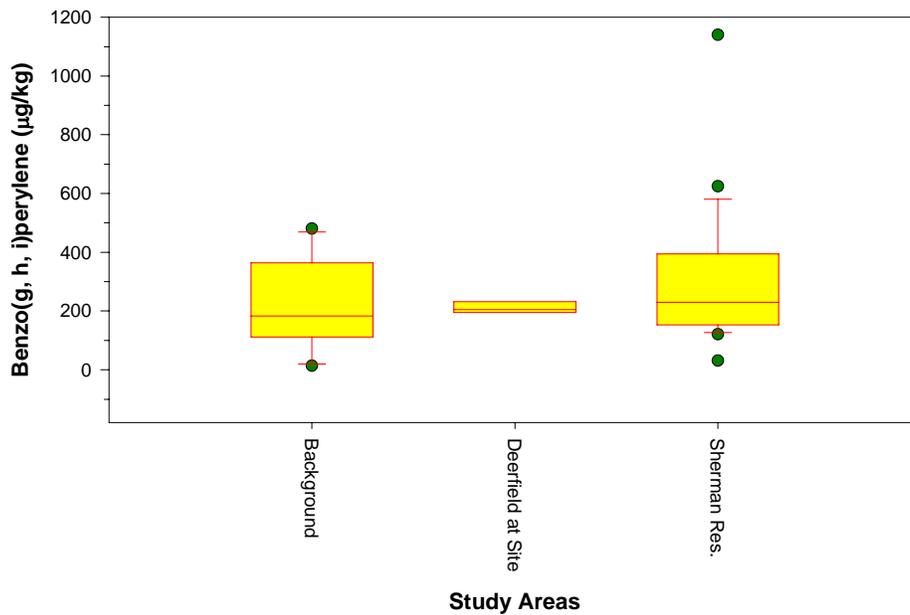


**Box-Whisker Plots
Sediments – SVOCs**

Benzo(b)fluoranthene

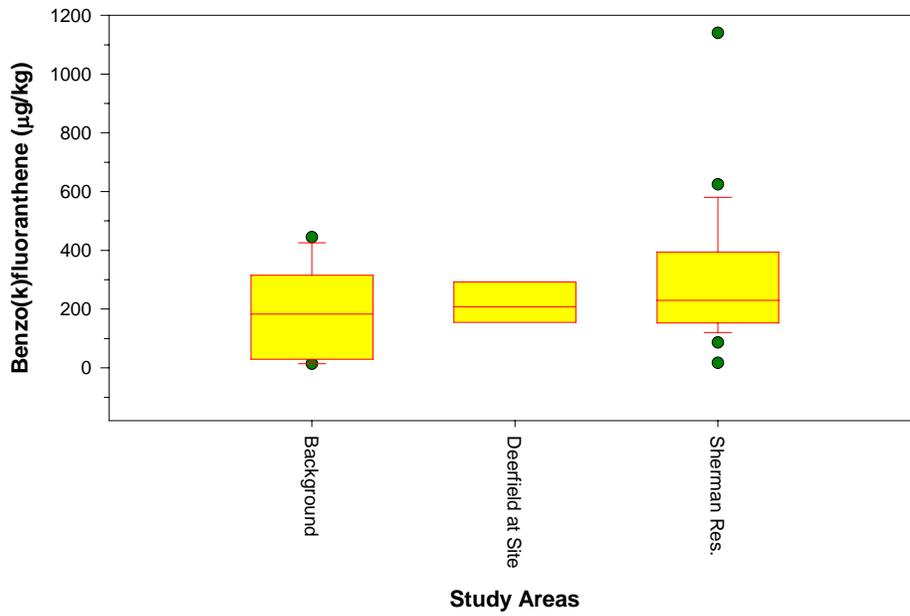


Benzo(g, h, i)perylene

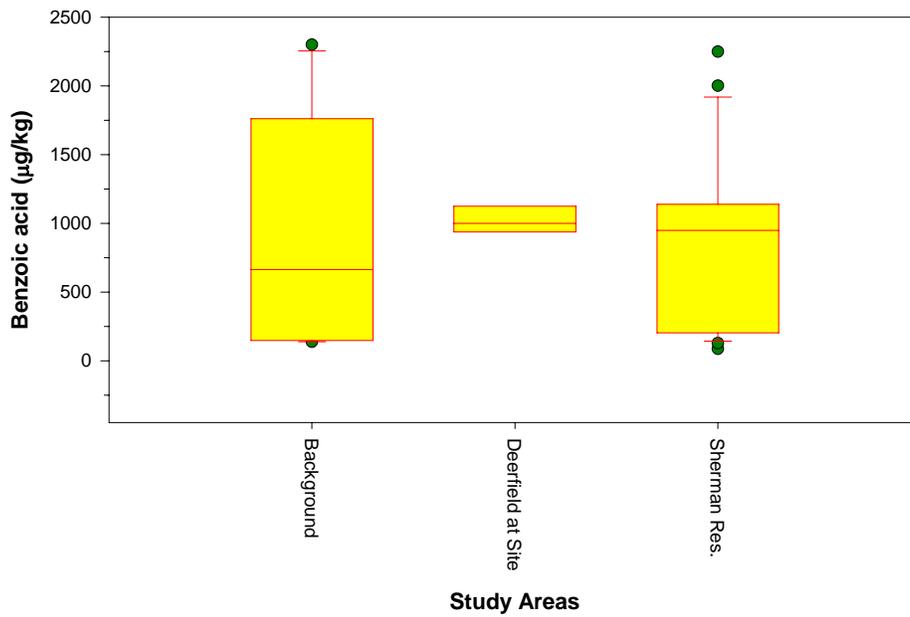


**Box-Whisker Plots
Sediments – SVOCs**

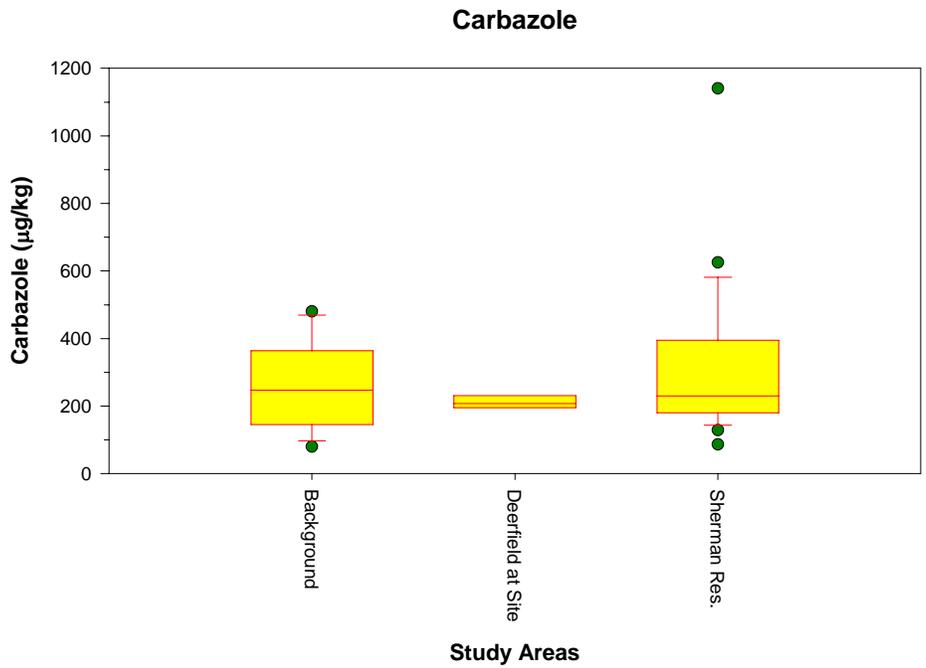
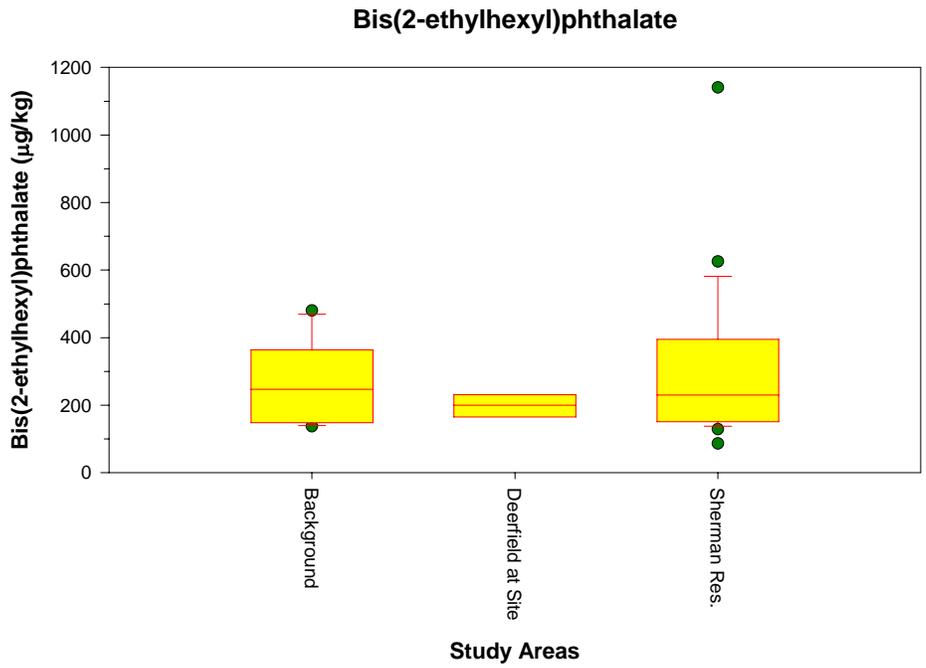
Benzo(k)fluoranthene



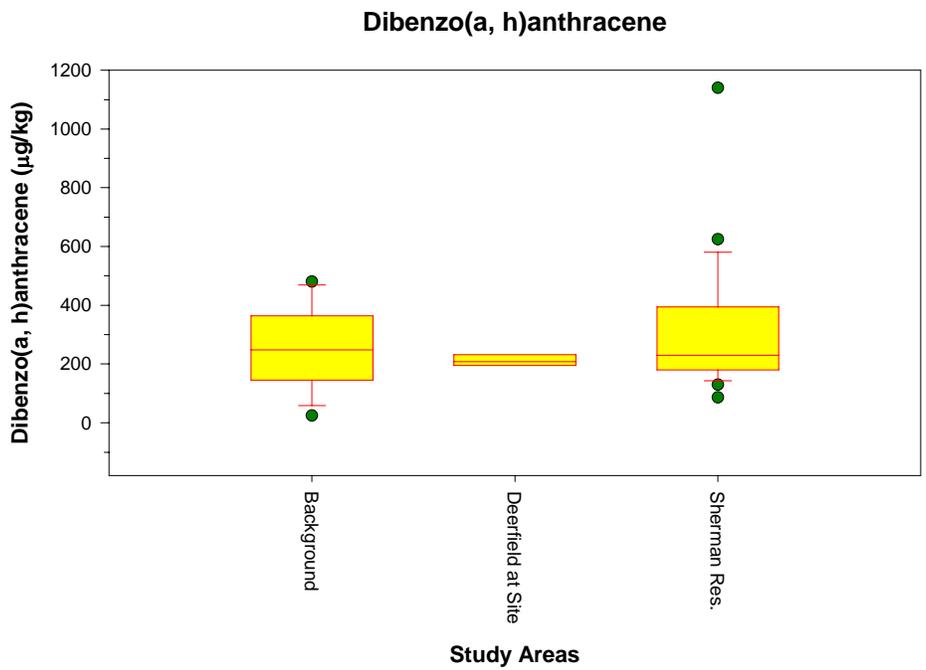
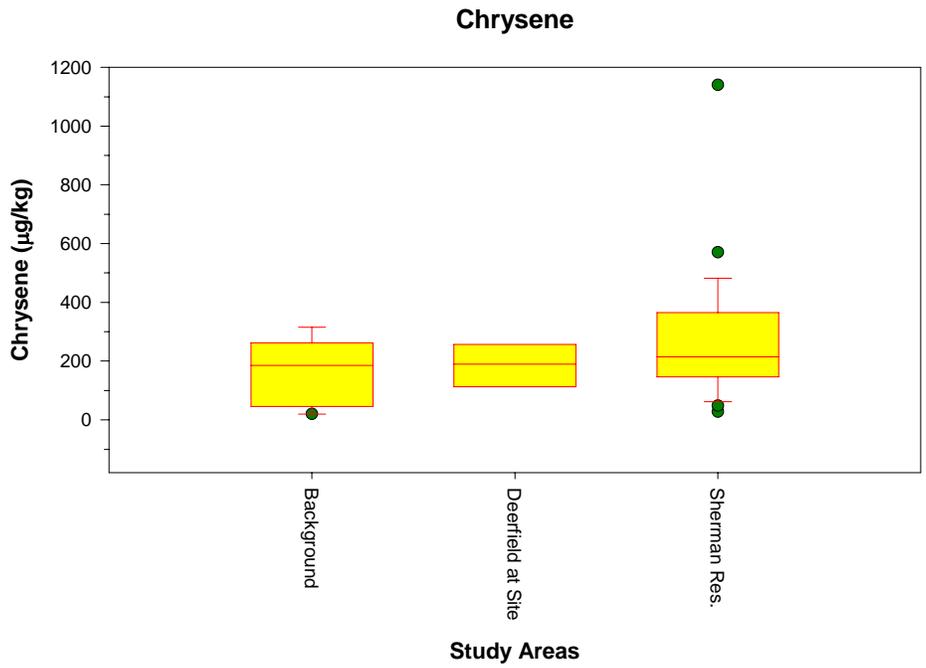
Benzoic acid



**Box-Whisker Plots
Sediments – SVOCs**

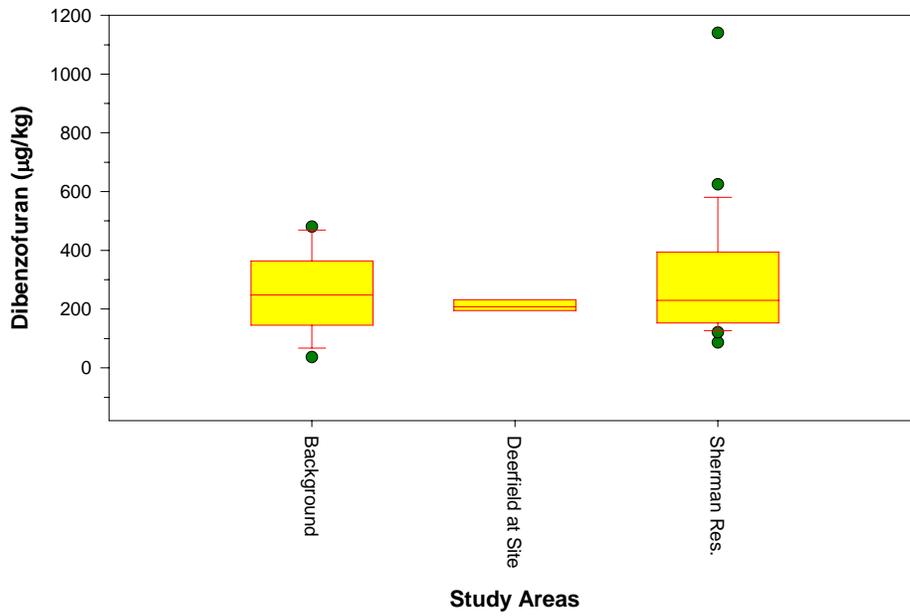


**Box-Whisker Plots
Sediments – SVOCs**

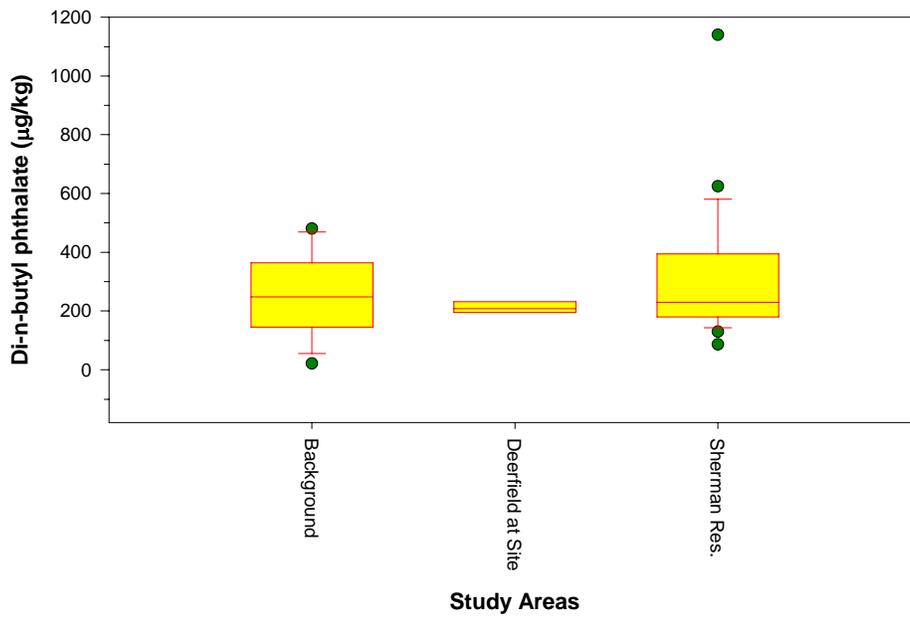


**Box-Whisker Plots
Sediments – SVOCs**

Dibenzofuran

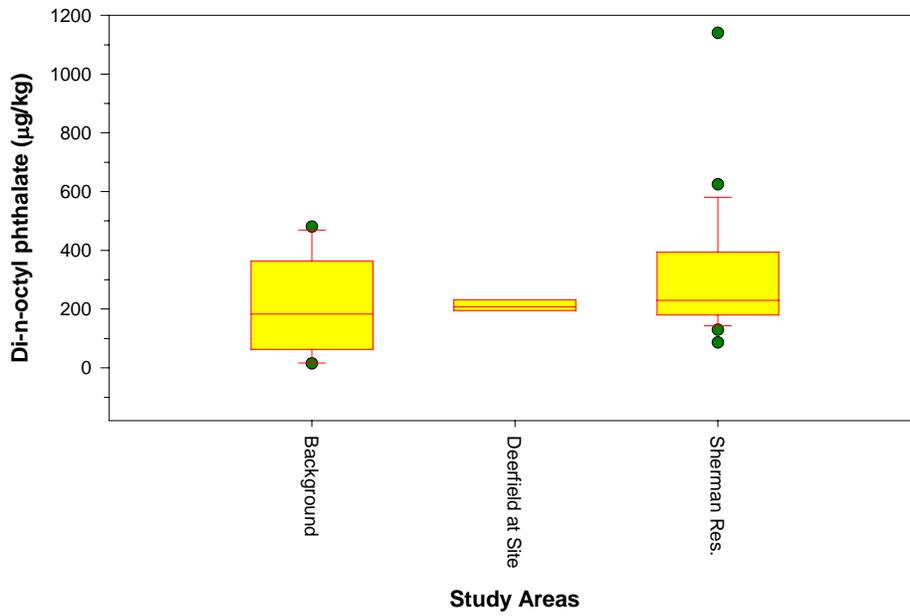


Di-n-butyl phthalate

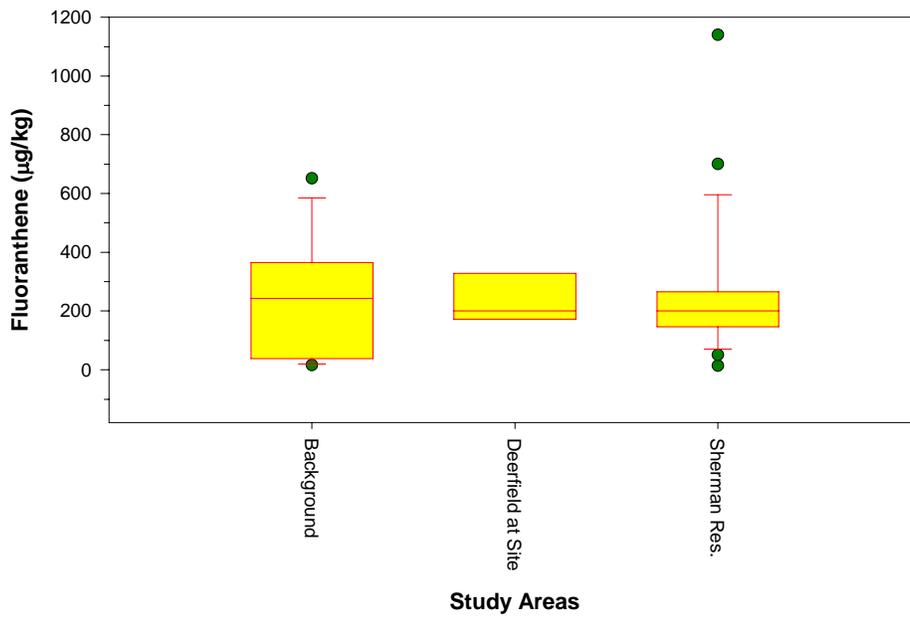


**Box-Whisker Plots
Sediments – SVOCs**

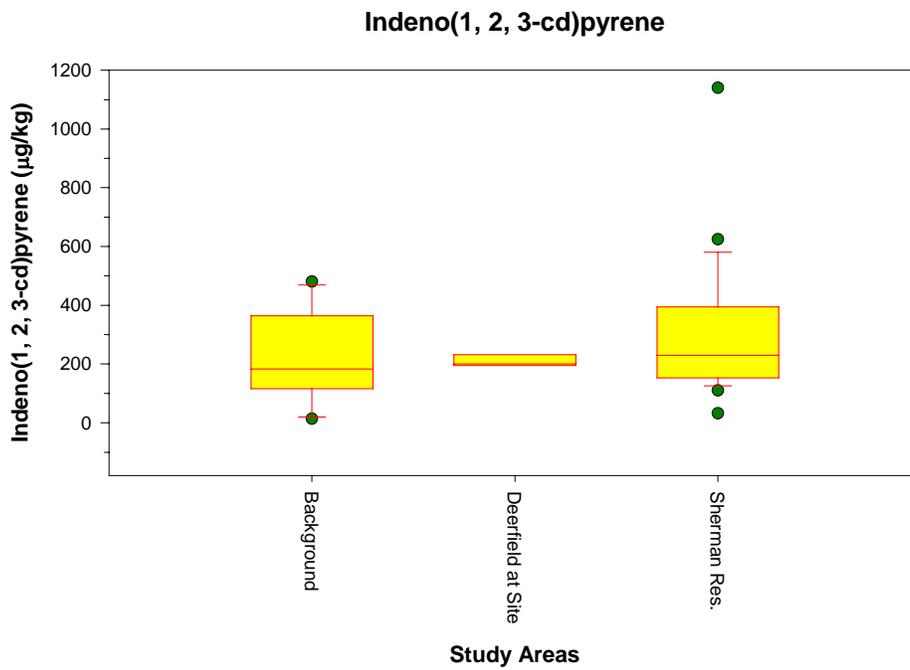
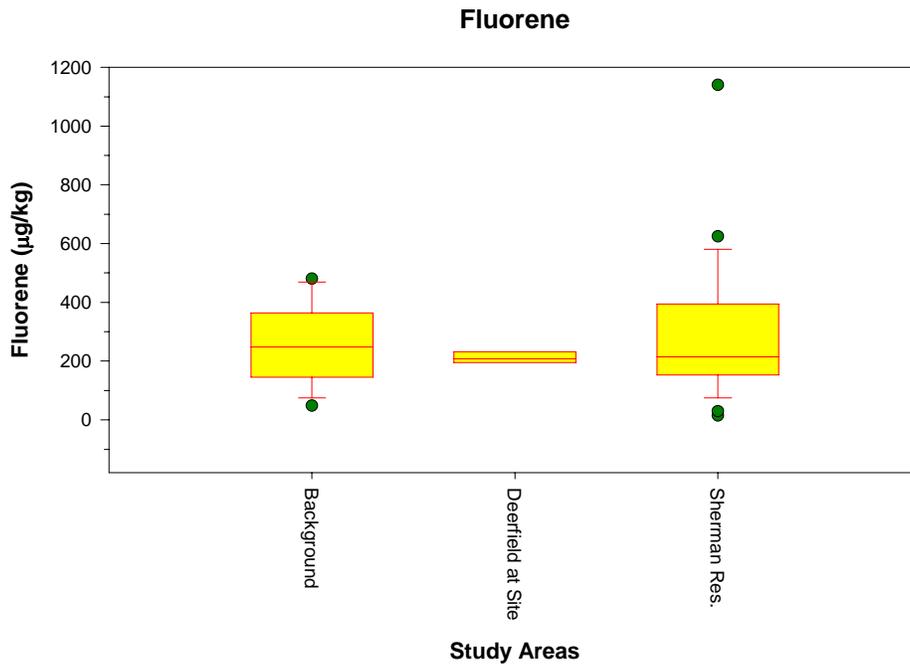
Di-n-octyl phthalate



Fluoranthene

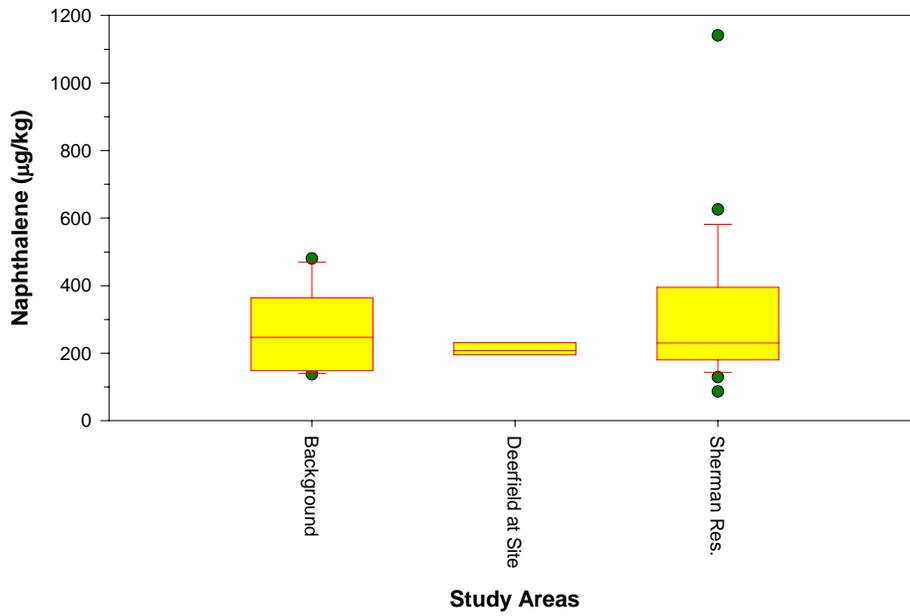


**Box-Whisker Plots
Sediments – SVOCs**

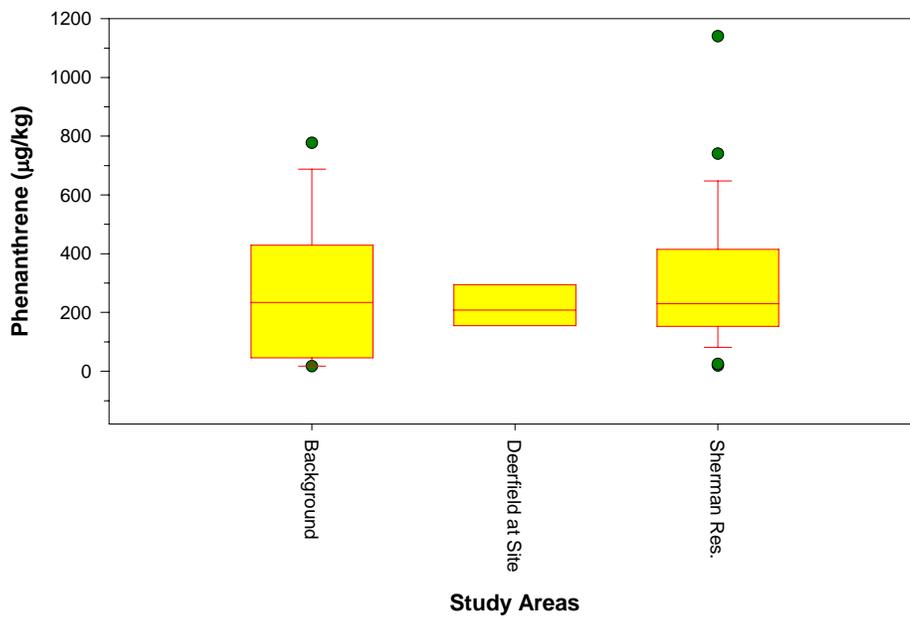


**Box-Whisker Plots
Sediments – SVOCs**

Naphthalene

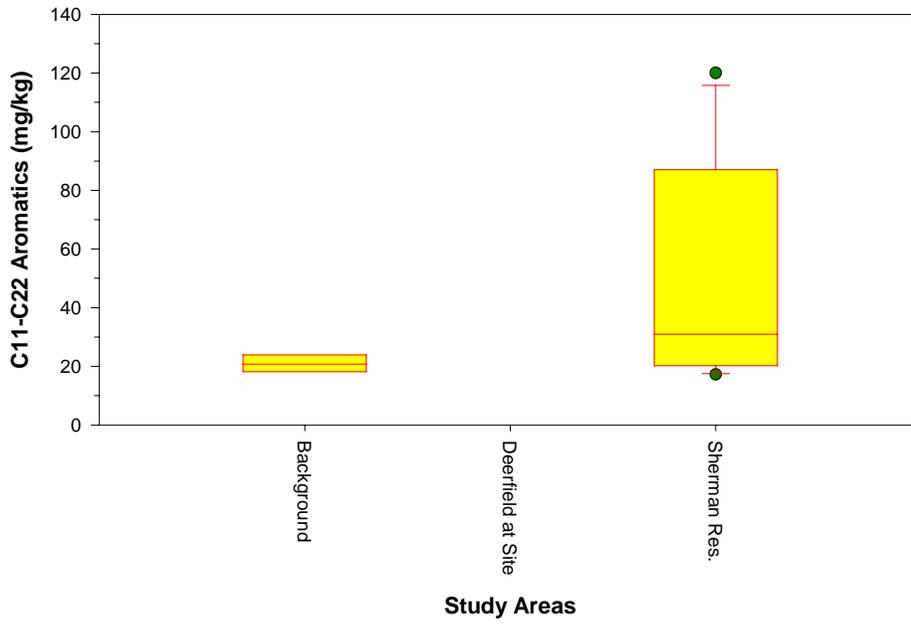


Phenanthrene

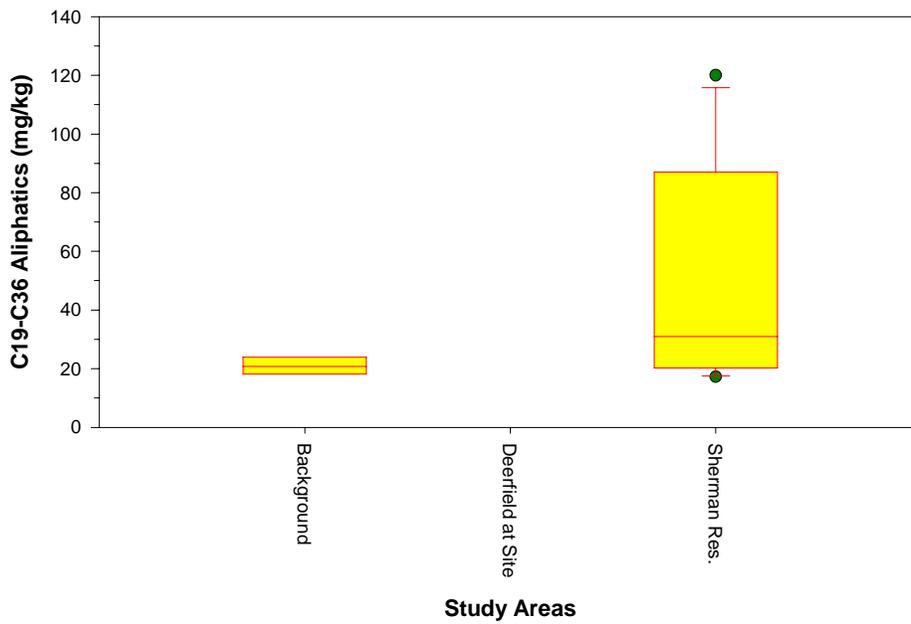


Box-Whisker Plots
Sediments – EPH, VPH, TPH

C11-C22 Aromatics

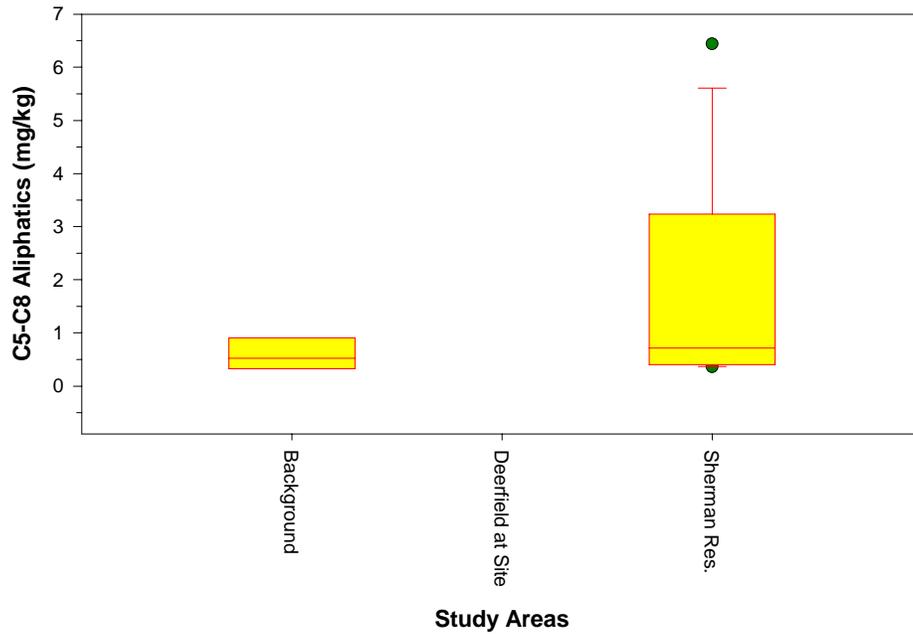


C19-C36 Aliphatics

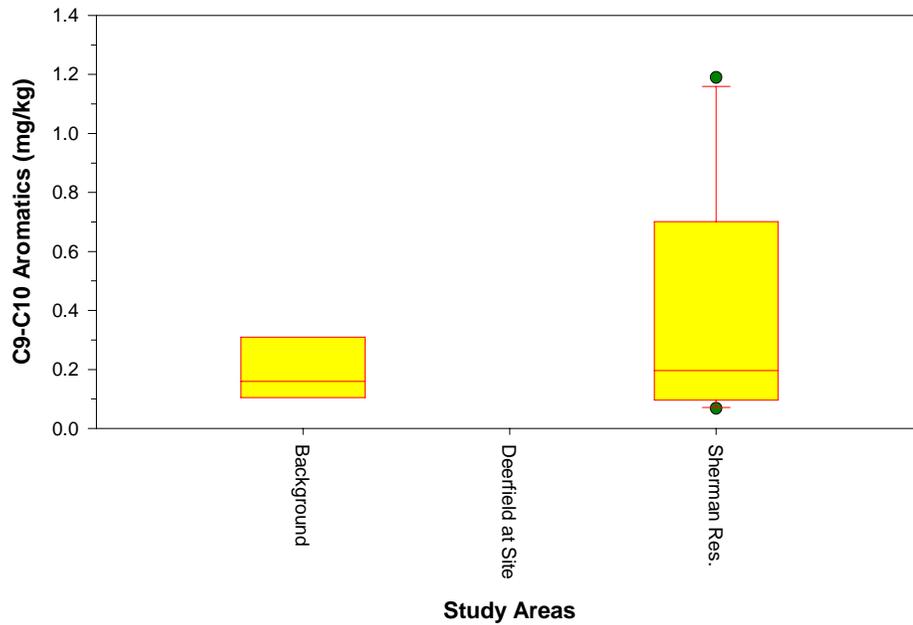


Box-Whisker Plots
Sediments – EPH, VPH, TPH

C5-C8 Aliphatics

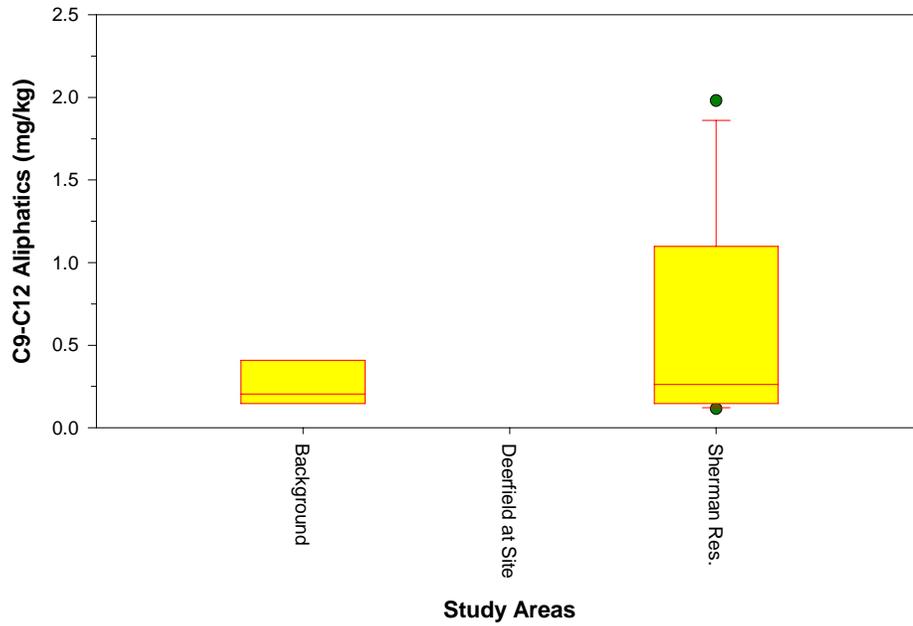


C9-C10 Aromatics

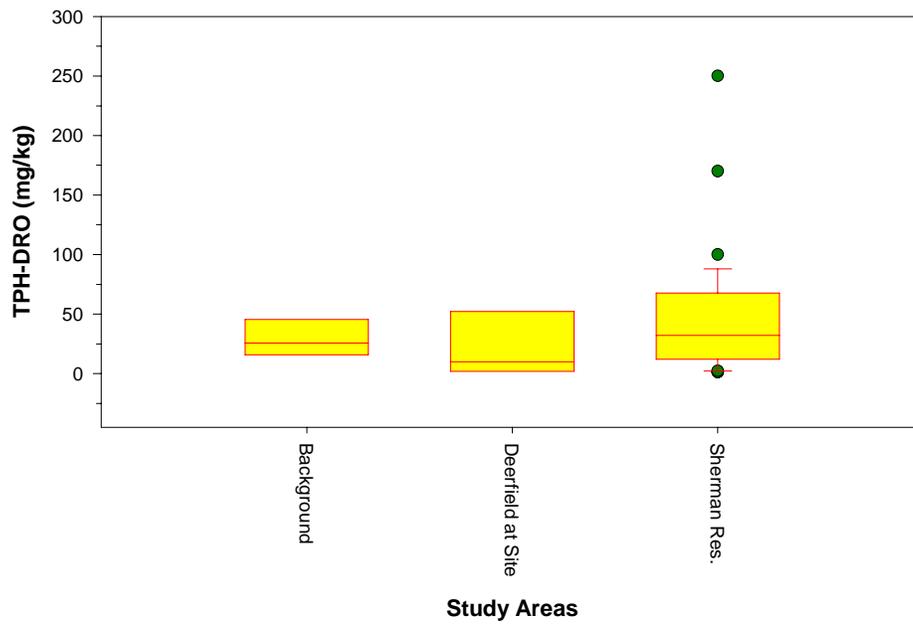


Box-Whisker Plots
Sediments – EPH, VPH, TPH

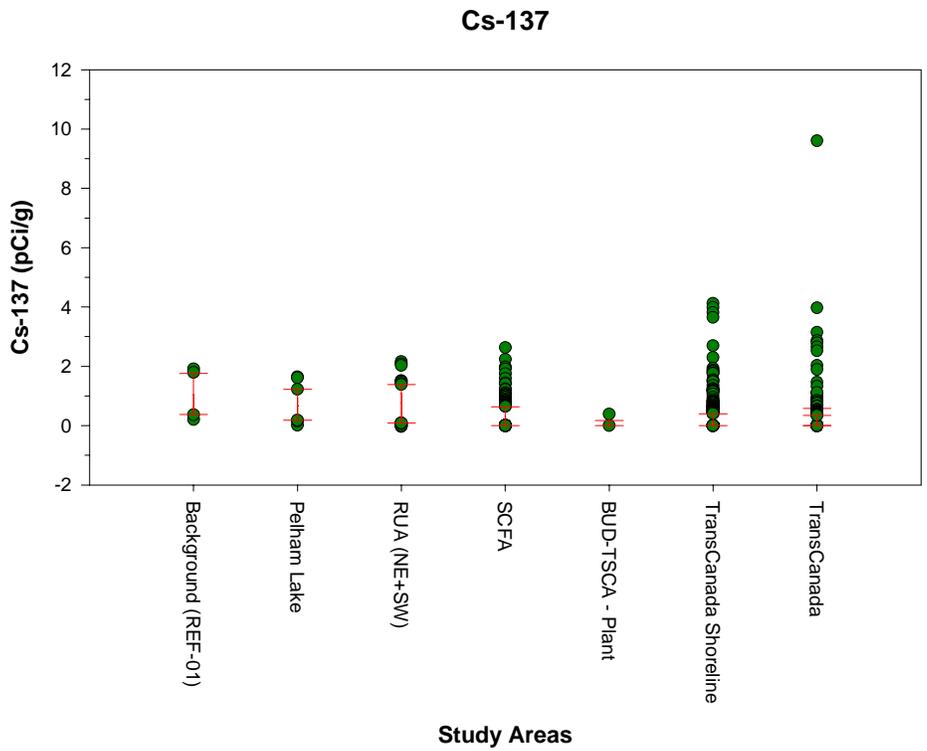
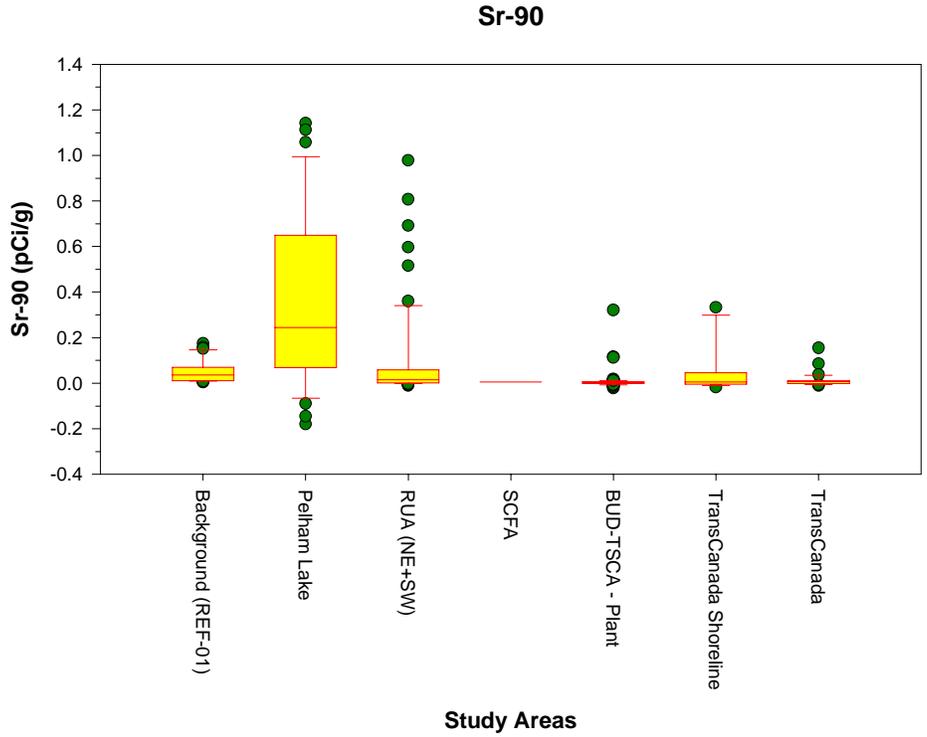
C9-C12 Aliphatics



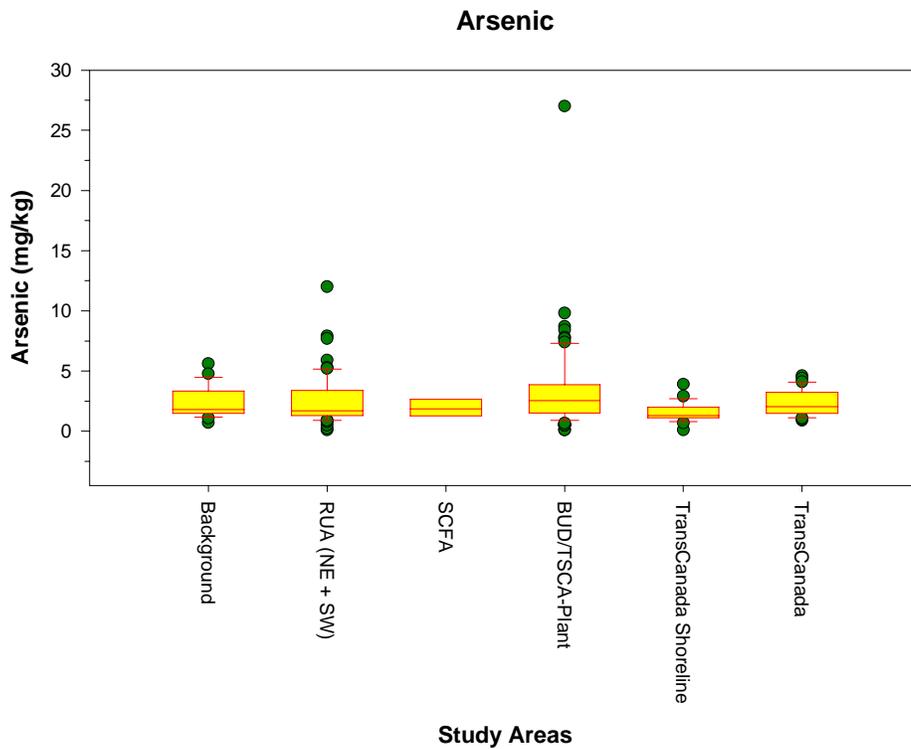
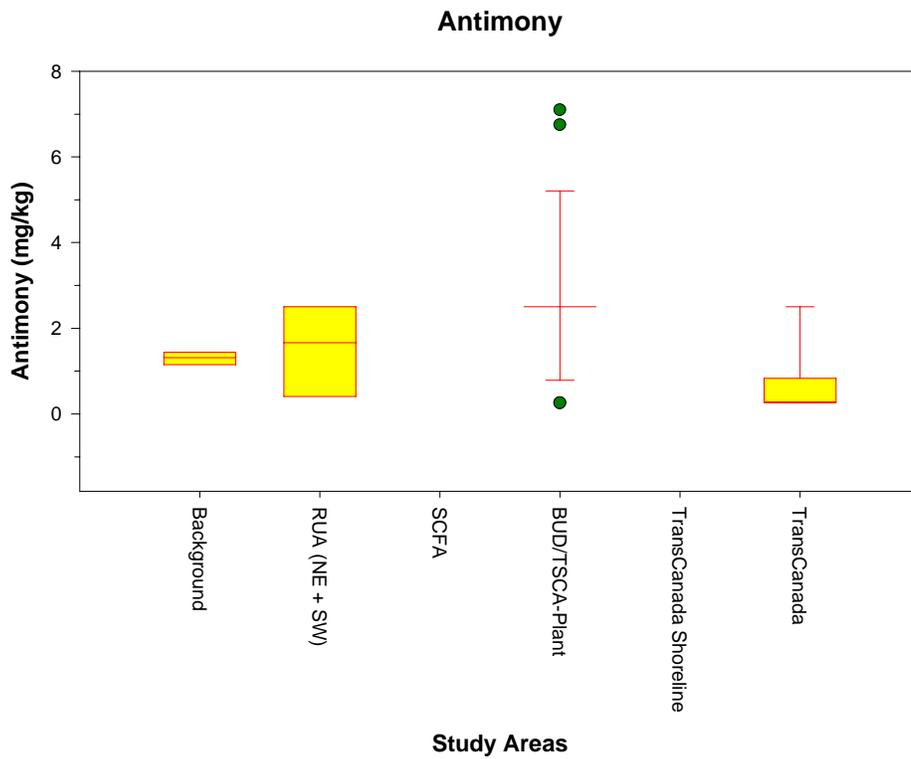
TPH- Diesel Range Organics (DRO)



Box-Whisker Plots
Surface Soils – Sr-90 and Cs-137



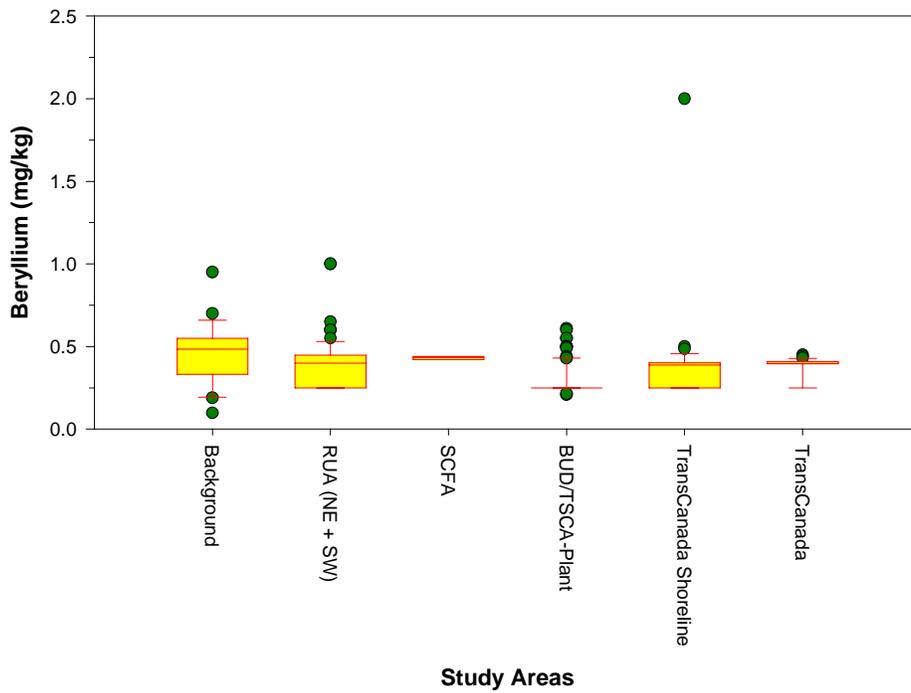
**Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics**



**Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics**

(Beryllium was detected in 2 / 137 soil samples)

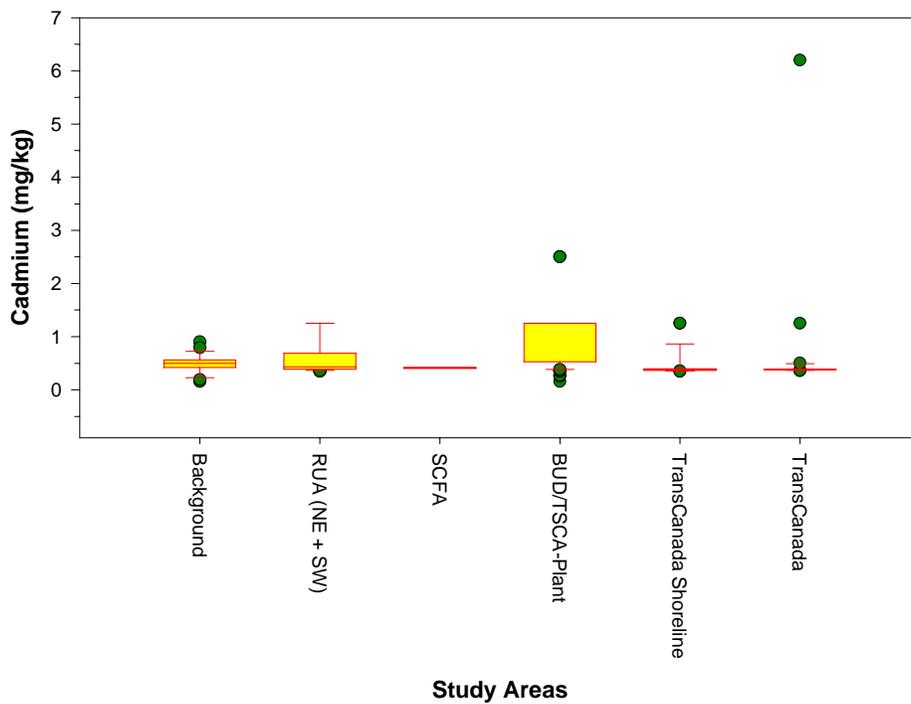
Beryllium



Study Areas

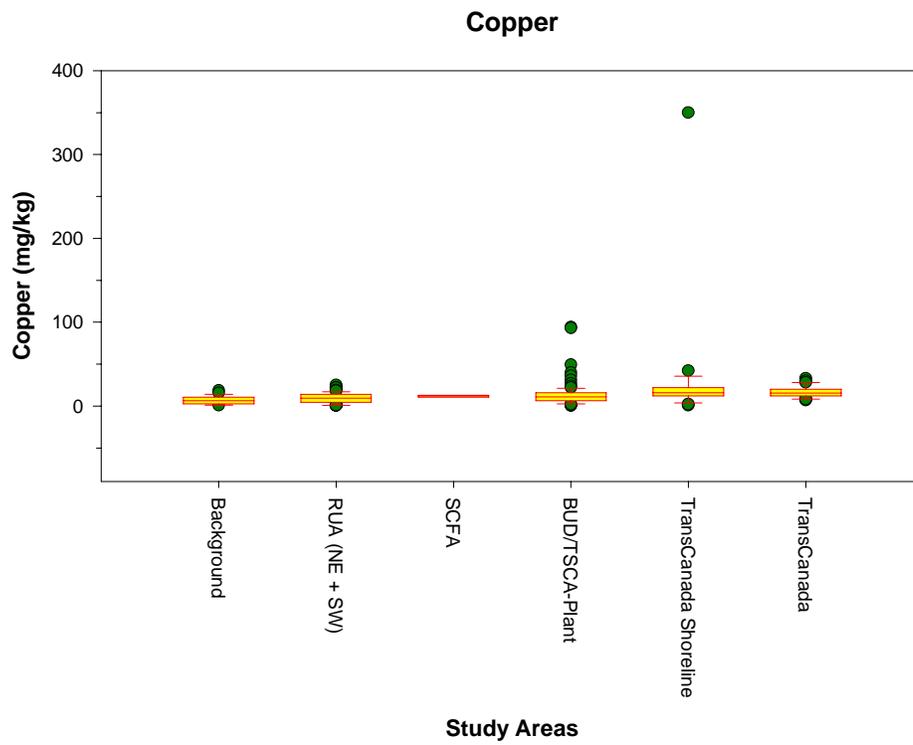
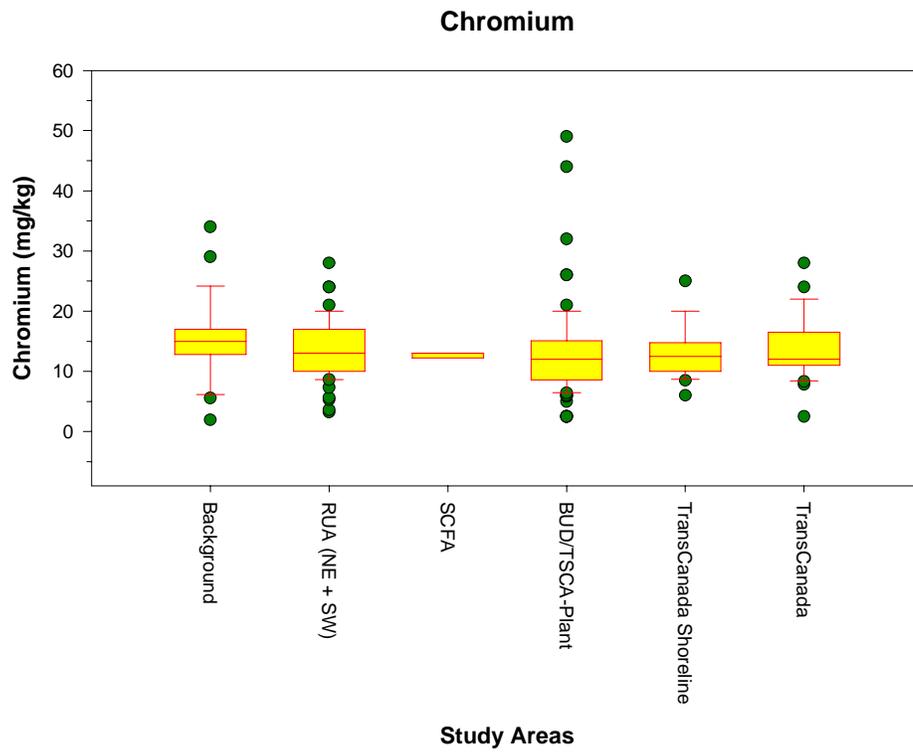
(Cadmium plot excludes SB1290102F, a non-detect with an elevated detection limit 76 mg/kg)

Cadmium



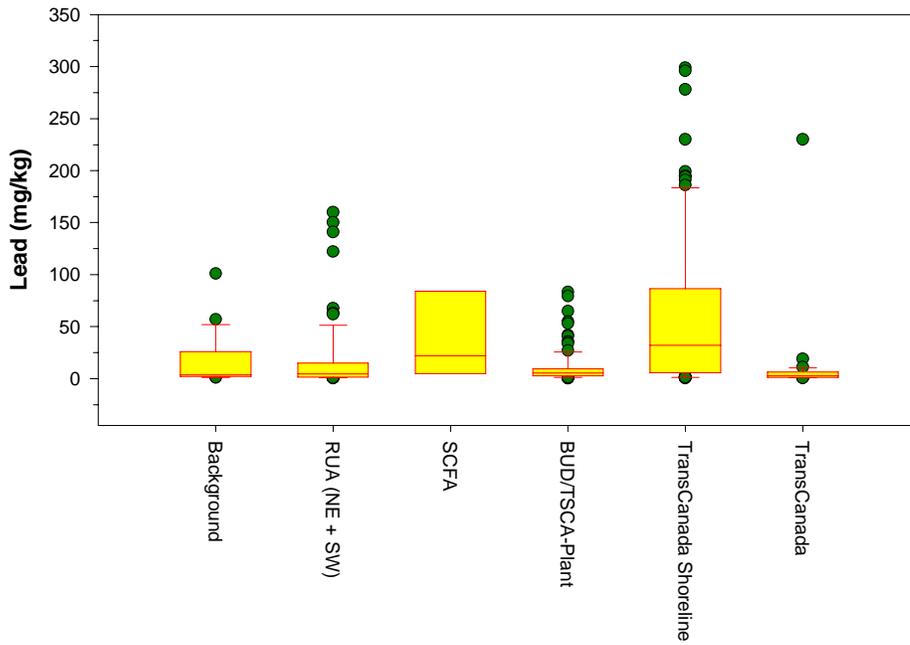
Study Areas

Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics



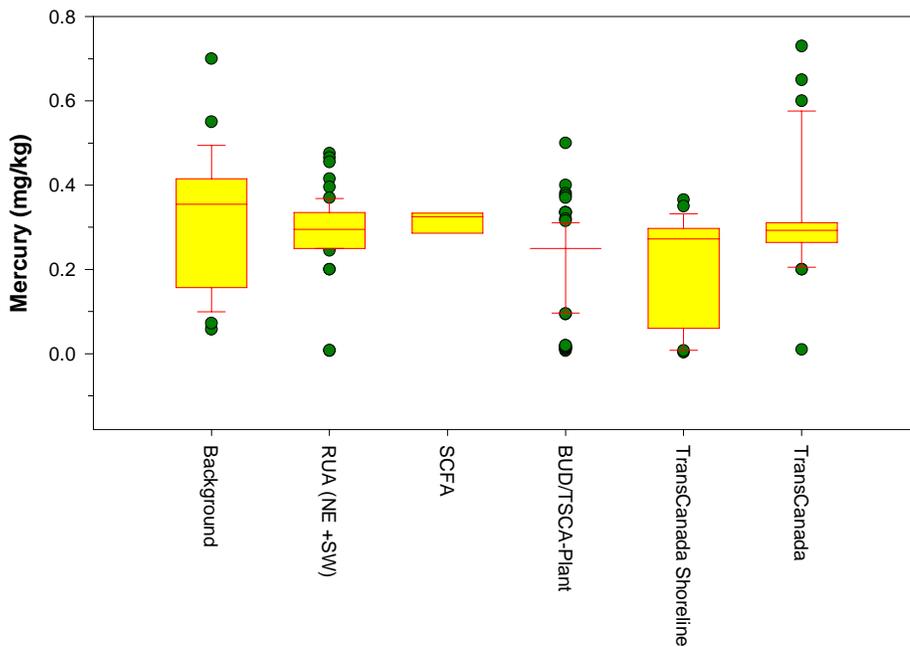
**Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics**

Lead



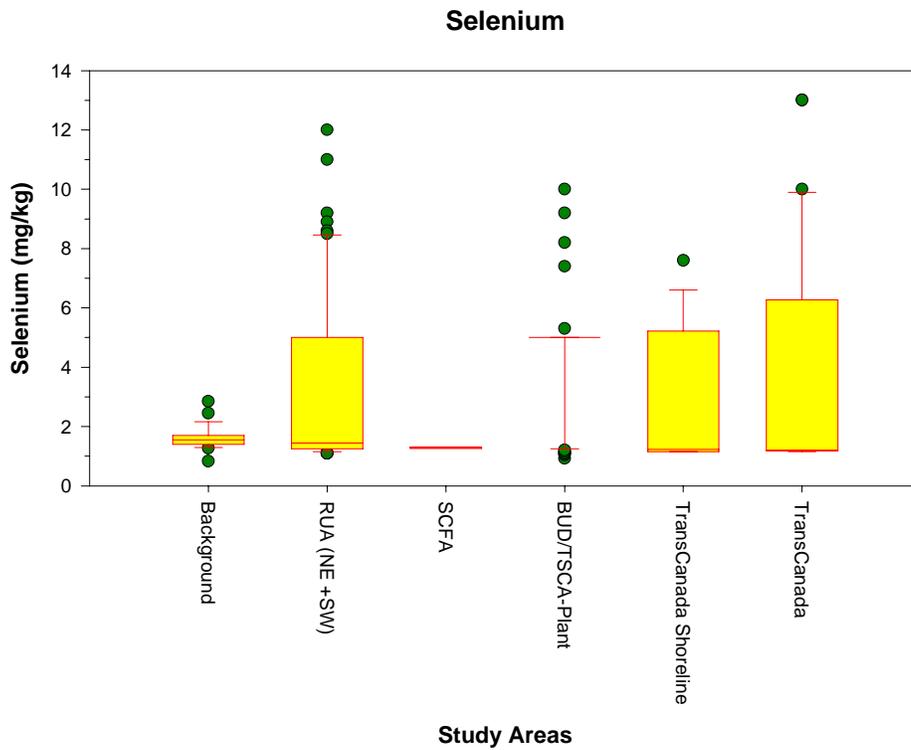
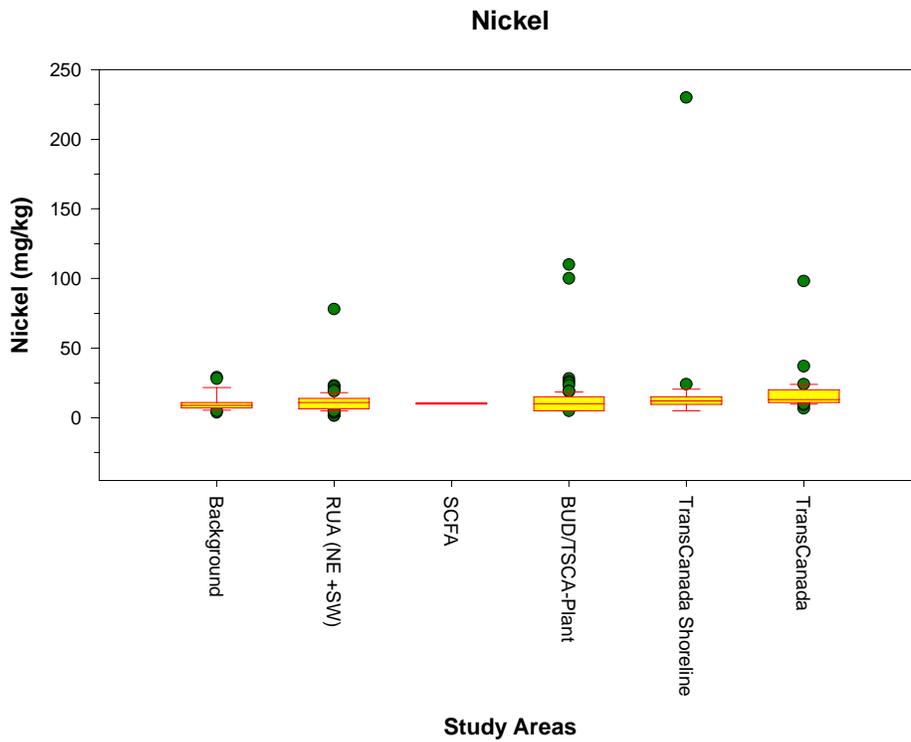
Study Areas

Mercury

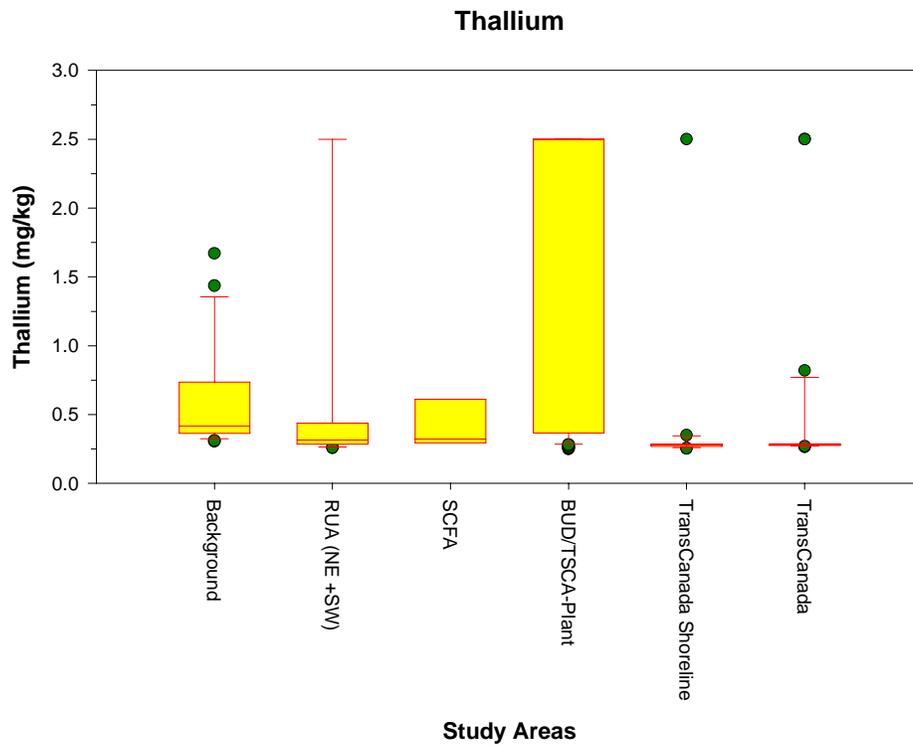
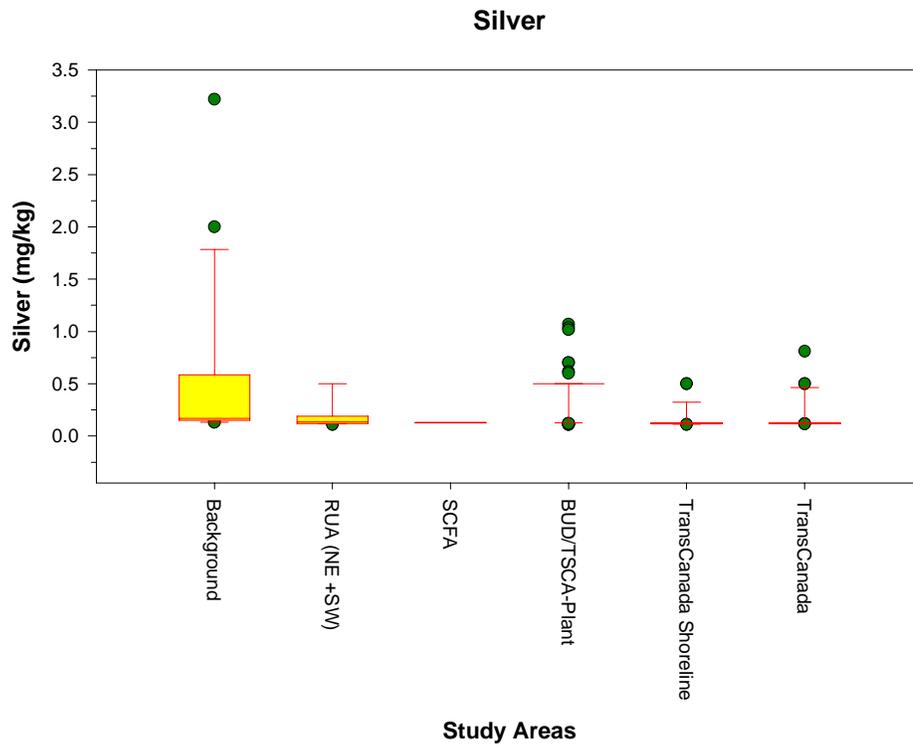


Study Areas

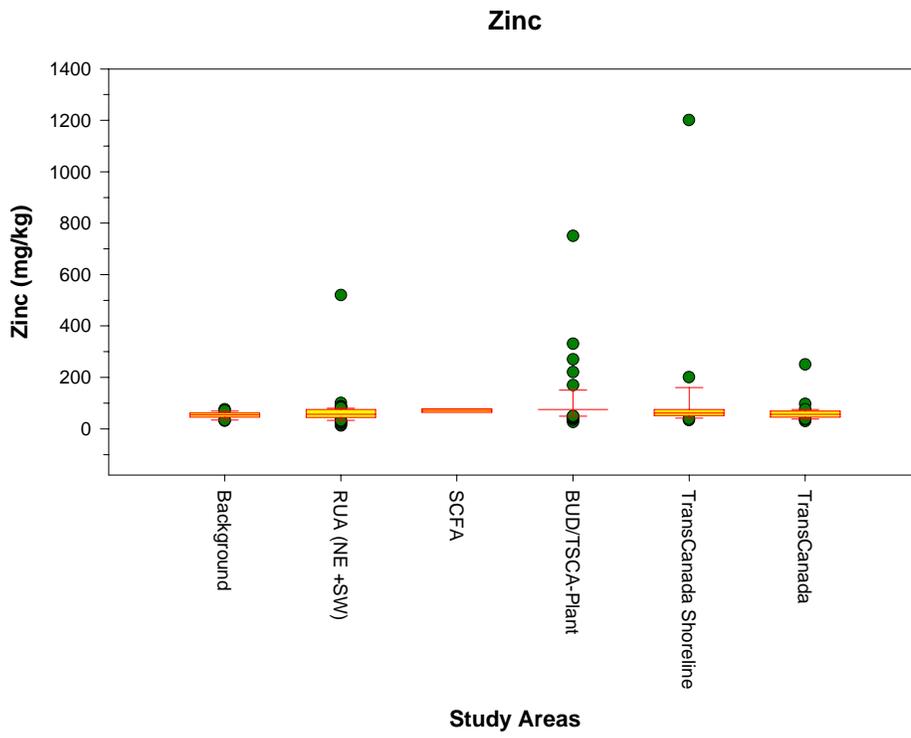
**Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics**



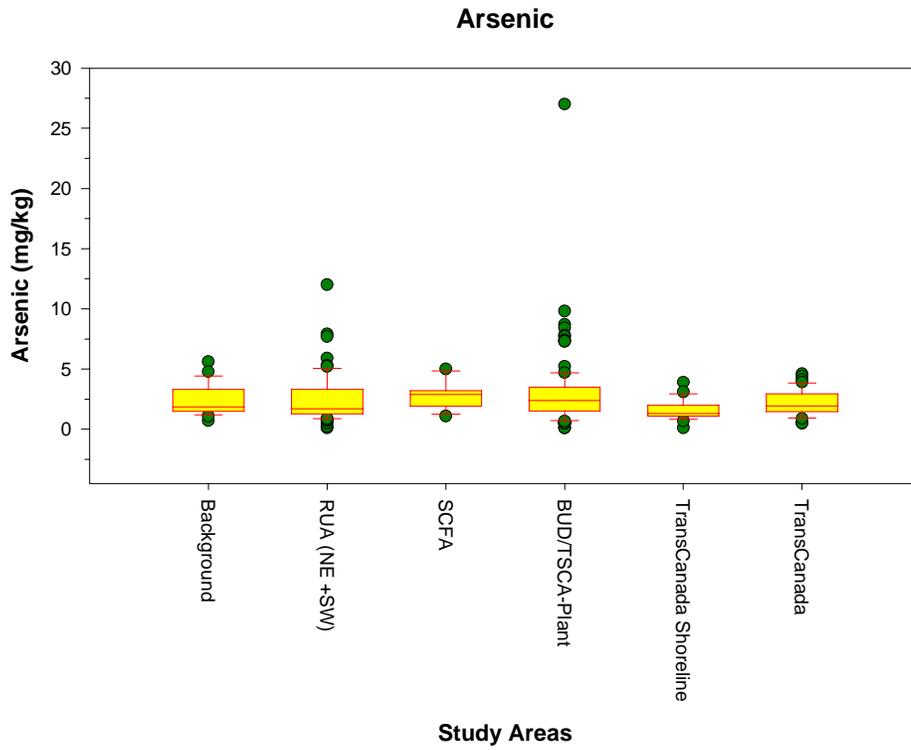
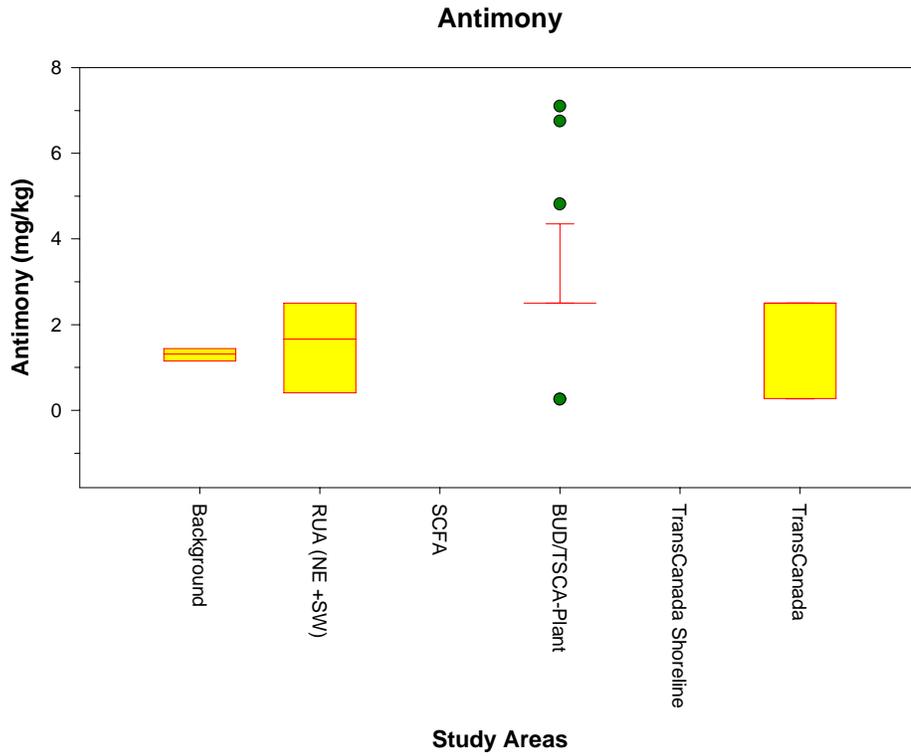
Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics



Box-Whisker Plots
Surface Soils (0 – 3 ft.) -- Inorganics

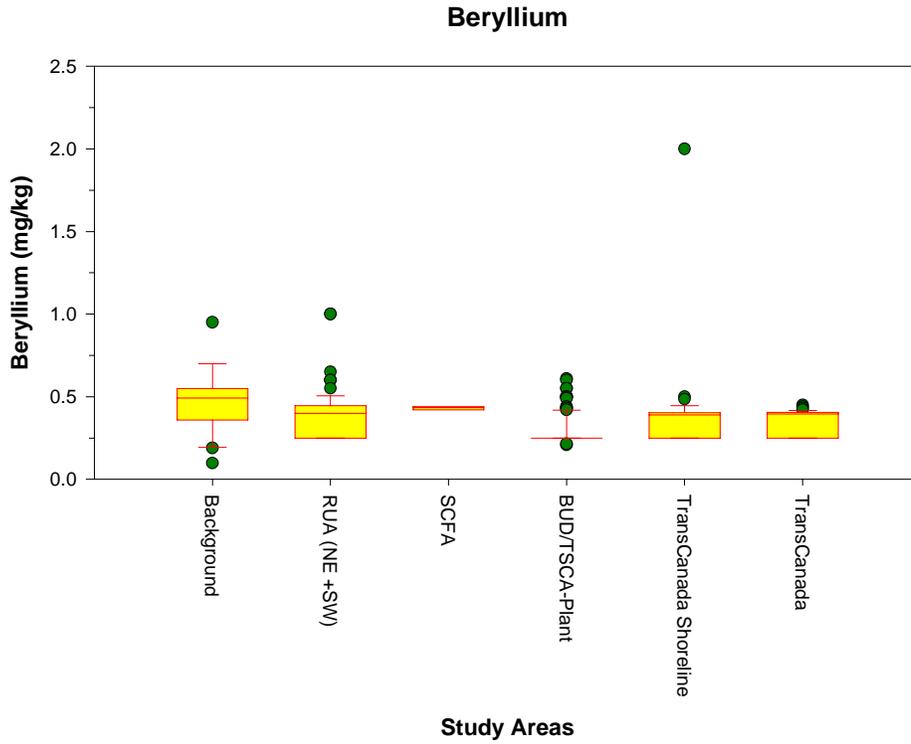


**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**

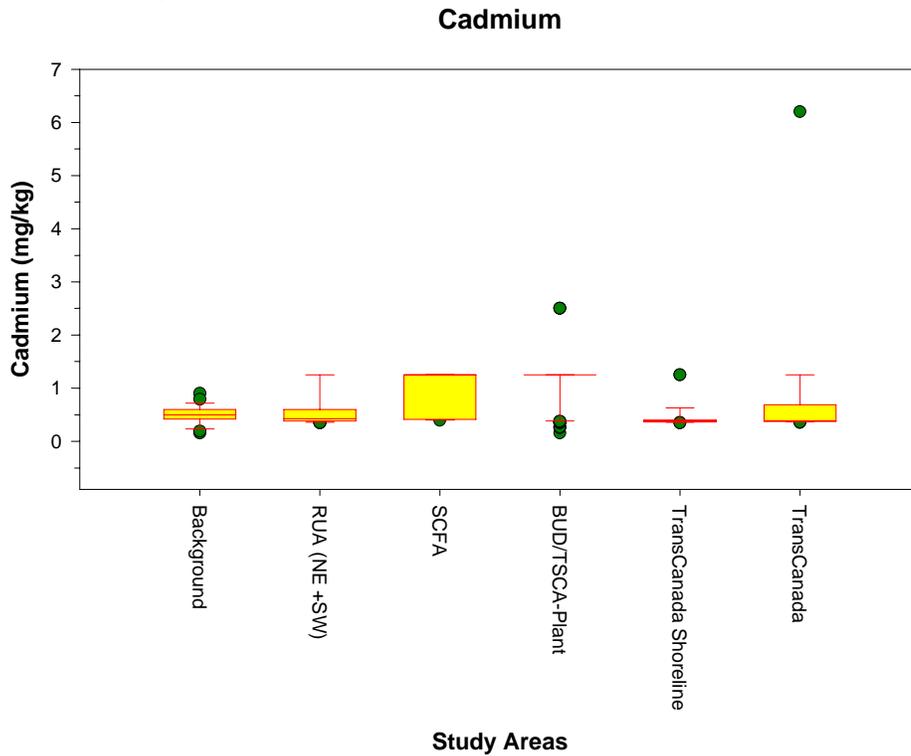


**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**

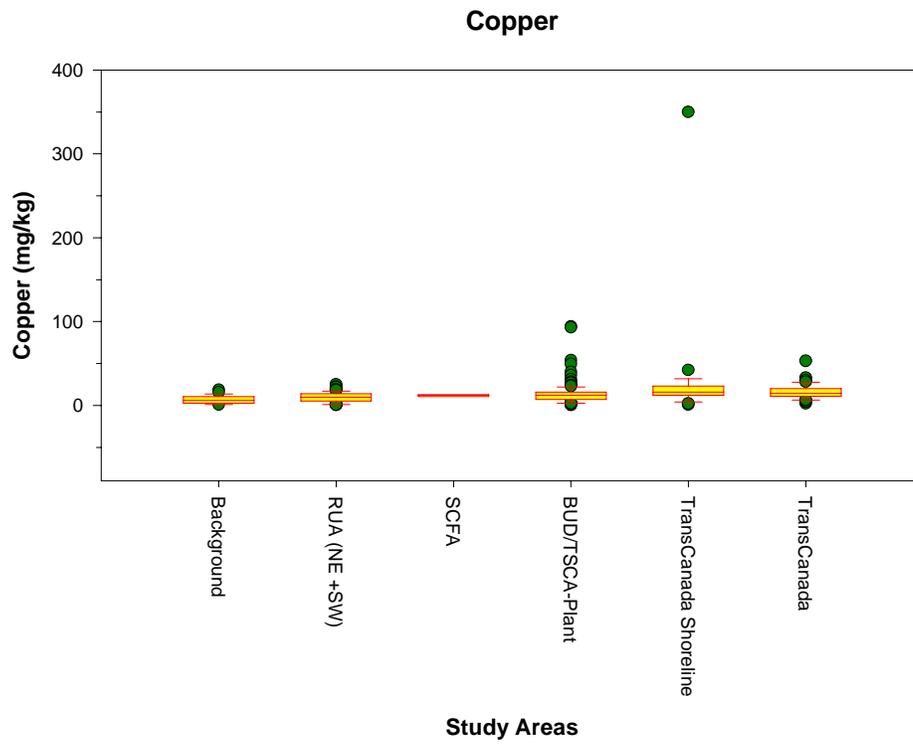
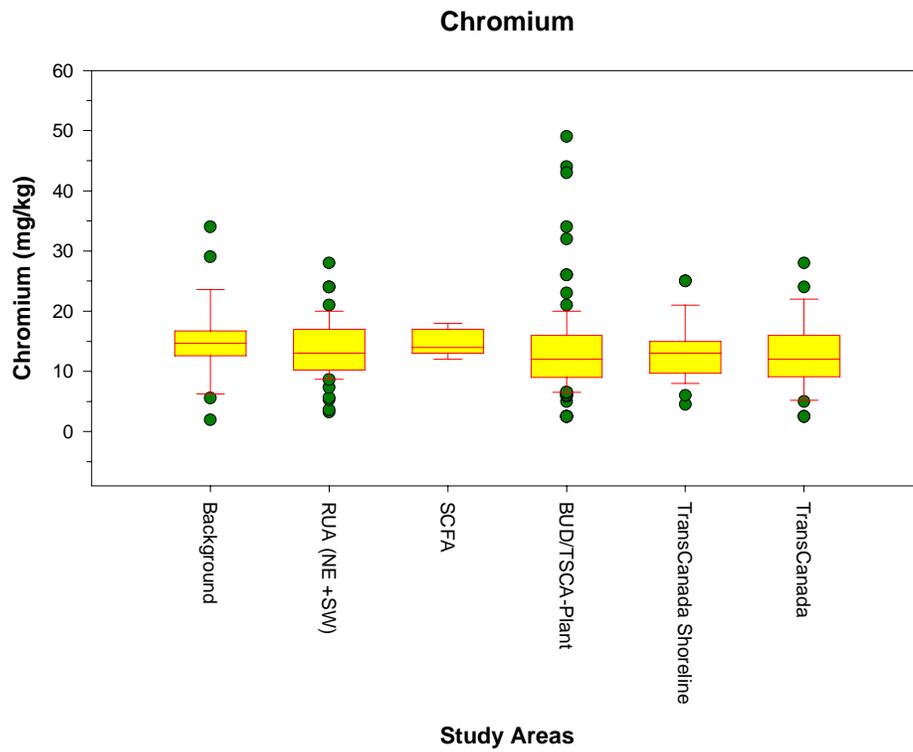
(Beryllium was detected in 2 / 137 soil samples)



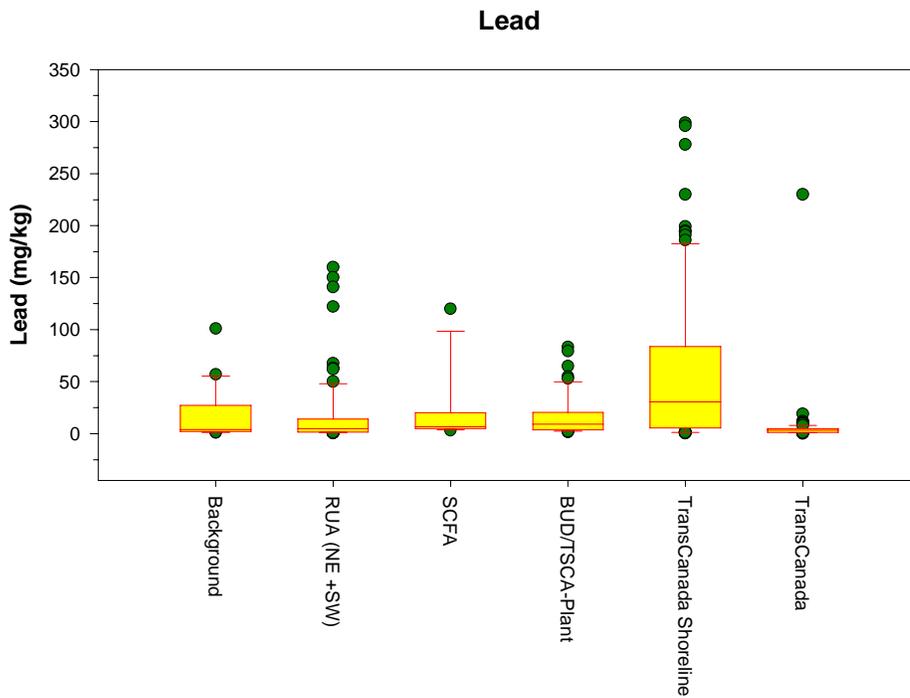
(Cadmium plot excludes SB1290102F, a non-detect with an elevated detection limit 76 mg/kg)



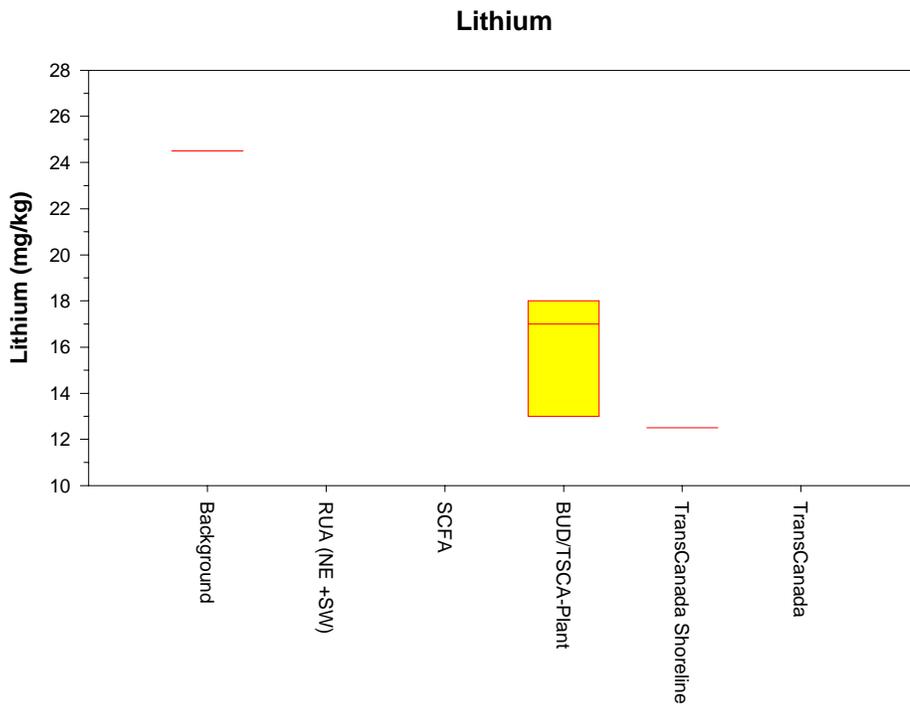
**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**



**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**

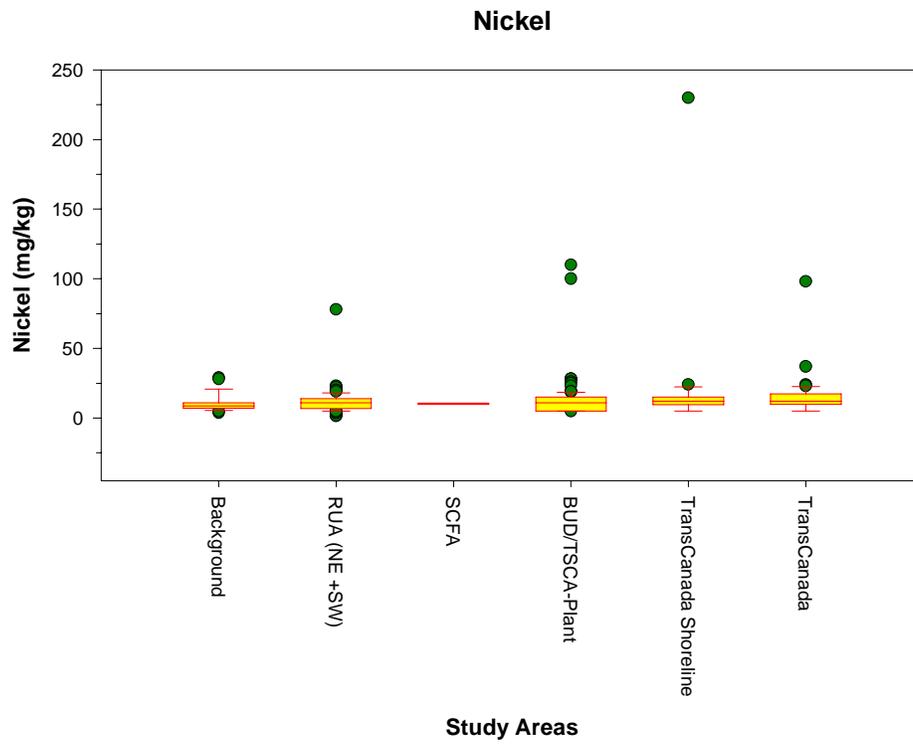
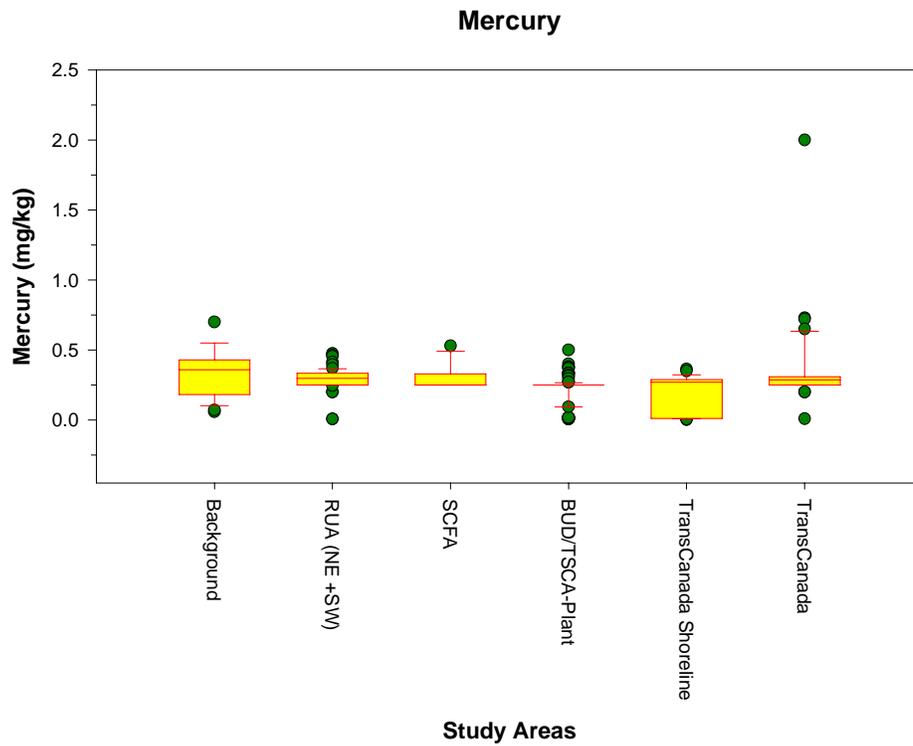


Study Areas

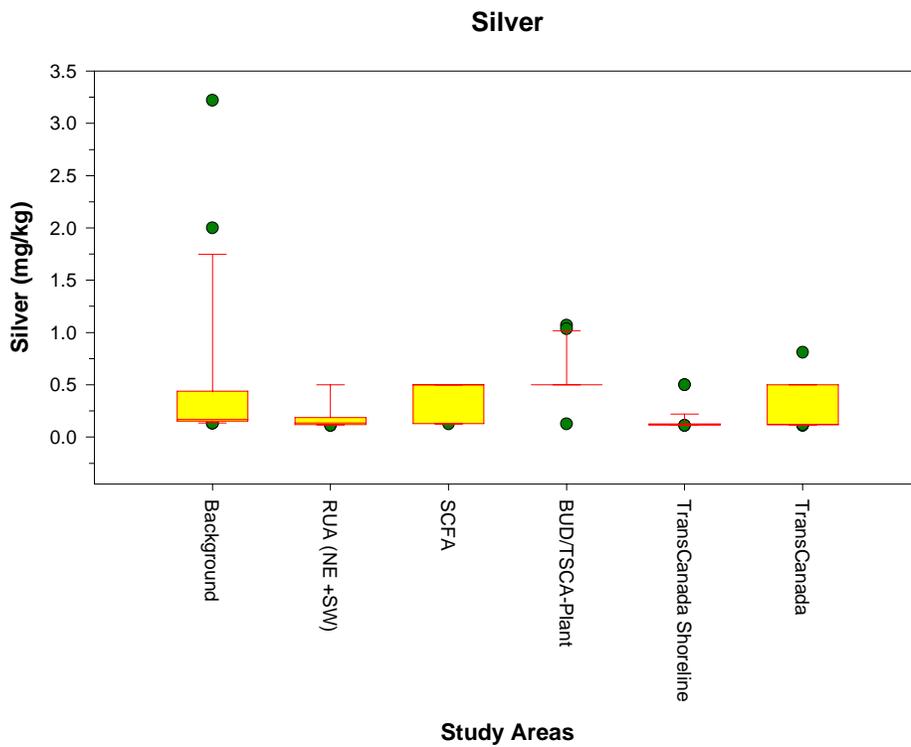
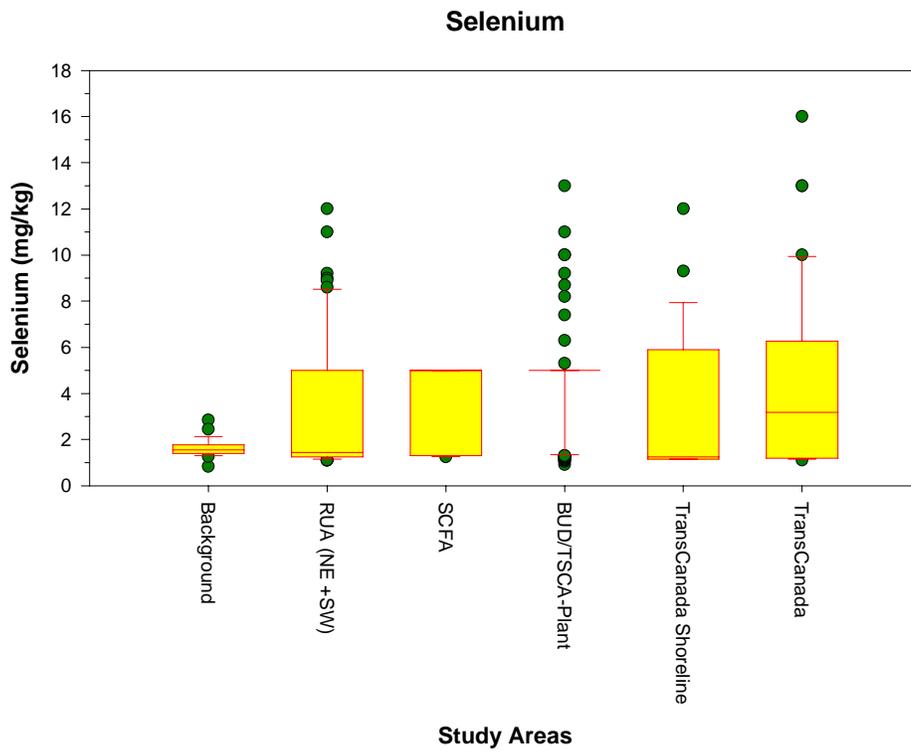


Study Areas

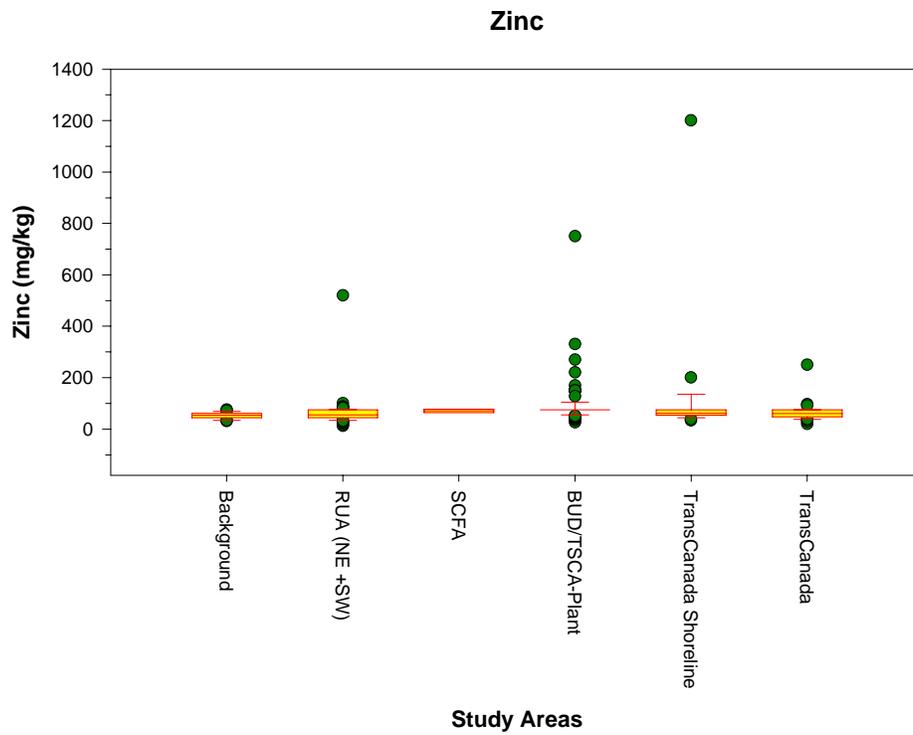
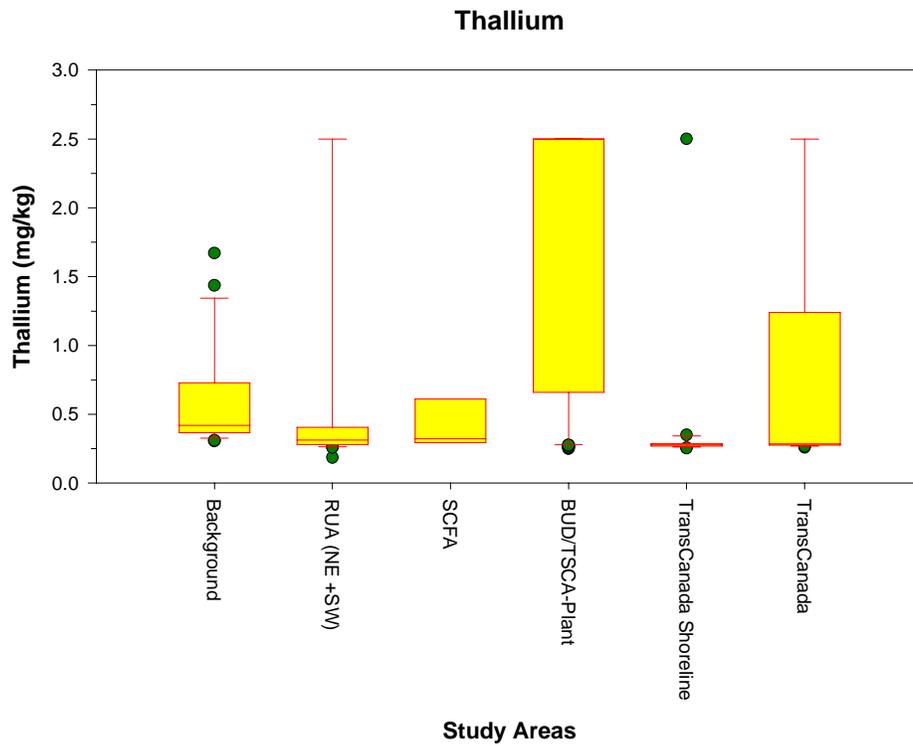
**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**



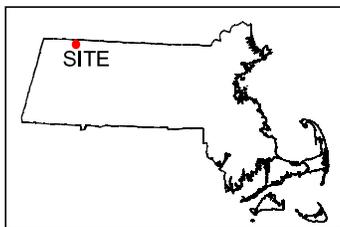
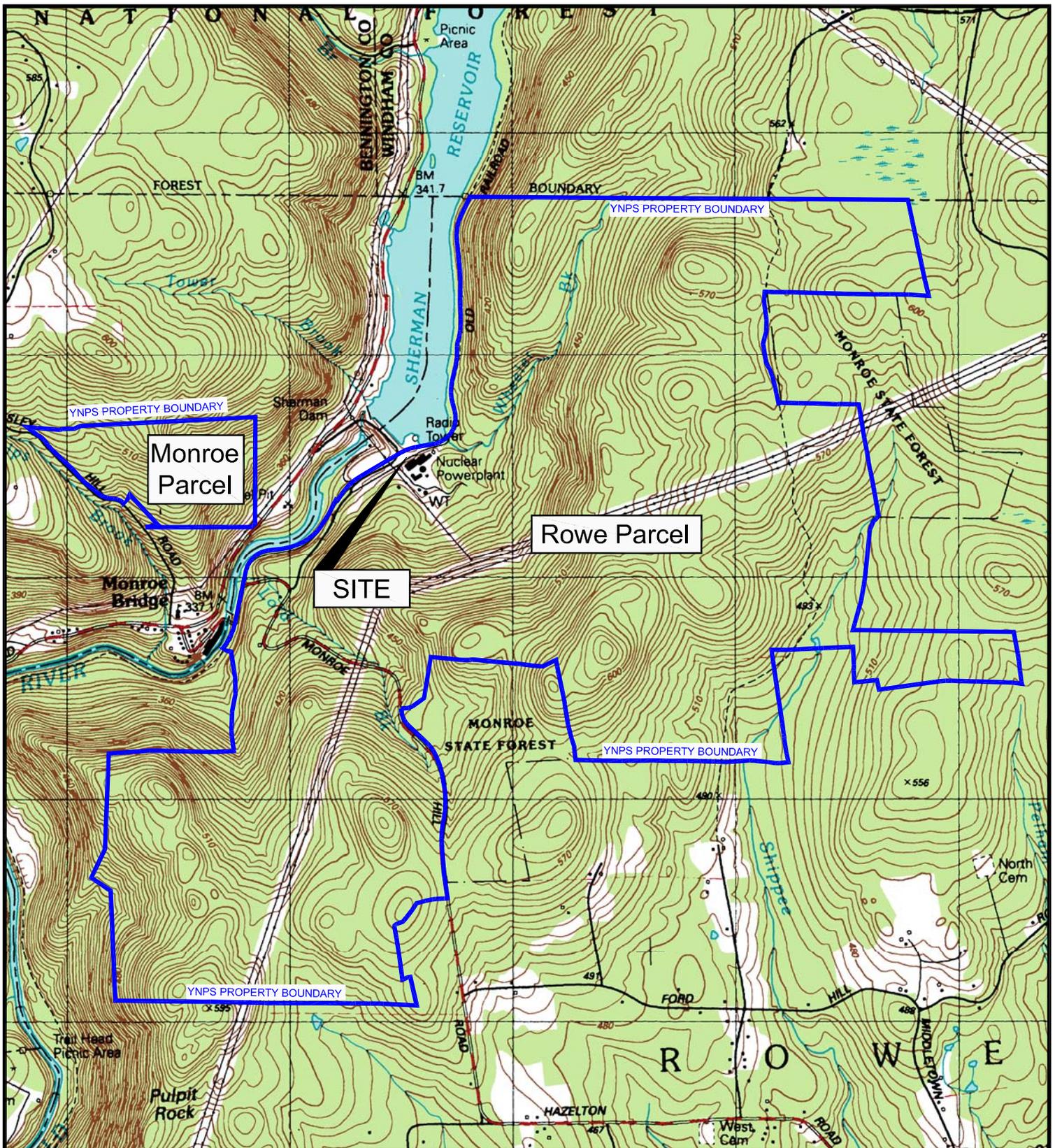
**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**



**Box-Whisker Plots
Soils (0 – 15 ft.) -- Inorganics**



Figures



APPROX. SCALE IN METERS



Gradient CORPORATION

238 MAIN STREET • CAMBRIDGE, MA 02142 • (617)395-5000

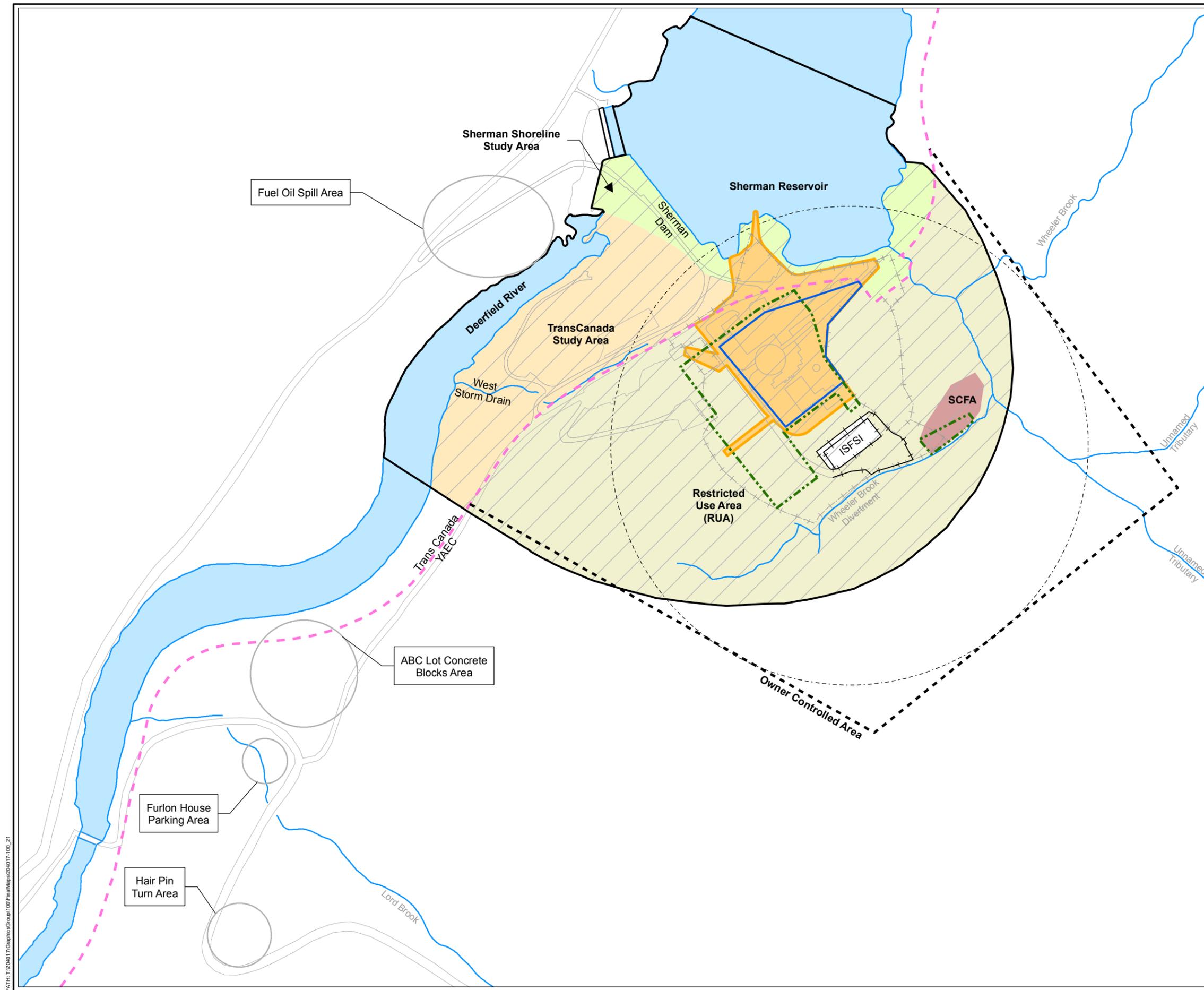
FIGURE 1-1

YNPS SITE LOCATION

YANKEE NUCLEAR – ROWE, MA

MODIFIED BY: RJAM CHECKED BY: DEM PROJ. NO.: 204017

DATE: 04/10/07 DATE: 04/10/07 FILE: 100_Locus



- LEGEND**
- Combined Study Areas
 - TSCA Deed Restricted Areas
 - C&A Area
 - Property Boundary
 - ISFSI Fence
 - BUD Area
 - 300 Meter Buffer Around ISFSI
 - Restricted Use Areas (RUA)

Note : Former structures and plant features shown for reference. These no longer exist.



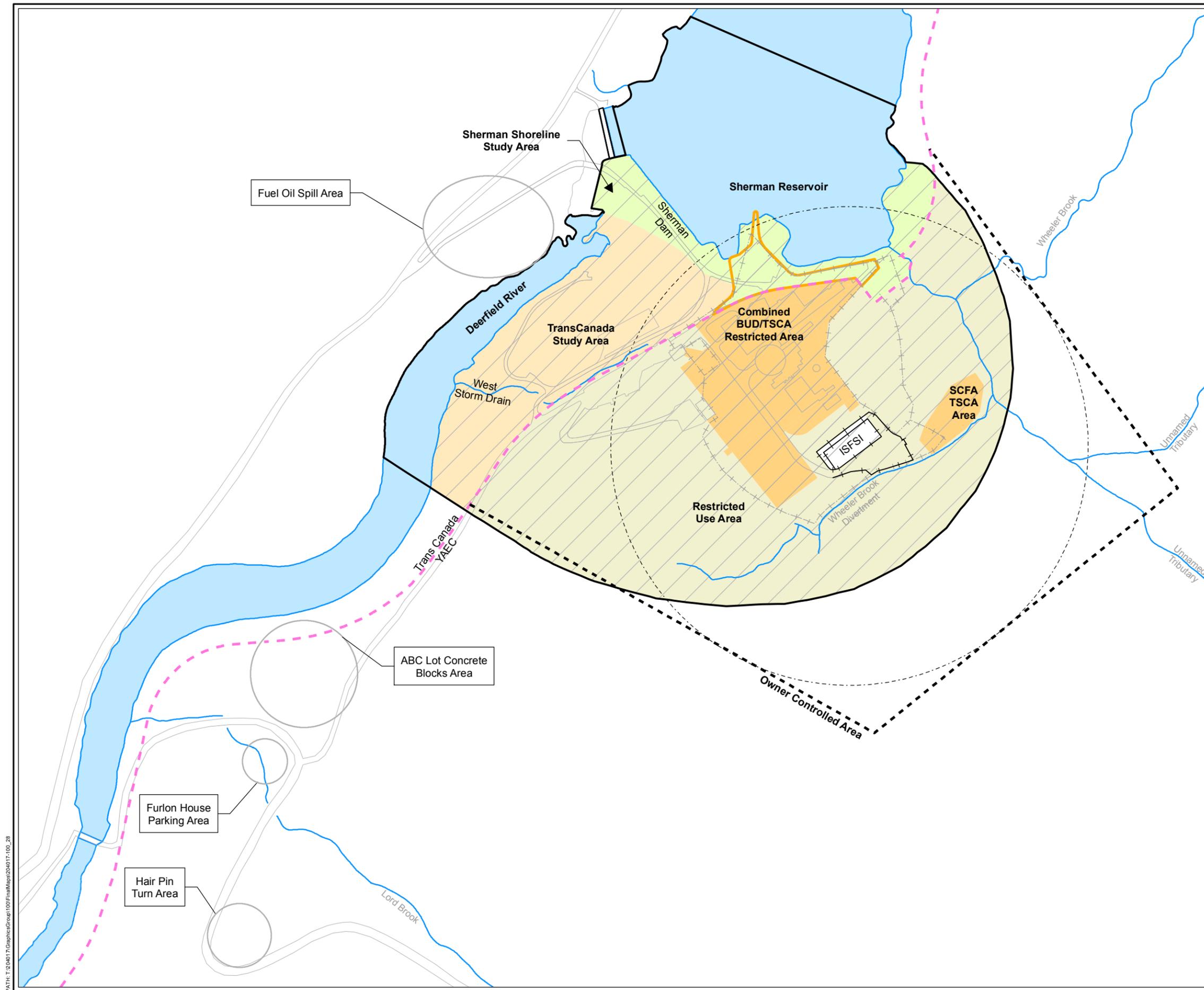
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-1
YNPS Study Areas and Restricted Areas

Yankee Nuclear Power Station,
 Rowe, MA

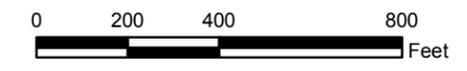
Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/18/07	Date:	06/18/07	File:	204017-100_21.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_21



- LEGEND**
- Combined Study Areas
 - Property Boundary
 - ISFSI Fence
 - 300 Meter Buffer Around ISFSI
 - BUD Boundary
 - Areas With BUD and or TSCA Restrictions
 - Restricted Use Areas (RUA)

Note : Former structures and plant features shown for reference. These no longer exist.



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

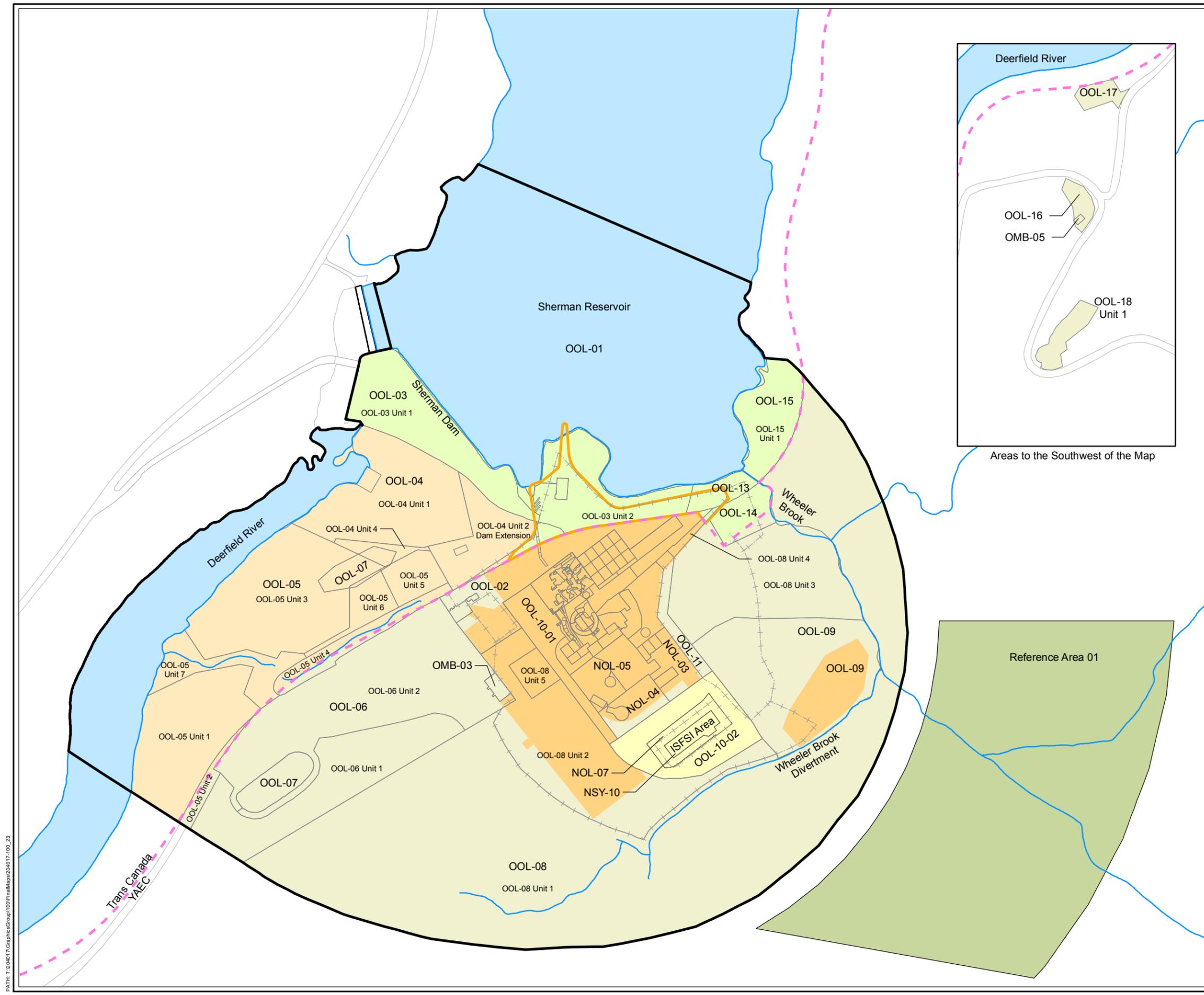
FIGURE 2-2

YNPS Study and Exposure Areas

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/18/07	Date:	06/18/07	File:	204017-100_28.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_28



LEGEND

- Property Boundary
- +- Fence

Note : Former structures and plant features shown for reference. These no longer exist.

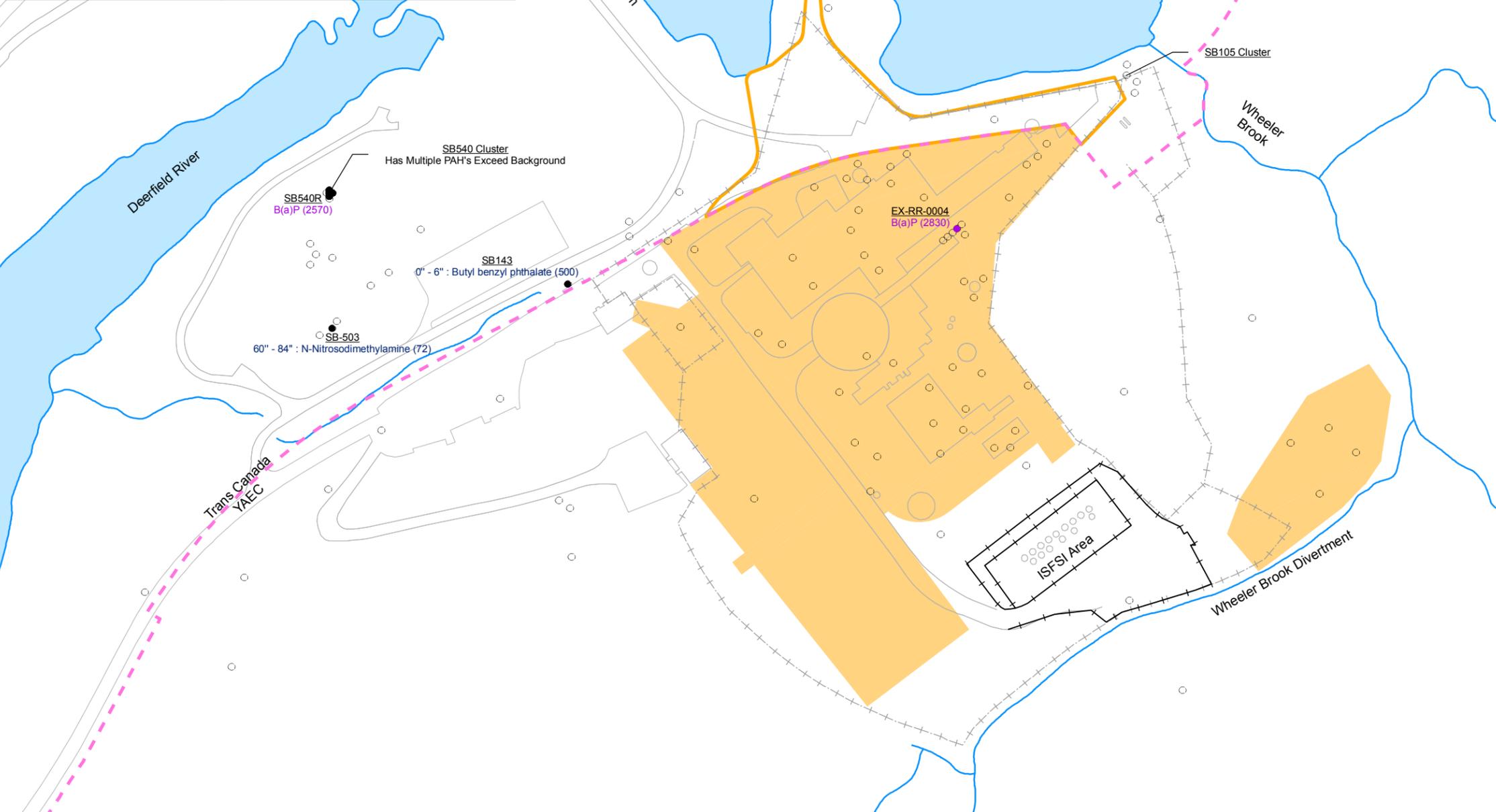
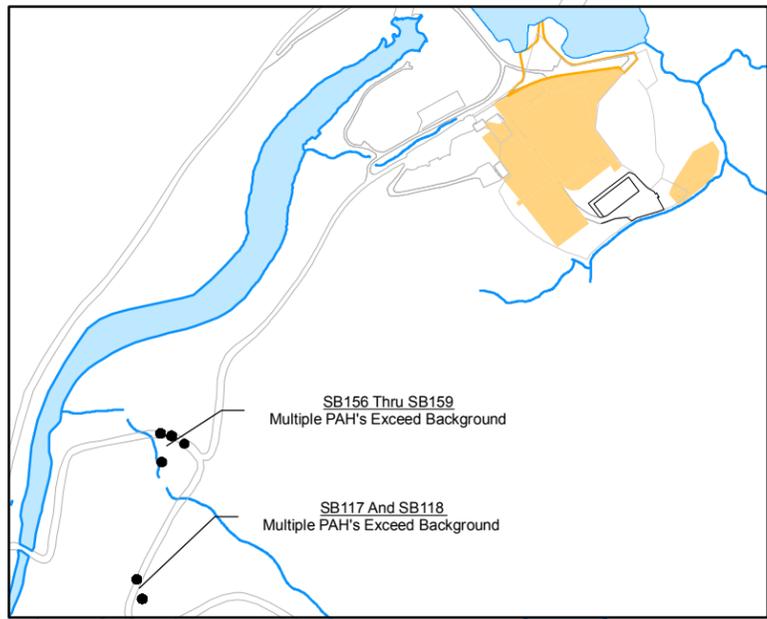


Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-3
 YNPS FSS
 Study Areas

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/12/07	Date:	04/12/07	File:	204017-100_23.mxd

PATH: T:\204017\GraphicsGroup\100\FinalMaps\204017-100_23



Exceed Both Criteria and Background
Exceed Background

LEGEND

- BUD/TSCA Sample Locations Which Exceed Background and Criteria
- Other Sample Locations With Exceedances
- Sample Locations With No Exceedances

Note : Former structures and plant features shown for reference. These no longer exist.

MCP S-1 values are shown for comparison only, they are not the basis of risk characterization.

SB-503
60" - 84" : N-Nitrosodimethylamine (72)

Sample ID
Depth : Analyte (Concentration in µg/kg)

Analyte	MCP S-1 (µg/Kg)	Maximum Background Concentration (µg/Kg)
Benzo(a)pyrene - B(a)P	2000	219
Butyl benzyl phthalate	N/A	ND
N-Nitrosodimethylamine	N/A	ND

N/A Not Available, ND Non-Detect



Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

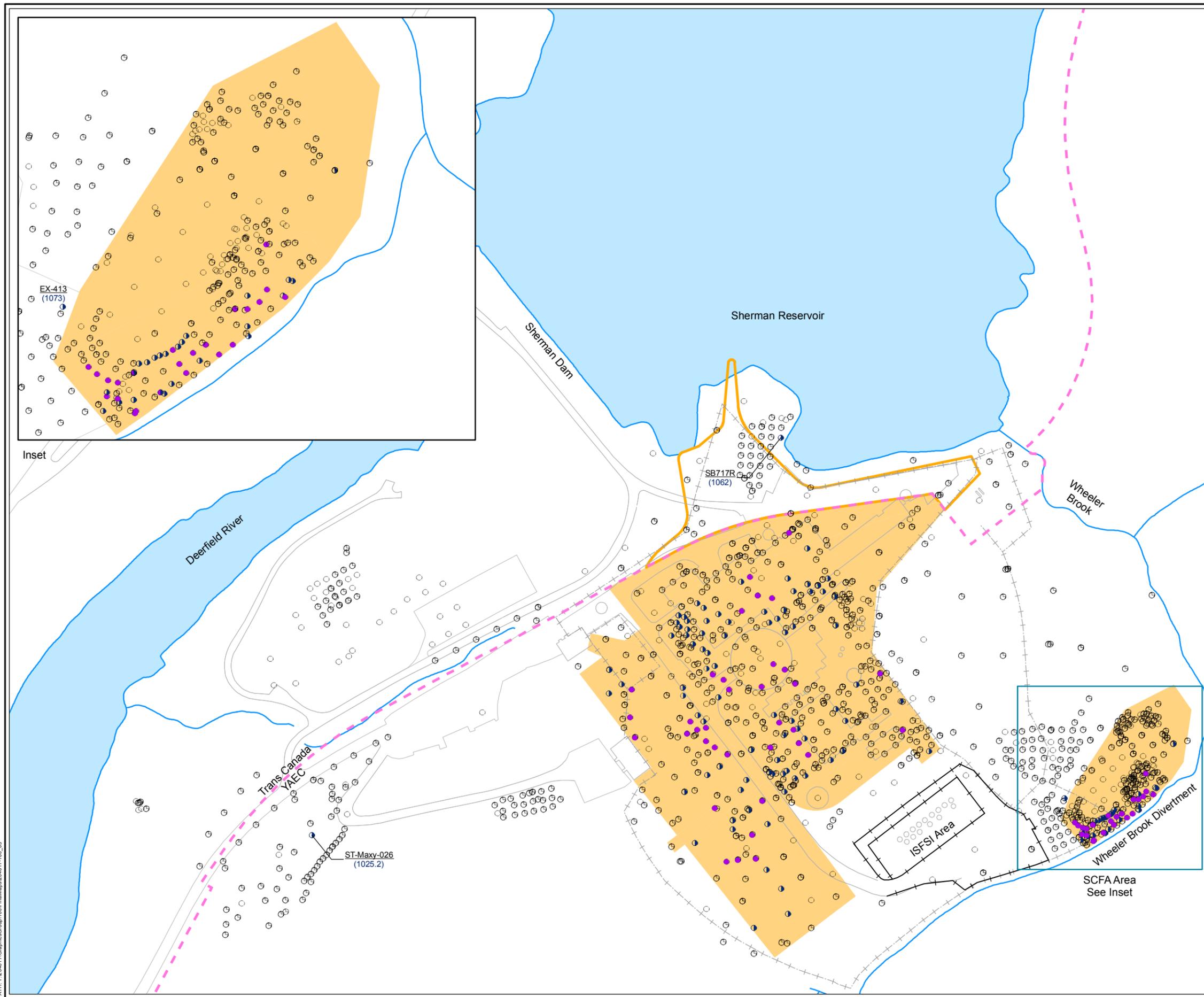
FIGURE 2-5

Soil Locations Exceeding MCP S-1 Criteria and/or Background -- SVOCs

Yankee Nuclear Power Station,
Rowe, MA

Drawing By: RJAM	Checked By: DEM	Project No.: 204017
Date: 06/18/07	Date: 06/18/07	File: 204017-100_02.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_02



LEGEND

- Sample Locations > 2000 µg/kg
- Sample Locations > 1000 µg/kg And ≤ 2000 µg/kg
- Sample Locations Detected ≤ 1000 µg/kg
- Nondetect

Note : Former structures and plant features shown for reference. These no longer exist.

EX-413
(1073)

Sample ID
(Concentration in µg/kg)

Sum of Aroclors Exceeding 1000 µg/kg

*Sum of Aroclors is an over-estimate of Total PCB Concentration due to double-counting



Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

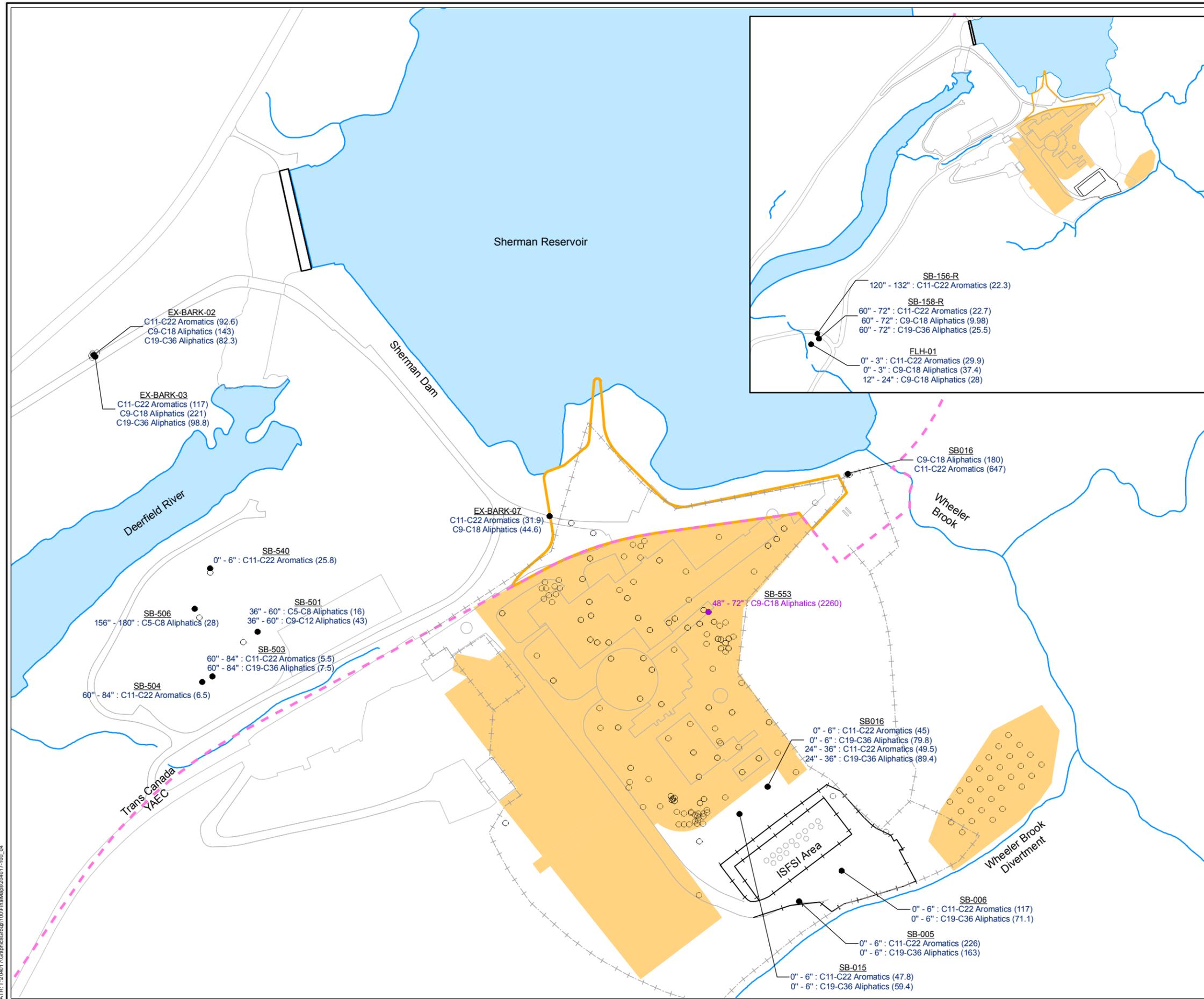
FIGURE 2-6

Soil Locations with Total PCBs

Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/10/07	Date:	04/10/07	File:	204017-100_03.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_03

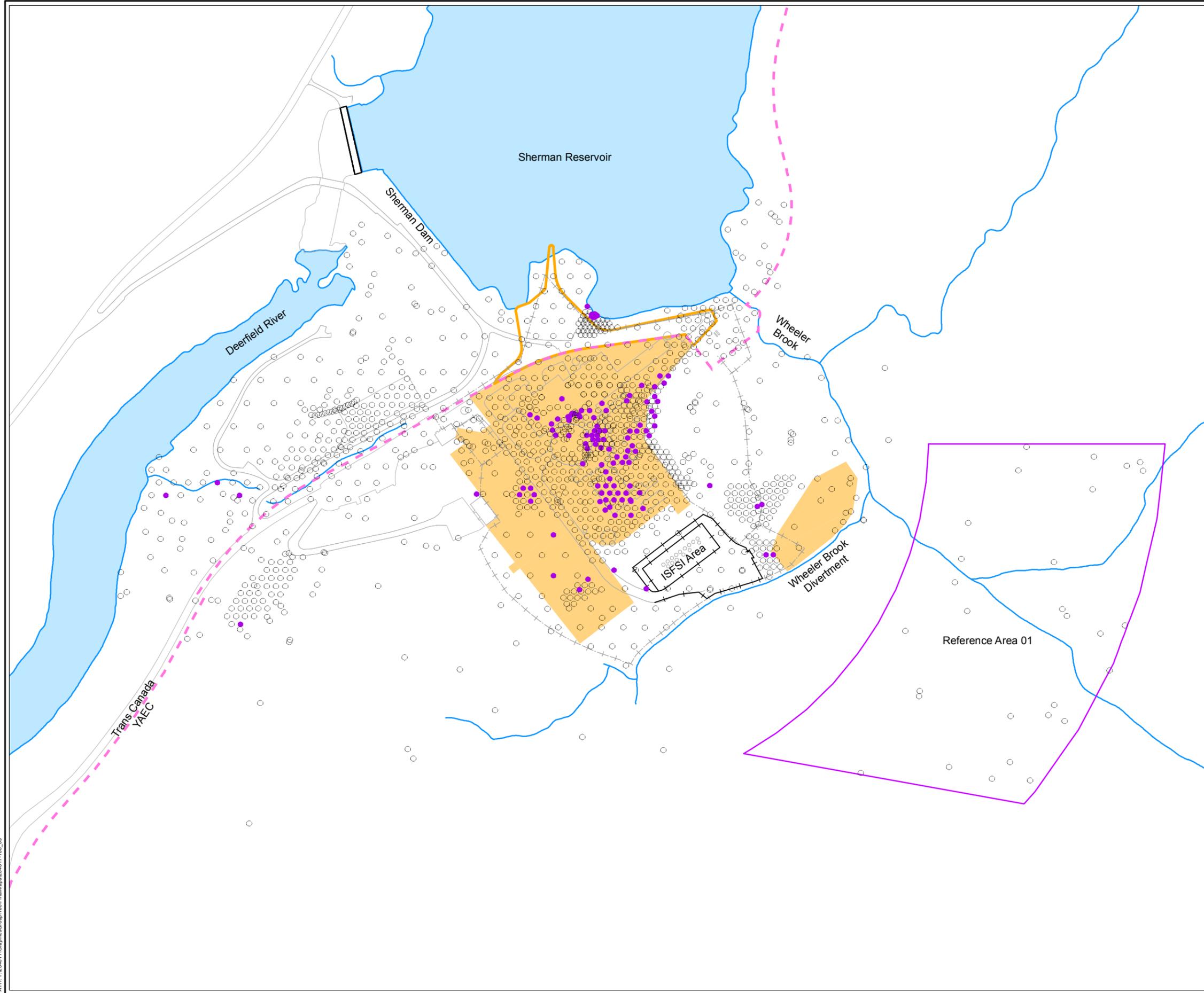


Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-7
Soil Locations Exceeding
MCP S-1 Criteria and/or
Background -- EPHs and VPHs
Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/18/07	Date:	06/18/07	File:	204017-100_04.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_04



LEGEND

- Sample Locations Where Co-60 Was Detected
- Nondetect

Note : Former structures and plant features shown for reference. These no longer exist.



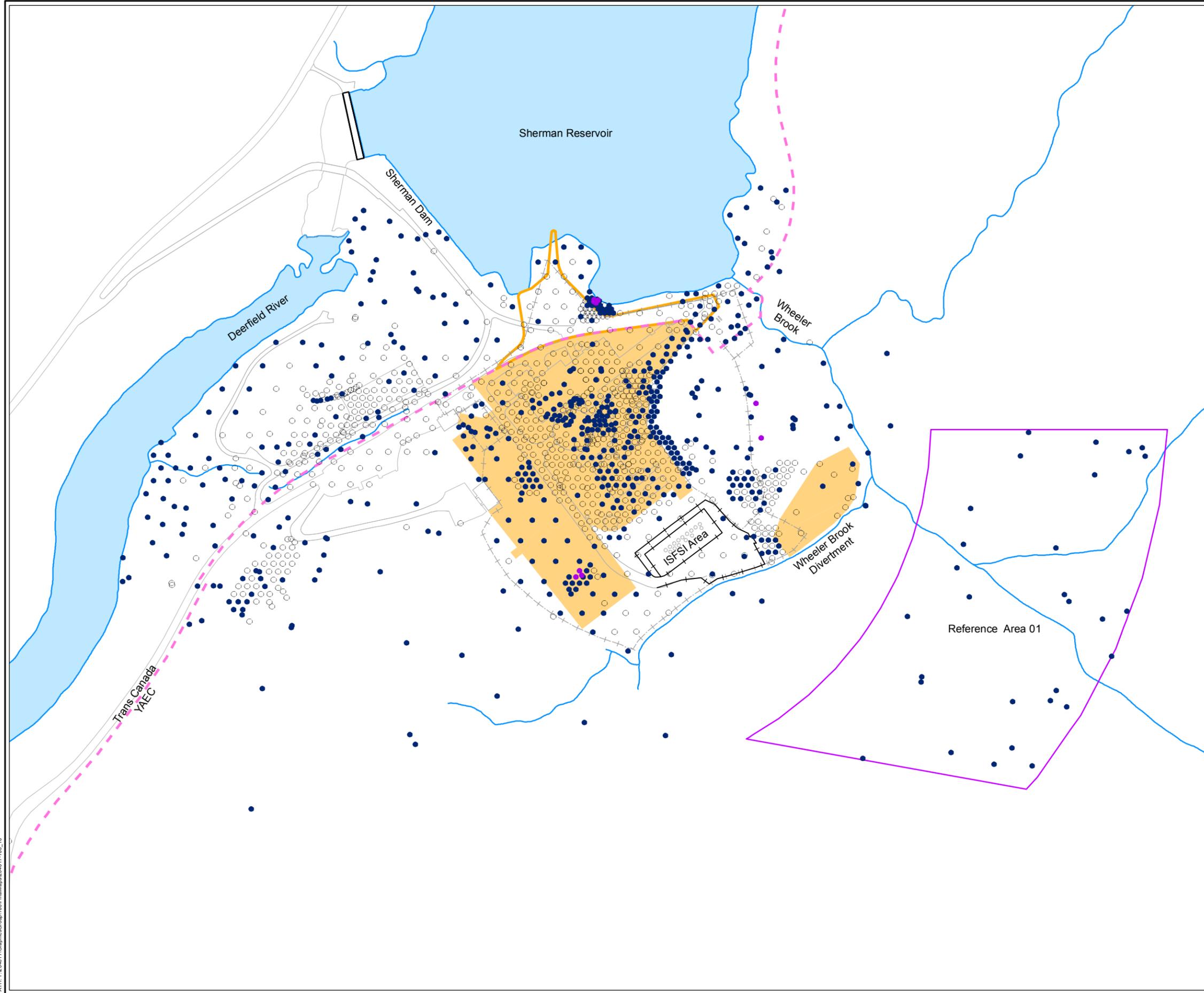
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-8
Soil Sample Locations
For Co-60

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/05/07	Date:	04/05/07	File:	204017-100_09.mxd

PATH: T:\204017\GraphicsGroup\100\Final\Maps\204017-100_09



LEGEND

- Sample Locations > 2 pCi/g
- Sample Locations ≤ 2 pCi/g
- Nondetect

Note : Former structures and plant features shown for reference. These no longer exist.



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

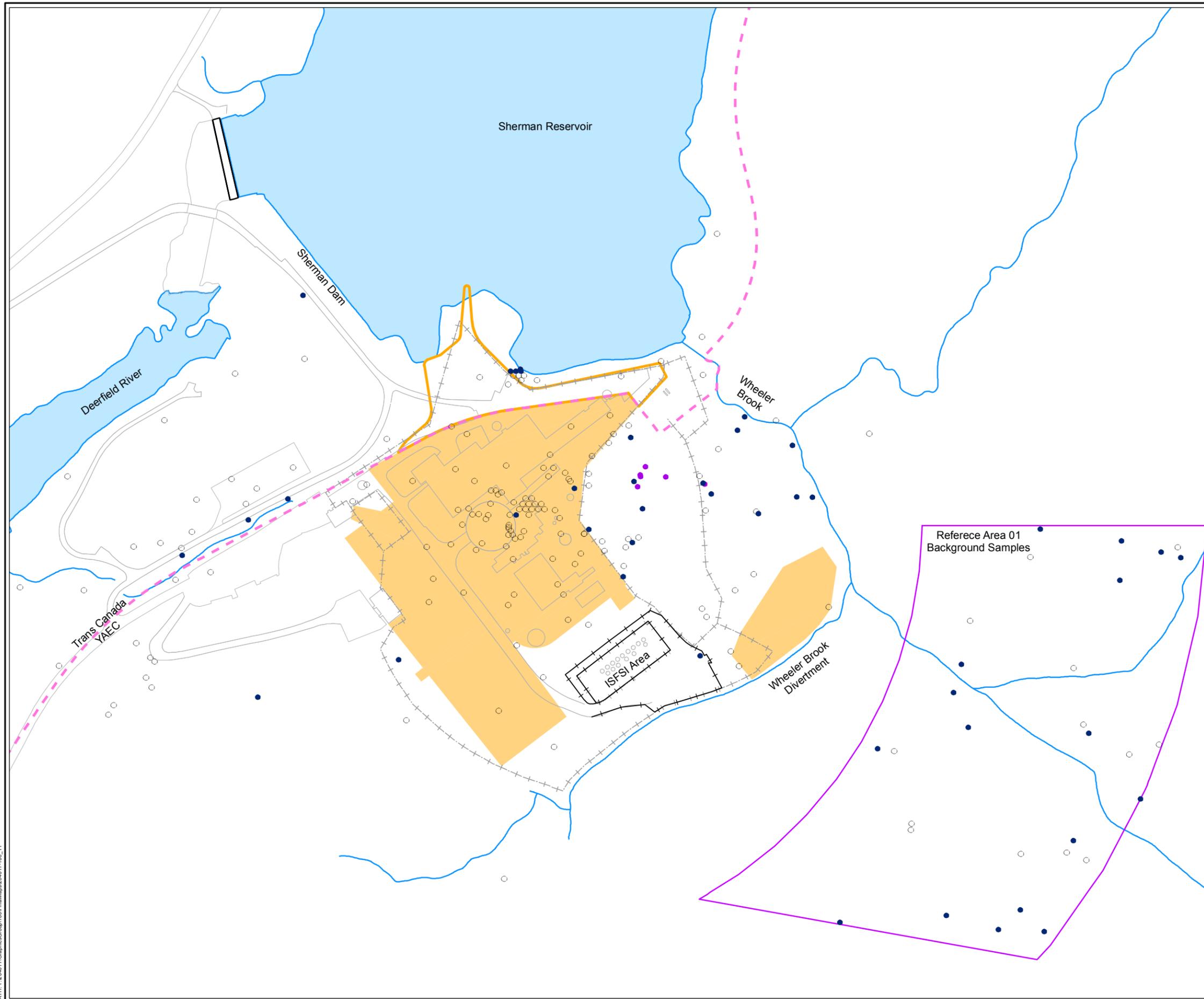
FIGURE 2-9

**Soil Sample Locations
 For Cs-137**

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/09/07	Date:	04/09/07	File:	204017-100_10.mxd

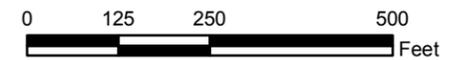
PATH: T:\204017\GraphicsGroup\100\Final\Maps\204017-100_10



LEGEND

- Sample Locations > 0.35 pCi/g
- Sample Locations ≤ 0.35 pCi/g
- Nondetect

Note : Former structures and plant features shown for reference. These no longer exist.



Gradient CORPORATION

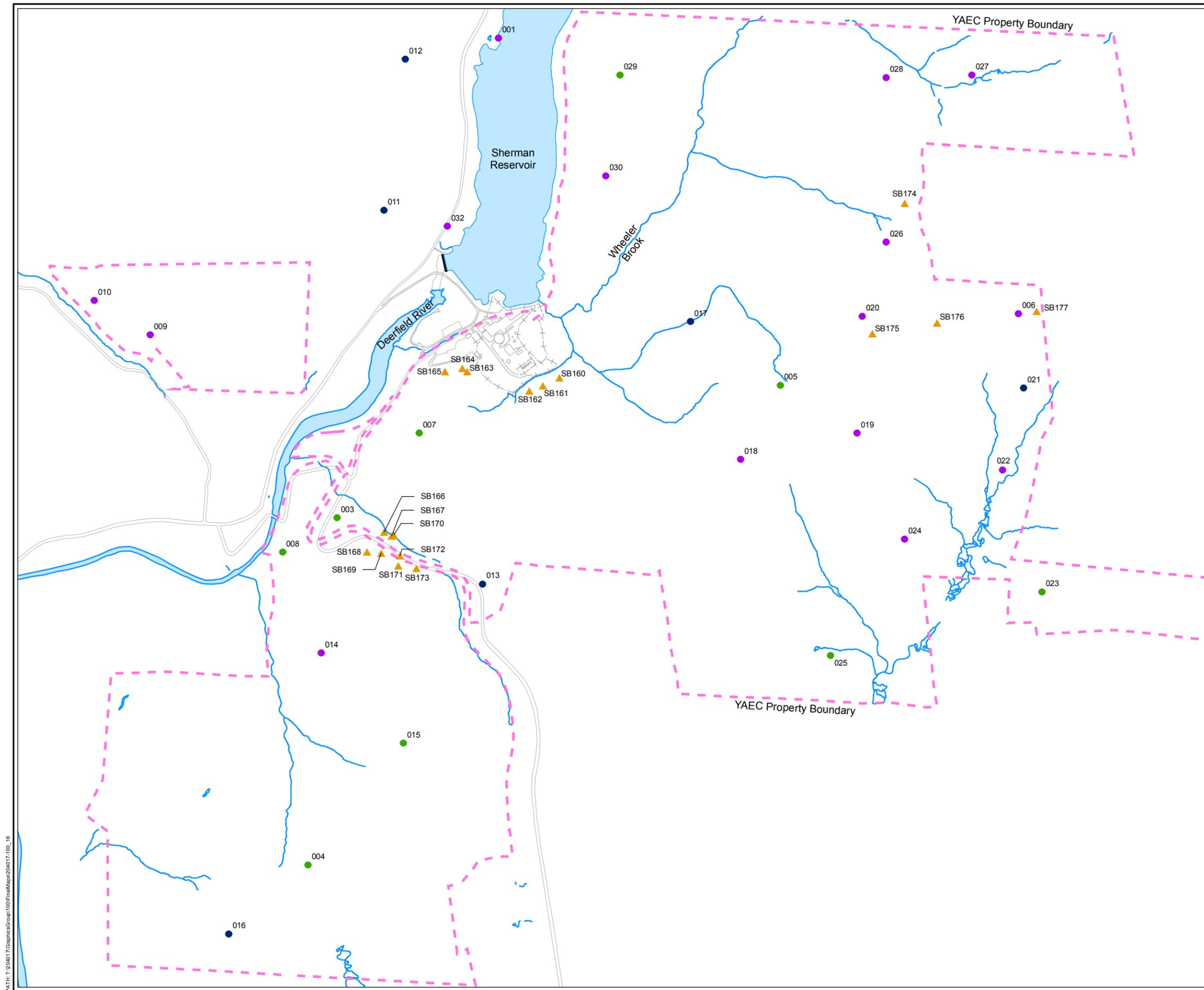
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-10

Soil Sample Locations For Sr-90

Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/09/07	Date:	04/09/07	File:	204017-100_11.mxd



LEGEND

Chemical Background Samples

▲ Background - OHM Samples

Cs-137 (pCi/g)

- 0.007 - 0.500
- 0.501 - 0.660
- 0.661 - 1.643

Note : Former structures and plant features shown for reference. These no longer exist.



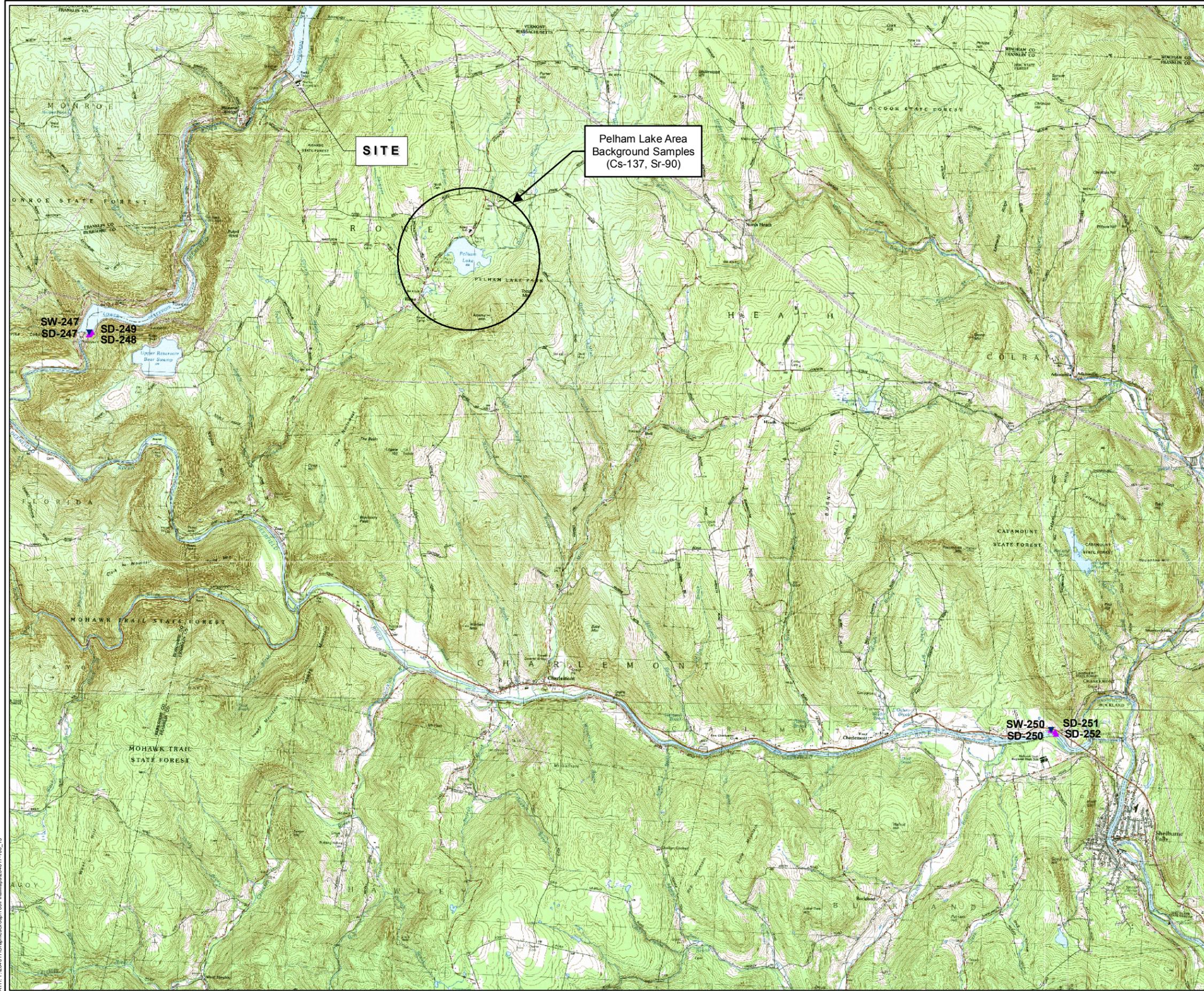
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-11
 Background Soil Sample Locations -- OHM
 and Historical Site Assessment (HSA)
 Radiological Data

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/05/07	Date:	04/05/07	File:	204017-100_16.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_16



- LEGEND**
- ▲ Sediment Samples
 - ▼ Surface Water Samples

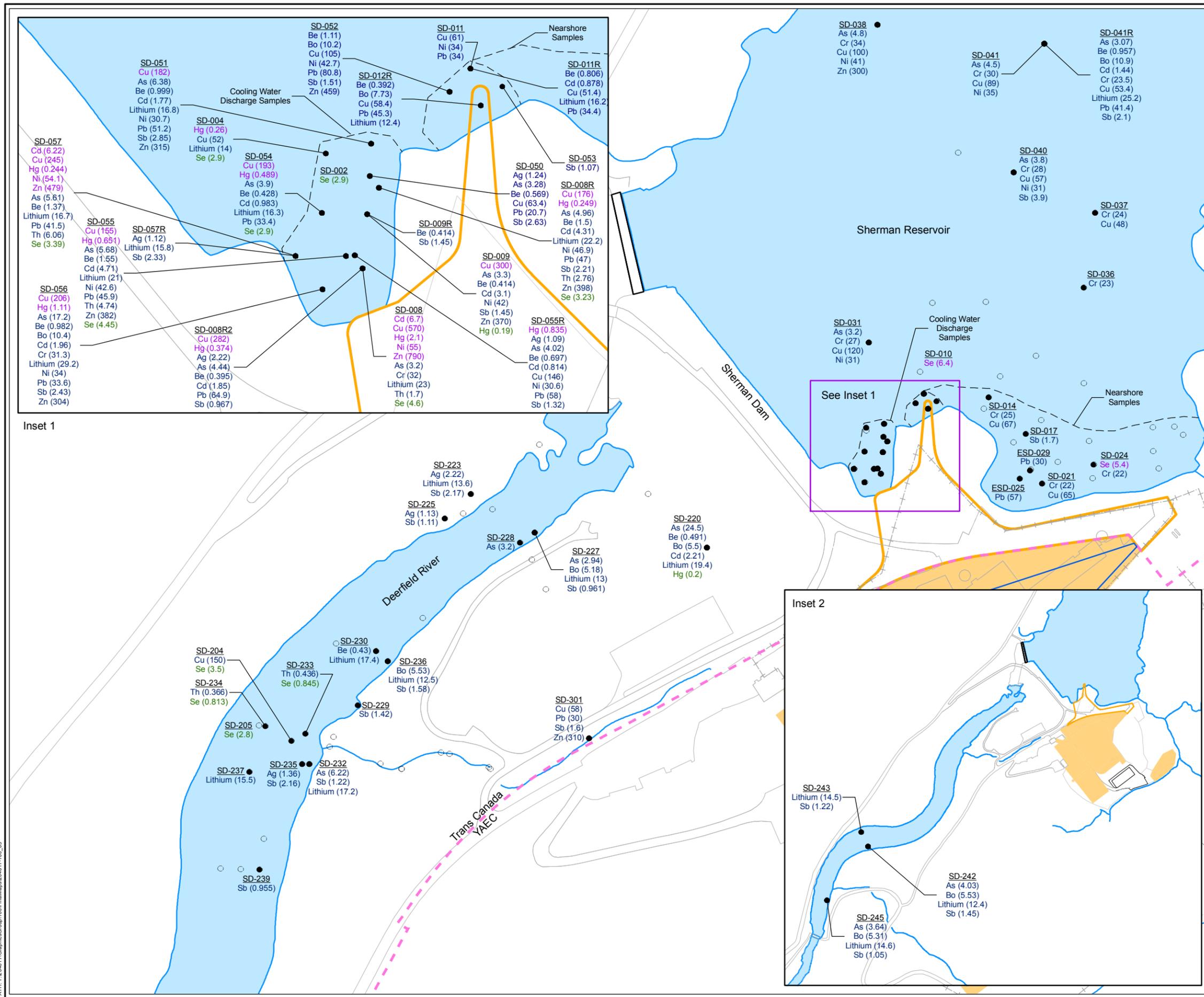


Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-12
 Background Soil Sample Locations
 for Radionuclides and Down-River
 Deerfield River Sample Locations
 Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	02/14/07	Date:	02/14/07	File:	204017-100_15.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Map\204017-100_15



Exceed Both Criteria And Background

Exceed Background

Exceed Criteria

LEGEND

- Sample Locations With Exceedances
- Sample Locations With No Exceedances

Note : Former structures and plant features shown for reference. These no longer exist.

SB001
Be (1)
Sample ID
Analyte (Concentration in mg/kg)

Analyte	Sediment Screen (mg/Kg)	Maximum Background Concentration (mg/Kg)
Antimony (Sb)	64	0.941
Arsenic (As)	33	2.8
Beryllium (Be)	N/A	0.358
Boron (Bo)	N/A	4.91
Cadmium (Cd)	5	0.633
Chromium (Cr)	110	21
Copper (Cu)	150	45
Lead (Pb)	130	19.6
Lithium	N/A	12.1
Mercury (Hg)	0.18	0.21
Nickel (Ni)	49	28
Selenium (Se)	0.1	4.9
Silver (Ag)	4.5	0.4
Thallium (Th)	N/A	ND
Zinc (Zn)	460	270

N/A Not Available
ND Non-Detect



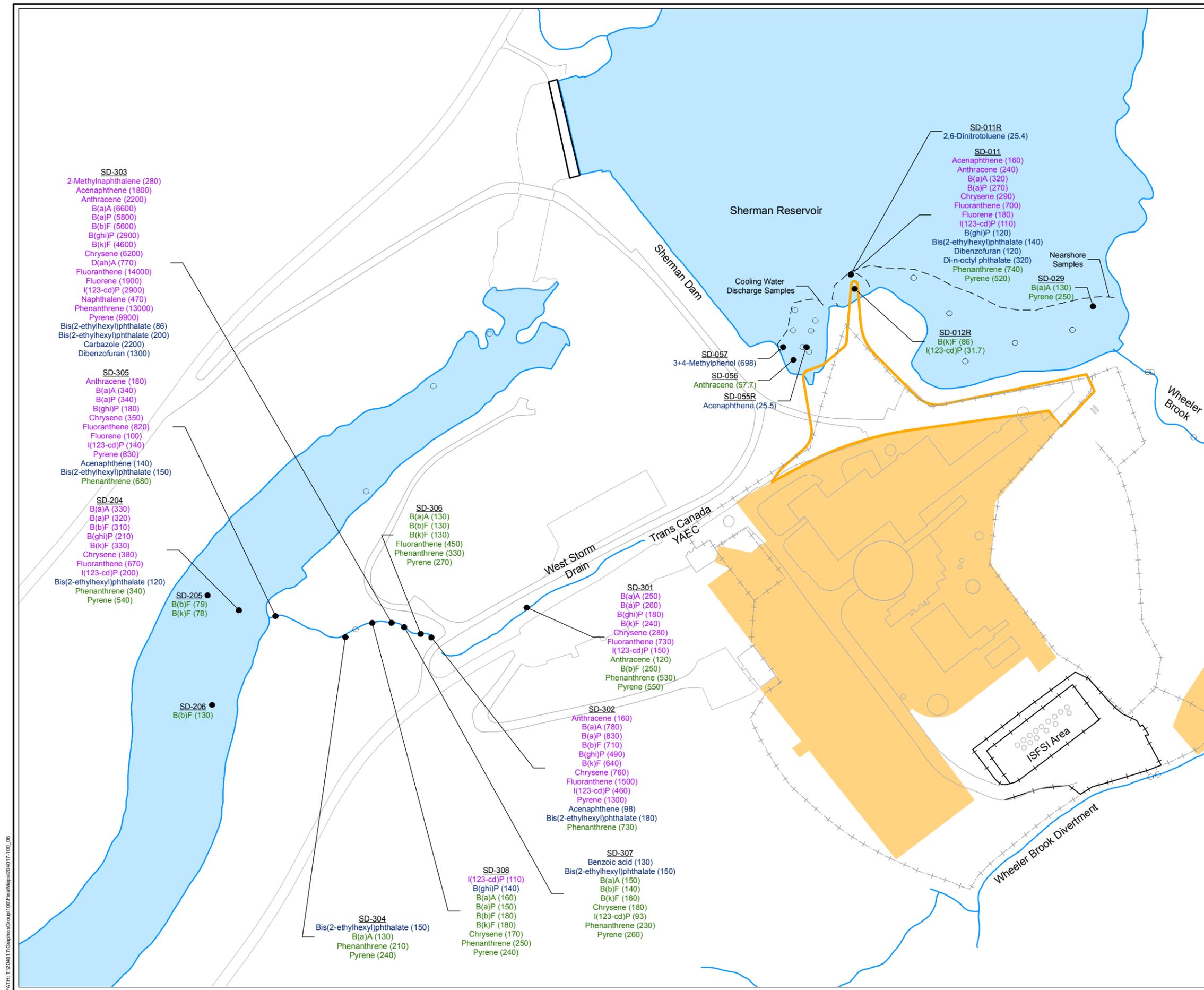
Gradient CORPORATION

20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-14
Sediment Locations Exceeding
Sediment Screen Criteria and/or
Background -- Inorganics

Yankee Nuclear Power Station,
Rowe, MA

Drawing By: RJAM	Checked By: DEM	Project No.: 204017
Date: 04/09/07	Date: 04/09/07	File: 204017-100_05.mxd



Exceed Both Criteria And Background

Exceed Background

Exceed Criteria

LEGEND

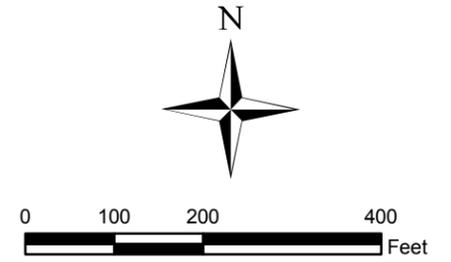
- Sample Locations With Exceedances
- Sample Locations With No Exceedances

Note : Former structures and plant features shown for reference. These no longer exist.

SD-206 B(b)F (130)
Sample ID
Analyte (Concentration in mg/kg)

Analyte	Sediment Screen (µg/Kg)	Maximum Background Concentration (µg/Kg)
2,6-Dinitrotoluene	N/A	ND
2-Methylnaphthalene	150	20.9
3+4-Methylphenol	N/A	230
Acenaphthene	150	21.5
Anthracene	57.2	124
Benzo(a)anthracene B(a)A	110	200
Benzo(a)pyrene B(a)P	150	230
Benzo(b)fluoranthene B(b)F	37	268
Benzo(g,h,i)perylene B(ghi)P	150	101
Benzo(k)fluoranthene B(k)F	37	220
Benzoic acid	N/A	ND
Bis(2-ethylhexyl)phthalate	13300	ND
Carbazole	N/A	80
Chrysene	170	273
Dibenzo(a,h)anthracene D(ah)A	33	24.6
Dibenzofuran	5100	36.3
Di-n-butyl phthalate	N/A	20.9
Di-n-octyl phthalate	N/A	37.4
Fluoranthene	423	651
Fluorene	77.4	48.6
Indeno(1,2,3-cd)pyrene I(123-cd)P	30	106
Naphthalene	176	ND
Phenanthrene	204	777
Pyrene	200	592

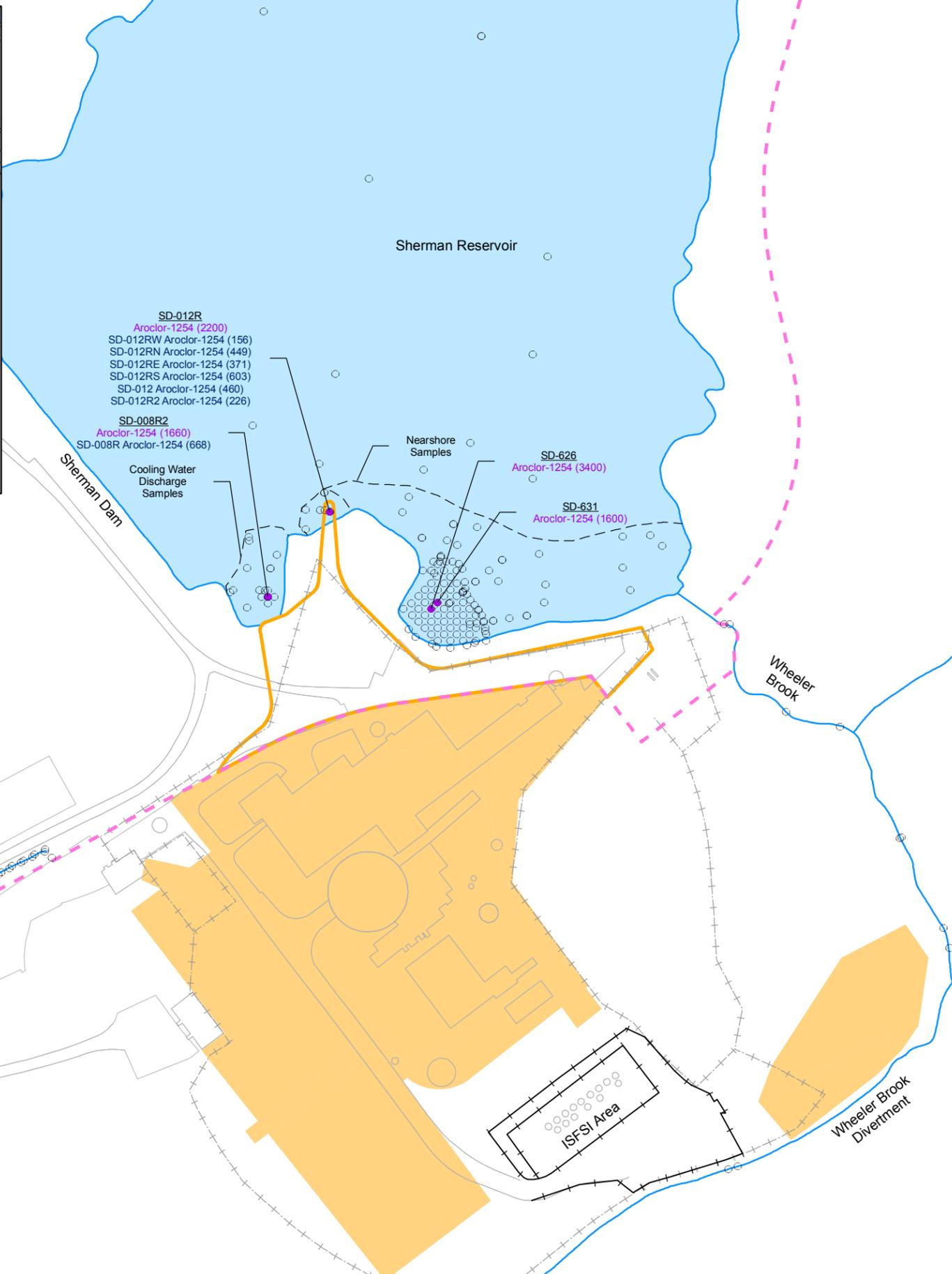
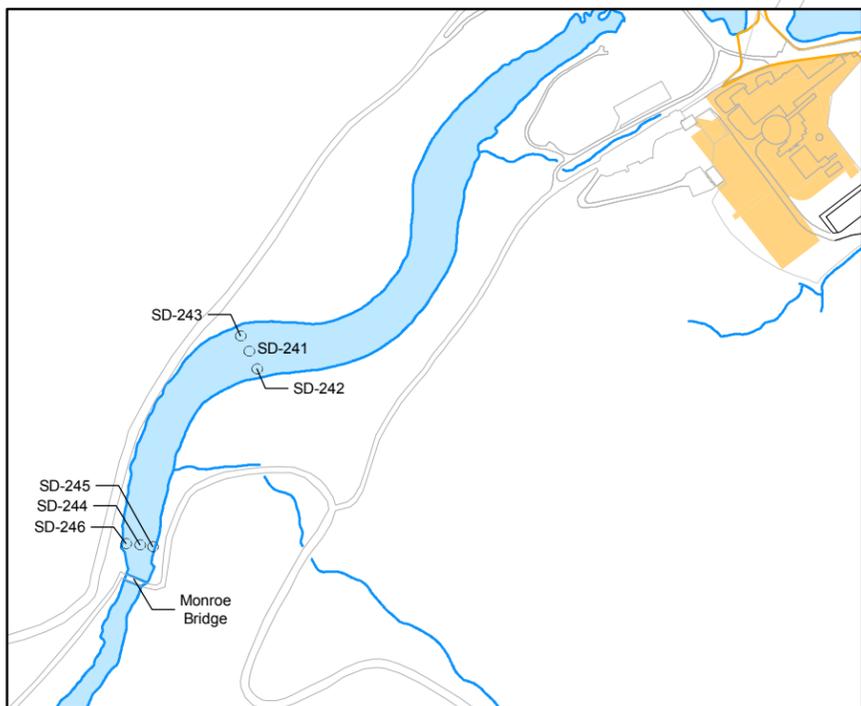
N/A Not Available, ND Non-Detect



Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-15
Sediment Locations Exceeding Sediment Screen Criteria and/or Background -- SVOC
Yankee Nuclear Power Station, Rowe, MA

PATH: T:\204017\GraphicsGroup\100\Final\Maps\204017-100_06



LEGEND

- Total PCBs ≥ 1000 µg/kg
- Total PCBs < 1000 µg/kg

Note : Former structures and plant features shown for reference. These no longer exist.

SD-008R2
Aroclor-1254 (1660)

Sample ID
Analyte (Concentration in µg/kg)
"R" Designates Resample



Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-16
Sediment Locations For PCBs

Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	05/08/07	Date:	05/08/07	File:	204017-100_07.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_07

SD-041R
C5-C8 Aliphatics (2.39)
C9-C12 Aliphatics (0.914)

SD-055
C5-C8 Aliphatics (6.44)
C9-C10 Aromatics (1.09)
C9-C12 Aliphatics (1.98)

SD-008R
C5-C8 Aliphatics (3.67)
C9-C10 Aromatics (0.77)
C9-C12 Aliphatics (1.58)

SD-057
C5-C8 Aliphatics (3.52)
C9-C10 Aromatics (1.19)
C9-C12 Aliphatics (1.16)

SD-056
C5-C8 Aliphatics (2.02)
C9-C12 Aliphatics (0.565)

Exceed Background

LEGEND

- Sample Locations With Exceedances
- Sample Locations With No Exceedances

Note : Former structures and plant features shown for reference. These no longer exist.

SD-057
C5-C8 Aliphatics (3.52)

Sample ID
Analyte (Concentration in mg/kg)

Analyte	Maximum Background Concentration (mg/kg)
C5-C8 Aliphatics	1.27
C9-C10 Aromatics	0.346
C9-C12 Aliphatics	0.451

There Is No Criteria For These Analytes



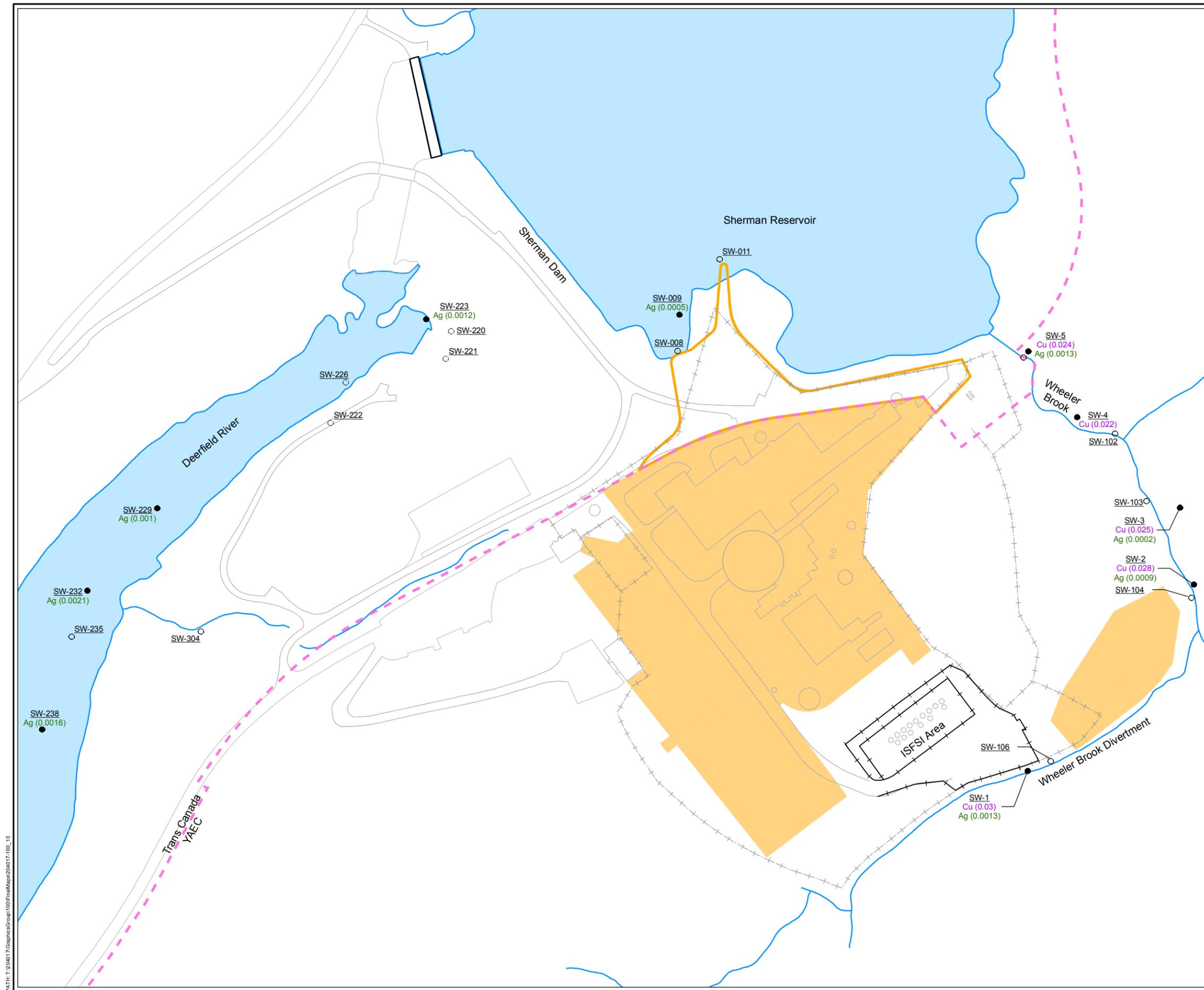
Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-17
Sediment Locations Exceeding Background Criteria -- VPHs

Yankee Nuclear Power Station,
Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	06/08/07	Date:	06/08/07	File:	204017-100_08.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_08



Exceed Both Criteria And Background

Exceed Criteria

LEGEND

- Sample Locations With Exceedances
- Sample Locations With No Exceedances

Note : Former structures and plant features shown for reference. These no longer exist.

SW-102
Se (0.0001)
Sample ID
Analyte (Concentration)

Analyte	Surface Water Screen (mg/L)	Maximum Background Concentration (mg/L)
Silver (Ag)	0.00012	0.0023
Copper (Cu)	0.009	ND

ND Non-Detect



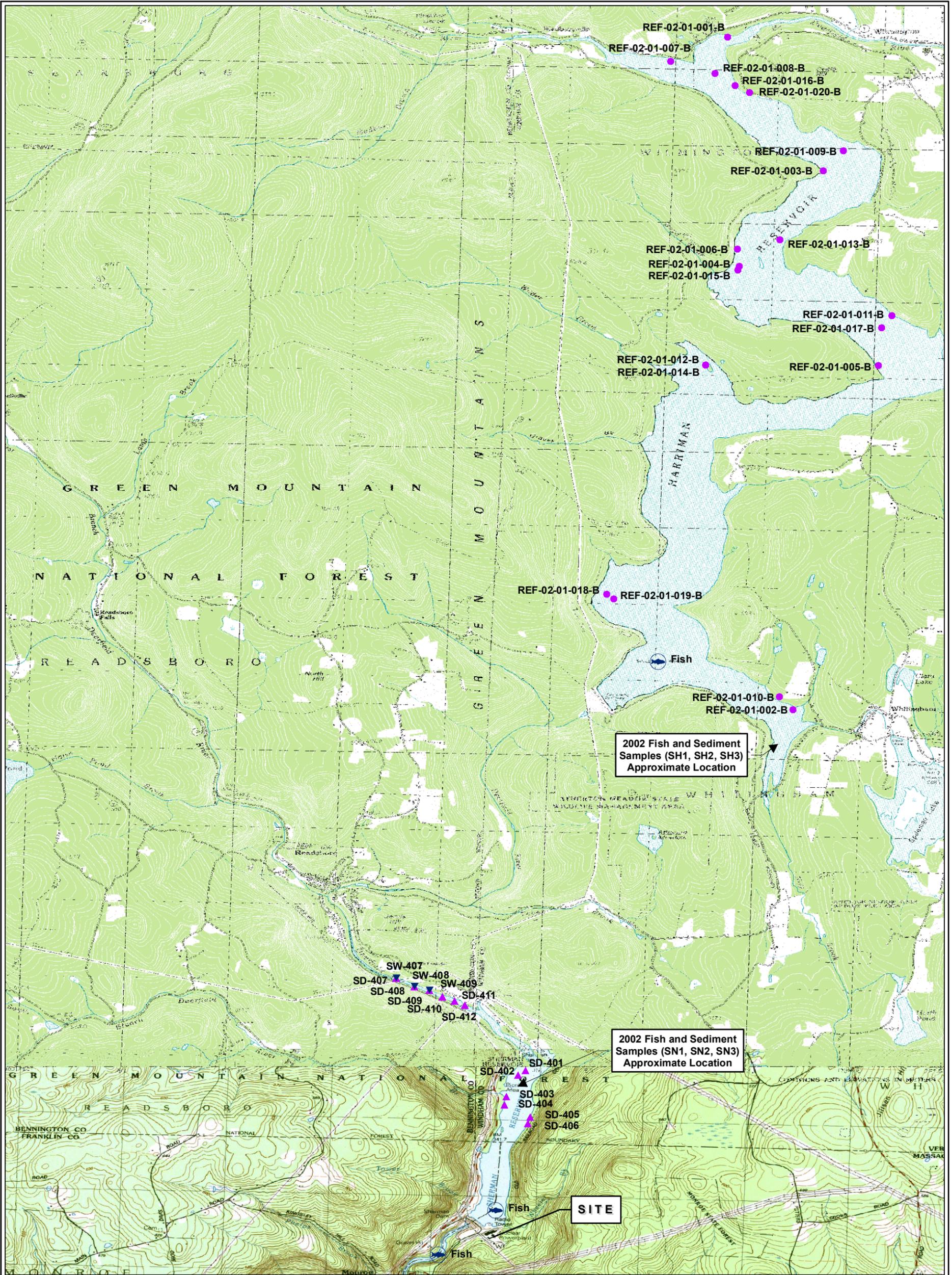
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-18
 Surface Water Locations Exceeding Surface Water Screening Criteria

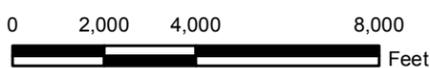
Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/06/07	Date:	04/06/07	File:	204017-100_013.mxd

PATH: T:\204017\Graphics\Group1\00\Final\Maps\204017-100_13



- LEGEND**
- Radionuclide Sediment Samples
 - ▲ OHM Sediment Samples
 - ▼ Surface Water Samples
 - 🐟 Fish Samples



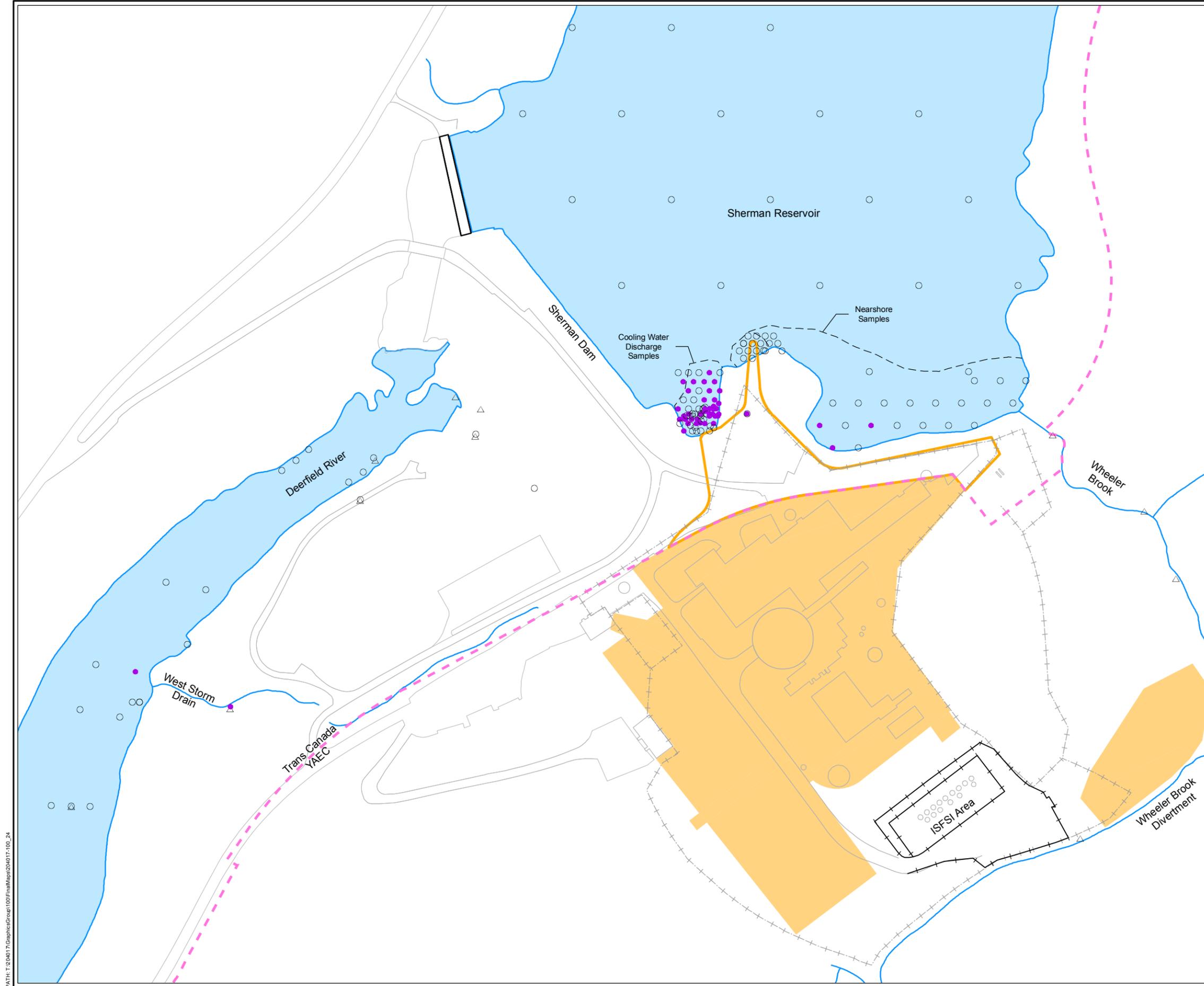
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-19

Background Sediment and Surface Water Sample Locations and Fish Sample Locations

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By: RJAM	Checked By: DEM	Project No.: 204017
Date: 05/23/07	Date: 03/16/07	File: 204017-100_14.mxd



LEGEND

- Sediment Samples Where Co-60 Was Detected
- Sediment Nondetects
- △ Surface Water Nondetects

Note : Former structures and plant features shown for reference. These no longer exist.



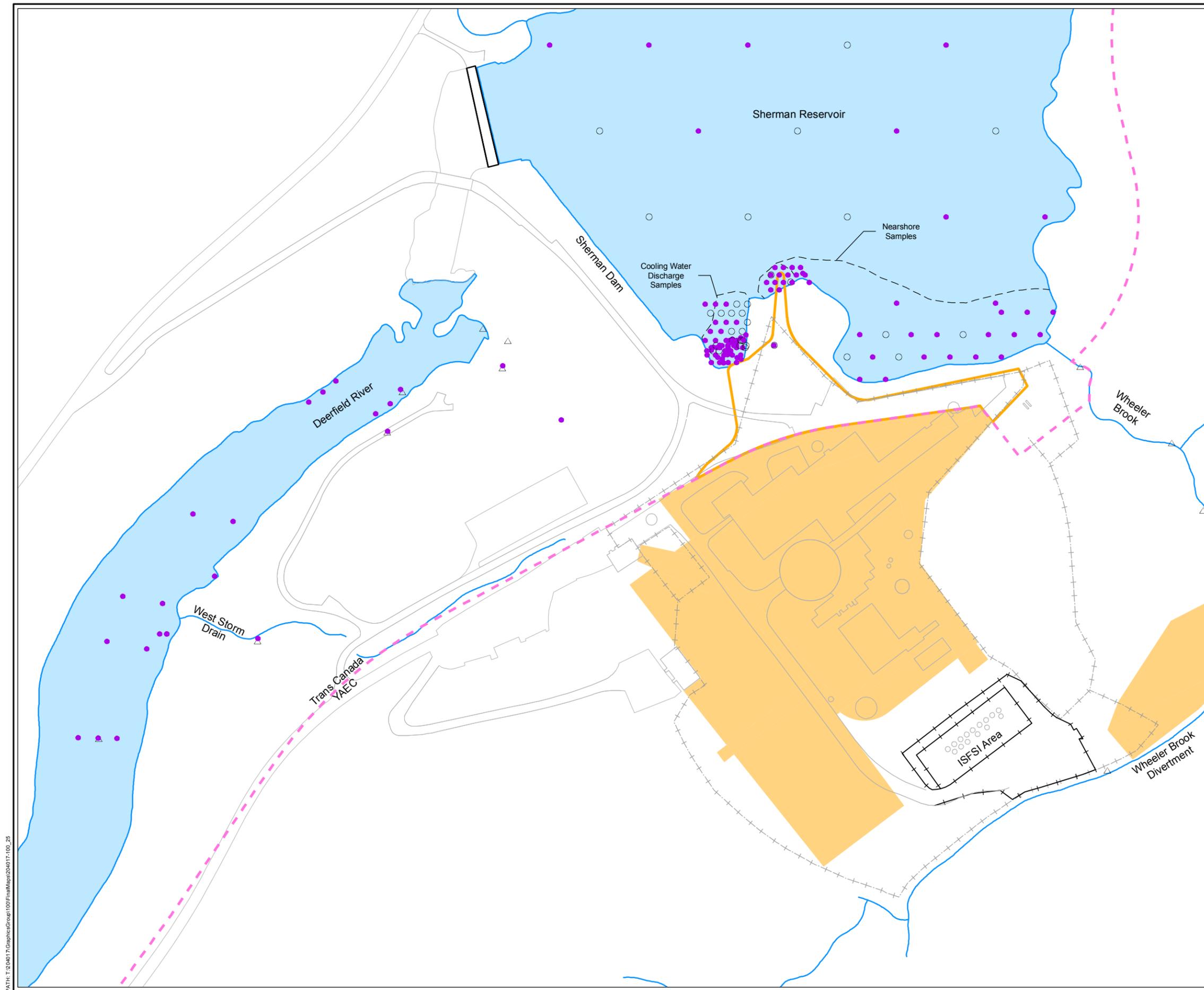
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-20
Sediment and Surface Water Sample Locations for Co-60

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/06/07	Date:	04/06/07	File:	204017-100_24.mxd

PATH: T:\204017\Graphics\Group1\100\Final\Maps\204017-100_24



LEGEND

- Sample Locations ≥ 0.5 pCi/g
- Sample Locations < 0.5 pCi/g
- △ Surface Water Nondetects

Note : Former structures and plant features shown for reference. These no longer exist.



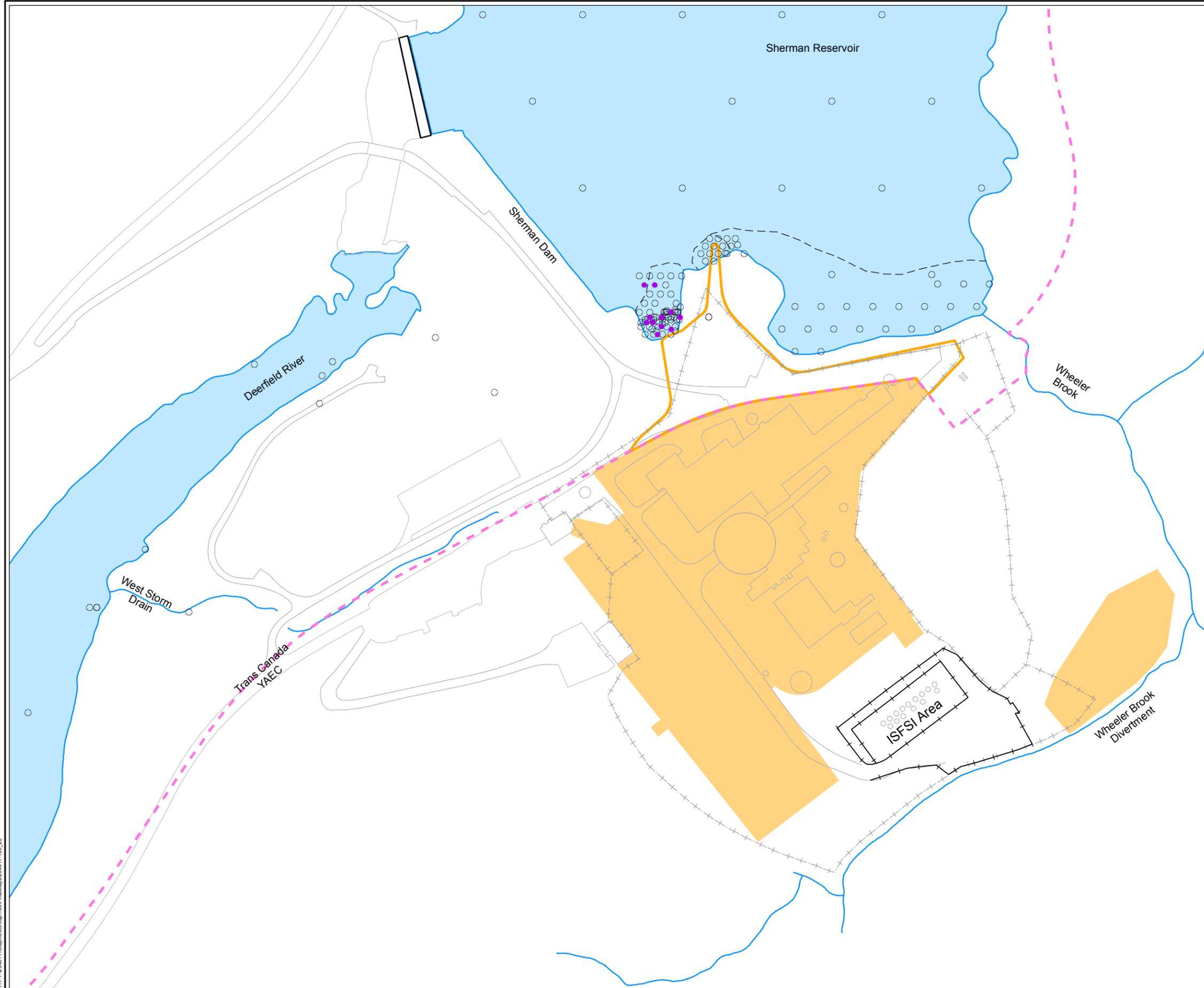
Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-21
Sediment and Surface Water
Sample Locations for Cs-137

Yankee Nuclear Power Station,
 Rowe, MA

Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/06/07	Date:	04/06/07	File:	204017-100_25.mxd

PATH: T:\204017\GraphicsGroup\100\FinalMaps\204017-100_25



LEGEND

- Sample Locations > 0.1 pCi/g
- Sample Locations ≤ 0.1 pCi/g

Note : Former structures and plant features shown for reference. These no longer exist.



Gradient CORPORATION
 20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 2-22

Sediment Sample Locations for Sr - 90

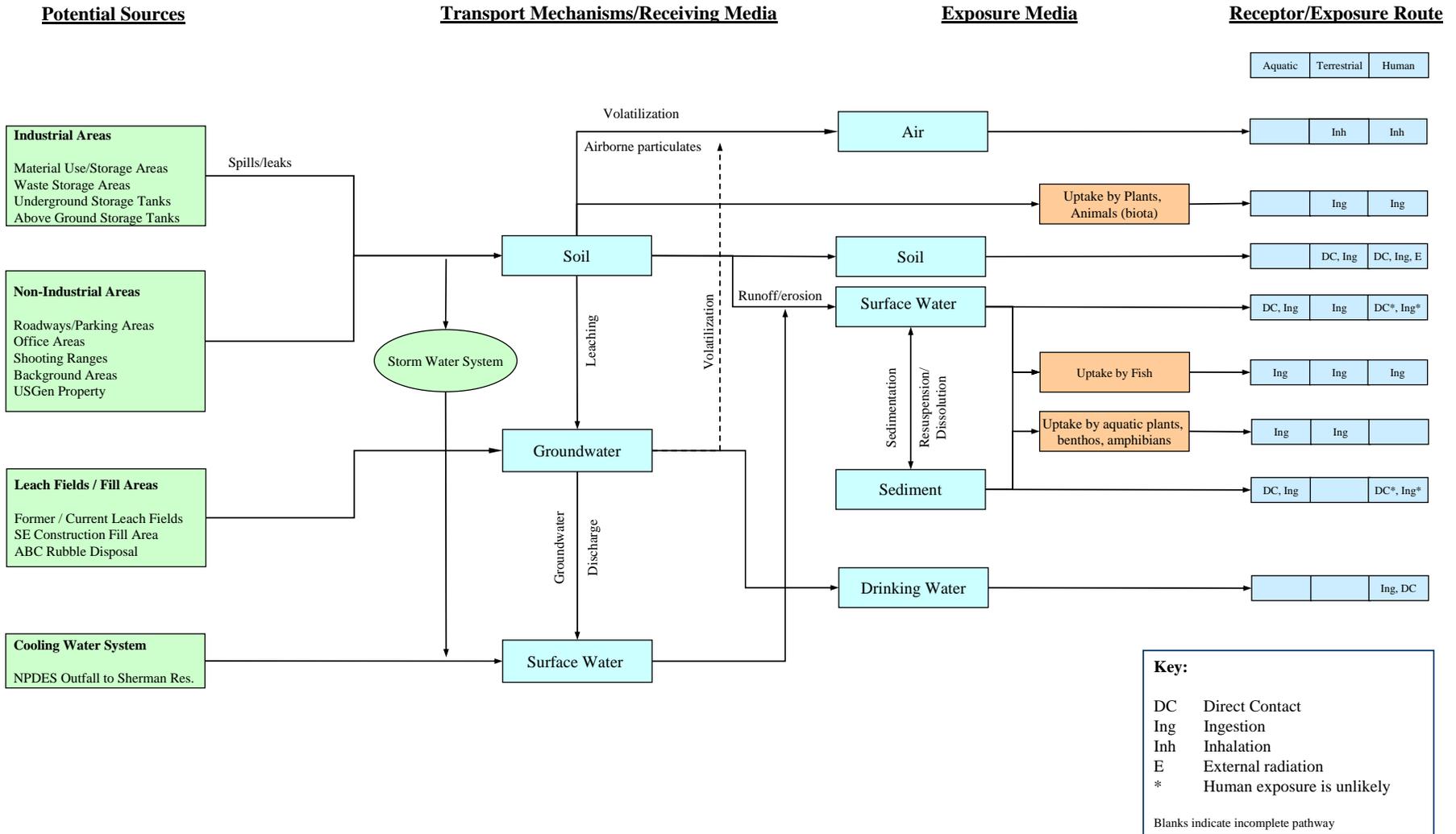
Yankee Nuclear Power Station,
 Rowe, MA

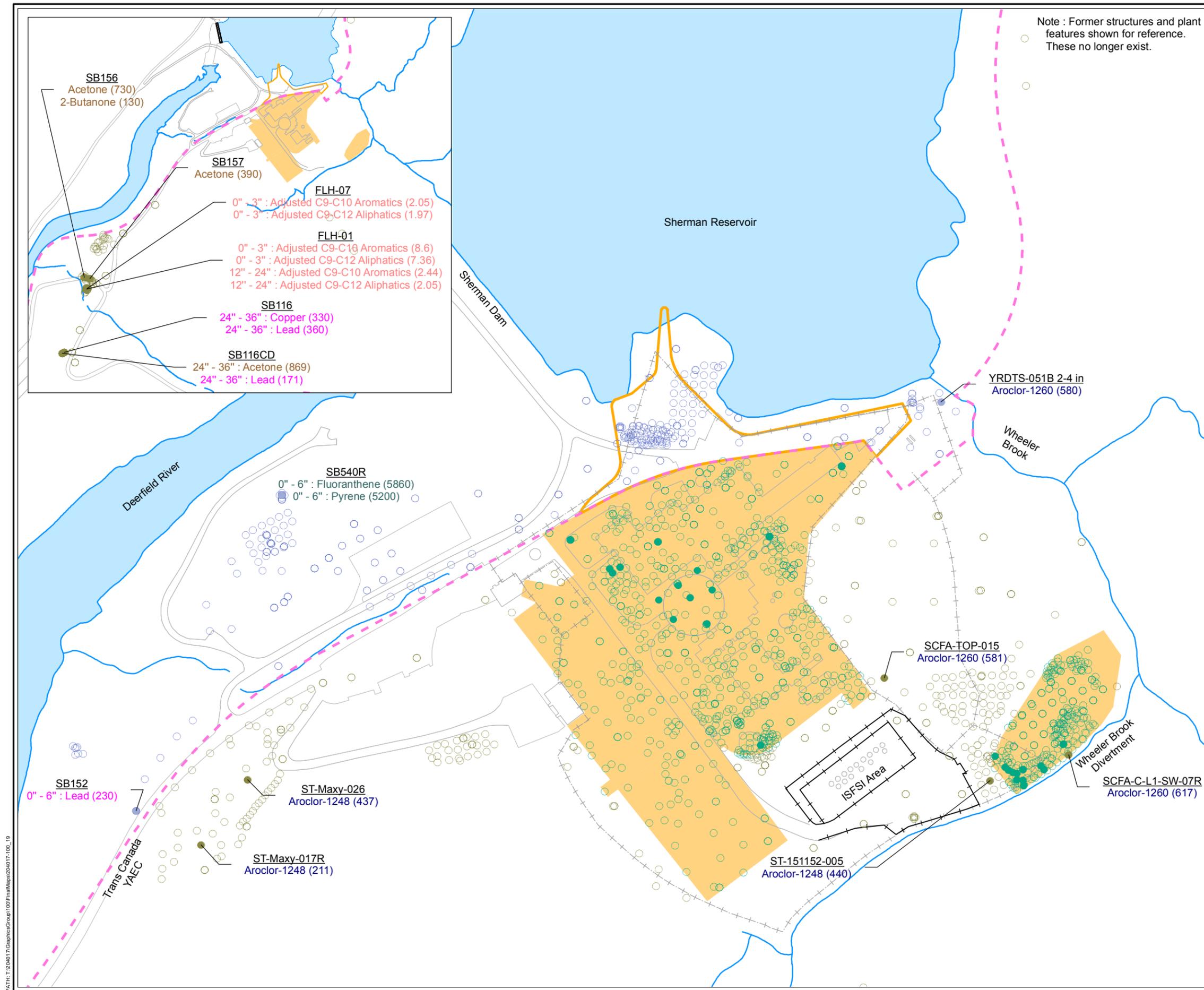
Drawing By:	RJAM	Checked By:	DEM	Project No.:	204017
Date:	04/06/07	Date:	04/06/07	File:	204017-100_26.mxd

PATH: T:\204017\GraphicsGroup\100\FinalMaps\204017-100_26

Figure 5-1
YNPS Human and Environmental Risk Assessment Conceptual Site Model

Chemical Release Sources, Pathways of Exposure, and Potentially Exposed Receptors





Note : Former structures and plant features shown for reference. These no longer exist.

LEGEND

Stations That Exceed 10 - Times the Study Area Mean

- BUD/TSCA Area Samples
- YAEC Non-BUD/TSCA Samples
- TransCanada Samples
- - - Property Boundary

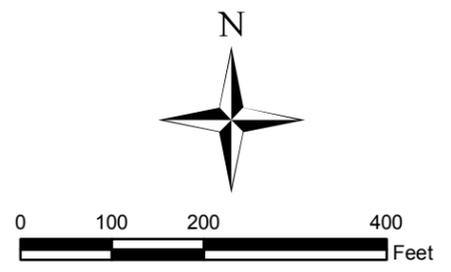
SB152
0" - 6" : Lead (230)

Sample ID
Depth : Analyte (Concentration)

Chemical Group	COPC	TransCanada Study Area Mean	Units
Inorganics	Lead	6.66	mg/Kg
PCBs	Aroclor-1260	51.36482143	µg/Kg
SVOC	Fluoranthene	537.74	µg/Kg
SVOC	Pyrene	484.77	µg/Kg

Chemical Group	COPC	Outside AUL Study Area Mean	Units
Inorganics	Copper	9.67	mg/Kg
Inorganics	Lead	16.34	mg/Kg
PCBs	Aroclor-1248	18.77	µg/Kg
PCBs	Aroclor-1260	52.67	µg/Kg
VOC	2-Butanone	5.13	µg/Kg
VOC	Acetone	26.13	µg/Kg
VPH	Adjusted C9-C10 Aromatics	0.15	mg/Kg
VPH	Adjusted C9-C12 Aliphatics	0.15	mg/Kg

Chemical Group	COPC	Inside AUL Study Area Mean	Units
Inorganics	Lead	10.29	mg/Kg
PCBs	Aroclor-1254	532.87	µg/Kg
PCBs	Aroclor-1260	163.28	µg/Kg
SVOC	Phenanthrene	335.15	µg/Kg
VOC	Toluene	92.63	µg/Kg
VPH	Adjusted C9-C10 Aromatics	3.09	mg/Kg
VPH	Adjusted C9-C12 Aliphatics	0.96	mg/Kg
EPH	Adjusted C11-C22 Aromatics	36.21	mg/Kg



Gradient CORPORATION
20 UNIVERSITY ROAD • CAMBRIDGE, MA 02138 • (617)395-5000

FIGURE 7-1
Soil Sample Locations With COPC Concentrations Exceeding 10 - Times the Study Area Mean
Yankee Nuclear Power Station, Rowe, MA

PATH: T:\204017\Graphics\Group1\00\Final\Map\204017-100_19

Method 3 Risk Characterization Former Yankee Nuclear Power Station Rowe, Massachusetts



Prepared for
Yankee Atomic Electric Company
49 Yankee Road
Rowe, Massachusetts 01367

Prepared by
Gradient Corporation
20 University Road
Cambridge, MA 02138

November 2007

Table of Contents

Executive Summary.....	ES-1
1 Introduction	1
1.1 Risk Characterization Goals	2
1.2 Method 3 Risk Characterization Framework	3
2 Site Description and Environmental Conditions.....	5
2.1 Site Background and Characteristics	5
2.1.1 Radionuclides Produced By Fission	6
2.1.2 Naturally Occurring Radionuclides	8
2.1.3 Radiological Monitoring During Operations.....	9
2.2 Study Areas and Foreseeable Future Use of the Site	11
2.2.1 Study Areas.....	11
2.2.2 Current and Future Use Scenarios	14
2.3 Site Investigations.....	14
2.3.1 Soil Sampling.....	15
2.3.2 Groundwater Wells, Water Supply Wells, and Sherman Spring	18
2.3.3 Sediment and Surface Water Sampling	20
2.3.3 Fish Sampling	22
2.4 Usability of Risk Characterization Data	23
2.4.1 OHM Analytical Program.....	23
2.4.2 Radionuclide Analytical Program.....	27
2.5 Chemical and Radionuclide Database.....	28
2.6 Remedial Actions and Site Restoration	31
2.7 Classification of Site Soils and Site Groundwater	32
3 Hazard Identification	33
3.1 Constituents of Potential Concern	33
3.1.1 Background Constituent Concentrations	34
3.1.2 Oil and Hazardous Material COPCs	37
3.1.3 Radionuclide COPCs.....	40
3.2 Applicable or Suitably Analogous Standards	42
4 Dose-Response Assessment	43
5 Exposure Assessment.....	45
5.1 Identification of Potential Receptors and Exposure Pathways	45
5.1.1 Current and Future Recreational Use.....	47
5.1.2 Hypothetical Future Commercial Use	48
5.1.3 Other Potential Receptors	49
5.1.4 Sensitivity Analysis	49
5.2 Determination of Exposure Point Concentrations	50
5.2.1 Soil.....	50
5.2.2 Sediment	52
5.2.3 Surface Water	53
5.2.4 Groundwater	54
5.2.5 Fugitive Dust	56

5.3	Exposure Quantification	57
5.3.1	Chemical Exposure Quantification Methods	58
5.3.2	Exposure Quantification for Radionuclides.....	61
6	Risk Characterization	65
6.1	Chemical Health Risks.....	65
6.1.1	Cancer Risks	65
6.1.2	Non-Cancer Health Hazards	66
6.1.3	Lead Risk Characterization.....	68
6.2	Radiological Risk Characterization	70
6.2.1	Internal Radiation Exposure Risks	70
6.2.2	External Radiation Exposure Risks	71
6.3	Comparison of Radionuclide Risk <i>versus</i> Dose.....	71
6.4	Combined Chemical and Radiological Risks.....	72
6.5	Comparison of EPCs to Applicable or Suitably Analogous Standards	72
7	Uncertainty Analysis	76
7.1	Environmental Sampling and Laboratory Analysis.....	76
7.2	Risks Associated with Background	78
7.3	Exposure Assumptions	79
7.4	“Hot Spot” Evaluation	80
7.5	Future Uses Including ISFSI.....	82
7.6	Toxicity Criteria.....	83
8	Risk to Public Welfare and Safety	84
8.1	Risk to Public Welfare.....	84
8.2	Risk to Safety.....	84
9	Environmental Risk Characterization	85
9.1	Stage I Screening Level Ecological Risk Assessment.....	85
9.2	Stage II Baseline Ecological Risk Assessment.....	86
9.2.1	Ecological Habitats and Communities.....	86
9.2.2	Ecological Receptors	87
9.2.3	Measurement Endpoints	87
9.3	Results and Conclusions	88
10	Conclusions and Findings	92
11	References	94

List of Tables

Table 2-1	Common Fission and Activation Product Radionuclides
Table 2-2	Data Completeness Summary
Table 2-3	Data Completeness - Analytes Less Than 90% Completeness
Table 2-4	Summary of Soil Sample Density
Table 3-1	Chemicals Detected in Surface Soil (0-3 ft bgs) – Background Areas
Table 3-2	Chemicals Detected in Sediment - Background Areas
Table 3-3	Chemicals Detected in Surface Water – Background Areas
Table 3-4	Radionuclides Detected in Surface Soil – Background Areas
Table 3-5	Radionuclides Detected in Sediment – Background Areas
Table 3-6	Fish Sample Results – OHM
Table 3-7	Fish Sample Results – 2006 Radionuclides
Table 3-8	Chemical COPCs in Surface Soil (0-3 ft bgs) – TransCanada Shoreline
Table 3-9	Chemical COPCs in Soil (0-3 ft bgs) – TransCanada Property
Table 3-10	Chemical COPCs in Soil (0-3 ft bgs) – YAEC Non-RUA
Table 3-11	Chemicals in Soil – Summary Statistics of YAEC Non-RUA Subareas
Table 3-12	Chemical COPCs in Soil (0-3 ft bgs) – YAEC Inside RUA
Table 3-13	Chemicals in Soil – Summary Statistics Plant RUA vs. SCFA RUA (0-3 ft bgs)
Table 3-14	Chemical COPCs in Sediment – Nearshore Sherman Reservoir
Table 3-15	Chemicals in Sediment – Summary Statistics Sherman Reservoir Subareas
Table 3-16	Chemical COPCs in Sediment – Deerfield River Adjacent to the Site
Table 3-17	Chemicals in Sediment – Summary Statistics Deerfield River
Table 3-18	Chemical COPCs in Sediment – Wheeler Brook
Table 3-19	Chemical COPCs in Sediment – West Storm Ditch
Table 3-20	Chemical COPCs in Surface Water – Sherman Reservoir
Table 3-21	Chemical COPCs in Surface Water – Deerfield River Adjacent to the Site
Table 3-22	Chemicals in Surface Water – Summary Statistics Deerfield River
Table 3-23	Chemical COPCs in Surface Water – Wheeler Brook
Table 3-24	Chemical COPC in Surface Water – West Storm Ditch
Table 3-25	Chemical COPCs in Groundwater – TransCanada Property
Table 3-26	Chemical COPCs in Groundwater – YAEC Non-RUA
Table 3-27	Chemical COPCs in Groundwater – YAEC Inside RUA
Table 3-28	Summary of Chemical COPCs by Media
Table 3-29	Radionuclide COPCs in Soil – TransCanada Shoreline
Table 3-30	Radionuclide COPCs in Soil – TransCanada Property
Table 3-31	Radionuclide COPCs in Soil – YAEC Non-RUA
Table 3-32	Radionuclide COPCs in Soil – YAEC Inside RUA
Table 3-33	Radionuclides in Soils – Plant RUA vs. SCFA RUA
Table 3-34	Radionuclide COPCs in Sediment – Nearshore Sherman Reservoir
Table 3-35	Radionuclides in Sediment – Sherman Reservoir
Table 3-36	Radionuclide COPCs in Sediment – Deerfield River Adjacent to the Site
Table 3-37	Radionuclide Surface Water Results
Table 3-38	Radionuclide Groundwater Results – March 2007
Table 3-39	Tritium Concentrations in Groundwater (2003 – 2007)
Table 3-40	Summary of Radionuclide COPCs by Media
Table 4-1	Toxicity Factors for Chemicals of Potential Concern
Table 4-2	Toxicity Factors for Radionuclide Constituents of Potential Concern

Table 5-1	Human Health Receptors and Exposure Pathways
Table 5-2	Exposure Point Concentrations (EPCs) – Chemical COPCs
Table 5-3	Exposure Point Concentrations (EPCs) – Radionuclide COPCs
Table 5-4	Exposure Factors: Child Recreator
Table 5-5	Exposure Factors: Adolescent Recreator
Table 5-6	Exposure Factors: Adult Recreator
Table 5-7	Exposure Factors: Commercial Use Scenario
Table 5-8	Exposure Factors: Child Subchronic Exposures
Table 6-1	Potential Chemical Cancer Risk and Non-Cancer Hazard Indices – Recreational Scenarios
Table 6-2	Potential Chemical Cancer Risk and Non-Cancer Hazard Indices – Hypothetical Commercial Scenarios
Table 6-3	Chemical Non-Cancer Hazard Indices
Table 6-4	Child Blood Lead Concentrations
Table 6-5	Cumulative Potential Cancer Risks – Current Use Recreator
Table 6-6	Cumulative Potential Cancer Risks – Foreseeable Future Use Recreator
Table 6-7	Cumulative Potential Cancer Risks – Hypothetical Future Commercial Use TransCanada Property
Table 6-8	Cumulative Potential Cancer Risks – Hypothetical Future Commercial Use YAEC Property Outside RUA
Table 6-9	Cumulative Potential Cancer Risks – Hypothetical Future Commercial Use YAEC Inside RUA
Table 6-10	Comparison of Detected OHM and Tritium to Groundwater Standards
Table 6-11	Comparison of Surface Water EPCs to Ambient Water Quality Criteria
Table 7-1	Potential Cancer and Non-Cancer Risks – OHM Background Exposure Scenarios
Table 7-2	Potential Hot Spot Identification
Table 8-1	Soil EPCs vs. Method 3 Upper Concentration Limits
Table 8-2	Groundwater EPCs vs. Method 3 Upper Concentration Limits

List of Figures

- Figure 1-1 YNPS Site Location
- Figure 2-1 YNPS Study Areas and Restricted Areas
- Figure 2-2 YNPS Study and Exposure Areas
- Figure 2-3 YNPS FSS Study Areas
- Figure 2-4 Soil Locations Exceeding MCP S-1 Criteria and/or Background -- Inorganics
- Figure 2-5 Soil Locations Exceeding MCP S-1 Criteria and/or Background -- SVOCs
- Figure 2-6 Soil Locations Exceeding MCP S-1 Criteria and/or Background -- PCBs
- Figure 2-7 Soil Locations Exceeding MCP S-1 Criteria and/or Background -- EPHs and VPHs
- Figure 2-8 Soil Sample Locations For Co-60
- Figure 2-9 Soil Sample Locations For Cs-137
- Figure 2-10 Soil Sample Locations For Sr-90
- Figure 2-11 Background Soil Sample Locations -- OHM and Historical Site Assessment (HSA) Radiological Data
- Figure 2-12 Background Soil Sample Locations for Radionuclides and Down-River Deerfield River Sample Locations
- Figure 2-13 Active and Inactive Groundwater Monitoring Well Locations
- Figure 2-14 Sediment Locations Exceeding Sediment Criteria and/or Background -- Inorganics
- Figure 2-15 Sediment Locations Exceeding Sediment Criteria and/or Background -- SVOC
- Figure 2-16 Sediment Locations For PCBs
- Figure 2-17 Sediment Locations Exceeding Sediment Criteria and/or Background -- VPHs
- Figure 2-18 Surface Water Locations Exceeding Surface Water Criteria and/or Background -- Inorganics
- Figure 2-19 Background Sediment and Surface Water Sample Locations and Fish Sample Locations
- Figure 2-20 Sediment and Surface Water Sample Locations for Co-60
- Figure 2-21 Sediment and Surface Water Sample Locations for Cs-137
- Figure 2-22 Sediment Sample Locations for Sr - 90
- Figure 5-1 YNPS Conceptual Site Model
- Figure 7-1 Soil Sample Locations With COPC Concentrations Exceeding 10-Times the Study Area Mean

List of Appendices

Appendix A	Sampling Results – Chemical
Appendix B	Sampling Results – Radionuclide
Appendix C	Toxicity Profiles
Appendix D	Exposure Equations
Appendix E	Human Health Chemical Risk Tables
Appendix F	Human Health Radionuclide Risk Tables
Appendix G	IEUBK Lead Model Outputs
Appendix H	Human Health Sensitivity Analyses
Appendix I	Ecological Risk Assessment
Appendix J	Box and Whisker Plots

List of Acronyms

ADD	Average Daily Dose
ADE	Average Daily Exposure
ATC	Allowable Threshold Concentration
AWQC	Ambient Water Quality Criteria
BCG	Biota Concentration Guideline
BERA	Baseline Ecological Risk Assessment
BUD	Beneficial Use Determination
C&A Fill	Concrete & Asphalt Fill
CMR	Code of Massachusetts Regulations
COPC	Chemical (or Constituent) of Potential Concern
CSF	Cancer Slope Factor
DCGL	Dose Concentration Guideline Limit
DOE	Department of Energy
DQO	Data Quality Objective
EPC	Exposure Point Concentration
EPH	Extractable Petroleum Hydrocarbons
ESD	East Storm Drain
FERC	Federal Energy Regulatory Commission
FSS	Final Status Survey
HEAST	Health Effects Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
HSA	Historic Site Assessment
HTD	Hard to Detect (radionuclides)
IEUBK	Integrated Exposure Uptake Biokinetic (blood lead model)
IRIS	Integrated Risk Information System
ISFSI	Independent Spent Fuel Storage Installation
LADE	Lifetime Average Daily Dose
LOAEL	Lowest Observed Adverse Effects Level
LTP	License Termination Plan
MADEP	Massachusetts Department of Environmental Protection
MADPH	Massachusetts Department of Health
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MMCL	Massachusetts Maximum Contaminant Level
NOAEL	No Observed Adverse Effects Level
NRC	Nuclear Regulatory Commission
OHM	Oil and Hazardous Material
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAF	Relative Absorption Factor
REMP	Radiological Environmental Monitoring Program
RfC	Reference Concentration
RfD	Reference Dose

RUA	Restricted Use Areas
SCFA	Southeast Construction Fill Area
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
UCL	Upper Concentration Limit
UCLM	Upper Confidence Limit on the Arithmetic Mean
UR	Unit Risk
US EPA	US Environmental Protection Agency
VOCs	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WSD	West Storm Ditch
YAEC	Yankee Atomic Electric Company
YNPS	Yankee Nuclear Power Station
YQAP	Yankee Quality Assurance Program
TEC	Threshold Effects Concentration
PEC	Probable Effects Concentration

Executive Summary

On behalf of Yankee Atomic Electric Company (YAEC), Gradient has prepared this Method 3 Risk Characterization relating to the environmental conditions following the completed plant decommissioning, environmental remediation, and site restoration activities at the former Yankee Nuclear Power Station (YNPS). The YNPS site is located in the Town of Rowe, situated in northwestern Massachusetts along the Deerfield River adjacent to Sherman Dam (Figure 1-1). The YNPS lies within approximately 1,800 acres owned by YAEC; the former nuclear plant occupied approximately 12 acres.

The Method 3 Risk Characterization has followed the requirements set forth in 310 CMR 40.0990 of the Massachusetts Contingency Plan (MCP) as stated in the Risk Characterization guidance (MADEP, 1995a). Where necessary and appropriate, guidance developed by the US Environmental Protection Agency (US EPA) was also incorporated. The Method 3 Risk Characterization is a quantitative assessment of the potential risks to human health, the environment, public welfare and safety posed by residual chemical and radiological constituents remaining in site soil, groundwater, surface water, sediment and fish following plant decommissioning.

YAEC is seeking to amend its YNPS license with the Nuclear Regulatory Commission (NRC),¹ which requires a process of radiological sampling and cleanup to demonstrate that the site meets the NRC standards. The standards and requirements are set forth in YAEC's License Termination Plan (LTP) to meet the requirements of 10 CFR 20.1402. YAEC has completed a Final Status Survey (FSS), which consisted of extensive radiological sampling of environmental media and radiation scans, to demonstrate compliance with the NRC license termination process. In addition, YAEC has met the Massachusetts Department of Public Health (MADPH) radiological guidelines set forth in 105 CMR 120.291. Both the NRC and MADPH establish radiological dose standards for the protection of human health. The NRC requires meeting a 25 mrem/yr radiological dose standard, whereas the MADPH requires meeting a more stringent, 10 mrem/yr dose standard. The site remediation and restoration conducted by YAEC complied with the more stringent 10 mrem/year MADPH standard.

In addition to satisfying the NRC and MADPH requirements, YAEC has also conducted a comprehensive environmental site closure as a voluntary action in accordance with guidelines established by the Massachusetts Department of Environmental Protection (MADEP) and US EPA. Because the

NRC and MADPH standards or guidelines only address radiological constituents, this additional assessment of human health risks associated with non-radiological constituents -- for convenience and clarity, non-radiological constituents are referred to here as "Oil or Hazardous Materials" (OHM) -- was conducted following MADEP and US EPA guidelines. The MADEP and US EPA require the assessment of "cumulative" (additive) risks associated with both radionuclides and OHM. This Method 3 Risk Characterization evaluates cumulative chemical and radiological risks to human health, the environment, public welfare and safety.

The risk assessment was conducted following the procedures set forth in draft work plans submitted to the MADEP and US EPA in January 2005, which were then finalized in September 2006 after obtaining Agency comments. Subsequent to the final work plans submitted in September 2006 (Gradient, 2006a, b), YAEC met with the Agencies on several occasions to provide interim data summaries and risk calculations. The MADEP provisionally approved the risk characterization work plans in January 2007, with comments on several components of the approach. A summary of the adjustments to the risk assessments to address the Agency comments has been provided to MADEP.

Although the ultimate disposition (site ownership and future uses) of the entire 1,800-acre site has not been finalized, the area formerly occupied by the YNPS has been restored and planted with vegetation, and the remainder of the site is undeveloped native woodlands. Furthermore, during the remediation of the portion of the site that encompassed the former industrial area, MADEP approval was obtained under the Beneficial Use Determination (BUD) guidelines to re-use concrete material as fill in some areas of the site (MADEP, 2004a). Within the BUD Area, the area that received concrete and asphalt fill (C&A Fill) was covered with at least 3 feet of graded soil cover. Areas within the BUD, but outside the C&A Fill area, also received a graded soil cover in most areas, which varied in depth depending on local topography from one to three or more feet in thickness.

There are several enforceable use conditions/restrictions that are in the process of being placed on portions of the YAEC property. These conditions/restrictions include the following (see Figure 2-1):

- The notice on the deed applicable to the BUD areas precludes any future use other than a closed BUD area without prior written approval of the MADEP.

¹ The NRC license was changed from an "operating" to a "possession only" license in 1992 when YNPS operations ceased. The amended NRC license would terminate the license provisions on YAEC property outside of the area containing the Independent Spent Fuel Storage Area (ISFSI), such that the amended license would pertain to the ISFSI area only.

- The notice on the deed applicable to the C&A Fill BUD area also precludes any future use other than a closed BUD fill area without prior written approval of the MADEP. Additional restrictions in the C&A Fill area prohibit (i) disturbing the soil cover, (ii) excavation in the BUD area, and (iii) invasive procedures including installation of soil borings or wells, without prior MADEP approval.
- A notice of landfill operations for the Southeast Construction Fill Area (SCFA), a former construction debris disposal area, will be filed. The notice on the deed prohibits any future use of the surveyed SCFA area other than its present use, without prior MADEP approval.
- A Declaration of Land Use Restrictive Covenant under the Toxic Substances Control Act (TSCA) was filed to cover those areas of the site where polychlorinated biphenyls (PCBs) remain in soils above 1.0 mg/kg, the TSCA threshold for "unrestricted" use. This deed restriction precludes any residential development in those designated areas of the site (surveyed and recorded on the deed). The TSCA deed restricted areas overlap the BUD and SCFA areas (see Figure 2-1).
- YAEC intends to file a deed restriction on the YAEC property that precludes future residential development within the study area of the former plant (see Figure 2-1).

For brevity, unless otherwise noted, the areas where these enforceable land use restrictions apply are termed the "Restricted Use Areas" (RUA).

Until the government provides an approved off-site storage repository for the spent nuclear fuel, the spent fuel has been stored in concrete containers at the Independent Spent Fuel Storage Installation (ISFSI) constructed at the site. The NRC license will remain in effect for the ISFSI area. A 300-meter buffer, the "Owner Controlled Area," will remain under YAEC's control until an off-site facility is available and the material is shipped off-site.² The ISFSI is fenced and guarded 7 days a week, 24 hours a day, such that the unrestricted human access/exposure will not be allowed in the Owner Controlled Area, which extends to the shoreline of Sherman Reservoir. Note that the ISFSI is within the Restricted Use Area.

A deed restriction is currently in place on the TransCanada property (because of the existence of the Sherman Dam and hydroelectric station) that similarly restricts any residential development of that property (see Figure 2-1).

The risk assessment evaluated potential current and plausible future exposure scenarios that are consistent with the foregoing land use restrictions. For example, the above-mentioned land use

² It is not known how long into the future it might be until the spent fuel can be removed; for planning purposes, YAEC has assumed it will be 16 years (and could be substantially more).

restrictions preclude residential development of the site in areas in the vicinity of the former YNPS plant, as well on the TransCanada property. A risk calculation for a residential scenario in these areas was not conducted for this reason. The baseline conditions evaluated in this risk characterization included the following plausible current and future use scenarios:

- Current Use Recreator ("walk through")
- Future Use Recreator (*e.g.*, frequent use)
- Hypothetical Future Commercial/Industrial Use

In this risk characterization, the potential human health risks associated with site-related constituents was compared to risks associated with exposure to naturally occurring or ubiquitous constituents in the environment. This is particularly important for naturally occurring radionuclides, inorganic constituents (*e.g.*, metals), and other chemicals associated with ubiquitous natural and anthropogenic sources. Thus, the risk characterization included an evaluation of background levels of radionuclides and chemicals in the vicinity of the site, in order to compare site risks with background risks. An evaluation of potential localized "hot-spots" was also included in this risk characterization.

Summary of Cumulative Human Health Risks

The risk characterization evaluated chemicals and radionuclides measured in soil, sediment, surface water, groundwater and fish.³ MADEP default exposure factors were adopted in the risk characterization for OHM. In the absence of MADEP guidance, US EPA default exposure factors were adopted for the risk characterization for radionuclides. As shown in the summary below, the human health risks for the foreseeable future uses of the site are less than the MADEP acceptable risk benchmark of 1 in 100,000 (equivalently expressed as 1/100,000, 10^{-5} , or 0.00001) increased lifetime cancer risk for recreational and hypothetical future commercial scenarios. For areas with use restrictions, potential risks for hypothetical residential use have not been ruled out.⁴ In addition, as discussed later in this Executive Summary and Section 6.5 of the report, several constituents in groundwater exceed drinking water standards. Even though groundwater from the BUD Area is not currently used for drinking water, by regulatory definition under the MCP, a condition of "Significant Risk to Human Health" exists at the site

³ Chemicals and radionuclides detected in fish at the site were also detected in background samples at comparable concentrations such that the fish consumption pathway was not included in the quantitative risk characterization.

⁴ The use restrictions preclude residential uses.

because drinking water standards are exceeded in several monitoring locations in the BUD Area. YAEC will continue to monitor groundwater conditions in the future.

As described in the text, exposure and risk associated with radionuclides for future unrestricted recreational and hypothetical commercial exposures on the YAEC property includes a 16 year "delay" in the possible earliest date such activities would be possible. YAEC will maintain the "Owner Controlled Area" around the ISFSI until a DOE nuclear fuel disposal facility is available—this period could be substantially longer than 16 years. The initial exposure point concentration of radionuclides for commercial and future recreational exposures was therefore "decay adjusted" to reflect this 16-year delay (this 16-year initial decay adjusted period was not applied to the current use recreational scenario).

Summary of Human Health Cancer Risk Calculations				
Exposure Scenario	Radionuclides	Chemicals	Cumulative Risks ^[a]	
			Site	Background^[b]
Current Use Recreator	8×10^{-8}	6×10^{-7}	7×10^{-7}	3×10^{-7}
Future Use Recreator	6×10^{-7}	2×10^{-6}	2×10^{-6}	2×10^{-6}
Hypothetical Future Commercial				
TransCanada	2×10^{-7}	3×10^{-7}	5×10^{-7}	5×10^{-6}
YAEC Outside BUD/TSCA	6×10^{-8}	2×10^{-7}	2×10^{-7}	5×10^{-6}
YAEC Inside BUD/TSCA	2×10^{-6}	3×10^{-6}	5×10^{-6}	5×10^{-6}
MADEP Risk Benchmark			1×10^{-5}	

Notes:

[a] Differences in the cumulative risks and the summation of radionuclide plus chemical risk is caused by rounding (individual results are expressed to only one significant figure).

[b] Background risks were evaluated for the same chemicals of potential concern as were included in the site-related risk estimates.

Non-Cancer Chemical Hazard Assessment

For the assessment of potential non-cancer chemical health hazards, estimated chemical intake is compared to an "acceptable" Reference Dose. The ratio of the estimated chemical exposure to the Reference Dose is termed a "Hazard Quotient," which when summed over multiple chemicals yields a "Hazard Index." When the Hazard Index (HI) ratio is less than or equal to one (e.g., $HI \leq 1$), there is little likelihood of adverse health risks and risk management actions are not generally considered necessary by MADEP or USEPA. For values of the HI greater than one (e.g., $HI > 1$), the possibility of potential adverse health impacts cannot necessarily be ruled out and risk management considerations may be

required. Because the Hazard Index for the child exposure scenario is inherently greater than for adults/adolescents (and the HI values are not additive for different age groups), only the HI values for the child receptor are summarized below for recreational pathways. As the summary indicates, the value of HI is less than one for the current and foreseeable future recreational use scenarios, and the HI is less than one for hypothetical future commercial use scenarios (adults). Subchronic HI values are also less than one.

Summary of Human Health Non-Cancer Chemical Hazard		
Exposure Scenario	Hazard Index	
	Site	Background
Current Use Recreator – Child	0.06	0.02
Future Use Recreator – Child	0.2	0.05
Future Use Recreator – Child (Subchronic)		
TransCanada	0.1	nc
YAEC Outside TSCA/BUD Area	0.2	nc
YAEC Inside TSCA/BUD Area	0.4	nc
Hypothetical Future Commercial Use (Adults)		
TransCanada	0.01	0.0008
YAEC Outside TSCA/BUD Area	0.05	0.0008
YAEC Inside TSCA/BUD Area	0.2	0.001
MADEP Benchmark	1	

nc: not calculated.

Summary of Environmental Risk Characterization

This Method 3 Risk Characterization also included an assessment of environmental (*e.g.*, ecological) risk, again following MADEP guidelines where available. The environmental risk characterization evaluated representative habitats and species either found at the site, or typical of northeastern deciduous hardwood habitats, including possible sensitive species. This evaluation included an assessment of both aquatic and upland habitats. The MADEP environmental risk characterization guidelines include a two-stage process that allows for a Stage I screening of detected chemical concentrations against MADEP screening benchmarks, followed by a detailed food web analysis in Stage II as necessary. The environmental risk assessment screened against background concentrations and detection frequency for chemical constituents in Stage I, and included the full Stage II assessment (*i.e.*, no screening out of chemicals on the basis of screening benchmarks).

Because no MADEP guidelines exist for the assessment of ecological risks for radionuclides, guidance developed by the U.S. Department of Energy (DOE) was used for the environmental assessment of potential risks to environmental receptors associated with radionuclides. During meetings and discussions with the MADEP, US EPA Region I, and representatives from US EPA Headquarters, the Agencies concurred that the DOE methods were the acceptable established approach for the assessment. In a manner similar to the MADEP guidelines for chemical risk assessment, the DOE approach includes a stepwise assessment, with the first step being a screening of radionuclides in soil or sediment to "Biota Concentration Guidelines" (BCGs) to determine whether an in-depth food web analysis will be required. In the case of radionuclides, the screening assessment indicated that all radionuclides were well below conservative BCGs, such that no food web analysis was needed or conducted.

The results of the ecological risk characterization for OHM are presented in terms of a Hazard Index (HI) for receptor species, which represents the calculated chemical intake or exposure relative to an acceptable intake, denoted as a Toxicity Reference Value (TRV). TRV values were selected from published literature based "No Observable Adverse Effects Levels" (NOAELs) and the "Lowest Observable Adverse Effects Levels" (LOAELs). The calculated Hazard Indices are summarized below.

Summary of Environmental Hazard Indices				
Receptor	Site		Background*	
	NOAEL	LOAEL	NOAEL	LOAEL
Birds				
robin	7	<1	4	<1
king fisher	<1	<1	<1	<1
Bald eagle	<1	<1	<1	<1
Mammals				
shrew	3	<1	2	<1
cottontail	1	<1	<1	<1
raccoon	<1	<1	<1	<1
fox	<1	<1	<1	<1

*Background HI values were calculated for the same COPCs using the same exposure factors used to calculate site-related values.

None of the LOAEL-based Hazard Indices exceed 1.0, the Agency benchmark commonly used to evaluate the potential for adverse ecological impact. The NOAEL-based Hazard Indices are above one

for the robin and shrew.. Similarly, the NOAEL-based background HI for the robin and shrew exceed one based on exposure to background concentrations of constituents of potential concern (COPCs).

A comparison of chemicals in sediment, soil, and surface water to published benchmarks was also conducted. This comparison was done by calculating a "Benchmark Quotient," which is simply the ratio of the chemical concentration relative to its benchmark value. Although several constituents exceed benchmarks (several metals, PCBs, and PAHs), these results do not imply significant risk to the environment for several reasons:

- COPCs (*e.g.*, selenium, zinc) that exceeded soil benchmarks for plants or soil macroinvertebrates on site, also exceeded these same benchmarks in local background sampling locations.
- Organic COPCs (PCBs and PAHs) which exceeded their "Threshold Effects Concentration" sediment benchmarks in several locations were below their "Probable Effects Concentration" benchmarks with only a few isolated exceptions.
- Fish sampled in Sherman Reservoir and the Deerfield River did not contain metals, radionuclides, or PCBs above respective concentrations in background samples, indicating aquatic food web impacts are unlikely.

The results of the environmental risk characterization yield the following evidence which support a finding of no significant risk to the environment:

- (1) Soil and sediment samples occasionally exceeded benchmarks, but the site-related benchmark quotients did not differ appreciably from background benchmark quotients. Moreover, the sample locations exceeding soil or sediment benchmarks did not demonstrate any spatial pattern that might have indicated localized potential hazards.
- (2) The LOAEL Hazard Indices for the food web ecological assessment were all less than or equal to one (*e.g.*, LOAEL HI ≤ 1).
- (3) Although the NOAEL HI was above one for several receptors, in all cases it was less than 10, and also did not differ appreciably from the NOAEL HI for background constituents.
- (4) Fish tissue samples did not reveal site-related COPCs above background, which provides a further indication that food web uptake of site-related constituents is not significant.
- (5) Site-related constituents did not exceed surface water quality standards in the Sherman Reservoir or Deerfield River samples.

On the basis of these multiple lines of evidence, the environmental risk characterization supports a finding of "No Significant Risk of Harm to the Environment" according to section 40.0995 of the MCP.

Comparison to Applicable or Suitably Analogous Standards

This Method 3 Risk Characterization also compared the environmental data to drinking water and surface water quality standards, which are considered by the MADEP as Applicable or Suitably Analogous Standards.

Several constituents currently exceed drinking water standards for several monitoring wells within the BUD footprint. There are no current drinking water wells in this area, nor could they be installed in the future under the constraints imposed by the land use restrictions. Nonetheless, the fact that there are no public sources of drinking water in the vicinity of the site requires that site groundwater be considered a Potential Drinking Water Source Area, classifying site groundwater as GW-1.

In 2006, arsenic (MW-107A, MW-101A), acetone (MW-101C), and tritium (MW-107C) exceeded their respective drinking water standards -- Massachusetts Maximum Contaminant Levels (MMCLs) and Federal Maximum Contaminant Levels (MCLs). In the most recent March, 2007 groundwater monitoring round, arsenic marginally exceeded its MCL in MW-111C, and tritium exceeded its MCL in MW-107C. Acetone in MW-111C was below its MCL in the "parent" sample, but exceeded its MCL in the duplicate analysis. All of these wells are all within the footprint of the BUD.

Constituent	Well	2006 (Maximum)	2007 (March)	MCL
Arsenic	MW-107A	0.0144	0.0094	0.010 mg/L
	MW-101A	0.016	0.0092	
	MW-111C	0.004	0.0101	
Acetone	MW-101C	4,890	2,890 (3,450 dup)	3,000 µg/L
Tritium	MW-107C	41,300	30,900	20,000 pCi/L

Arsenic is naturally occurring, and there is no identifiable pattern in space or time, suggesting that arsenic in groundwater is not evidence of a site-related "release." In addition, the detected concentrations of arsenic are only marginally above drinking water standards, and are within the range of background levels found within Massachusetts public drinking water supplies. Although arsenic has exceeded its drinking water standard in several wells, it is neither widespread nor consistent over time across the site. Furthermore, the wells that have exceeded the arsenic drinking water standard are within the BUD area where no current drinking water wells exist, and none can be installed in the future under the BUD

restrictions. For these reasons, arsenic was not included in the baseline risk calculations for current or hypothetical future uses of the site (arsenic was considered in a sensitivity analysis presented in an appendix).

Although the Tritium concentration in MW-107C in March 2007 was above the concentration measured in December, 2006, the overall Tritium trend in MW-107C is a declining one over time. This trend is expected to continue now that remediation of the site is complete. Similarly, acetone in MW-111C, which measured 14,000 µg/L in 2004, also exhibits a declining trend that is expected to continue.

YAEC will continue to monitor groundwater according to the monitoring plan provided to the MADEP in order to evaluate whether these constituents decline to levels below their respective drinking water standards.

Chemicals detected in surface water from the Sherman Reservoir and Deerfield River did not exceed surface water quality standards. Several inorganic constituents sporadically exceeded surface water quality standards in Wheeler Brook samples, as was true for several inorganic constituents in background surface water samples.

Risk to Public Welfare and Safety

The YNPS has been completely dismantled and the site has been restored. There are no remaining conditions such as rusted or corroded drums, unsecured pits, lagoons, ponds, *etc.* Areas of the site where residual constituents exist are subject to land use restrictions to control future uses of those areas. The only remaining component of the site relating to past operations is the ISFSI, which contains the stored spent nuclear materials. The ISFSI is guarded 7 days a week, 24 hours per day. Furthermore, radiation from the ISFSI drops to background levels within 100 to 200 meters of the ISFSI. Safety issues relating to the operation of Sherman Dam (activities within the vicinity of the dam and intake structure, maintenance of flood control requirements, *etc.*) are regulated under the FERC license that addresses public safety. Upon this basis, it can be concluded that the site poses "No Significant Risk to Safety."

The MCP also specifies that the risk to public welfare should be evaluated by considering whether nuisance conditions that might affect public welfare exist at the site. The risk characterization evaluated the possible human health risks relating to residual chemicals and radionuclides in

environmental media, with the findings summarized above. In addition, the MCP requires a determination of whether constituent concentrations exceed Upper Concentration Limits (UCLs) prescribed in 310 CMR 40.0996. As discussed in this report, site-wide soil and groundwater exposure point concentrations for OHM constituents are below their respective Method 3 UCLs. Although there are no UCLs for radionuclides, as noted above, the only site-related radionuclide above drinking water standards is tritium in groundwater within the C&A Fill area of the site where there are no current drinking water wells, and restrictions noted above preclude installation of future wells. These site conditions support a finding of "No Significant Risk to Public Welfare" under the MCP.

Conclusions

According to the 310 CMR 40.0993 of the MCP, the results of a Method 3 Risk Characterization support a finding of "No Significant Risk to Human Health" if:

- No exposure point concentration of OHM is greater than an applicable or suitably analogous public health standard;
- No cumulative cancer risk exceeds the MADEP acceptable limit (10^{-5}); and
- No cumulative non-cancer risk (*e.g.*, Hazard Index) exceeds the MADEP acceptable limit (*e.g.*, $HI \leq 1$).

As described in this report, the cumulative potential cancer risk estimates and the cumulative non-cancer Hazard Indices both meet the above Agency guidelines. Because arsenic, acetone, and tritium exceed drinking water standards in several monitoring wells on the YAEC property, by regulatory definition this results in a condition of "Significant Risk to Human Health" according to the MCP. As discussed in this report, arsenic occurs naturally in groundwater. The arsenic concentrations detected sporadically at the site do not exhibit a spatial pattern indicative of a site-related release condition, and the concentrations detected are within background concentrations measured in public drinking supplies within Massachusetts. While groundwater at the site is classified as a Potential Drinking Water Source Area, groundwater impacts exceeding public health standards are limited to areas of the site where groundwater is not currently being used as a source of drinking water, and land use restrictions under the BUD preclude installation of drinking water wells within these areas. Therefore, there is currently no potential for adverse exposure or risk posed by current conditions. Nevertheless, as a Potential Drinking Water Source Area, the potential exists for groundwater to be used as a source of drinking water in the future (from wells installed outside the C&A Fill BUD area), and such use could pose a potential condition of

significant risk of future exposure. As such, the condition of significant risk posed by site groundwater is a potential risk in the future, but not under current conditions. By definition under the MCP, the lack of significant risk posed by current conditions, but potential future risk posed by current groundwater conditions, indicates that site groundwater does not pose a Substantial Hazard. Continued natural attenuation,⁵ risk management controls, including groundwater monitoring to evaluate whether groundwater impacts fall below MMCLs/MCLs, and a prohibition on the installation of drinking water wells on the YAEC property within the C&A Fill BUD area, address these conditions.

The results of the risk characterization indicate cumulative cancer risks for the current and foreseeable uses of the site (open land/recreation), are below the MADEP 10^{-5} risk threshold, and cumulative HI values less than 1. The same conclusion holds for hypothetical future commercial uses of the YAEC and TransCanada properties. These results support the finding of "No Substantial Hazard" to human health as defined in 310 CMR 40.0956 of the MCP. No additional "Activity Use Limitations" under the MCP are needed for the YAEC property other than the land use restrictions defined earlier.

Neither OHM nor radionuclides exceed public health standards on the TransCanada property. Similarly, cumulative human health risks for recreation and hypothetical commercial uses are below 10^{-5} and the Hazard Index is less than one ($HI < 1$) on the TransCanada property. These results support a finding of No Significant Risk to Human Health on the TransCanada property according to the MCP.

The results of the Method 3 Environmental Risk Characterization found no evidence of biologically significant harm, no indication of the potential for biologically significant harm above background, and no concentrations of OHM above applicable or suitably analogous standards. These results support the finding of No Significant Risk of Harm to the Environment according to 310 CMR 40.0995 of the MCP.

⁵ The radioactive half-life of tritium is 12 years, which means that the concentration of tritium reduces by 50% every 12 years by natural radioactive decay.

1 Introduction

This report presents the Method 3 Risk Characterization to support the site closure post decommissioning, cleanup, and restoration at the Yankee Nuclear Power Station (YNPS). The YNPS is located in the town of Rowe, situated in northwestern Massachusetts along the Deerfield River adjacent to Sherman Dam (Figure 1-1). Yankee Atomic Electric Company (YAEC) owns the former YNPS that occupied approximately 12 acres of land surrounded by approximately 1,800 acres.

The YNPS began operations in 1961 and ceased operation in 1992, at which time its operating license with the Nuclear Regulatory Commission (NRC) was changed from its prior "operating" license to a "possession only" license. The plant has been dismantled and YAEC is amending its possession-only license with the NRC such that it will cover YAEC property for the area occupied by the Independent Spent Fuel Storage Installation (ISFSI). In order to amend its NRC license, YAEC has completed a process of radiological sampling and cleanup, as required by the NRC in 10 CFR 20.1402 and set forth in the YAEC (2003a) License Termination Plan (LTP). In addition, YAEC is complying with the Massachusetts Department of Public Health (MADPH) requirements for meeting radiological guidelines set forth in 105 CMR 120.291. Both the NRC and MADPH require compliance with radiological "dose-based" requirements for the protection of human health upon plant closure, license termination and/or property disposition.

In parallel with cleaning up the site to amend the NRC license and meet the MADPH radiological dose requirements, YAEC has conducted a comprehensive environmental closure to ensure that the property would pose no adverse human or environmental risks once YAEC transfers title of the property.⁶ The environmental site closure is being performed as a voluntary action in accordance with guidelines established by the Massachusetts Department of Environmental Protection (MADEP) and U.S. Environmental Protection Agency (US EPA), as well as requirements established by the NRC and MADPH.

Because the NRC and MADPH standards or guidelines only address radiological constituents, this additional assessment of human health risks associated with non-radiological constituents -- for convenience and clarity non-radiological constituents are referred to here as Oil and Hazardous Materials (OHM) -- was conducted following MADEP and US EPA guidelines. In addition, both MADEP and US

EPA require the assessment of "cumulative," or additive risks associated with both radionuclides and chemicals. This Method 3 Risk Characterization evaluates potential cumulative chemical and radiological risks to human health, the environment, public welfare and safety, to satisfy the requirements of the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. This risk assessment also followed US EPA risk assessment guidance and Department of Energy (DOE) guidelines for the assessment of risks associated with radionuclides in the absence of MADEP guidelines for these constituents.

1.1 Risk Characterization Goals

The NRC/MADPH "dose-based" methods and the MADEP/US EPA "risk-based" methods for radionuclides contain similarities and several differences. They are similar in that both share the common purpose of ensuring protection of human health and the environment. Perhaps the clearest difference between the approaches is that the NRC approach sets an upper limit on the human exposure in any one year (in mrem/yr), where the dose is forecast over a time-span of 1,000 years. The highest dose in any one year within that 1,000-year time span must comply with the NRC (or MADPH) dose limits. In contrast, the risk-based approach evaluates the exposure and risk over the course of an "exposure period," such as a lifetime. In addition, the evaluations differ somewhat in their respective definition of the area over which an individual may be exposed (the "exposure unit" for the evaluation). Yet, as noted above, despite these differences, both approaches are designed to ensure protection of human health.

The overall goal of the cumulative risk characterization approach described herein, is to determine whether post-closure environmental site conditions (*e.g.*, existing structures removed, remediation of radionuclides and chemicals as necessary, and site restoration including a final soil grading plan over portions of the former industrial area) pose a significant risk to human health, the environment, public welfare and safety.

The risk characterization evaluated potential incremental human health risks posed by site-related constituents and compared these risks to those associated with exposure to naturally occurring or ubiquitous constituents in the environment (*i.e.*, "background" concentrations that exist in the absence of the site). This is particularly important for naturally occurring radionuclides, inorganic constituents (*e.g.*, metals), and other ubiquitous chemicals or radionuclides (*e.g.*, Cs-137 and Sr-90) associated with

⁶ Future uses are not currently defined, although those areas beyond the former YNPS are currently undeveloped. Section 2.2 discusses likely future uses of the site, including enforceable restrictions on future uses in portions of the YAEC property.

anthropogenic sources. Thus, as described below, the risk characterization included an evaluation of background levels of radionuclides and chemicals in the environment within the vicinity of the site in order to compare site risks with background risks.

1.2 Method 3 Risk Characterization Framework

This Method 3 Risk Characterization was conducted in accordance with 310 CMR 40.0990 of the MCP following the MADEP Risk Characterization guidance (MADEP, 1995a). Under the MCP, a Method 3 Risk Characterization involves four components: risk to human health, the environment, public welfare, and safety. MADEP risk characterization guidelines share the same underlying procedures established by US EPA for evaluating human health and ecological risks to environmental contaminants. Although the MCP indicates that the cumulative risk of cancer-causing constituents must be addressed, MADEP does not have any published radiological risk assessment guidance.⁷ Thus, the assessment of radiological risks primarily relied on US EPA guidance, with the most recent guidance set forth in the US EPA (2000) Soil Screening Guidance for Radionuclides: Technical Background Document, providing the primary source. In addition, the RESRAD⁸ multipathway risk assessment modeling system developed by the U.S. DOE (ANL, 2001) for radionuclides also served as a source of information as needed.

In addition to this cumulative human health risk assessment for the overall site closure, a focused risk assessment in support of the Toxic Substances Control Act (TSCA) Risk-Based Disposal Approval Application (RBDAA) was prepared pursuant to a request by US EPA Region I in support of US EPA approval for cleanup of polychlorinated biphenyls (PCBs) in site sediment (ERM, 2004a). That assessment, along with subsequent revisions based on comments received from the US EPA, was completed and approved by the US EPA on September 28, 2004. The cumulative risk assessment presented here for the site includes an evaluation of residual PCBs at the site, and other possible Constituents of Potential Concern (COPCs) where residual concentrations remain above background levels since completion of site remedial actions.

The MCP Method 3 Risk Characterization approach involves the following evaluation steps or procedures:

⁷ MADEP guidance simply states that cumulative risks of cancer-causing constituents must be addressed, without any specific mention of a need to address radiological constituents.

⁸ "RESRAD" is the name of the modeling program used to evaluate radionuclide exposure and dose, it is not an acronym.

- *Hazard Identification* determines reasonably foreseeable uses of the site, categorizes soil and groundwater, establishes background conditions, identifies constituents of concern, and identifies applicable or suitably analogous standards.
- *Dose-Response Assessment* describes the relationship between the level of exposure and the likelihood of an adverse effect.
- *Exposure Assessment* identifies potential routes of exposure, potential hypothetical receptors that could be exposed to residual chemicals or radionuclides remaining at the site, and the frequency, duration, and extent of potential hypothetical exposures.
- *Risk Characterization* combines the information from the previous three steps to quantify estimates of risk for carcinogenic and noncarcinogenic health effects, and compare these risk estimates to applicable risk management thresholds.
- *Uncertainty Analysis* identifies the nature and the general magnitude of the uncertainty and variability inherent in the characterization of risks.

Established risk characterization procedures set forth in MADEP and US EPA guidance documents were followed, including the following:

- "Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan" (MADEP, 1995a).
- Pertinent MADEP Technical Updates and numerical standards pertaining to risk characterization (MADEP, 2002a; 2002b; 2002c; 2006a; 2006b).
- "Risk Assessment Guidance for Superfund; Volume 1: Human Health Evaluation Manual. Part A." (US EPA, 1989).
- US EPA's Soil Screening Guidance for Radionuclides: Technical Background Document (US EPA, 2000).

2 Site Description and Environmental Conditions

This section presents a brief overview of the facility setting, history, and the environmental investigations pertinent to the risk characterization. A brief discussion of the nuclear fission process is provided to provide perspective on the nature of radionuclides produced by fission, which when released to the environment, are those that are of potential concern in this risk characterization.

2.1 Site Background and Characteristics

YNPS was built between 1958 and 1960 as a prototype plant intended to operate for six years. It was originally designed as a 145-megawatt electric generating plant, and later increased to 185 megawatts. The plant ultimately operated for over 30 years, from 1961 until 1992 when the YAEC Board of Directors decided to cease power operations permanently at YNPS and decommission the facility.

The site is located along the eastern shore of the Deerfield River adjacent to Sherman Dam, one of the several dams along the Deerfield River used for hydroelectric power generation (see Figure 1-1 and Figure 2-1). YAEC currently owns the land upon which the former YNPS operated, and the surrounding lands. The YAEC property is divided into two parcels, separated by the Deerfield River:

- Rowe Parcel – Approximately 1,800 acres located in the northwest corner of Rowe, Massachusetts, to the east of the Deerfield River. The former nuclear plant itself occupied approximately 12 of the 1,800 acres of the Rowe Parcel.
- Monroe Parcel – Approximately 89 acres located in Monroe, Massachusetts, to the west of the Deerfield River.

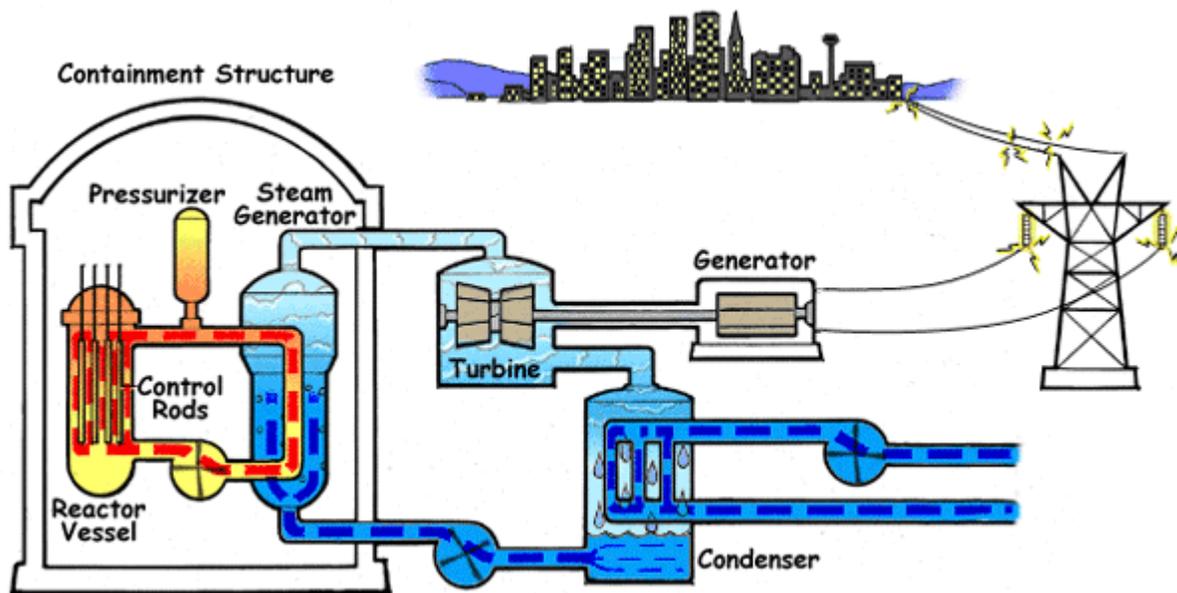
The majority of the property surrounding the former nuclear plant represents an area where there is no reasonable possibility (extremely low probability) of residual impacts from operations at the YNPS. An ASTM Phase I survey in 2005 (ERM, 2006a), and a supplemental Phase I conducted in May 2006 (Stratex, 2006), confirmed the lack of Recognized Environmental Conditions (RECs) as defined by ASTM Standard 1527-05 in the outlying areas. A REC is defined as *“The presence or likely presence of any hazardous substance or petroleum products under conditions that indicate an existing release, a past release or a material threat of a release of any hazardous substance or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term included hazardous substance or petroleum products even under conditions in compliance with laws.*

The term is not intended to include de minimis conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimis are not RECs.” These areas have, therefore, been excluded from the risk analysis, although a portion of the outlying area was used as a background sample location and included in that respect.

2.1.1 Radionuclides Produced By Fission

To provide perspective on the radiological constituents evaluated in the risk assessment, a brief overview of the production of fission and activation products from the former nuclear reactor is provided here. The operation of a nuclear reactor results in the creation of two types of radionuclides; fission and activation products. Fission products are the direct result of U-235 absorbing a thermal neutron and splitting (fissioning) into two smaller nuclear fragments, each of which has an excess of neutrons. The resultant fragments initially have a significant amount of kinetic energy, but due to their mass do not travel outside the confines of the fuel pellet. When the fragments stop, they lose their kinetic energy by transferring it to the medium they are in (*i.e.*, heating the reactor coolant). The fragments are still radioactive and can decay by either negatron or neutron emission in order to reach a stable nuclear configuration. The additional neutrons (referred to as delayed neutron emission) become available to induce more fission reaction events at some distance from the initial reaction site.

Most of the fission events occur within the nuclear fuel pins that comprise a nuclear fuel element, which in turn are a component of a nuclear reactor core. Each pin is designed to keep the fission products within their metal clad container once they are created. Occasionally during reactor operations, some of these fuel pins (much less than one percent) develop a defect. When this failure occurs, some of the fission fragments enter the circulating water of the reactor coolant system.



The fission fragments created during the fission process can be atoms with an atomic mass number that ranges from approximately 70 to 160 with predominant nuclides at approximately 95 and 139. Most of the radioactive fission products have short half-lives and decay by the emission of a beta particle. Most of the beta decays are accompanied by the near spontaneous emission of a gamma ray. A small fraction of fission radionuclides have half-lives greater than one year. A listing of some common fission products is provided in Table 2-1, sorted by half-life.

Activation Radionuclides -- Non-Transuranics

As discussed above, each fission event causes the emission of “free neutrons”, on average 2.5 neutrons are emitted per event. Some of these neutrons go on to cause other fission events, while others interact with other materials in or around the reactor core. The interaction of neutrons with other non-radioactive material often results in the “activation” of a stable atom. The neutron interaction can occur by direct bombardment of metal components near the core, or it can occur with corrosion products carried in the reactor coolant as they travel through the core. For instance, if a neutron is absorbed by Co-59, the creation of Co-60 results, which is a radioactive form of cobalt that decays by beta emission with a half-life of 5.26 years. In this example, Co-59 is a normal constituent of the steel alloys contained within the materials that make up and surround the reactor core.

Activation products can be created from stable atoms that are contained within the circulating reactor coolant because this coolant passes through the reactor core where a high population of neutrons is present during reactor operations. Some of these stable atoms result from corrosion and wear products from the operation of valves and pumps that are part of the reactor coolant system. A listing of some common *non-transuranic* activation radionuclides is provided in Table 2-1.

Two of the radionuclides listed in Table 2-1 are activation products that come from sources other than metallic components. Tritium (H-3) results from the neutron interaction with boric acid (added as a neutron moderator) and lithium (an added pH control agent). Carbon-14 is formed as a result of activation of N-14 (from trace concentrations of dissolved nitrogen), and O-17 (from oxygen in water molecules).

Activation Products -- Transuranics

An additional type of activation process results in the activation of U-238 and its resultant activation products. Of the total uranium contained in a typical reactor core, approximately three percent is U-235 (the fissionable form) and 97 percent is U-238. Some of the fission neutrons interact with the predominant U-238, resulting in U-239 and then Np-239 by beta decay, followed by Pu-239 by beta decay. These activation products may again absorb a neutron creating other radioactive elements with atomic numbers greater than uranium (uranium's atomic number is 92), commonly referred to as transuranic radionuclides. Most of the transuranic radionuclides have short half-lives and decay by alpha particle emission. These activation products are usually insoluble materials and generally remain within the reactor core except when the fuel undergoes failures, thereby allowing fission products to enter into the reactor coolant system. If no fission products are detected in areas outside of the reactor core, then it is reasonable to conclude that there will be no transuranic radionuclides. Table 2-1 lists the long-lived transuranic radionuclides that are important during reactor operations.

2.1.2 Naturally Occurring Radionuclides

Naturally occurring radionuclides are present in soil, groundwater, and surface water, sediment and food stocks. These radionuclides are categorized as terrestrial or cosmic, depending on their origin. The terrestrial radionuclides are found in the earth's crust, in both bedrock and soils. These terrestrial radionuclides include U-234, U-235, U-238, and Th-232. Each of these radionuclides is the first isotope

in a chain of successive radionuclides that form by decay, ending in a stable isotope of lead. These decay chains include radioisotopes of U, Th, Pa, Ac, Ra, Rn, Po, Pb, and Bi. The decay modes of each radioisotope in the series include the emissions of alpha particles, beta particles, and gamma rays depending on the specific isotope. Also, the relative abundance of each of these radioisotopes may differ due to the various chemical properties of each element and the specific geochemistry of the area. Because of the ubiquitous presence of these radionuclides, they are found in plants and animals as well as soils, surface water and groundwater.

The cosmic radionuclides are produced from nuclear interactions within the atmosphere principally from solar charged-particle radiation. The radionuclides produced from these cosmic sources include K-40, C-14, H-3, and Rb-87. Like the terrestrial radionuclides, these cosmic radionuclides are generally taken up within specific systems in the biosphere and can be found in soils, vegetation, animals, surface and groundwater, and bedrock.

Historical above ground nuclear weapons testing (during the 1970s and earlier) has contributed to radioactive material found in the environment, and material from this source is considered part of the measurable "background" as it is not related to YNPS operations. The principal radionuclides of concern from weapons testing are Cs-137 and Sr-90. Differentiating the contribution of Cs-137 and Sr-90 from fallout versus YNPS plant operations is done by comparing the site with samples from background areas, as well as examining the suite of radionuclides detected relative to those relating to plant operations.

2.1.3 Radiological Monitoring During Operations

In 1958, approximately two years before YNPS began operation, the Radiological Environmental Monitoring Program (REMP) was initiated. It continued throughout the entire 31-year period of operation and decommissioning, and continues today with a reduced scope (YAEC, 2006a). The program was designed to provide an early indication of the appearance or accumulation of radioactive material in the environment caused by plant operations and to verify the adequacy and functioning of effluent controls and monitoring systems. Data collected for the REMP was intended to compare radioactivity in areas possibly influenced by plant operations to areas that were not influenced by plant operations, based on factors such as direction and distance from the plant.

Since the primary goal of the REMP was to provide data on measurable levels of radiation and radioactivity in the environment that resulted from plant activities, measurements were focused on radionuclides that were previously observed or potentially present in treated liquid and gaseous effluent waste streams. Routine examination of environmental samples during the REMP included gamma isotopic analysis for 23 nuclides (activation and fission products), gross beta analysis, and tritium analyses.

As part of the Phase II-Comprehensive Site Assessment (ERM, 2005), REMP sampling results were reviewed for 1983 to 2003, a period that encompassed the last ten years of plant operation and the first ten years after operation ended. Review of these data yielded the following observations (ERM, 2005):

- Air samples were collected continuously and analyzed weekly at five areas possibly influenced by plant operations and two areas that were not influenced by plant operations. Radioactivity above instrument background,⁹ measured at all seven areas, was attributable only to nuclides that are naturally occurring or ubiquitous from historical weapons testing (Cs-137, Cs-134, Ru-103, Ru-106, Be-7), with a spike in 1986 due to the Chernobyl incident.
- Soil sample analyses were performed every three years at the seven air sampling locations, using a portable gamma spectrometry analysis system with confirmatory analysis of core samples. The review of soil data indicated only the presence of naturally occurring K-40 and two products of weapons testing fallout (Th-232 and Cs-137).
- Surface water samples were collected monthly from the discharge point in Sherman Reservoir, at Bear Swamp (6.3 km downstream), and in Harriman Reservoir (upstream). No gamma emitters were detected, and gross beta concentrations in samples from Bear Swamp were comparable to those in Harriman Reservoir. During YNPS operations, tritium concentrations in Bear Swamp were higher than in Harriman reservoir -- but always below the EPA's drinking water Maximum Contaminant Level (MCL). Tritium concentrations in Sherman Reservoir surface water fell to concentrations indistinguishable from Harriman Reservoir after the end of plant operations.
- Groundwater samples were collected monthly from the on-site potable water well and from Sherman Spring. No gamma emitting radionuclides were detected at either location. Tritium was detected at Sherman Spring throughout the 20-year period, with steadily decreasing concentrations that became indistinguishable from background concentrations in surface water in Harriman Reservoir.
- Sediment core samples were collected semi-annually from Sherman Reservoir and the Deerfield River (36.1 km downstream) and one area in Harriman Reservoir. Natural K-40 was detected in all samples. Co-60 and Cs-137 were the only plant-related radionuclides consistently detected at low levels in Sherman Reservoir sediment samples

⁹ Instrument background represents the radiation counts from the analytical instruments when readings are taken with no sample in the instrument.

collected near the outfall (the result of licensed liquid releases). Samples from areas of the Sherman Reservoir upstream of the cooling water discharge outfall, and samples from the Deerfield River sample location downstream of the plant contained no detectable amounts of plant-related radioactivity.

- Fish samples were collected in the vicinity of the discharge point in Sherman Reservoir and in Harriman Reservoir. Only naturally occurring K-40 and fallout related Cs-137 were detected, and no differences were observed between the locations.

The REMP data provide useful historical monitoring to detect the possible presence of radionuclide releases from the plant, but were not used in calculation of quantitative risk estimates. Instead, recently completed FSS radionuclide data together with the Phase II radionuclide data are those used here to evaluate risks from radionuclides, because these results are more recent, more comprehensive, and more representative of current site conditions following plant decommissioning and site restoration.

2.2 Study Areas and Foreseeable Future Use of the Site

Plant decommissioning and demolition, as well as site restoration have been completed. All radiological systems, structures and components, with the exception of the ISFSI have been removed from the site. The spent nuclear fuel is being stored in the ISFSI, an on-site dry cask storage facility, until the US Department of Energy (US DOE) satisfies its obligations to remove the spent fuel to a federal facility. The ISFSI is fenced and protected by surveillance 24 hours a day. Although the plant decommissioning and environmental restoration was completed in 2006, the YNPS license with the NRC will be amended to apply to the ISFSI area, but will not be officially "terminated" until such time that the DOE removes the spent fuel to permanent storage at a federally licensed storage facility (no such facility currently exists). Thus, YAEC will retain control of the portion of the site consisting of the ISFSI and surrounding areas until the spent fuel is removed. The Owner Controlled Area (as depicted on Figure 2-1), which encompasses a 300-meter border surrounding the ISFSI, will be subject to surveillance 7 days a week, 24 hours a day by security guards. Unrestricted access by the public is not allowed in the Owner Controlled Area.

2.2.1 Study Areas

Based on the large size of the site, differences in historic use in particular portions of the site, and restrictions on certain future uses in designated areas, the site was divided into the following areas, which

together comprise the Combined Study Area (Figure 2-1). These study areas have been extensively investigated for OHM and radionuclides.

- **Beneficial Use Determination (BUD) Area.** The BUD area is the portion of the site located within the former industrial area of the plant where foundations and rubblized concrete from structures were used as fill in restoring site grades under a BUD approved by MADEP (see Figure 2-1). The BUD allowed for the on site reuse of building debris that met MADEP requirements (the material was free of any plant-related radiological constituents) to be used as fill in restoring the site. This process is a form of recycling that does not adversely impact environmental quality, reduces the amount of waste generated that would otherwise take up space in a landfill and reduces the need for trucking added fill on to the site for use in grading during restoration. As a component of the final site restoration/grading plan, a 3-foot cover of clean soil was placed over those portions of the BUD Area subject to filling. The area with 3-feet of cover overlying fill is designated the Concrete and Asphalt Fill (C&A Fill) Area located within the BUD Area. Cover depths vary from one to three feet in the remainder of the BUD Area outside the C&A Fill Area. As a condition of MADEP approval of the BUD, a notice was placed on the deed of the property that prohibits any future use other than a closed BUD area without prior written approval of the MADEP. In the C&A Fill Area additional restrictions prohibit (i) disturbing the soil cover, (ii) soil/fill excavation, and (iii) invasive procedures including installation of soil borings or wells, without prior MADEP approval and the oversight of a Licensed Site Professional (LSP).
- **Southeast Construction Fill Area (SCFA).** The SCFA encompasses a former construction debris landfill, composed primarily of re-graded native soils (excavated to facilitate construction of the YNPS) with minor amounts of construction debris and rubble. Approximately 13,050 yd³ of OHM-impacted soil (primarily PCBs in paint and lead from sandblast grit) were removed from the SCFA during Phase IV remedial response actions in compliance with the MCP. An SCFA Closure Report has been filed. A notice on the deed of the property will be filed and this notice will prohibit any future use of the SCFA Area other than its present use, without prior MADEP approval.
- **TSCA Deed Restricted Area.** A Declaration of Land Use Restrictive Covenant under the Toxic Substances Control Act (TSCA), was filed to include those areas of the site where PCBs remain in soils above 1.0 milligram per kilogram (mg/kg), the TSCA allowable concentration for "unrestricted" land use. This deed restriction specifically precludes any residential development in those portions of the site where PCBs in soil exceed 1 mg/kg (surveyed and recorded on the deed). The TSCA deed restricted areas overlap the BUD and SCFA Areas.
- **Restricted Use Area (RUA).** YAEC intends to file a deed restriction that precludes future residential development on the YAEC property in those areas in the vicinity of the former power plant (see Figure 2-1). Note that the RUA will encompass the areas the YAEC and TransCanada properties designated as the Combined Study Area on Figure 2-1.
- **TransCanada Property Study Area** – This study area is that portion of the site on property owned by TransCanada. The TransCanada Area includes former parking areas and a former leach field. The portion of the TransCanada Study Area bordering Sherman Reservoir is termed the "Shoreline Study Area." Note that a portion of the BUD Area

extends onto the TransCanada property within the Shoreline Study Area. In addition, there is a deed restriction on the TransCanada property that precludes residential development.

- **West Storm Ditch (WSD)** – The WSD is an intermittent drainage channel that carries groundwater seepage and stormwater runoff from former parking areas and portions of the former industrial area. During YNPS operations, the WSD also carried permitted water discharges (*e.g.*, plant sump discharges). The WSD starts at the western portion of the former industrial area and flows under the paved access road and into the Deerfield River, south of Sherman Reservoir. In the fall of 2004, sediment and soil with PCB concentrations above 1 mg/kg and radionuclides exceeding FSS criteria were removed from the WSD (ERM, 2006b). In addition, as part of the decommissioning and site restoration process, the stormwater collection system in the former plant area was removed and sealed, reducing future runoff flows in the WSD.
- **Sherman Reservoir** – Sherman Reservoir is the impoundment of the Deerfield River behind the Sherman Dam. This reservoir was formerly used as a source of circulating cooling water during YNPS operations. The reservoir is about 2 miles long, ¼-mile wide, and up to 75 feet deep along its central channel with steep, rip-rap banks and heavily forested shorelines. Sediment remediation for PCBs in the vicinity of the East Storm Drain (ESD) outfall was completed in 2004 (ERM, 2006b).
- **Deerfield River** – The Deerfield River starts in Vermont and travels through the northwestern portion of Massachusetts. The river abuts the site along its eastern shore for over a mile. The river flows rapidly immediately downstream of Sherman Reservoir and then flows moderately to the Monroe Bridge Dam. The river was divided into two study areas, the Deerfield River adjacent to the site, and the Deerfield River downriver from the site.
- **Wheeler Brook** – Wheeler Brook, with associated wetlands, is a perennial stream that transects the northeastern corner of the YNPS site and flows into Sherman Reservoir, directly north of the BUD Area. This perennial brook may dry up or be reduced in size during the dry season, making it an ill-suited habitat for fish. The Wheeler Brook Divertment was constructed by YAEC in 1980 to divert stormwater and surface water from upland areas around the industrial area into Wheeler Brook (ERM, 2004b).

As noted earlier, the ASTM Phase I site investigation of the Monroe Parcel, and the outlying areas of the YAEC property confirmed the lack of Recognized Environmental Conditions beyond the study areas noted above.

For brevity, study areas on the YAEC property that fall within the BUD, TSCA, and SCFA areas, are referred to here as the "BUD/TSCA" areas. Areas within the YAEC RUA outside of these areas are referred to as the "non-BUD/TSCA" areas or "outside BUD/TSCA" areas. Where appropriate, specific study areas, such as the SCFA/TSCA areas are referenced.

2.2.2 Current and Future Use Scenarios

Although the future status of the site is currently not fully defined, the areas of the site formerly containing the YNPS have been restored and planted with grass; the areas beyond the former YNPS remain in their pre-existing undeveloped condition. In situations where the end use of a property has not been defined, in the absence of enforceable restrictions on future uses the MCP generally requires the evaluation of potential risk under a hypothetical residential scenario in the risk characterization. However, in the case of this site, there are or will be enforceable restrictions in place that prohibit future residential development in the areas of the YAEC property in the vicinity of the former power plant. In addition to the restrictions precluding future residential use, YAEC will maintain control over the Owner Controlled Area for the foreseeable future until the government makes available a permanent storage facility (off-site) for the spent nuclear fuel and the material is removed from the site. As discussed below, residential development is also restricted on the TransCanada property. Therefore, this assessment evaluates current and foreseeable future recreational use scenarios, as well as hypothetical future commercial use scenarios (though none are known to be planned at this time), as described in later sections.

2.3 Site Investigations

Comprehensive environmental investigations of soil, sediment, surface water, groundwater, and fish have been conducted by YAEC to support plant decommissioning, site remediation, site restoration, and site closure. These investigations provide the body of data and information used for this Method 3 Risk Characterization. The site investigations for "Oil and Hazardous Materials" (OHM) have been documented in a series of reports that have been submitted to the MADEP (ERM, 2004b; 2005; 2006c; 2007a), and are also available on the Yankee website, www.yankeerowe.com. OHM data collected from the site characterization efforts from 2000 through March 2007 were used in this risk characterization.

In addition to environmental investigations for OHM, an extensive radiological site sampling and characterization program has been completed by YAEC. The site investigation and compliance program necessary to allow the termination of its NRC operating license is described in the YAEC (2003a) LTP. As part of the LTP, YAEC conducted a review of all historical data contained in the Historic Site Assessment (HSA), which represents a qualitative review of historic data, and documents the events and circumstances that occurred during plant operation and decommissioning that contributed to radioactivity

above background levels. This information was used to identify, bound, and classify radiological survey areas for structures, soil, and sediment. The LTP also defines the methods adopted during the now completed FSS, which developed rigorously-controlled quantitative data from the site to demonstrate compliance with NRC and MADPH standards. The FSS study areas are shown on Figure 2-2.

Chemical and radiological data were compiled into an electronic database for the site. The data in the electronic database were collected during the following investigations and sampling efforts:

- Historical data collected in 1997 during earlier decommissioning stages for soil, groundwater, storm sewer/catch basin sediments, and Sherman Reservoir sediments (these data were not used for risk characterization because they did not account for remediation or the current condition of the property);
- Sampling conducted to support remediation of the PCB paint chip release under the MCP and TSCA;
- OHM sampling in support of the Site Closure Plan (as set forth in Field Sampling Plans);
- Sampling to address MADEP comments on the Phase II Comprehensive Site Assessment Report;
- Radiological data compiled in the Historical Site Assessment (HSA) which includes data for soils, sediments, and groundwater; and
- Radiological data collected for the FSS to support an amended NRC license.

2.3.1 Soil Sampling

OHM

Soil quality at the site has been characterized as part of the overall site closure program and to assess the potential for OHM impacts, as reported in the following ERM documents:

- Baseline Environmental Report: Yankee Nuclear Power Station Site Closure Project Rowe, Massachusetts (ERM, 2004b);
- Phase II Comprehensive Site Assessment Report (ERM, 2005);
- Supplemental Phase II Comprehensive Site Assessment Report (ERM, 2006c);
- Addendum to the Phase II Comprehensive Site Assessment Report (ERM, 2007a);
- TSCA Sediment Final Report (ERM, 2006d);
- TSCA Soil Final Report (ERM, 2007b); and
- Phase IV Final Inspection Report (ERM, 2007c).

Investigation of site soil quality in support of site closure relied on the results of previous site investigation efforts and a comprehensive review of actual and potential sources of OHM release at the site. Two soil sampling approaches were employed in the initial characterization efforts: grid sampling with spacing at approximately 100 feet to provide site-wide characterization, and targeted sampling in the vicinity of potential source areas or where previous sampling indicated possible impacts. Background soil samples, intended to represent naturally-occurring conditions, were collected from undisturbed areas in the vicinity of the site. Both Geoprobe and manual sampling methods were used to collect soil in a manner that complied with YNPS Procedure *DP-8120, Collection of Site Characterization and Site Release Samples*. Geoprobe samples were collected from 0 to 6 inches, 2 to 3 feet, and at a 1-foot interval above the water table (or at 14 to 15 feet or refusal if the water table was not encountered). Manual soil samples were collected from 0 to 6 inches and 2 to 3 feet using stainless steel hand augers or Geoprobos. Samples were each given a unique sample identification, field observations were recorded, and sampling points were located by Global Positioning System (GPS) or by flagging and surveying. Samples were preserved on ice or in a refrigerator, and sample handling was documented using chain-of-custody protocols in accordance with YNPS Procedure *DP-8123, Sample Security and Chain of Custody*.

Numerous additional sampling programs were completed between January, 2005 and September, 2006 that were associated with site decommissioning and demolition efforts, landfill closure and in response to MADEP requests based on review of numerous reports submitted to support MADEP oversight of site closure efforts. During Phase II efforts alone, soil samples were collected from over 25 areas at the site. These sampling locations are shown in Figures 4A and 4B of the Supplemental Phase II Comprehensive Site Assessment Report (ERM, 2006c), and are included on maps of the data presented in this report. Figures 2-4 through 2-7 present all soil sample locations for OHM used in this risk characterization, highlighting concentrations that exceed the MCP S-1 criteria or maximum site-specific background concentrations.¹⁰

Radionuclides

Soil samples for radiological characterization were collected as prescribed in the LTP and approved by the NRC. As required by the NRC for the amended license and to support decommissioning of the YNPS, an FSS has been conducted. The FSS study area, comprising approximately 30 acres of the

site, included the Owner Controlled Area, a 20-meter wide buffer zone outside the Owner Controlled Area, and other routinely utilized plant areas including the Visitor Information Center, Training Center, SCFA, parking lots, storm drain outfall areas, and part of Sherman Reservoir (Cumming, 1998). The FSS study areas are depicted on Figure 2-3. The main objective of the FSS was to demonstrate that residual radioactivity for each survey unit and potential doses from small areas of elevated activity were below the release criteria (25 mrem/yr for NRC and 10 mrem/yr for MADPH). During planning of the FSS, the HSA and other pertinent documents were reviewed to establish plant-related radionuclides and survey unit classifications based on site characterization. The FSS was conducted using a combination of fixed measurements, traditional scanning surveys, and other advanced survey methods. The survey included sampling of surface soils (0 - 15 cm), subsurface soils in excavation/remediation areas, groundwater, and sediments. The radiological sampling procedures followed the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidelines, which is the approach endorsed by MADPH, USEPA, and the NRC. This comprehensive radiological assessment program included the collection of data from the site that was suitable for use in this risk assessment. Soil sampling locations for Co-60, Cs-137, and Sr-90 are shown in Figures 2-8 through 2-10.¹¹

In addition to the FSS sampling, sediment, surface water, and fish samples were collected and analyzed for radiological parameters and uranium (metal) to address comments made by the MADEP on the Phase II Comprehensive Site Assessment Report.

Naturally occurring radionuclides are ubiquitous in soils, sediments, and water, and as a result, are also present in plants and animals. These radionuclides have both terrestrial sources (U-238, U-235, U-238, Th-232 and their decay products) and cosmic sources (K-40, H-3, Rb-87). In addition to these natural radionuclides, above-ground nuclear weapons testing released radioactive material to the environment (*e.g.*, Cs-137, Sr-90) that contributes to background radioactivity. In order to differentiate between natural radionuclides at the site and those produced during operations at YNPS, comparisons were made between measured concentrations in samples from the industrial areas and concentrations in similar samples collected from areas unaffected by plant operations (*i.e.*, background concentrations). Background radionuclide sampling locations, typically located off-site, were selected based on factors

¹⁰ As described in Section 2.5, samples representing materials excavated or remediated are not included in the risk characterization.

¹¹ These three radionuclides are shown as they are the most prevalent. All soil sample locations were analyzed using gamma spectroscopy (*e.g.*, for Co-60 and Cs-137), and a subset were analyzed for hard-to-detect radionuclides (*e.g.*, Sr-90).

such as meteorological history and dispersion calculations, relative direction from the plant, river flow, and distance (YAEC, 2002).

In evaluating the results of environmental sample analyses, it is necessary to consider the variability of natural and man-made sources of radioactivity, and the distribution of radionuclides in the environment and their uptake in environmental media. This variability is dependent on many factors including release rates, past spatial variability of radioactive fallout from nuclear weapons tests and its ongoing redistribution, contribution from cosmic radioactivity, groundwater dynamics, soil characteristics, farming practices, and feed type. Any one of these factors could cause significant variations in measured levels of radioactivity and these factors need to be considered in order to distinguish between natural and YNPS related radioactivity.

Background reference locations for radionuclides (Cs-137, Sr-90) were selected to represent similar environmental characteristics (vegetative cover, soil type, and disturbance) and located in a direction that was least impacted by airborne radiological releases from YNPS (*i.e.*, from the main stack, the old incinerator, or re-suspension of contaminated soils). Soil samples for Cs-137 and Sr-90 were collected from three reference locations to determine their respective background concentrations. The Non-Impacted Area (NIA-01), as shown in Figure 2-11, was sampled during the Historical Site Assessment as one reference data set; the locations of background samples for OHM are also shown on Figure 2-11. Soil samples from the vicinity surrounding Pelham Lake, located east/southeast of YNPS, was chosen as another reference area for Cs-137 and Sr-90. This area, in a separate valley from the one in which YNPS was located, is shown in Figure 2-12. Finally, a reference area designated "REF-01," was sampled during the FSS (Figure 2-8).

2.3.2 Groundwater Wells, Water Supply Wells, and Sherman Spring

Groundwater monitoring has occurred at the site since the first monitoring well was installed in 1977. Since that time, a total of 83 monitoring wells have been installed. Currently, 26 monitoring wells have been abandoned in part due to site decommissioning, leaving 57 monitoring wells (including nested wells) currently available for sampling. The locations of historic and current wells are shown in Figure 2-13. Two fresh water supply wells, one that previously served the Furlon House (DW-002, now abandoned) and one that serves the site (DW-001, active), have been included in the groundwater

sampling program. In addition, surface seeps designated the "Sherman Spring" have also been sampled as part of the groundwater monitoring program.

OHM

Wells were generally sampled quarterly for one (1) year and then sampled periodically thereafter. During 2003 and 2004, groundwater was sampled from 36 shallow interval monitoring wells, 11 intermediate monitoring wells, 11 bedrock monitoring wells, the two fresh water supply wells, and Sherman Spring in accordance with the Groundwater FSP (ERM, 2003). In March and November of 2005, wells that previously exceeded MCP Reportable Concentration (RC) values were sampled again. A comprehensive round of well sampling was conducted in April and May of 2006 to address comments made by the MADEP on the Phase II Comprehensive Site Assessment Report, and wells that exceeded RCs were sampled again during June and July of 2006. Between January 2005 and September 2006, Sherman Spring and the fresh water supply well that served the plant were each sampled twice, and the well that served Furlon House was sampled once. Additional groundwater sampling was conducted during September and December of 2006. The latest round of groundwater sampling was completed in March of 2007. Groundwater samples were collected using low-flow techniques in accordance with YNPS Procedure *DP-9745* (YAEC, 2006b). Groundwater monitoring results have been reported by ERM elsewhere; the results are discussed in Section 3 of this report.

Radionuclides

Radiological constituents have been routinely monitored in groundwater, primarily for gamma-emitting nuclides, plus tritium and strontium. Following the installation of new wells in 2003, a quarterly groundwater sampling program was initiated, sampling active monitoring wells, when available. The number of wells sampled increased further in the Spring of 2006, and then again in the Fall of 2006 when samples were collected from a total of 57 wells, Sherman Spring, and the potable well that serves the site. A summary of the groundwater monitoring program and results is provided in the following reports:

- Yankee Nuclear Power Station 2006 Interim Groundwater Report.
- August 31, 2006, Submittal of Groundwater Compliance Plan for License Termination at YNPS. (BYR 2006-074)
- September 1, 2006, Groundwater Monitoring Plan to Support Closure Under the MA Contingency Plan. (BYR 2006-075)

- November 21, 2006, Update of Status of Groundwater Activities. (BYR 2006-108)
- February 15, 2007, Final Groundwater Condition Report. (BYR 2007-016)

As documented in the foregoing reports, the distribution of groundwater contamination at the YNPS site has been monitored over the last several years by means of a quarterly sampling program. All wells have been analyzed for the full suite of 10 gamma-emitting radionuclides, tritium, gross alpha, gross beta and 11 hard-to-detect (HTD) radionuclides, during at least one quarterly sampling round. Many have been analyzed for the full suite of radionuclides during several of the quarterly sampling events. This monitoring program has shown that only detectable concentrations of tritium are present in site groundwater. Low levels of Cs-137, Sr-90, and Co-60 have been identified sporadically during analysis of groundwater; however, these instances were investigated and found to be caused by one of three reasons:

1. Intrusion of surface water, which had been in contact with contaminated soil, into damaged well heads or road-boxes in adjacent areas.
2. False positive detections from expected statistical variations in laboratory analyses.
3. Improper onsite laboratory practices that introduced contamination into the sample being analyzed (*e.g.*, lab cross contamination events).

The absence of radionuclides other than tritium in groundwater samples is consistent with soil-water partition coefficients (K_d) presented for these radionuclides in literature. The partition coefficients control the distribution of the radionuclides in groundwater, as compounds with low K_d values are strongly partitioned to groundwater relative to soil and geologic material, while compounds with higher K_d values are more readily partitioned to the solid phase. The K_d value for tritium greatly favors its transport in the liquid phase (*i.e.*, groundwater), while the K_d values of cobalt, strontium, and cesium favor their retention in the soil. The radiological monitoring results for groundwater are discussed further in Section 3.

2.3.3 Sediment and Surface Water Sampling

OHM

Sediment samples were collected manually using a core tube, a Ponar or torpedo dredge, or divers. Surface water samples were collected directly into sample containers without disturbing the sediment. Prior to the site-wide environmental evaluation that was initiated in the fall of 2003, sediment

sampling focused on identifying sediments with the potential to have been impacted by the release of PCB-containing paint chips.

In August 2003, sediment samples were collected from 36 locations in Sherman Reservoir, six locations in the Deerfield River, five locations in the West Storm Drain Ditch, and six locations in Wheeler Brook. In July 2004, sediment samples were collected from 10 locations in the Deerfield River near the confluence of the river and the West Storm Ditch, and from six locations in the West Storm Ditch. Surface water samples were also collected at five locations in Wheeler Brook in July 2004. Sediment sampling locations are shown in Figures 2-14 through 2-17 and surface water locations are shown in Figure 2-18.

Between May and August of 2006, additional sediment and surface water samples were collected to address comments made by the MADEP on the Phase II Comprehensive Site Assessment Report (ERM, 2005; 2006c). Three surface water samples and six sediment background samples were collected in the Deerfield River, upstream of Harriman Reservoir, and 10 surface water samples and 30 sediment samples were collected from the river downstream of the Sherman Dam (see Figure 2-12 and Figure 2-19 for downstream and upstream sample locations). Three surface water samples and 13 sediment samples were collected in Sherman Reservoir in the vicinity of the Intake Structure, the Discharge Structure, and the East Storm Drain Outfall. Six surface water samples were collected from Wheeler Brook. One surface water and one sediment sample were collected from the West Storm Drain Ditch, and from along the historic seep line of Sherman Spring and a spring to the south of Sherman Spring (see previously cited figures).

Radionuclides

During the FSS, sediment samples were collected from the upstream reference area (REF-02) in Harriman Reservoir (Figure 2-19), and the Sherman Reservoir survey area (OOL-01). Sample locations and results for the Sherman Reservoir samples for Cs-137, Sr-90, and Co-60 are shown in Figures 2-20, 2-21, and 2-22, respectively. Between May and August of 2006, additional sediment and surface water samples were collected to address comments made by the MADEP on the Phase II Comprehensive Site Assessment Report, as described earlier. These "Phase II" sample locations for radionuclides are also shown with the OHM sample locations on the previously described figures.

Background reference locations for radionuclides (Cs-137 and Sr-90) were collected from Harriman Reservoir, located on the Deerfield River upstream of Sherman Reservoir and YNPS, and portions of the Deerfield River upstream of Sherman Reservoir were chosen (Figure 2-19). The sediment background results for Cs-137 and Sr-90 are discussed in Section 3.

2.3.3 Fish Sampling

OHM

Fish were collected at the site during 2002 to evaluate whether PCBs resulting from the paint chip release were present in fish in Sherman Reservoir. Fish were also collected from the East Storm Drain (ESD) area, the northern end of Sherman Reservoir, and Harriman Reservoir during the Phase II Comprehensive Site Assessment in 2006 (Figure 2-19 indicates sampling areas). Concentrations of PCBs in fish collected in 2002 and 2006 were comparable, and concentrations in fish collected from Sherman Reservoir (ESD area) and the Deerfield River were consistent with background concentrations in fish collected from Harriman Reservoir as discussed in Section 3.

Radionuclides

Historical fish sampling for radionuclides was conducted as part of the Radiological Environmental Monitoring Program (REMP). Both Cs-137 and naturally occurring K-40 were detected in fish. A summary of the REMP sampling results is provided in the Phase II Comprehensive Site Investigation Report (ERM, 2005). As that summary indicates, since the cessation of YNPS operations, the Cs-137 concentration in fish from the Sherman Reservoir does not differ from the Cs-137 concentration in Harriman Reservoir fish.

Fish tissue sampling for radionuclides was conducted in June and July of 2006, and again in November 2006, to address comments made by the MADEP on the Phase II Comprehensive Site Assessment Report (ERM, 2005). Fish were collected from Harriman Reservoir at historic sampling locations, at the southern end of Sherman Reservoir (*e.g.*, ESD area), and from the Deerfield River between the outfall of the West Storm Drain Ditch and the Monroe Bridge Dam. Fish were collected using trot lines and electrofishing methods. The results are discussed in Section 3 of this report.

2.4 Usability of Risk Characterization Data

This section describes procedures performed to ensure and determine overall usability of the non-radiological environmental site closure data used in the YNPS Method 3 Risk Characterization. The data were collected and evaluated using rigorous Quality Assurance/Quality Control (QA/QC) protocols.

2.4.1 OHM Analytical Program

All site closure QA/QC requirements and procedures for OHM, including Data Quality Objectives (DQOs), analytical methods, and data validation/data usability guidelines, were defined in the project Quality Assurance Project Plan (QAPP) (Gradient, 2003; 2004a; 2005a). Overall, with very minor exceptions, the vast majority of the soil, sediment, groundwater, and surface water results were considered usable for incorporation in the risk characterization. The general QA/QC program and data usability findings are summarized below.

Sample analyses of soil, sediment, groundwater, and surface water were performed by several program-approved analytical laboratories (*e.g.*, Spectrum Analytical Services, Agawam, MA; Northeast Laboratory Services, Waterville, ME). All data packages generated in support of the YNPS site closure contained documentation consistent with the requirements of the QAPP and Field Sampling Plans generated by ERM.

Parameters analyzed during the YNPS program included Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), Pesticides, Polychlorinated Biphenyls (PCBs), Total Metals by Inductively Coupled Plasma (ICP) and graphite furnace, Total Mercury, dioxins/furans, alcohols, EPH/VPH, and wet chemistry analyses (in groundwater only; included Chemical Oxygen Demand, Chloride, Cyanide, Nitrate, Sulfate, Total Alkalinity, and Total Dissolved Solids). With the exception of wet chemistry parameters and MADEP EPH/VPH, all analyses were performed using US EPA SW-846 Methods (US EPA, 1986) and where applicable, were consistent with the requirements set forth by the MADEP (MADEP, 2004b).

Method modifications were performed for some analyses, as follows:

- **PCBs in Soil and Sediment** - PCBs in soil and sediment incorporated a revised extraction method per a request by US EPA Region I. Soil and sediment samples were

oven-dried overnight at 60°C and prepared for analysis using methylene chloride/soxhlet extraction procedures. The soil and sediment PCB results were reported in dry weight, quantitated using the oven-dried percent solids, which in general was 99-100%.

- **Metals Analyses in Groundwater** - In addition to total metals or priority pollutant metals, boron and lithium were analyzed in select groundwater samples.
- **PAHs in Groundwater and Sediments** - SVOC analyses were performed in both the full scan mode for the full compound list and also *via* 8270C Selected Ion Monitoring (SIM) mode for Polynuclear Aromatic Hydrocarbons (PAH) and pentachlorophenol to achieve some of the lower MADEP Reportable Concentration (RC) values for these compounds.
- **Tentatively Identified Compound Analysis** - Tentatively Identified Compound (TIC) analyses were requested for a percentage of groundwater/surface water samples.

Data Validation Procedures

Site closure data were formally validated by ERM according to the YNPS QAPP beginning in 2003. Data generated prior to 2003 were not formally validated; however, Gradient performed a usability assessment of the historical data (Gradient, 2004c).

Modified Tier II and Modified Tier I data validation reviews of the soil, sediment, groundwater, and surface water results were performed by ERM based on the US EPA Region I Guidelines (US EPA, Region I, 1988a; 1988b; 1993; 1996; 2004) and professional judgment. Per the QAPP, a full Region I Tier II validation review was performed on at least 25% of the data generated, while the majority of the remaining data underwent a Modified Tier I review. During validation, individual data results were evaluated against the project-defined criteria for QC parameters including precision, accuracy, and/or sensitivity. The data were also assessed for usability based upon the site-specific DQOs and professional judgment. Data that did not fall within the QC bounds defined in the QAPP were qualified during the validation, and any data qualifiers were added to the YNPS site database where all data are maintained. The validators generated narrative reports that summarized all technical issues affecting accuracy, precision, and sensitivity of the data, and summarized actions taken, qualifiers applied, and any miscellaneous technical issues.

A small percentage of the data used in the risk characterization was not validated (this includes 2006 and 2007 groundwater samples yet to be validated, some sediment samples from Phase II also to be validated, SCFA samples, and select resampled locations). However, data usability is considered to be

unaffected, since the vast majority of the data were validated using strict QA/QC protocols, and these validated data are considered representative of the overall high quality of the site closure data.

Data Usability Procedures

During the data usability evaluation, the validated data were further assessed by Gradient for overall precision, accuracy, representativeness, comparability, completeness, and sensitivity (also known as "PARCCS" parameters). Gradient reviewed ERM's individual data validation reports and summarized the overall findings in several Data Usability Reports (Gradient, 2004b; 2004c; 2004d; 2005c 2005d; 2005e; 2006), providing a summary of the technical data usability evaluation performed on the samples collected.

The most comprehensive DQO to defining overall data usability is completeness. Completeness is defined as the percentage of data compared to the total amount of data collected that is judged to be valid to achieve the objectives of the investigation. Although completeness is one of the PARCCS elements, it in fact embodies three QC acceptance criteria: precision, accuracy, and sensitivity. While data that are estimated (qualified J) or nondetected (qualified U) are considered usable and "valid" for project decisions, rejected data (qualified R) are considered unusable, or "invalid," and are excluded from the data set. Thus, completeness is directly affected by rejected data as is readily seen from the definition of completeness below:

$$\% \text{ Completeness} = \frac{(\text{Total \# Results} - \text{Total \# Rejected Results})}{\text{Total \# Results}} \times 100$$

As described in the QAPP, the completeness criterion for the YNPS site investigations was 90%, and is consistent with the requirements of the MCP (MADEP, 2004b). During the data usability review, completeness was evaluated on three levels for each matrix validated: general analytical categories (*i.e.*, organics and inorganics), individual analytical parameters, (*i.e.*, VOCs, SVOCs, PCBs, *etc.*) and individual compounds/analytes.

Usability Statistics Summary for Risk Characterization Data

An overall summary of the data completeness for the soil, sediment, groundwater, and surface water samples is presented in Table 2-2. With some very minor exceptions, completeness criteria were met for the vast majority of the data used in the risk characterization. As indicated in Table 2-2, with the exception of herbicides, all of the general analytical parameter groups easily met or exceeded the 90% DQO for completeness, and no significant data gaps were identified. Table 2-3 presents a chemical-specific summary for those chemicals where 10% or more of their values were rejected during validation (*e.g.*, 90% or less completeness). The overall data usability for each matrix is described below.

Soil

- Soil data used in the risk characterization achieved 98% completeness, meeting the completeness DQO of 90% (Table 2-2).
- Several individual soil organic compounds (VOCs, SVOCs, herbicides) and a single inorganic analyte (antimony) did not achieve the 90% DQO (Table 2-3). However, this is a minor data usability issue because in nearly every case, none of the individual compounds were detected in the usable results, and/or at least 50% of the results for the individual compounds were considered usable.

Sediment

- Sediment data used in the risk characterization achieved 96% completeness, meeting the completeness DQO of 90% (Table 2-2).
- Several individual soil organic compounds (VOCs, SVOCs) and a single inorganic analyte (antimony) did not achieve the 90% DQO (Table 2-3). However, this is a minor data usability issue because in nearly every case, none of the individual compounds were detected in the usable results, and/or at least 50% of the results for the individual compounds were considered usable.

Groundwater

- Groundwater data used in the Method 3 Risk Characterization achieved 96% completeness, meeting the completeness DQO of 90% (Table 2-2).
- Several individual groundwater organic compounds (VOCs, SVOCs, herbicides) did not achieve the 90% DQO (Table 2-3). However, this is a minor data usability issue because the majority of analytes affected were never detected, and for those that were detected, at least 50% of the results for the individual compounds were usable.

Surface Water

- Surface water data used in the risk characterization achieved 98% completeness, meeting the completeness DQO of 90% (Table 2-2).
- Several individual surface water VOCs did not achieve the 90% DQO (Table 2-3). However, this is considered a minor data usability issue since none of the individual compounds were detected in the usable results.

Thus, with the minor exceptions noted here, the vast majority of the soil, sediment, groundwater, and surface water data used in the risk characterization met or exceeded the DQOs set forth in the QAPP, and the majority of the data results were considered usable for risk characterization.

2.4.2 Radionuclide Analytical Program

YAEC developed and implemented a comprehensive QA Program for radiological sampling and analysis activities to ensure conformance with the established regulatory requirements of the NRC and accepted industry standards. The YAEC organization utilized the Site's NRC approved Yankee Quality Assurance Program (YQAP) to ensure that the radiological FSS and Site Groundwater Monitoring were performed in a safe and effective manner. This program and supporting documents utilized specific industry standards for quality assurance and quality control measures to govern the implementation of the FSS and groundwater monitoring activities which were reflected in a comprehensive set of supporting site procedures, plans and instructions.

The QA/QC measures of the YQAP were integrated into the site decommissioning activities, including the development of the LTP and groundwater monitoring activities and were implemented as part of the site's radiological remediation and monitoring programs. FSS and groundwater monitoring activities essential to data quality were implemented and were conducted under approved procedures and regulatory oversight by NRC. The effective implementations of administrative controls were verified through Independent Quality Assurance oversight activities. Corrective actions were taken if deficiencies were identified. These measures were applied to the related radiological analytical services provided by off-site vendors, in addition to any on-site vendors, contractors or sub-contractors supporting radiological surveys and groundwater monitoring activities.

The QA/QC measures ensured that trained individuals were utilized to perform activities in support of the site radiological remediation and monitoring programs. These surveys were performed

using approved written procedures and properly calibrated instruments that were sensitive to the suspected contaminants of concern. In addition, QC measures were taken to obtain quantitative information to demonstrate that results had the required precision and were sufficiently free of errors to accurately represent the site radiological investigations. QC checks were performed as prescribed by the implementing procedures for both radiological field measurements and laboratory analysis (both on-site and third party). The YAEC Quality Assurance organization assessed the performance of FSS and groundwater related activities.

The YNPS radiological program included radionuclide analyses in groundwater, soil, surface water, sediments, and fish. Radiological analyses were performed by AREVA Environmental Laboratory (E-Lab) and General Engineering Laboratory (GEL). Radiological analytical data were validated using guidance defined in Yankee procedures DP-8603, "*Radiological Data Quality Assessment*" (9/2005) and DP-8880, "*Radiochemical Data Verification and Validation for Samples taken for the Purpose of Final Status Survey (FSS) and FSS-Related Characterization*" (10/2005). Numerous assessment reports were generated by Yankee in support of the data review.

Radiological QA/QC procedures were defined in Yankee's AP-8852 "*FSS Quality Assurance Project Plan*" (5/2006) and AP-9601 "*YNPS Site Characterization and Site Release QAPP for Sample Data Quality*" (4/2006). The QC program included routine collection and analysis of blind duplicates, for which precision criteria were generally met.

2.5 Chemical and Radionuclide Database

Gradient has maintained a comprehensive database of OHM data for soil, sediment, surface water, and groundwater collected at the site. Environmental characterization data from 2000 to the present were used in the risk characterization. The data used in the risk characterization are organized according to the following investigation events:

- 2000 - 2001 ISFSI
- 2000 MCP Phase I
- 2002 MCP Phase II
- 2003 MCP Phase II
- 2004 - 2005 SCFA

- 2004 Environmental Samples
- 2005 Environmental Samples
- 2005 TSCA Samples
- 2006 Environmental Samples (including Phase II)
- 2006 TSCA Samples
- 2007 Environmental Samples

Historical site data collected prior to 2000 were not used in the risk assessment.¹² In addition, predevelopment well water samples, samples from remediated locations, waste characterization samples, and samples that were not environmental characterization samples (*e.g.*, concrete, wastewater, sandblast grit, *etc.*), were not used.

The following data were excluded from the risk assessment:

- Field duplicates
- Samples from excavated/remediated locations that no longer represent site conditions at site closure
- Data rejected during validation

Some samples had multiple sets of results for the same analytical parameter and one or more sets of these results were excluded as follows:

- For samples with laboratory reanalyses (*e.g.*, more than one lab result per field sample), the usable chemical result was determined during data validation.
- Results that exceeded the laboratory calibration range were excluded and the reanalyzed results were used.
- PAH results analyzed by Method 8270C SIM (*e.g.*, lower detection limits) were used for samples that were also analyzed by Method 8270C.
- The SVOC results for US EPA Method 8270 were used preferentially for COPC screening over the SVOCs also reported from the results of Method EPH-04-1.
- VOCs analyzed by US EPA Method 8260 were used preferentially over those VOCs also reported with the Method VPH-04-1.1 results.
- Unadjusted EPH and VPH carbon fractions were replaced by their adjusted fractions.
- Total petroleum hydrocarbons were not included as COPCs because they were analyzed separately as the combination of EPH and VPH fractions.

¹² Background samples for radionuclides collected during the Historical Site Assessment were used.

- Naphthalene was detected using both SVOC and VOC methods (US EPA Methods 8270 and 8260); the SVOC naphthalene results were used.
- Results with higher detection limits for samples analyzed by both Alpha Analytical and Northeast Laboratories for the same analytical parameters were excluded.
- Samples analyzed for PCBs by Northeast Laboratories were excluded if the same sample was also analyzed by Spectrum Analytical.
- PCB results analyzed by Spectrum Analytical by Method SW846 3545A were excluded if they were also analyzed by Method SW846 3540C.

Samples collected from the following study areas were also not included in the risk assessment:

- Sediment samples from the Storm Drain System (the majority of the drain systems have been removed).
- Soil samples from the ISFSI Area. This was sampled prior to construction of the ISFSI, and contaminated soils were excavated and removed and new fill material was brought in upon which the ISFSI was constructed. The ISFSI is fenced and guarded, preventing any unrestricted human exposure to this area.
- An area containing buried railroad ties (from a historical rail spur along Sherman Reservoir). When the sample cluster of SB-105 samples was collected, the elevated SVOC detections were found to be associated with pieces of railroad ties in the samples (*e.g.*, combined with soils when the samples were collected). Thus, the majority of the SB-105 samples were not representative of soil conditions, but rather the SVOCs in the railroad ties. This issue is documented in the ERM closure memo prepared for that location.¹³ Samples SB105-J, SB-105-T and SB-105-U were usable for risk characterization as they were considered representative of soil.

Appendix A lists all the OHM chemical samples and analytes that were detected and used in the risk assessment. All data marked as "R" (rejected) were deemed to be unusable in risk assessments. Data qualifiers including "U" (undetected), "J" (estimated), "L" (biased low), and "K" (biased high) were deemed usable as are detected data with no qualifiers.

Field duplicates were collected as one component of the overall QA/QC program. Field duplicates do not represent "independent" samples and would amount to "double-counting" a given sample if both the parent and duplicate were used. Gradient compared the summary statistics of the data with the parent sample only and the data using the average of the parent and field duplicate. This analysis revealed that the averages of the two datasets were similar (Appendix Table E.1). For consistency and

¹³ ERM memorandum to Ken Dow (YAEC) and David Merrill (Gradient), "Railroad bed test pit and sampling – summary of activities and recommendations," August 21, 2006.

expediency, only the parent sample ("Field Sample") was used and the "Field Duplicate" samples were not used in the risk characterization.

In addition, Gradient was provided the Historical Site Assessment and Final Status Survey radiological data. The FSS data were used for the Method 3 Risk Characterization; the HSA data from background sample areas were used, as were FSS background sample data.

Radionuclide data used in this Method 3 Characterization are presented in data tables in Appendix B.

A summary of the number of soil samples in the site database for OHM and radionuclides broken into study areas is provided in Table 2-4. Over 1,000 soil samples were collected for radionuclides on the YAEC property, and over 500 on the TransCanada property. For OHM, over 1,000 soil samples were analyzed for PCBs on the YAEC property, and nearly 200 samples for PCBs collected on the TransCanada property. In addition, hundreds of samples were collected for inorganics, VOCs, SVOCs, and petroleum hydrocarbons. This data set represents a very robust characterization of the environmental conditions at the site at the completion of environmental remediation/restoration. The sample results for soil (and sediment and groundwater) are discussed later in this report.

2.6 Remedial Actions and Site Restoration

An Immediate Response Action (IRA), conducted to remediate the impact of the release of paint chips containing PCBs from the vapor container (VC), was completed by February 2001. This IRA consisted of the removal of sediment from storm drains, the installation of sediment socks in the storm drains, and painting of the VC to control the source of PCB release. Sediment remediation activities to address this PCB release into the Sherman Reservoir and the West Storm Ditch were completed in November 2004, and wetland restoration continued through 2005.

The Phase IV Final Inspection Report (ERM, 2007c), summarizes the extensive remedial actions that were completed at the site. In all, approximately 25,000 cubic yards of soils were remediated. Soils that were impacted by radionuclides, petroleum, lead and PCBs were removed from the site as "mixed wastes." Some soils just impacted by PCBs were thermally treated to remove PCBs, and the remediated soils were used on site as fill during re-grading and restoration of the site.

2.7 Classification of Site Soils and Site Groundwater

Soil and groundwater at the site were categorized in accordance with 310 CMR 40.0930 as required for a Method 3 Risk Characterization. MADEP defines three classifications of soil (S-1, S-2, S-3) and groundwater (GW-1, GW-2, GW-3) based on the nature of potential exposure. Soil classifications are based on accessibility of site soil, and the frequency and intensity of potential exposure. Soil classification S-1 is based on the assumption of highest potential for exposure, while classification S-3 assumes the lowest potential for exposure. Groundwater classifications are also based on the type of potential exposure. Classification GW-1 represents groundwater that is a potable water source. Classification GW-2 addresses potential risks associated with volatilization of compounds from shallow groundwater and infiltration into buildings. Classification GW-3 sets the standard in groundwater such that if discharged to surface water, the groundwater would meet surface water standards.

The MADEP has indicated it considers the groundwater at the site to be GW-1 due to the lack of public water supplies in the area of the site. In addition, all groundwater beneath the site is characterized as GW-3 because all groundwater in Massachusetts is considered as a source of discharge to surface water. No dwellings exist at the site, such that GW-2 standards do not apply.¹⁴

Classification of soils for human exposure potential is defined in the MCP under 301 CMR 40.0933. Soil category S-1 applies to soils where potential exposure to soils is frequent, such as under a residential use scenario. As noted above, land use restrictions control possible contact with soils for this former industrial portion of the site. For recreational activities or hypothetical commercial use, the intensity and frequency of potential soil contact is expected to be lower as compared to a residential exposure scenario. Areas outside the BUD where little or no fill was added are defined under the MCP as areas of "accessible surface soil." For low frequency contact in these areas the soils are classified as S-2. Within the BUD areas covered with 3-feet of soil cover, the soils are considered "potentially accessible." For low frequency contact potential, these soils are classified as S-3.

¹⁴ The only building on site is the guard house. Even if groundwater is within 15 feet below grade, no volatile organic compounds were detected in the drinking water well (DW-001), so even if the groundwater were considered GW-2, it would comply with the GW-2 standards.

3 Hazard Identification

The Hazard Identification component of the Risk Characterization identifies constituents of potential concern, associated chemical toxicity profiles, and applicable or suitably analogous standards to be used in the risk characterization.

3.1 Constituents of Potential Concern

Based on the operations and materials used at the plant, samples from environmental media were analyzed for the following Constituents of Potential Concern (COPCs) (Gradient, 2005a, b):

- VOCs;
- SVOCs;
- Petroleum hydrocarbons;¹⁵
- Priority pollutant 13 metals, plus boron and lithium;
- Hexavalent and trivalent chromium;
- Total cyanide and cyanide amenable to chlorination;¹⁶
- Chlorinated herbicides;
- PCBs;
- Dioxins and furans;
- Hydrazine; and
- Radiological constituents.

Specific analytical methods used for each of the above chemical analyses are defined in the QAPP (Gradient, 2005a, b). Methods for radiological parameter analyses are described in the LTP (YAEC, 2003a).

All constituents detected in soil, sediment, surface water, or groundwater were retained as COPCs if their frequency of detection was greater than 5% (evaluated in each Study area) and they exceed background concentrations.

¹⁵ Depending on the levels of total petroleum hydrocarbons found, additional extractable petroleum hydrocarbon/volatile petroleum hydrocarbon (EPH/VPH) analyses may have been performed (MADEP, 2002a).

¹⁶ MADEP subsequently requested physiologically available cyanide methods in the event that cyanide was detected; however, none was detected.

3.1.1 Background Constituent Concentrations

Chemicals and radionuclides were selected as COPCs only if they exceeded their respective concentrations in background samples. The MCP 310 CMR 40.0006 (MADEP, 2006a) defines background as "levels of oil and hazardous material that would exist in the absence of the disposal site of concern which are either:

- a) Ubiquitous and consistently present in the environment at and in the vicinity of the disposal site of concern, and attributable to geologic or ecological conditions, or atmospheric deposition of industrial process or engine emission;
- b) Attributable to coal ash or wood ash associated with fill material;
- c) Releases to groundwater from a public water supply system; or
- d) Petroleum residues that are incidental to the normal operation of motor vehicles. "

Background samples were collected in both on- and off-site areas that are believed not to be impacted by historical use of the site (Figures 2-11, 2-12, 2-19). Site-specific summary statistics of the detected chemical background concentrations observed in soil (0 – 3 feet), sediment, and surface water are presented in Table 3-1 through Table 3-3, respectively. Detected concentrations were compared against MADEP soil, sediment, and water quality criteria, respectively. Although no monitoring wells were specifically installed as background wells, the on-site drinking water well (DW-001) can serve as a surrogate for background. The only chemical constituents detected in DW-001 were boron, copper, and C9-C10 aromatic hydrocarbons (0.03 mg/L, 0.002 mg/L, and 14.3 µg/L, respectively).

Tables 3-1 through 3-3 list statistics only for those chemicals ever detected in each particular medium. Summary statistics for all chemicals analyzed for, and sample-specific chemical background data for all media, are presented in Appendix A (Tables A.1.2, A.2.2, A.3.2. and A.4.2).

Given their ubiquitous presence in the environment, MADEP (2002d) has developed statewide background levels for metals and PAHs in both "natural" soil and soil containing fill material. In comparing MADEP background concentrations to the site-specific background soil concentrations, the site-specific concentrations are comparable to, although as a whole somewhat lower than, those reported by MADEP (2002d) (Tables 3-1 and 3-2).

Background levels of radionuclides were also evaluated in the risk assessment. Sources of background radionuclide data include:

- Data collected by YAEC in the vicinity of Pelham Lake (Figure 2-12) for its Radiological Environmental Monitoring Program (REMP);
- Soil samples collected for the Historical Site Assessment (HSA) characterization data collected to support the LTP (Figure 2-11);
- Soil samples collected during the FSS (study area REF-01, Figure 2-8); and
- Sediment samples collected during the Phase II sampling event (Figure 2-19).

Site-specific summary statistics of the detected radionuclide background concentrations observed in soil and sediment are presented in Tables 3-4 and 3-5, respectively. Strontium (Sr-90) and cesium (Cs-137) are the two site-related radionuclides that are also present in background soil and sediment samples. A further discussion of these two radionuclides and their background concentrations comes later in this report.

Radionuclides were not detected in background surface water samples. The on-site drinking water well (DW-001), which can be considered a background well, did not contain detectable radionuclides. Sample-specific radionuclide background data for all media are presented in Appendix B (Tables B.1.2, B.2.2, B.3.2. and B.4.2). Summary statistics for radionuclide background samples for soil and sediment are provided in Table 3-4 and Table 3-5, respectively.

Prior to the PCB remediation of sediments in the East Storm Drain area of Sherman Reservoir, fish in Sherman Reservoir were sampled in 2002 for PCBs in filet tissues (Table 3-6). At MADEP's request, additional fish samples were collected in 2006 as part of the Phase II sampling event from Harriman and Sherman Reservoir, as well as the Deerfield River. When evaluating whether site-related constituents have affected local fish, we focused on fish sampling performed in 2006 because they represent the most current post-remediation site conditions.

Fillet and whole body fish samples were analyzed for inorganic elements and PCBs (Table 3-6). PCBs in fish were analyzed using both congener and Aroclor methods, (US EPA Methods 1668A and 8082, respectively). Aroclor-1254 was detected in one of two Sherman fish samples. However, the total PCB concentration (congener method) in Harriman fish exceeded the respective values for fish samples collected from Sherman Reservoir and Deerfield River. These data indicate that the low (*e.g.*, part per billion) PCB concentrations in Sherman fish are consistent with background levels found in the environment.

Inorganic constituents (metals) detected in Sherman Reservoir and Deerfield fish were below their respective concentrations in Harriman fish samples for all analytes except antimony, arsenic, and selenium. Arsenic was detected in a Sherman brown trout fillet sample as an estimated value (*e.g.*, qualified) of 0.31 mg/kg; however, it was not detected in the duplicate sample, nor detected in any other fish from the Sherman, Deerfield, or Harriman sampling locations. On this basis, the arsenic detected in the one Sherman fish sample is not considered to be site-related. Antimony was detected in a single brown trout fillet sample from the Deerfield, but was not detected in the sample of the brown trout offal (tissues including viscera, bones, skin, *etc.* other than the fillet), nor was it detected in any other fish samples. Selenium was detected in a Sherman Yellow Perch fillet sample, but not detected in composite samples or in any other fish samples. For these reasons, inorganics are not identified as COPCs in fish.

The Phase II radionuclides results for fish are summarized in Table 3-7. Tritium (H-3) and technetium (Tc-99) were detected in the Summer, 2006 composite fillet fish samples. The Tc-99 results for Sherman and Deerfield fish samples were less than the concentration in the Harriman fish sample. Tc-99 was not detected in fish collected in the Fall 2006 sample round. Although tritium was detected in the Summer 2006 Sherman composite fillet sample, the detected concentration (0.5 pCi/g) was comparable to that found in its corresponding Harriman fish sample (0.2 pCi/g). Tritium was not detected in any of the Fall 2006 fish samples. For these reasons, neither Tc-99 nor H-3 is considered to be elevated above background. Sr-90 was detected in a whole-body yellow perch fish sample in the Fall 2006 Sherman sample event, but was not detected in any of the Summer 2006 samples, nor any other samples from the Fall 2006 fish collection. The lack of any other detected radionuclide in the Fall 2006 Sherman fish samples, coupled with the lack of Sr-90 in any other fish from either the summer or fall 2006 samples, suggests lab contamination as a plausible reason for the reported detection of Sr-90 in the Fall, 2006 yellow perch sample. A reanalysis of the Sherman yellow perch sample did not detect any Sr-90, confirming that the prior analysis result was a lab contaminant.

Given that the chemical and radionuclide data for fish were comparable to background concentrations, exposure to fish is not evaluated further in the human health risk characterization.

3.1.2 Oil and Hazardous Material COPCs

As specified in the MCP, OHM constituents detected in soil, sediment, surface water, and fish were retained as COPCs if both of the following conditions were met:

1. Constituents were detected in greater than 5% of environmental samples, evaluated for each identified Study Area; and
2. Constituent concentrations exceeded background or local conditions.

As discussed above, site-specific information was used to characterize local background conditions in order to identify COPCs for soils, surface water, and sediment. Median and maximum detected concentrations of constituents in specific media were compared to the site background levels following MADEP protocols. Detected concentrations were also compared to detected background concentrations using statistical models (*i.e.*, box and whisker plots presented in Appendix J), to determine if observed site concentrations were comparable to background conditions.

For groundwater, no specific background wells were installed, and COPCs in groundwater were therefore not screened against background conditions. In addition, MADEP recommends evaluating risks for the groundwater pathway using data from individual monitoring wells separately (MADEP, 1995a), as opposed to averaging across a study area (as is done for other media). Groundwater sample results were not averaged, or pooled across multiple wells to determine chemical detection frequency across the site; results for each well (including nested wells) were evaluated independently. Thus, chemicals detected in groundwater were retained as COPCs, and not screened out based on detection frequency. Samples from quarterly monitoring from 2002 – 2006 were reviewed for potential trends. As discussed in further detail in Section 5.2.4 and Appendix Table E.2.1, the concentrations of constituents detected in earlier sample rounds demonstrate a decline with time. Therefore, the analytical results from the 2006 and Q1 2007 sample rounds were used to assess groundwater exposures in this risk assessment.

For all other media, constituents present at levels consistent with background levels were not retained as COPCs for the risk assessment. A summary of the OHM detection frequency and comparison to background concentrations to identify COPCs in each study area and media are presented in the following:

- Soils: TransCanada Shoreline, TransCanada Property, and YAEC outside the BUD/TSCA Areas (Tables 3-8 to 3-13).
- Sediment: Sherman Reservoir, Deerfield River adjacent to the site, Wheeler Brook, and WSD (Tables 3-14 to 3-19).
- Surface Water: Sherman Reservoir, Deerfield River adjacent to the site, Wheeler Brook, and WSD (Tables 3-20 to 3-24).
- Groundwater: TransCanada Property, YAEC outside the BUD/TSCA areas, and YAEC Within BUD/TSCA areas (Tables 3-25 to 3-27)

Screening against background concentrations and detection frequencies in accordance to MCP guidelines identified the following OHM parameter groups as COPCs (see Table 3-28 for detailed chemical listing):

COPCs – OHM Constituents	
Soils	Inorganics, Dioxin/Furans, EPH, VPH, PCBs, SVOCs, VOCs
Sediment	Inorganics, VPH, PCBs, SVOCs, VOCs
Surface Water	Inorganics, SVOCs, VOCs
Groundwater	Inorganics, VPH, VOCs

Note: PCBs – Polychlorinated Biphenyls, SVOCs – Semivolatile Organic Compounds, VOCs – Volatile Organic Compounds, EPH - Extractable Petroleum Hydrocarbons, and VPH - Volatile Petroleum Hydrocarbons.

Arsenic is a naturally occurring inorganic compound in soil. As summarized in Table 3-8 and 3-9, the maximum and median arsenic results for soil samples from the TransCanada property are comparable to their respective background values following the MADEP methods outlined above. Thus, arsenic is not a COPC in soil on TransCanada property. For soil samples from the YAEC property, there are several outlier arsenic results such that the maximum concentration exceeds the local background maximum (5.6 mg/kg) by more than 50% (one of the MADEP benchmarks for determining whether site-related constituents exceed background concentrations). On this basis, arsenic on the YAEC property might be considered elevated above background. Additional statistical comparisons summarized below reveal that arsenic is not elevated above background (see also Box-Whisker plots in Appendix J).

Comparison of Arsenic in Soils With Background Concentrations (Concentrations in mg/kg)			
Statistic	YAEC (All Samples)	YAEC (Non BUD/TSCA areas)	Background
Number of Samples	237	66	28
Median	2.3	1.7	1.85
Geometric Mean	2.17	1.95	2.0
GSD	2.01	2.05	1.85
95% UCLM	3.01	3.02	3.07
95 th Percentile	7.3	7.05	5.0
Maximum	27 (99.6-percentile)	12 (98.5-percentile)	5.61 (96.6-percentile)
DEP Background	20 mg/kg		

Notes:

YAEC soil samples include samples from 0 – 15 feet below ground surface.

Geometric Mean and GSD (Geometric standard deviation): Mean and standard deviation of the logarithm of the concentrations, respectively, converted back from log to "real" space.

95% UCLM: 95-percent upper confidence limit on the arithmetic mean (calculated using the "H-statistic" and lognormal distribution fit.)

As is evident from an inspection of the statistical summaries above, the median value for the Non-BUD/TSCA areas is less than the local background median. The maximum arsenic concentration (12 mg/kg) in Non-BUD/TSCA soil samples exceeds the local background (5.61 mg/kg) by more than 50%. However, this result is not in itself unexpected given that the non-BUD/TSCA sample set contains 66 samples, whereas the background sample set is substantially smaller, with 28 samples. The maximum value from the Non-BUD/TSCA samples represents the 98.5-percentile of the distribution of 66 values. This percentile is further out on the upper "tail" of the distribution compared to the maximum from the background dataset, which represents the 96.6-percentile of the 28 background samples. When compared on the basis of their respective 95th percentiles of each distribution, the Non-BUD/TSCA result (7.05 mg/kg) does not exceed the respective background result (5.0 mg/kg) by more than 50%. In addition, 62/66 (94%) of the soil samples from non-BUD/TSCA areas are less than the maximum concentration from site-specific background (5.61 mg/kg). Moreover, all of the Non-BUD/TSCA soil samples fall below the MADEP background concentration for arsenic (20 mg/kg). In fact, only a single soil sample (27 mg/kg, SB058) from within the former plant area exceeds the MADEP background concentration. In other words, 99.5% of the 237 soil samples from the YAEC property are less than the MADEP background value of 20 mg/kg. On the basis of the foregoing statistical comparisons, arsenic is not a COPC in soil at the site.

3.1.3 Radionuclide COPCs

In addition to environmental sampling for chemical constituents, YAEC conducted regular radiological monitoring for personnel protection, waste classification, and disposal. Only radionuclides expected to be present in any area of the site due to plant operations (*i.e.*, are plant-related rather than naturally occurring) were evaluated. YAEC developed a list of radionuclides that are site-related COPCs as the foundation of its license termination with the NRC. The criteria used to determine that a radionuclide was a site-related COPC included (YAEC, 2003b):

- Whether the radionuclide is a fission product (including activation products);
- The radionuclide half-life;
- The estimated abundance in the plant waste streams; and
- The relative dose potential.

For instance, a radionuclide with a long half-life was not included as a COPC if it was never identified in any of the plant's waste streams during operations or in the comprehensive REMP monitoring. Based on discussions with MADEP, uranium (metal) was included as a COPC (OHM), although it is not a radionuclide required to be evaluated in the LTP and FSS.

The radionuclide COPCs used for risk assessment, listed below, are those in the FSS and agreed upon with the MADEP as indicated in the MADEP letter dated October 7, 2005 (BWSC-RTN #1-13411).

COPCs – Radionuclides	
Gamma Emitting	Ag-108m, Am-241, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, Mn-54, Nb-94, Sb-125
Hard to Detect (HTD)	C-14, Cm-243, Cm-244, Fe-55, H-3, Ni-63, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, Tc-99

Similar to the OHM COPC selection, radionuclide COPCs were included in the risk characterization when:

1. The radionuclide was detected in greater than 5% of environmental samples for each identified Study Area; and
2. The radionuclide concentration in the Study Area exceeded background or local conditions.

For soil and sediments, site-specific information was used to characterize local conditions and identify radionuclide COPCs. In particular, Cs-137 and Sr-90, which are both plant-related radionuclides, also are found in the environment as a consequence of historical weapons testing fallout. Thus, while not naturally occurring, these two radionuclides have an appreciable anthropogenic background component. Median and maximum detected concentrations of Cs-137 and Sr-90 were compared to the site-specific background levels following MADEP protocols. Detected concentrations were also compared to detected background concentrations using statistical models (*i.e.*, box and whisker plots and t-test comparison of sample means, as presented in Appendix J), to determine if observed site concentrations are comparable to background conditions.

The detection frequency, and mean and maximum concentrations of radionuclides in soil and sediment by study area are presented in Tables 3-29 to 3-33 for soils (TransCanada Shoreline, TransCanada Property, YAEC Non-BUD/TSCA area, and YAEC BUD/TSCA area, respectively), and Table 3-34 through Table 3-36 for sediment (Nearshore Sherman Reservoir, Sherman Reservoir, and the Deerfield River adjacent to the site, respectively).

No radionuclide constituents were detected in the surface water samples from Sherman Reservoir or Deerfield River (Table 3-37); therefore, no radionuclide COPCs were included for this exposure pathway. Similarly, as discussed earlier, radionuclides were not identified as COPCs in fish based on comparison to the background fish samples.

As discussed earlier, YAEC has conducted an extensive groundwater monitoring program for radionuclides. Groundwater monitoring reports, summarizing the sampling program and results, have been submitted to the NRC and the MADEP. Based on the radiological sampling program, tritium has been identified as the site-related radionuclide that has impacted groundwater. Table 3-38 summarizes the radionuclide results for the most recent March, 2007 sampling event. As this summary indicates, tritium was the only radionuclide COPC detected in groundwater. Table 3-39 presents tritium groundwater results from 2003 to present for all site wells. Tritium exceeds its drinking water MCL in MW-107C, which is a well within the C&A Fill BUD Area. The enforceable restrictions in the C&A Fill

BUD area prevent the installation of any future wells in this area.¹⁷ Given that tritium exceeds its drinking water standard (*e.g.*, MCL) and the groundwater is defined as GW-1, an evaluation of the hypothetical consumption of drinking water from within the BUD area is presented in a later section.

The radionuclide COPCs identified at the YNPS by environmental medium and study area are summarized in Table 3-40.

3.2 Applicable or Suitably Analogous Standards

Section 310 CMR 40.0993(2) of the MCP requires that Applicable or Suitably Analogous Standards be identified in a Method 3 Risk Characterization. In Massachusetts, standards are available for drinking water, surface water, and air quality. As required by the MCP, Massachusetts Drinking Water Quality Standards are applicable to site groundwater if site groundwater is classified as GW-1. National Ambient Water Quality Standards are applicable to surface water in Sherman Reservoir, the Deerfield River adjacent to the site, and Wheeler Brook. A comparison of detected concentrations of COPCs to applicable or suitably analogous standards is presented in Section 6.5.

¹⁷ Even though use restrictions cannot be used to preclude groundwater use or exposure under the MCP, the location of potential groundwater extraction (and thus human exposure) on the YAEC property would necessarily be from a well location outside the footprint of the C&A Fill BUD area.

4 Dose-Response Assessment

The risk characterization evaluated both potential non-cancer and cancer risks associated with the COPCs. The US EPA and MADEP have established chemical toxicity factors used in this assessment. For OHM constituents, the toxicity factors used for the risk characterization include:

- Oral cancer slope factors (CSF)
- Inhalation cancer unit risk factors (UR)
- Chronic oral reference doses (RfD)
- Chronic inhalation reference concentrations (RfC)

US EPA's Integrated Risk Information System (IRIS) database, Health Effects Assessment Summary Tables (US EPA, 1997), and MADEP-recommended toxicity criteria (MADEP, 1994; 1995a; 2002a, 2004c) were used as sources for the toxicity data used in the risk characterization. Secondary sources included Provisional Guidance for Quantitative Risk Assessment for Polycyclic Aromatic Hydrocarbons (US EPA, 1994) and US EPA Region 9 Preliminary Remediation Goals. In cases where RfCs were not available, the Massachusetts Allowable Threshold Concentrations (ATC) were used (MADEP, 1995b).

Because there are no US EPA-derived toxicity criteria for dermal exposures, oral toxicity factors were used and appropriately modified using relative absorption factors (RAFs) to be applicable to dermal exposures as described in US EPA's dermal guidance (US EPA, 2001a).

During discussions with MADEP on the work plans for the risk characterization, the MADEP requested that the assessment include an evaluation of short-term, subchronic exposures (*i.e.*, less than 7 years, or seasonal exposures). In some instances, exposure averaged over shorter than "chronic" time-periods, even when combined with subchronic toxicity values that are generally greater than chronic toxicity factors, can lead to larger estimates of non-cancer health hazards. In order to evaluate this possibility, we conducted a subchronic health hazard assessment as part of the risk characterization.

Appendix C contains toxicity profiles from the MADEP Residential Shortform (MADEP, 1992) for the OHM COPCs at the site. A summary of the toxicity factors for COPCs is presented in Table 4-1.

Potential non-cancer health risks associated with exposure to lead are assessed using the Integrated Exposure Uptake Biokinetic (IEUBK) blood lead model. The lead risk assessment is presented in Section 6.1.4.

For radiological constituents, toxicity factors published in US EPA's Health Affects Summary Tables (HEAST), and updates¹⁸ were used. These toxicity factors include:

- Radiological oral cancer slope factors (rCSF_o)
- External exposure cancer slope factor (rCSF_e)

The toxicity factors for radionuclide COPCs used in this Method 3 Risk Characterization are presented in Table 4-2.

¹⁸ The most current toxicity factors are published at: <http://www.epa.gov/radiation/heat/index.html>.

5 Exposure Assessment

The exposure assessment identifies human receptors that could potentially be exposed to impacted site-related media (*e.g.*, soil, sediment, groundwater, and surface water) and describes the exposure pathways and routes evaluated in the risk characterization. This section also describes the calculation of exposure point concentrations (EPCs) for COPCs in soil, fugitive dust, groundwater, sediment and surface water, and the exposure factors and equations used to quantify exposures.

5.1 Identification of Potential Receptors and Exposure Pathways

Although the ultimate disposition (site ownership and future uses) of the entire 1,800-acre site has not been finalized, the area formerly occupied by the YNPS has been restored and planted with vegetation, and the remainder of the site is undeveloped native woodlands. During the remediation of the portion of the site that encompassed the former industrial area, a MADEP approval was obtained under the BUD guidelines to re-use concrete and asphalt material as fill (as long as they met MADEP-approved "clean" thresholds). This C&A Area within the BUD Area received 3 feet of graded soil cover, and areas within the BUD beyond the C&A Area generally received some amount of cover material, which varied in depth depending on local topography from 1 to 3 or more feet in thickness. In addition, the TSCA deed-restricted area prevents residential development in areas where residual PCBs exist above 1.0 mg/kg and less than 10 mg/kg on the site. As discussed earlier, land use restrictions prevent residential development within the Restricted Use Areas (RUA) of the YAEC and TransCanada properties (see Figure 2-1), as discussed further below.

There are several enforceable use conditions/restrictions that are in the process of being placed on portions of the YAEC property. These conditions/restrictions include the following (see Figure 2-1):

- The notice on the deed applicable to the BUD areas precludes any future use other than a closed BUD area without prior written approval of the MADEP.
- The notice on the deed applicable to the C&A Fill BUD area precludes any future use other than a closed BUD fill area without prior written approval of the MADEP. Additional restrictions in the C&A Fill area prohibit (i) disturbing the soil cover, (ii) excavation in the BUD area, and (iii) invasive procedures including installation of soil borings or wells, without prior MADEP approval.
- A notice of landfill operations for the Southeast Construction Fill Area (SCFA), a former construction debris disposal area, will be filed. The notice on the deed prohibits any

future use of the surveyed SCFA area other than its present use, without prior MADEP approval.

- A Declaration of Land Use Restrictive Covenant under the Toxic Substances Control Act (TSCA), was filed to cover those areas of the site where PCBs remain in soils above 1.0 mg/kg, the TSCA threshold for "unrestricted" use. This deed restriction will preclude any residential development in those designated areas of the site (surveyed and recorded on the deed). The TSCA deed restricted areas overlap the BUD and SCFA areas (see Figure 2-1).
- YAEC intends to file a deed restriction preventing future residential development on the YAEC property in the vicinity of the former power plant (see Figure 2-1).

These areas are collectively the "Restricted Use Areas." For brevity, study areas on the YAEC property that fall within the BUD, TSCA, and SCFA areas, are referred to here as the "BUD/TSCA" areas. Areas within the YAEC RUA outside of these areas are referred to as the "non-BUD/TSCA" areas or "outside BUD/TSCA" areas. Where appropriate, specific study areas, such as the SCFA/TSCA areas are referenced.

Until the government provides an approved off-site storage repository for the spent nuclear fuel, the spent fuel has been stored in concrete containers at the Independent Spent Fuel Storage Installation (ISFSI) constructed at the site. The NRC license will remain in effect for the ISFSI area. A 300-meter buffer, the "Owner Controlled Area," will remain under YAEC's control until an off-site facility is available and the material is shipped off-site.¹⁹ The ISFSI is fenced and guarded 7 days a week, 24 hours a day, such that the unrestricted human access/exposure will not be allowed in the Owner Controlled Area, which extends to the shoreline of Sherman Reservoir.

A deed restriction also is in place on the TransCanada property (because of the existence of the Sherman Dam and hydroelectric station) that similarly restricts residential development of that property (see Figure 2-1).

The risk assessment evaluated potential exposure scenarios that are consistent with the foregoing site conditions and land use restrictions. The baseline conditions evaluated in this risk assessment included the following plausible exposure scenarios:

¹⁹ It is not known how long into the future it might be until the spent fuel can be removed; for planning purposes, YAEC has assumed it will be 16 years (and could be substantially more).

- Current Use Recreator ("walk through")
- Future Use Recreator (*e.g.*, frequent use)
- Hypothetical Future Commercial/Industrial Use

Table 5-1 presents the exposure pathways and receptors. The conceptual site model (Figure 5-1) illustrates the potential source areas, mechanisms of transport, exposure pathways, and receptors for the site. The following sub-section presents the rationale for whether an environmental medium was included or excluded in this risk characterization, and the receptors potentially exposed to COPCs in environmental media.

5.1.1 Current and Future Recreational Use

For this baseline risk characterization, the most plausible current and future exposure scenarios at the site involve possible recreational activities. Although recreational activities could presumably occur anywhere on the 1,800-acre YAEC property, the exposure and risk scenarios assumed that recreation would be focused in the vicinity of Sherman Reservoir adjacent to the former site, what has been termed the "Sherman Shoreline" study area (see Figure 2-2). However, it should be emphasized that this area has several features that may inhibit or reduce the likelihood of frequent recreational use:

- The shoreline is steep and rocky in this area, making access to the water difficult.
- The bank drops off rapidly beneath the water surface, with water depths typically 5 to 8 feet deep in the East Storm Drain discharge area, making wading difficult or impossible.
- The terrain in the shoreline study area is ill-suited for launching canoes, kayaks, or other small boats.
- The Sherman Dam hydroelectric intake structure and dam spillway make this area of the reservoir dangerous for boating or swimming, which are prohibited near the dam.

As noted above, until the ISFSI is removed, any access to the Owner Controlled Area of the site, which includes the majority of the shoreline study area, will be controlled by YAEC. Consequently, recreators would in fact be restricted from using this area, for recreational or any other purpose. Once the ISFSI is removed, foreseeable future recreational use in the vicinity of the site would no longer be controlled by YAEC (though possible recreation in this area would remain constrained by the physical conditions noted above).

Based on the foregoing considerations, two recreational scenarios have been evaluated in this risk characterization:²⁰

Current Use Recreator	Future Use Recreator
<ul style="list-style-type: none"> • "Pass Through" recreation – 1 hour/day, 1 day per week, 7 months of the year • Fishing, wading, soil/sediment contact 	<ul style="list-style-type: none"> • "Frequent Use" recreation – 4 hours/day, 3 days per week, 7 months of the year. • Fishing, wading, soil/sediment contact • Groundwater consumption (future well)

Table 5-1 summarizes the exposure pathways for both scenarios. As noted above, the current use recreator does not include possible groundwater consumption at the site, whereas under possible future scenarios, it is conceivable that a drinking water well could be installed to provide water for restrooms or drinking fountains under a hypothetical future scenario (although any such well could not be installed in the area subject to the restrictions in the BUD). Although sediment and surface water exposure in this vicinity is likely to be *de minimis* due to the physical conditions of this area noted above, hypothetical risks from incidental ingestion and dermal exposure to sediment and surface water were evaluated to be conservative. Further details on the exposure pathways and exposure factors are discussed later in this section.

The exposure pathways evaluated for OHM and radionuclides were similar with a few exceptions. Exposure to external radiation due to radionuclides in soil, which is unrelated to ingestion or direct contact, was limited to the radionuclides. US EPA guidance does not provide a method to evaluate dermal contact with radionuclides in soil/sediment. Radionuclide risks were not assessed for inhalation of fugitive dust, as this pathway is likely to be *de minimis*. Finally, radionuclides were not detected in surface water, eliminating the need to assess that exposure pathway for radionuclide exposures.

5.1.2 Hypothetical Future Commercial Use

Although there are currently no known plans for future commercial/industrial use of the site at this time, this exposure scenario was evaluated in the absence of restrictions that might preclude such future use. Potential routes of exposure for the hypothetical commercial use include those evaluated for

²⁰ At the request of MADEP, we have assumed that recreators would spend their entire recreational activities in the shoreline area, adopting high-end default exposure frequency assumptions requested by MADEP. As noted, the physical characteristics of

recreational activities. The commercial use exposure pathways are summarized in Table 5-1. The areas evaluated for hypothetical future commercial exposure include (see also Figure 2-2):

- TransCanada Property (areas not in the shoreline area where the dam would preclude development)
- YAEC Property within BUD/TSCA area
- YAEC Property outside BUD/TSCA area

5.1.3 Other Potential Receptors

Other potential receptors such as construction/utility workers, Sherman Dam maintenance workers, and recreational park maintenance workers (*i.e.* landscapers) were considered. The potential risks to these receptors were not assessed quantitatively because of the reduced potential exposure of these receptor groups compared to that of the future hypothetical commercial scenarios that were evaluated. That is, the potential exposure (and risks) for the hypothetical commercial use (*e.g.*, potential use/exposure for 250 days per year) are greater than any of these other potentially exposed groups.

5.1.4 Sensitivity Analysis

The baseline risk characterization quantitatively evaluated the current and future recreational scenarios, and hypothetical future commercial scenarios, for the TransCanada and YAEC properties separately. For the baseline scenarios, the exposure units were assigned to coincide with the study areas for which a substantial amount of data exist. Current and future recreational use exposure units were assumed for the baseline analysis to occur in the "Sherman Shoreline" area (Figure 2-2). For hypothetical commercial exposure on the TransCanada property, the exposure unit is the area shown on Figure 2-2, excluding the "Sherman Shoreline" study area. Hypothetical commercial exposure was evaluated separately on the YAEC property for the BUD/TSCA and the Outside BUD/TSCA study areas (Figure 2-2).

As a sensitivity analyses, we also examined exposure and risks for additional recreational scenarios as indicated below:

this area (relative to other areas along the Sherman shoreline) would tend to act as natural impediments to frequent recreation in this area.

Exposure Areas	Recreational	Hypothetical Commercial
Baseline Scenarios		
Sherman Shoreline area	X	--
YAEC Inside BUD/TSCA areas	--	X
YAEC Outside BUD/TSCA areas	--	X
TransCanada	--	X
Sensitivity Analysis		
YAEC Inside BUD/TSCA areas	X	--
YAEC Outside BUD/TSCA areas	X	--
TransCanada (incl. WSD sediment)	X	--

The results of the human health sensitivity analyses are presented in Appendix H. As that analysis indicates, the sensitivity analysis scenarios for site-related OHM or radionuclide exposures are within MADEP guidelines.

5.2 Determination of Exposure Point Concentrations

Estimating intake or exposure to OHM and radionuclides is a function of the respective EPCs in environmental media, coupled with intake factors. As discussed in Section 2, the data collected at the site from 2000 to 2006 were used in the risk assessment. The following sub-sections present the approach used to estimate EPCs for the environmental media to be evaluated in the exposure and risk assessment.

5.2.1 Soil

Soil sampling efforts have focused on defining the environmental conditions in the vicinity of the former industrial area of the site. Figures 2-4 through 2-7 summarize OHM sampling locations, highlighting detected concentrations above background concentrations and/or MADEP soil guideline values (S-1).²¹ Figures 2-8 through 2-10 summarize the FSS soil sample results for Co-60, Cs-137, and Sr-90, respectively. The summary of soil samples by analytical matrix presented earlier in Table 2-4 reveals a robust sampling effort at the site.

²¹ Note that MADEP S-1 soil guidelines are used as comparative benchmarks only. They do not form the basis for risk characterization in this report.

As specified in MADEP (1995a) guidance, the EPCs are based on the average concentrations of COPCs within an exposure area. The Study Areas defined previously (Inside BUD/TSCA, Outside BUD/TSCA, TransCanada property excluding shoreline, TransCanada Shoreline) were evaluated as the exposure units and the EPCs were determined by averaging results within each respective area. Averaging areas (exposure units) smaller than these study areas were considered, but for several reasons was not evaluated explicitly. The most plausible future site uses are for recreational purposes, and the averaging areas would be unlikely to be smaller than these study areas. Hypothetical commercial use would also be unlikely to encompass smaller averaging areas. As a practical matter, reducing the averaging area to exposure units on the order of several acres would have reduced the number of samples (for OHM in particular) to only a handful of samples, or in a sense resulting in a risk characterization virtually on a sample by sample basis.

Instead of subdividing the site into arbitrarily smaller averaging areas, a "hot-spot" evaluation was conducted to determine whether any particular sub-areas within defined the study areas warranted a more focused risk characterization over smaller exposure units (see Section 7.4). As that analysis indicates, no "hot spots" within the site warranted further consideration.

For recreational and commercial use scenarios, the EPCs included samples collected in surface/near surface soils down to 3 feet, which includes the majority of the soil samples for OHM. Samples within the C&A Fill area currently contain 3 feet of overburden, however this overburden is implicitly ignored in the EPC calculation (and exposure calculations), which is a health-protective, conservative assumption.

The majority of soil samples collected during the FSS for radionuclide analyses were from surficial soils. In areas where remediation was required, these "surface" samples were collected within the footprint of the excavation/remediation area and are thus "confirmation" samples demonstrating YAEC achieved the cleanup required to meet NRC and MADPH "Dose Concentration Guideline Limits" (DCGLs). In such instances, the samples represent soil conditions beneath any backfill placed in excavated areas. Moreover, areas within the C&A Area are now covered by 3-feet of clean soil cover, and the BUD area outside the C&A Area generally contains cover material as well.

Consistent with MADEP (1995a) guidance, one half of the sample detection limit was used for non-detects in the EPC concentrations. In cases where the average concentration was higher than the

maximum detected concentration (an artifact of elevated detection limits substituted for non-detected results), the maximum detected concentration was used as the EPC. For radionuclides, sample results less than the minimum detected concentration (MDC) indicate a non-detected result. When the lab-reported sample result was less than the MDC (*i.e.*, a non-detected value), one-half the lab-reported sample result (*e.g.*, a sample-specific detection limit) was used in calculating the average.

Occasionally sample results for radionuclides are reported by the lab as negative activity values. This is because radiochemical analyses are the result of two measurements for activity; one for the sample and one for the measurement instrument with a sample container without any environmental media (*i.e.*, "instrument background"). The instrument background activity is subtracted from the sample activity when reporting the results. Background values are not a single, constant value, but vary around an average value, which is true for the sample activity when it too is at the background level. Thus there will be occasions when the sample activity is less than the background activity, and in such instances the sample result is reported as a negative activity. These negative results indicate that there is no detectable activity for the radionuclide in that sample. Soil EPCs for OHM and radionuclide COPCs are presented in Tables 5-2 and 5-3, respectively.

As noted above, the EPCs are based on soil samples collected from 0 – 3 feet bgs for OHM. A comparison of these 0 - 3 feet results, with samples from 0 – 6 inches, and 0 – 15 feet is provided in Table E.2.2. Based on a comparison of the mean and median values of the results shown in Table E.2.2, there is no significant difference between these data sets. Moreover, as has been discussed, up to 3-feet of cover now exists over the majority of the YAEC Restricted Use Areas.

5.2.2 Sediment

Sediment EPCs were calculated for chemical and radionuclide COPCs for Sherman Reservoir and Deerfield River sediment samples adjacent to the site. EPCs were not calculated for Wheeler Brook because no COPCs were identified in this study area. For Sherman Reservoir, near-shore samples were used to estimate EPCs in sediment (*e.g.*, see Figure 2-14). Near-shore areas were used because the most plausible exposure scenario is recreational exposure to sediments while walking along the shore areas, and potentially wading into shallow water. The water depth (on the order of 5 to 8 feet) for sample locations in near-shore areas, and even greater in off-shore areas, is such that exposure to sediments is improbable. Note also that sediment samples from the small embayment adjacent to the intake structure

for Sherman Dam were excluded from the EPC calculation in the human health risk characterization, as human activity in that area is prohibited. Statistical summaries of the COPC sample results for the near-shore, off-shore, and Cooling Water Discharge areas are provided in Table 3-15. Note that the EPCs for the Sherman Shoreline area are higher than the EPCs for the Deerfield sediments (Table 3-17). As a conservative approach, the exposure and risk characterization evaluated recreational use in the Sherman Shoreline area.

Non-detected results were included in the EPC calculation in the same manner adopted for soils (explained above). Sediment EPCs for chemical and radionuclide COPCs are presented in Table 5-2 and Table 5-3, respectively.

5.2.3 Surface Water

Surface water data from the environmental site investigations (2000 – 2006) were used to calculate average exposure point concentrations of COPCs in surface water for Sherman Reservoir, Wheeler Brook, and the Deerfield River adjacent to the site. Non-detected results were addressed in the same manner described previously. Surface water EPCs for chemical COPCs are presented in Table 5-2.

Radiological sampling reported in the 2002 YAEC Annual Radiological Environmental Report (YAEC, 2002) indicates that radionuclides were not detected in surface water samples from Sherman Reservoir, and "gross-beta" activity, an indicator of hard to detect radionuclides, was consistent with levels upstream in Harriman Reservoir. Additional radiological analyses for surface water samples collected for the MCP Phase II sampling similarly found no detectable radionuclide COPCs in surface water samples from Wheeler Brook or the Deerfield River (Table 3-35). Tritium was detected in MCP Phase II samples from the Sherman Spring (ranging from 748 to 3,480 pCi/L). The Phase II tritium samples, and the sample results for Sherman Spring in December, 2006 (1,130 pCi/L) and March, 2007 (452 pCi/L), are in all cases well below the drinking water MCL (20,000 pCi/L). The surface water pathway for radionuclides is considered a *de minimis* pathway and it was not evaluated in the human health risk characterization.

5.2.4 Groundwater

Unlike soil and sediment exposures, which are assessed by averaging within an "exposure unit," MADEP required the groundwater exposure analysis to be evaluated on a well by well basis (*i.e.*, not averaged over wells within a defined area). To characterize current and potential future risks associated with groundwater consumption, groundwater samples collected in 2006 and March, 2007 were used to evaluate the EPCs of chemicals of potential concern. We also evaluated chemicals detected during all monitoring rounds from 2000 to 2006 to examine trends in order to determine whether use of the 2006/2007 monitoring data would overlook chemicals of possible concern.

For all chemicals detected from 2000 through 2006, we used the maximum detected concentration within this time period and calculated "screening level" risks assuming consumption of drinking water for a lifetime. Any OHM for which the maximum detected value gave a calculated cancer risk above 10^{-6} or Hazard Index above 0.1 (*e.g.*, risk benchmarks 10-fold lower than MADEP threshold values), was evaluated to examine trends, and determine whether pre-2006 data should be considered in the risk characterization. This initial screening identified the following OHM for further evaluation: Aroclor-1254, benzidine, benzo(a)pyrene, tetrahydrofuran, acetone, arsenic, antimony, beryllium, chromium, and selenium (sample results in Appendix E).

1. Aroclor-1254 was detected historically in three wells: MW-5, MW-107B, and MW-107D. The three wells are adjacent to each other, located in the C&A Fill BUD Area. Aroclor-1254 was detected in MW-5 in 2002, 2003, and 2004. This well was abandoned and additional wells installed in the area because the road box protecting MW-5 had been damaged and paint chips were thought to have entered the well *via* storm water runoff. In the surrounding wells sampled since 2004 Aroclor-1254 was never detected. Aroclor-1254 was detected in samples from wells MW-107B and MW-107D in 2004, but not in samples collected in 2006. In addition, Aroclor-1254 was not detected in surrounding wells. The sporadic detection of PCBs (which do not readily migrate in groundwater) is associated with paint chips or PCB-containing soils entrained in the samples (*i.e.*, a "well effect") and is not representative of groundwater conditions. PCBs are not considered as COPCs in groundwater.
2. Benzidine was detected in a single well cluster (MW-108A, MW-108B, and MW-108C) in 2004 at concentrations ranging from 2.1 to 3.4 $\mu\text{g/L}$. Only well MW-108B was resampled in 2005 and 2006, and benzidine was not detected in either year. Due to the isolated location of this well (on the small peninsula adjacent to Sherman dam), the lack of benzidine in any other well, and the absence of benzidine in MW-108B in subsequent years, benzidine is not considered a COPC in groundwater.
3. Benzo(a)pyrene was detected in one sample (MW-102C) collected in 2003 with a concentration of 0.13 $\mu\text{g/L}$ (less than its MCL of 0.2 $\mu\text{g/L}$). Although this well was not

sampled in subsequent years for benzo(a)pyrene, surrounding wells sampled in later years did not show detectable benzo(a)pyrene. Because benzo(a)pyrene was only detected in one out of 90 groundwater samples collected between 2000 and 2006, the detected result in the 2003 sample is considered to be an anomaly and B(a)P is not considered a COPC in groundwater.

4. Tetrahydrofuran was detected in several wells sampled between 2000 and 2006, with wells MW-105C, MW-110C, and MW-111B all having elevated results. In MW-105C, tetrahydrofuran was not detected in 2004, but detected in 2006 samples. The concentration in MW-105C decreased from 512 µg/L (April) to 62.6 µg/L (September). The most recent March 2007 sample result for MW-105C is 21.8 µg/L, confirming the declining trend. Tetrahydrofuran in MW-110C declined from 2,160 µg/L (April 2006) to 56 µg/L (September); tetrahydrofuran was not detected in MW-105C in March 2007. Similarly, in MW-111B tetrahydrofuran declined from 4,470 µg/L (April 2006) to 5 µg/L (September), and was not detected in March 2007 in MW-111B. The tetrahydrofuran is believed to be associated with glues used when well risers were installed on the monitoring wells. The marked decline in tetrahydrofuran concentrations in 2006 is further confirmed by the March 2007 monitoring results. While tetrahydrofuran is included as a COPC, the EPC is based on the 2007 data.
5. Acetone was detected in several wells sampled from 2000 to 2006, with the highest concentrations found in MW-101C and MW-103C. In MW-101C, the acetone has declined from a high of 14,000 µg/L (May 2004) to 3,570 µg/L (December 2006), and most recently 2,890 µg/L (March 2007). In MW-103C, the acetone concentration has decreased from 6,200 µg/L (2003), 378 µg/L (2005), <10 µg/L (2006), and 74.8 µg/L in the March 2007 sampling round. The 2007 data are considered to be representative of the current site conditions, and were used for the acetone EPC in groundwater.
6. Arsenic, a naturally occurring metal, was detected sporadically in several wells at the site, most consistently in MW-107A. There are no apparent trends in the magnitude or location of the arsenic sporadically detected in monitoring wells. Arsenic was not detected in monitoring wells on the TransCanada property. Arsenic was detected in two wells outside the BUD area (CFW-5 – 0.0063 mg/L; CFW-6 – 0.0049 mg/L) in March 2007, in both instances the results are below the drinking water standard for arsenic (0.010 mg/L). These wells did not contain detectable arsenic in prior sampling rounds, and these low concentrations (very near detection limits) are not considered indicative of site-related release of OHM. As discussed later, the sporadic nature of arsenic in monitoring wells, the fact that the detected concentrations fall within statewide and regional background levels for public water supplies, and the lack of any significant indication of arsenic sources at the site, all suggest that the sporadic arsenic detected in monitoring wells is not related to a site-related "release" of arsenic.
7. No trends were observed for the remaining metals (antimony, boron, chromium, and selenium), such that the most recent 2006/2007 groundwater data were used to estimate their EPC values.

At the request of MADEP, the EPCs in groundwater were calculated on a well-by-well basis. In comparing the data for groundwater sampled between 2000 and 2006, the maximum concentrations in 2006 were generally lower than previous yearly maximum concentrations (Appendix Table E.2.1). Based

on this observation together with the trends described above, the maximum detected concentrations from the latest sampling rounds in 2006 and March 2007 from each study area (regardless of well from within the study area) were used as the EPCs for groundwater (Table 5-2). This conservative approach replaced the need to calculate risks associated with each of the large number of wells on-site. If the maximum concentrations taken from any well do not pose a significant risk, exposure to constituents from specific individual wells would by definition yield risks less than or equal to the maximum potential risk calculated here. In cases where analytes were detected prior to 2006, and not detected in 2006/2007, these analytes were not evaluated in the risk assessment.

Tritium is the only plant-related radionuclide detected routinely in groundwater. Groundwater data from 2003 to March, 2007 sampling of all YNPS monitoring wells were reviewed for potential trends over the 20 monitoring rounds for tritium. The only well where tritium has exceeded its drinking water standard during this time period is well MW-107C, located within the BUD Area. Tritium in MW-107C has declined from a high value of 48,000 pCi/L in 2003, down to 29,100 pCi/L (December, 2006) and most recently 30,900 pCi/L (March, 2007). The observed decline in tritium concentrations is consistent with the fact that significant source term has been removed/remediated at the site. This continuing decline is expected to be confirmed during the future groundwater monitoring.

The highest tritium concentration detected outside the BUD area was found in well MW-106A, which is on the TransCanada property. Tritium in MW-106A has declined from 13,100 pCi/L in February, 2006, down to 3,010 pCi/L (December, 2006) and in the most recent March, 2007 sample the parent sample did not detect tritium (<104 pCi/L), but it was detected in the duplicate sample (2,850 pCi/L). Tritium does not exceed drinking water standards in MW-106A.

For the risk characterization, the most recent 2006/2007 tritium results are used as the EPC for groundwater (Table 5-3) to best reflect current and future site conditions. Note that because tritium undergoes radioactive decay, its average concentration over time is calculated using the decay-adjusted methods described in Section 5.3.2.

5.2.5 Fugitive Dust

There are no data for COPCs in fugitive dust, and thus these must be estimated in order to evaluate exposure to fugitive dust *via* inhalation. The COPC concentrations in air for resuspended

particulates were estimated based on the COPC concentrations in surface soil using the following equation (MADEP, 1995a):

$$C_{\text{dust}} = \text{EPC}_{\text{soil}} \times \text{PM}_{10} \times \text{CF} \quad (5-1)$$

where:

C_{dust}	=	Effective concentration of constituents in air from fugitive dust (mg/m^3)
EPC_{soil}	=	COPC concentration in surface soil (mg/kg)
PM_{10}	=	Concentration of particulate matter in air < 10 microns in diameter ($\mu\text{g}/\text{m}^3$)
CF	=	Conversion factor ($10^{-9} \text{ kg}/\mu\text{g}$)

These particulates are assumed to be derived from soil and, therefore, to have the same constituent concentrations as in soil. The MADEP default PM_{10} concentration of $32 \mu\text{g}/\text{m}^3$ was used. This is the MADEP default for open field situations in which soil is sparsely vegetated or bare and particulate matter readily becomes airborne. However, as an area becomes more vegetated, it is less likely that soil particulate matter will become airborne. Therefore, on a site-specific basis, MADEP indicates that the percentage of PM_{10} that is soil-derived may be reduced to as low as 40% (MADEP, 1995a). At present, the restored site (*e.g.*, the former industrial area) is an open grass field. The default PM_{10} concentration of $32 \mu\text{g}/\text{m}^3$ for the estimation of fugitive dust COPC EPCs for OHM is likely to be a high-end estimate. The EPCs are presented in Table 5-2.

5.3 Exposure Quantification

In order to evaluate chemical risks and non-cancer hazards, it is necessary to estimate the chemical intake, expressed as an average daily dose or average daily exposure rate, for the pathways of possible exposure. Chemical intake varies as a function of the chemical concentration in a particular environmental medium, the frequency of contact with, or intake of, that medium, and the duration of the exposure. Section 5.3.1 presents the methodology used to estimate the chemical intake and/or exposure; the analogous methods used for radionuclides are presented in Section 5.3.2.

5.3.1 Chemical Exposure Quantification Methods

Exposure to COPCs in an environmental medium depends on both chemical-specific and receptor-specific factors. Chemical intake for either ingestion or direct contact (*e.g.*, dermal exposure) with soil, sediment, water or food, can be expressed as (MADEP, 1995a):²²

$$ADD = \frac{EPC \times IF \times RAF \times ED \times EF \times CF}{BW \times AT} \quad (5-3)$$

where:

ADD	=	Average daily dose (mg/kg-day)
EPC	=	Exposure point concentration (mg/kg or mg/L depending on medium)
IF	=	Intake factor (mg/d or L/day depending on medium)
RAF	=	Relative absorption factor (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor – depending on intake factor units
BW	=	Body weight (kg)
AT	=	Averaging time (days)
		$AT_{\text{cancer}} = 70 \text{ yrs} \times 365 \text{ days/yr}$
		$AT_{\text{non-cancer}} = ED \times 365 \text{ days/yr}$

The media and exposure pathway-specific equations used to quantify exposure are presented in Appendix D. MADEP-recommended default exposure factors were adopted in the risk assessment, and are provided in Tables 5-4 through 5-7, and discussed briefly below. Exposure factors for subchronic exposure evaluation are summarized in Table 5-8, and discussed in Section 6.1.2.

For carcinogenic risks, the chemical intake is averaged over a lifetime (*e.g.*, 70-year average lifetime). In order to estimate non-cancer hazards, the dose is averaged over the duration of exposure (ED), rather than a lifetime. These differences in the averaging period for the respective assessments are required due to the different underlying nature of the chemical dose-response toxicity factors used for cancer *versus* non-cancer assessment, and are reflected in the definition of the averaging time (*e.g.*, AT) variable above.

²² EPC is referred to as the concentration of OHM in MADEP terminology. MADEP guidance also separates the exposure frequency term into a term for the number of events per day, multiplied by the number of events per year, yet typically the number of events per day is implicitly given a value of 1.0 (MADEP, 1995a). In the equation here, these two exposure factors are combined into a single exposure frequency term for simplicity.

The MADEP (1995a) recommended default exposure duration of 30 years was adopted for recreational exposure calculations, except for the subchronic risk evaluation which averages over shorter exposure durations as discussed in Section 6. For recreators, exposures were evaluated for three age groups consistent with MADEP guidelines (*e.g.*, as set forth in the MADEP Short Forms). The age groups included children (ages 1-7 years), adolescents (8-18 years), and adults (18-31 years). For the hypothetical future commercial use exposure scenario, exposures were evaluated for adults for a default 25 year exposure duration, as recommended by MADEP (1995a).

As noted earlier, for the foreseeable future recreational scenario, a high-end exposure frequency of 3 days per week, 7 months per year was assumed as recommended in the MADEP Risk Assessment Shortforms. Note that the high-end exposure frequency for recreational activities applies to all recreational activities for a hypothetical individual. No adjustment to this high end assumption was made to adjust for recreational time spent elsewhere, either on the YAEC property beyond the former industrial area, or away from the property entirely. For the current use recreator, the high end default exposure frequency was adjusted to 1 day per week, which likely is an overestimate given that public access will be restricted in the YAEC Owner Controlled Area until the ISFSI is removed.

Incidental ingestion of soil and/or sediment can occur from hand-to-mouth contact during outdoor activities, and from contact with soil, sediment, or dust tracked indoors (MADEP, 1995a). The default recommended daily incidental ingestion rate for this exposure pathway is 100 mg/day for children and 50 mg/day adolescents/adult (MADEP, 1995a). Because incidental ingestion can occur due to contact with either soil or sediment, when both are evaluated together, the total ingestion rate must either be split between soil and sediment, or the two must be evaluated independently. If this were not done, application of the default to each pathway independently would amount to "double-counting," yielding total ingestion rates for children and adults that are double the recommended values. For this risk characterization, the soil and sediment pathways were evaluated independently for each exposure scenario, applying the MADEP default incidental ingestion rate to each pathway. When the risks were summed across exposure routes for each scenario, the higher of the soil *versus* sediment pathway was included in the cumulative risk estimate as a conservative approach.

For drinking water exposure pathways, MADEP (1995a) provides default daily water intake assumptions for residential exposure scenarios only: 1 L/day for children to age seven years, 2 L/day for adolescents and/or adults. For the future recreational exposure, and hypothetical future commercial use,

50% of these daily default drinking water ingestion rates were assumed to be from a future on-site well. Ingestion of surface water while wading (*e.g.*, hand to mouth, or splashed water) was estimated to be 0.01 L/day for all three receptors.

Dermal Pathway Intake Factor (IF)

For the dermal exposure pathway, chemicals are assumed to permeate the skin and become absorbed into the body. The "intake" depends on the body surface area that is potentially exposed, and the "loading" of either soil or water onto the skin. Thus, the intake factor in Equation (5-3) is given by:

$$IF = SA \times AF \quad (5-4)$$

where

SA = Skin surface area in contact with medium (cm²/day)
 AF = Adherence factor -- mass of soil/sediment adhered to skin (mg/cm²)

Dermal contact with soil was assumed to occur over 2,434 cm² of skin for the child, and 5,657 cm² for the adolescent and adult, representing the MADEP-recommended estimates for the face, hands, forearms, lower legs and feet (MADEP, 2002d). The same surface areas were used for dermal contact with sediment and surface water while wading. Dermal exposure to surface water during recreational activities (*e.g.*, wading) was assumed to occur 1 hour/day (current use) or 4 hours a day (future use).

Relative Absorption Factors (RAFs)

Relative absorption factors (RAFs) were primarily obtained from MADEP guidance documents, (MADEP, 1994; 1995a; 2002a; 2006b). In accordance with MADEP (1995a), RAF values were based on the following default absorption efficiencies.

Default Absorption Efficiencies

Exposure Pathway	VOCs	SVOCs	Inorganics
Soil ingestion	0.99	0.91	0.39
Soil dermal contact	0.11	0.17	0.03
Water ingestion	0.99	0.92	0.4
Water dermal contact	1	1	1

The RAFs used in this risk assessment are presented in Table 4-1.

Inhalation Pathway

For inhalation exposures to OHM, the risk characterization is based on comparing the ambient concentration to a concentration-based toxicity benchmark (either a non-cancer "reference concentration," or a cancer "unit risk factor"). Consequently, instead of an average daily dose, it is necessary to calculate an effective average COPC concentration in air. The effective average COPC concentration accounts for the amount of time an individual is exposed to COPCs in a particular exposure setting. The effective average daily exposure for the inhalation pathway was calculated using the following equation (MADEP, 1995a):

$$ADE_{\text{air}} = \frac{C_{\text{air}} \times ET \times EF \times ED}{AT} \quad (5-5)$$

where:

ADE_{air}	=	Time averaged daily exposure (mg/m^3)
C_{air}	=	COPC concentration in air (mg/m^3), calculated from Equation 5-1
ET	=	Fraction of day exposed (hr/24-hr)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)
		$AT_{\text{cancer}} = 70 \text{ yrs} \times 365 \text{ days/yr}$
		$AT_{\text{non-cancer}} = ED \times 365 \text{ days/yr}$

5.3.2 Exposure Quantification for Radionuclides

Potential exposure to radionuclides is calculated in terms of radioactivity (in pico-curies, or "pCi") rather than in chemical mass units. Exposures *via* the ingestion pathway are calculated using similar approaches to those described above in Section 5.3.1 for chemical exposure, but here expressing exposure as the total amount of radioactivity (pCi) received over the exposure duration. In the equations below, the radiation exposure is expressed in terms of an "intake factor," for either ingestion (*e.g.*, soil, water, food) or inhalation. Radiation intake for these pathways is given by (US EPA, 2000):²³

$$IF = EPC \times IR \times EF \times ED \quad (5-10)$$

where:

IF	=	Intake factor (pCi)
EPC	=	Exposure point concentration (<i>e.g.</i> , pCi/g, pCi/L)
IR	=	Media intake rate (<i>e.g.</i> , g/day, L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)

The intake factor for radionuclides is a function of exposure duration and exposure frequency. Exposure factors for the radiological risk calculations are consistent with those for the OHM risk calculations, and are presented in the risk calculation tables in Appendix F. Note that because the radiological risk calculations are based on US EPA guidelines (in the absence of MADEP guidelines), the exposure factors follow US EPA guidelines. Following the US EPA approach, the age categories are broken into children and adolescent/adult, where the adolescent/adult is a single category ("adult"), for both the recreation and commercial scenarios. This distinction does not make a material difference in the risk assessment results.

The concentration of radionuclides in the environment declines over time according to radionuclide-specific decay rates. Thus, the EPC is not a constant, but rather declines as a function of time according to the following exponential equation:

$$EPC(t) = EPC_0 e^{-\lambda t} \quad (5-11)$$

where

EPC(t)	=	Concentration as a function of time (pCi/g)
EPC ₀	=	Initial concentration at time t=0 (pCi/g)
λ	=	$\frac{\ln(2)}{t_{1/2}}$ is the decay constant (per year)
t _{1/2}	=	Half-life (years)
t	=	time (years)

The average concentration (\overline{EPC}) over a particular time period (T) is given by integrating the time-dependent concentration term over the time period:

²³ The equations presented by US EPA (2000) are for a "risk-based" concentration in soil, air, water, *etc.* The intake is given by

$$\begin{aligned}\overline{\text{EPC}} &= \frac{1}{T} \int_0^T \text{EPC}_0 e^{-\lambda t} dt \\ &= \text{EPC}_0 \frac{(1 - e^{-\lambda T})}{T\lambda}\end{aligned}\tag{5-12}$$

In the above equation, the time period "T" is equivalent to the ED in Equation (5-10). Thus, combining the expression for the average concentration for the EPC in Equation (5-12) with the intake factor expression in Equation (5-10), gives the following decay-adjusted intake factor:

$$IF = \text{EPC}_0 \frac{(1 - e^{-\lambda T})}{\lambda} \times IR \times EF\tag{5-13}$$

where EPC_0 is the exposure point concentration at the beginning (time $t=0$) of the exposure period, assumed here to be the time of measurement. Note that the decay-adjusted EPC concentration is used by US EPA.²⁴

For radionuclides with short half-lives (*e.g.*, shorter than the typical exposure duration of interest), the time-averaged concentration can be appreciably less than the initial concentration. Conversely, for long-lived radionuclides, the adjustment for radioactive decay is insignificant.

In addition to accounting for radioactive decay, intake factors (*e.g.*, ingestion rates, *etc.*) typically differ for children and adults. Exposure factors for the radionuclide risk calculations are provided with the detailed calculations in Appendix F.

One further consideration is important for assessing exposure to radionuclides for the future use recreational and hypothetical commercial use scenarios. As noted earlier, the Owner Controlled Area of the site will remain under YAEC's control until the spent fuel is removed under DOE obligations. As a consequence, unrestricted future public access to the Owner Controlled Area will not be allowed until the spent fuel is removed. For planning purposes, YAEC is assuming that the spent fuel removal will occur no sooner than 16 years from now (though it could be appreciably longer). As a consequence, the starting

simply rearranging those equations such that they are expressed as a "risk equation" without substituting a "target risk" value.

²⁴ <http://rais.ornl.gov/rad-ssg/radssl1.shtml>

point for the future recreational use and hypothetical commercial use scenarios is 16 years in the future. Therefore, for these scenarios, the exposure to radionuclides included an initial "decay adjustment" such that the "initial" concentration used in the exposure assessment was decay adjusted for 16 years, to give the estimated concentration in year 2023. In other words, the initial concentration of radionuclides in Equations (5-10) and (5-11) is:

$$EPC_o = EPC_{2006} e^{-\lambda t} \quad (5-14)$$

where EPC_{2006} (pCi/g) is the EPC determined at the completion of site restoration (2006), and the other terms are as previously defined.

6 Risk Characterization

This section summarizes the approach used to calculate total potential risks from exposures to non-radiological as well as radiological COPCs. EPCs were also compared to Applicable or Suitably Analogous Standards as required by the MCP.

6.1 Chemical Health Risks

6.1.1 Cancer Risks

Carcinogenic risks are characterized as the incremental probability that an individual will develop cancer during his or her lifetime due to chemical exposure. The term "incremental" implies that this risk corresponds to the added probability of cancer above the background cancer risk typically experienced by all individuals in the course of daily life. Cancer risks are expressed as a unitless probability (*e.g.*, one in a million, 0.000001, or 10^{-6}) of an individual developing cancer over a lifetime, above the background risk, as a result of the exposure.

For all pathways except inhalation, cancer risks for non-radiological constituents were calculated by multiplying the lifetime average daily dose (see Section 5.3) by the oral cancer slope factor:

$$\text{Cancer Risk} = \text{ADD} \times \text{CSF} \quad (6-1)$$

where:

Cancer Risk	=	Incremental cancer risk in a lifetime (dimensionless)
ADD	=	Average daily dose over lifetime (mg/kg-day)
CSF	=	Oral cancer slope (mg/kg-day) ⁻¹

For inhalation exposure pathways, cancer risk is calculated by multiplying the lifetime average daily exposure (see Section 5.3) by the inhalation unit risk value:

$$\text{Cancer Risk} = \text{ADE}_{\text{air}} \times \text{UR} \quad (6-2)$$

where:

Cancer Risk	=	Incremental cancer risk in a lifetime (dimensionless)
ADE_{air}	=	Time-averaged (lifetime) chemical concentration in air (mg/m^3)
UR	=	Inhalation unit risk factor (risk per mg/m^3)

The above equations were used to calculate cancer risk for each receptor by pathway and COPC. The COPC-specific risks associated with the pathway were then summed for each receptor, and these pathway-specific risks were in turn summed to estimate the excess lifetime cancer risk (ELCR) for the receptor. Cancer risks estimated from chemical exposures were added to the cancer risks estimated from radiological exposures (described below) to derive cumulative cancer risks for each of the receptor groups (presented in Section 6.3).

Table 6-1 summarizes the total chemical (sum of all pathways) ELCR by receptor for the current and future recreational use scenarios. Detailed risk sheets are presented in Appendix E. The ELCR for recreational exposure scenarios range from 6×10^{-7} for current use scenario, to 2×10^{-6} for the foreseeable future recreational scenario. The potential risks for OHM under a hypothetical future commercial scenario summarized in Table 6-2 range from 3×10^{-7} (TransCanada property), 5×10^{-7} (YAEC outside BUD/TSCA), to 3×10^{-6} (YAEC inside BUD/TSCA). All of these hypothetical cancer risks are less than the MADEP risk threshold of 10^{-5} .

6.1.2 Non-Cancer Health Hazards

The US EPA and other agencies have developed acceptable daily intakes and reference concentrations, referred to as RfD and Reference Concentration (RfC), respectively.²⁵ The RfD or RfC values represent estimates of the daily exposure level that can be experienced by an individual, including sensitive individuals such as children, for a lifetime with negligible risk of adverse health effects. Therefore, if the estimated exposure from the site is equal to or less than the RfD or RfC then adverse non-cancer health impacts are not expected. However, if the estimated exposures from the site are greater than the RfD or RfC, this indicates that further evaluation is necessary.

To evaluate potential non-cancer health hazards, the ratio of the chemical exposures to the acceptable daily intake or concentrations is calculated. This ratio is referred to as a Hazard Quotient, or HQ. For ingestion and dermal exposures, HQs were calculated using the following equation:

²⁵ These RfDs and RfCs have been adopted by other state agencies, including MADEP.

$$HQ = \frac{ADD}{RfD} \quad (6-3)$$

where:

HQ	=	Hazard Quotient (dimensionless)
ADD	=	Average daily dose of chemical (mg/kg-day)
RfD	=	Oral Reference Dose (mg/kg-day)

For inhalation exposures, the HQ for each COC was calculated using the following equation:

$$HQ = \frac{ADE_{\text{air}}}{RfC} \quad (6-4)$$

where:

HQ	=	Hazard Quotient (dimensionless)
ADE _{air}	=	Time-averaged (over exposure duration) chemical concentration in air (mg/m ³)
RfC	=	Inhalation Reference Concentration (mg/m ³)

Equations (6-3) and (6-4) described above were used to calculate the HQ for each chemical by exposure pathway for each receptor. The sum of these HQs for each pathway represent the pathway-specific HI for each receptor. A total HI for a receptor was determined by summing the HIs over all the exposure pathways evaluated (MADEP, 1995a).²⁶ When the HI is less than one (*e.g.*, HI<1), then no adverse health effects are expected.

Table 6-3 summarizes the total chemical (sum of all pathways) Hazard Indices by receptor for the current and future recreational use scenarios. Detailed calculations are presented in Appendix E. The results for recreational scenarios range from HI=0.05 (current use child recreator) to HI=0.17 (future use child recreator). The Hazard Indices for adults/adolescents are lower than those for the child. For hypothetical future commercial use scenarios, the results summarized in Table 6-3 are HI=0.01 (TransCanada), HI=0.04 (YAEC outside BUD/TSCA), and HI=0.2 (YAEC inside BUD/TSCA). The potential non-cancer health hazards for all of these exposure scenarios is below the MADEP non-cancer threshold of one (*e.g.*, HI<1).

²⁶ Summing HIs for different chemicals represents a conservative approach that may overestimate actual Site risks because the Reference Dose for a COC is based on a specific toxicological endpoint (*e.g.*, liver or kidney effects, *etc.*). A more accurate estimate of potential non-carcinogenic health risks involves summing HI values with the same toxicological endpoints. However, as a conservative screening step, HI values for all COCs and pathways were summed for each receptor to determine if non-carcinogenic health risks posed by the Site were likely to be of concern.

As recommended by MADEP, potential non-cancer health hazards associated with subchronic exposure were also assessed. We evaluated subchronic hazards for the recreational exposure scenario, assuming childhood exposure from 1-2 years of age for 7 months (MADEP, 1995a). The results of this evaluation indicate that the subchronic HI values are less than or equal to one for recreational exposures on TransCanada and the YAEC properties (see Table 6-3; detailed calculations are in Appendix H).

6.1.3 Lead Risk Characterization

The assessment of the possible non-cancer impacts of lead exposure was conducted following established US EPA approaches. According to scientific literature published by US and Canadian scientists, blood lead levels are considered the most reliable indicator of potential adverse health effects of lead (US EPA, 1994; 2001b; ATSDR, 1999; CDC, 1991; Hilts *et al.*, 1998; Feldman and Randel, 1994). Thus, in the assessment of potential health impacts from lead-contaminated soils, significant weight must be given to the blood lead data. US EPA notes that "Blood lead concentrations are not only indicators of recent exposure, but also are the most widely used index of internal body lead burdens associated with potential health effects" (US EPA, 1994).

Children's exposures to lead were assessed using the Integrated Exposure and Uptake Biokinetic (IEUBK) Model (US EPA, 1994; 2002b). The IEUBK Model is a computer-based deterministic simulation that estimates the blood lead concentration in children resulting from their exposure to lead in soil, dust, drinking water, diet, and air. Specifically, the model estimates the intake and uptake of lead into the body and then uses biokinetic modeling to predict blood lead levels. Because of variations in behavior and physiology among individual children, different children will have different blood lead levels, even if they are exposed to the same environment. The IEUBK Model addresses this by treating its central estimate of blood lead concentration (averaged over childhood from age 0 to 7 years) as a geometric mean (GM) of a lognormal distribution among similarly exposed children. A default geometric standard deviation (GSD) of 1.6 is used to calculate the proportion of children in the variable population falling above a target blood lead level of 10 µg/dL.

Although the baseline risk characterization evaluated recreational exposure scenarios as the most plausible for the site, a hypothetical child residential exposure was evaluated for lead risks because the IEUBK model is most commonly used for this purpose. Given that recreational (and commercial)

exposure scenarios involve less frequent exposure compared to a residential scenario, the use of the residential exposure parameters for the IEUBK model is a conservative (health protective) assumption.²⁷

Child lead risks were evaluated for lead exposure on the YAEC Property, because it is the study area with the highest average lead concentration (28.7 mg/kg) in soil (see Table 6-4). Risks were not evaluated for exposure to other study areas with lower lead concentrations, because those estimated here for the child resident exposure scenario provide an upper bound estimate for all study areas. For the drinking water pathway, the lead concentration used for groundwater consumption (0.0053 mg/L) is the maximum value of the 2006 samples (Table 6-4). Inhalation of lead (in airborne dust) was assessed based on the model default concentration of 0.1 $\mu\text{g}/\text{m}^3$ in the air along with default assumptions of the time spent outdoors as well as the inhalation rates of children between the ages of 0 and 7 years. The air lead value of 0.1 $\mu\text{g}/\text{m}^3$ represents background levels of lead in air, and is several fold higher than air lead levels that would be estimated solely on the basis of suspended soil from the site. Assessment of lead in diet incorporated the model default values because no site-specific measurements are available for fruits, vegetables, or game animals for local residents. Additionally, there were no detections of lead in the surface water. The model default maternal blood lead level of 2.5 $\mu\text{g}/\text{dL}$ was used to establish the mother's contribution to the child's blood lead level.

The IEUBK model output is given in Appendix G. The model estimates geometric mean blood lead concentrations for each year of the first 7 years of a child's life. These blood lead concentrations are averaged over 7 years and are shown in Table 6-4. The model also estimates the probability that a child will have a blood lead level that exceeds a target blood lead level of 10 $\mu\text{g}/\text{dL}$. The estimated geometric mean child resident blood lead level is 1.34 $\mu\text{g}/\text{dL}$. The probability of a child's blood lead level exceeding 10 $\mu\text{g}/\text{dL}$ is 0.001% (Table 6-4). These results, calculated for a high end exposure scenario (child resident), assure that there would be no significant risks associated with lead exposure on either YAEC or TransCanada property for either recreational or commercial uses.

²⁷ Although an adult lead model is available to evaluate risks from exposure to lead for adults and adolescents, adult risks to lead were not assessed because the child is more sensitive.

6.2 Radiological Risk Characterization

6.2.1 Internal Radiation Exposure Risks

The US EPA classifies all radionuclides as carcinogens, based on their property of emitting ionizing radiation and on the extensive weight of evidence provided by epidemiological studies of radiologically-induced cancers in humans. At radionuclide-contaminated sites, the US EPA generally evaluates potential human health risks based on radiation toxicity (*i.e.*, adverse effects caused by ionizing radiation rather than on the chemical toxicity of each nuclide). Intake by ingestion, inhalation, and absorption are potentially important exposure pathways for radionuclides. As summarized in Section 5.3.2, radionuclide intake is expressed in units of activity (*i.e.*, picocurie or pCi) rather than mass. Radionuclides that enter the body through these internal exposure pathways may become incorporated into tissues and emit alpha, beta, or gamma radiation.

Cancer risk associated with exposures to radionuclides in soil (*e.g.*, soil ingestion, inhalation of particulates) and groundwater were evaluated using the equations given below.

$$\text{Risk}_{\text{oral}} = \text{IF}_o \times \text{rCSF}_o \quad (6-5)$$

$$\text{Risk}_{\text{inhalation}} = \text{IF}_i \times \text{rCSF}_i \quad (6-6)$$

where

IF_o, IF_i = Radionuclide Intake factors for oral and inhalation exposures (pCi)
 rCSF_o = Radionuclide oral ingestion cancer slope factor (Risk/pCi)
 rCSF_i = Radionuclide inhalation cancer slope factor (Risk/pCi)

The intake factors (IF_o and IF_i) are defined in Section 5.3.2.

When radioactive decay products of a nuclide also contribute to cancer risk, the cancer slope factor used to characterize the risk of the parent radionuclide plus daughter products (*e.g.*, $\text{rCSF}+\text{D}$) is used to characterize cancer risks.

6.2.2 External Radiation Exposure Risks

Radionuclides can have a deleterious effect on humans without being taken into or brought into contact with the body. This is because high-energy beta particles and photons from radionuclides from contaminated air, soil, or water can travel long distances with only minimum attenuation in these media before exerting their energy in human tissue. Such "external radiation" exposures can result from exposure to residual radionuclides at the site. Gamma and x-rays are the most penetrating of the emitted radiation and comprise the primary contribution to the radiation dose from external exposures.

Cancer risk associated with external radiation exposures was evaluated using the following equation (US EPA, 2000):²⁸

$$\text{Risk} = \overline{\text{EPC}} \times \left(\frac{\text{EF}}{365 \text{ days/yr}} \right) \times \text{ED} \times \text{ACF} \times [\text{ET}_o + (\text{ET}_i \times \text{GSF})] \times \text{CSF}_{\text{ext}} \quad (6-7)$$

where:

$\overline{\text{EPC}}$	=	Average concentration in soil (pCi/g), defined by Equation (5-12)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (years)
ACF	=	Area correction factor (default = 0.9; US EPA, 2000)
ET_o	=	Exposure time fraction outdoors (default = 0.073; US EPA, 2000)
ET_i	=	Exposure time fraction indoors (default = 0.683; US EPA, 2000)
GSF	=	Gamma shielding factor (default = 0.4; US EPA, 2000)
CSF_{ext}	=	Cancer slope factor for external radiation (risk/yr per pCi/g)

Tables 6-5 through 6-9 present the total radionuclide risk for the current and future use recreational exposure scenarios and hypothetical future commercial use, respectively. Detailed risk calculations are presented in Appendix F.

6.3 Comparison of Radionuclide Risk *versus* Dose

As noted earlier, the NRC and MADPH have established radioactive dose-based criteria (*e.g.*, 25 mrem/yr and 10 mrem/yr, respectively) that are applied for regulatory purposes. These dose-based

²⁸ This is the same equation used by the Soil Screening Guidance for Radionuclides electronic calculator at: http://risk.lsd.ornl.gov/rad_start.shtml.

criteria can be related to the cancer risk calculations using a so-called "dose conversion factor," or DCF. The DCF represents the radiation dose per unit of radiation activity for a particular exposure pathway (radionuclide-specific). The interrelationship between cancer risk and radiation dose is explained in more detail in Appendix D.

6.4 Combined Chemical and Radiological Risks

The cancer risks for chemical and radiological pathways are additive. Thus, the estimate of cumulative risk posed by chemicals and radionuclides is simply the summation of their respective risk estimates. Tables 6-5 through 6-9 present the combined OHM and radiological potential risk for the current use recreator, future use recreator, and hypothetical future commercial worker, respectively. As these results indicate, the incremental lifetime cancer risks posed by current and foreseeable future recreational uses of the site fall within acceptable risk benchmarks established by MADEP (and also within the US EPA 10^{-6} to 10^{-4} risk range). Hypothetical future commercial uses of TransCanada and the YAEC property also yield potential cancer risks within acceptable Agency risk thresholds.

It should be emphasized that the risks that are calculated to be site-related do not appreciably differ from background risks for any of the foreseeable use scenarios (background risk calculations are discussed in Section 7.2)

6.5 Comparison of EPCs to Applicable or Suitably Analogous Standards

Section 310 CMR 40.0993(2) of the MCP requires that Applicable or Suitably Analogous Standards be identified in a Method 3 Risk Characterization. Standards pertinent to this assessment are available for drinking water and surface water. Under the MCP, Massachusetts Drinking Water Quality Standards -- Massachusetts Maximum Contaminant Levels (MMCLs) and Federal Maximum Contaminant Levels (MCLs) -- are applicable to groundwater classified as GW-1. National Recommended Water Quality Criteria (*e.g.*, AWQC) are applicable to surface water.

OHM and tritium samples collected from 2000 to 2006 were compared against their respective drinking water standards. Table 6-10 presents all constituent concentrations exceeding their respective drinking water standard. Note that DW-001, the plant water supply well, has never had a drinking water standard exceeded, and there are no other current drinking water wells in this area, nor could they be

installed in the C&A Fill BUD area in the future. Nonetheless, the fact that there are no public sources of drinking water in the vicinity of the site requires that site groundwater be considered a Potential Drinking Water Source Area, classifying site groundwater as GW-1.

In 2006, arsenic (MW-107A, MW-101A), acetone (MW-101C), and tritium (MW-107C) exceeded their respective drinking water standards. In the most recent March, 2007 groundwater monitoring results, arsenic exceeded its MCL in MW-111C and tritium exceeded the MCL in MW-107C. Acetone in MW-111C was below its MCL in the "parent" sample, but exceeded its MCL in the duplicate analysis. All of these wells are all within the footprint of the C&A Fill BUD area.

The March 2007 arsenic in MW-111C (0.0101 mg/L), marginally exceeds the MCL of 0.010 mg/L, whereas the December 2006 sample (0.004 mg/L) was below the arsenic MCL. Note that the average of the two arsenic results for MW-111C (0.0071 mg/L) is below the arsenic MCL. Tritium in MW-107C exceeds its MCL of 20,000 pCi/L in the December, 2006 sample (29,100 pCi/L), and the March, 2007 sample (30,900 pCi/L).

Constituent	Well	2006 (Maximum)	2007 (March)	MCL
Arsenic	MW-107A	0.0144	0.0094	0.010 mg/L
	MW-101A	0.016	0.0092	
	MW-111C	0.004	0.0101	
Acetone	MW-101C	4,890	2,890 (3,450 dup)	3,000 µg/L
Tritium	MW-107C	41,300	30,900	20,000 pCi/L

Although drinking water wells cannot be installed in the C&A Fill BUD area (under the deed restriction), an evaluation of the risk associated with arsenic and tritium (which exceeded their MCLs in one well each) is presented here under the assumption that the groundwater is used for drinking water. Risks assuming the drinking water exposure factors used for the commercial use exposure scenario are summarized below.

Constituent	Concentration	MCL	Cancer Risk	Hazard Index
Arsenic	0.0101 mg/L (MW-111C, Mar 2007)	0.010 mg/L	5×10^{-5}	0.3
Tritium	30,900 pCi/L (MW-107C, Mar 2007)	20,000 pCi/L	1×10^{-5} [a] 4×10^{-6} [b]	n/a
[a] Assuming drinking water consumption beginning in 2006.				
[b] Assuming drinking water consumption beginning in 2023 (e.g., 16 years in the future)				

Arsenic is naturally occurring, and there is no identifiable pattern in space or time that indicates a site-related release. In addition, the detected concentrations of arsenic are only marginally above drinking water standards, and are within the range of background levels reported by the USGS for public drinking water supply wells in Massachusetts and New England (Ayotte *et al.*, 2006). The median arsenic concentration in Massachusetts water supplies is in the range of 0.005 to 0.010 mg/L, the 80th percentile values are in the range of 0.010 to 0.020 mg/L, and the 95th percentile is over 0.020 mg/L (Robinson and Ayotte, 2006). As reported by these authors, arsenic concentrations in groundwater tend to be higher in eastern New England relative to the western regions. Although arsenic has exceeded its drinking water standard in several wells, it is neither widespread nor consistent over time across the site, and may be an artifact of variations in groundwater geochemistry. These wells are located in the C&A Fill BUD area where future construction of drinking water wells is prohibited.

Tritium has declined from a high value of 48,000 pCi/L in MW-107C in September, 2003, and it is expected to continue this decline as a result of the completed site remediation. Similarly, acetone in MW-111C, which measured 14,000 µg/L in 2004, also exhibits a declining trend that is expected to continue. Both of these wells are located in the C&A Fill BUD area where future construction of drinking water wells is prohibited.

Based on the above results, drinking water containing tritium or arsenic above their MCLs would result in a condition of significant risk under 310 CMR 40.0993 of the MCP. Continued monitoring according to a MADEP-approved groundwater monitoring plan will be used to evaluate whether any drinking water standards are exceeded in the future.

Chemical concentrations in surface water from Sherman Reservoir, the Deerfield River samples collected adjacent to the site, Wheeler Brook, and the WSD were compared against US EPA (2002a) National Water Quality Criteria (AWQC) as summarized in Table 6-11. None of the EPCs for Sherman

Reservoir or the Deerfield River exceeded the AWQC standards.²⁹ Several constituents (cadmium, silver, and thallium) sporadically exceeded their AWQC in Wheeler Brook surface water samples.

²⁹ A single sample for thallium (0.003 mg/L) from a surface spring on the TransCanada property exceeded the AWQC value of (0.002 mg/L). The EPCs in Table 6-11 are average concentration values unless the average exceeded the maximum detected concentration – a statistical artifact caused by using ½ the detection limits for non-detects.

7 Uncertainty Analysis

There are inevitable uncertainties inherent in current risk assessment methodologies that may result in either the under- or over-estimation of potential health risks. Guidance and default exposure factors recommended by MADEP and US EPA recommend conservative (*i.e.*, health protective) approaches so that potential risks are more likely be overestimated rather than underestimated. This section provides both qualitative, and quantitative where possible, discussion of how uncertainties in the risk characterization may impact the exposure and risk estimates.

7.1 Environmental Sampling and Laboratory Analysis

The environmental sampling and analysis process may result in errors associated with sample collection, analytical procedures, or overall characterization of contamination at the site. For the YNPS site, there are sufficient sampling data to adequately characterize impacts to soil, sediment, surface water and groundwater at the site for the purpose of risk characterization. Specifically, soil, sediment, surface water and groundwater data are representative of current site conditions and allow the calculation of EPCs that provide a reasonable estimate of the COPC concentrations in these media.

One source of uncertainty associated with the analytical program lies in the estimation of concentrations for samples with high detection limits that resulted from various reasons (*i.e.*, low percent solids in sediment samples, and dilution). These high detection limits, when used in averaging the detected concentration and the non-detected concentrations to calculate the EPCs, bias the EPCs high. In cases where the average concentration is calculated to be higher than the maximum observed concentration due to these high detection limits, the maximum concentration was used as the EPC. These maximum concentration EPCs were then evaluated in the risk assessment, likely overestimating true risks.

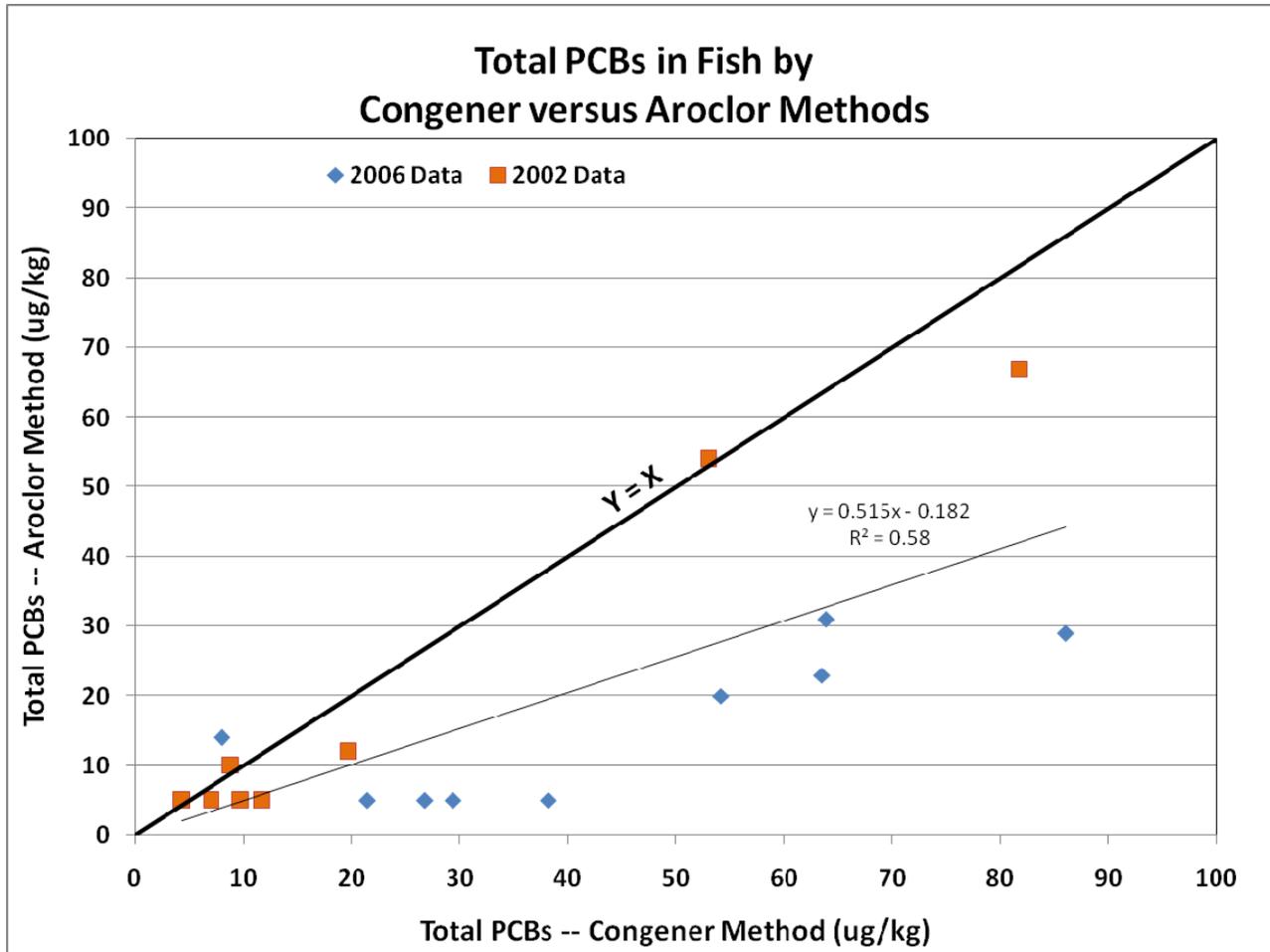
One major conservative assumption adopted in the human health risk characterization, was that the soil cover in the C&A Fill and BUD areas was ignored from the purpose of the EPC estimation and the exposure calculations. That is, soil samples that were collected as "surface" samples prior to backfill, grading and restoration, were used in the exposure estimates as though they remain "surface" samples. No reduction in radiation dose (which soil cover provides), and no reduction in potential contact was assumed for these soils which are now covered.

The risks associated with potential PCB exposure were based on exposures to Total PCBs using measurements from U.S. EPA standard analytical procedures for PCB Aroclor mixtures (*e.g.*, Method 8082). These methods rely upon the laboratory providing an Aroclor “best fit” result to the Aroclor standards. Because environmental samples are subject to weathering (*e.g.*, evaporation, dissolution, biological degradation), matching the Aroclor patterns of the environmental sample with the “original” (unweathered) sample, can introduce uncertainty in the reported results. This uncertainty can lead to either under or overpredictions of Total PCBs.

The source of the PCBs at the site were PCB-containing paints. PCBs within this dried paint matrix are believed to be less subject to environmental weathering than would PCBs that are released directly to the environment as an oil (*e.g.*, from electrical equipment). Thus, measuring Total PCBs using standard Aroclor methods as was done at the YAEC site, is not believed to introduce a large source of uncertainty.

So called PCB “congener” analytical methods (*e.g.*, Method 1668A) exist that provide an alternative laboratory procedure for estimating Total PCBs. The PCB congener methods are not routinely performed. At the YAEC site, PCB congener methods were used for fish samples. A comparison of the Total PCB results for the Aroclor and congener methods provides some insight on the uncertainty introduced by quantifying PCBs using Aroclor methods. As these data shown on the figure below suggest, the Aroclor Total PCB results tend to be somewhat lower than the congener Total PCB results for fish.

It is not possible to use these results to quantify the potential uncertainty of the Aroclor Total PCB results in soil or sediment. The fish tissue results represent a different environmental matrix, subject to different environmental and biological conditions and chemical extraction methods. Qualitatively, this comparison suggests that the two methods are consistent within an approximate 2-fold range.



7.2 Risks Associated with Background

Site-specific background samples analyzed for OHM and radionuclides (Cs-137 and Sr-90) were used to calculate risks associated with background exposures for the current and future recreator, and future commercial workers. The background risks for each evaluated exposure scenario were calculated using the same COPC list, exposure parameters, and toxicity values as adopted for the baseline risk assessment. A summary of the background risks for OHM is provided in Table 7-1. Detailed risk calculations are presented in Appendix E for OHM, and Appendix F for radionuclides (summaries provided previously in Tables 6-5 through 6-9). These background risks are compared below to the site baseline risks.

Receptors	Background		Site – Related	
	Cancer Risk ¹	Hazard Index ²	Cancer Risk ¹	Hazard Index ²
Current Recreational Use	3×10^{-7}	0.02	7×10^{-7}	0.07
Future Recreational Use	2×10^{-6}	0.05	2×10^{-6}	0.2
Commercial Use (TransCanada)	5×10^{-6}	0.0008	5×10^{-7}	0.01
Commercial Use (YAEC Non BUD/TSCA)	5×10^{-6}	0.0008	2×10^{-7}	0.05
Commercial Use (YAEC BUD/TSCA areas)	5×10^{-6}	0.001	5×10^{-6}	0.2

Notes

1 – Cumulative OHM and radiological risk.

2 – OHM hazard index for child (recreational scenario) or adult (commercial scenario).

In comparing the "site-related" risks to background, the hypothetical site-related risks for all scenarios do not differ appreciably from background risks. In general, it is expected that site-related risks will be at least somewhat higher than background risks because COPCs are included in the baseline risk calculations only if their concentrations exceed those expected as background, or if the COPC is not naturally occurring and has no background component. However, there are situations where the maximum site-related COPC concentration exceeded the maximum background COPC concentration, while the average site-related COPC concentration was less than the average background COPC concentration (*e.g.* Cs-137). In this situation, the COPC is retained in the site-risk calculation as a result of the elevated maximum concentration,³⁰ but background risks are higher because they are based on the average concentration. The calculated "site-related" risks include chemicals and radionuclides that are also present in background media, although the "site-related risks do not separately account for this "background" component (*e.g.*, the risks due to background are not subtracted). Thus, the site-related risks do not represent the "incremental risk" above background, but rather a combination of site-related risks plus the risk associated with background levels of those OHM and/or radionuclide chemicals of concern that have a background component (*e.g.*, metals, Cs-137, Sr-90, *etc.*).

7.3 Exposure Assumptions

The exposure factors necessary to estimate chemical intakes are both uncertain, and variable within a given population. Conservative MADEP default exposure parameters were adopted. These exposure factors are a combination of central tendency values (*e.g.*, body weight, skin surface area), and "high end" values (*e.g.*, exposure frequency and duration, intake, *etc.*) such that the resulting exposure estimate is considered to represent a highly exposed individual..

³⁰ Inspection of the box-whisker plots (Appendix J) of additional percentiles of the data supports retaining Cs-137 as a COPC.

Default high-end incidental soil ingestion rates, routine outdoor exposure, and a 30 year exposure duration, were adopted as recommended by MADEP. Not only were high-end MADEP default exposure factors adopted, exposure scenarios were evaluated despite conditions that would render them improbable. For example, the steep and rocky shoreline and the prohibited recreational access near the dam are conditions that will inevitably limit potential recreational activities (hence potential exposure) to sediment and surface water from Sherman Reservoir in the immediate vicinity of the former YNPS. Despite these conditions limiting recreational potential, risks from soil, sediment and surface water exposure in the Sherman Reservoir were assessed as a conservative approach.

7.4 “Hot Spot” Evaluation

MADEP guidance recommends evaluating the possible presence of localized "hot spots." The MCP defines a hot spot as a discrete location with contamination concentrations that are substantially higher (10 up to 100 times higher) than concentrations in the surrounding area. Table 7-2 provides a summary of all samples results exceed 10 times the average concentration within a given study area, and Figure 7-1 is a plot of those sample locations. These results are discussed below.

- SB-540 on the TransCanada property contained fluoranthene (5,860 µg/kg) and pyrene (5,200 µg/kg) exceeding their respective mean values of 538 µg/kg and 485 µg/kg, by over 10-fold. However, both results are well below their soil S-1 values of 1,000,000 µg/kg (same for both). This single sample location, well below its S-1 soil criteria, contains other samples in the vicinity that document the lack of significant PAH impacts, and is not considered a "hot spot."
- YRDTS-051B on the TransCanada shoreline area had an Aroclor 1260 of 580 µg/kg which is 11-fold higher than the respective mean value (51.4 µg/kg) for the shoreline area. However, this one value is well below the MCP S-1 value (2,000 µg/kg) for residential settings, and is not considered a “hot spot.”
- Sample SB116 located near the hair-pin turn approximately 3,000 feet southwest of the former plant had a copper concentration (330 mg/kg) approximately 34-fold greater than the mean copper concentration for the Outside BUD/TSCA Area (9.7 mg/kg). Lead (360 mg/kg) in SB116 exceeded the Outside BUD/TSCA mean (16.3 mg/kg) by 22-fold. The copper concentration in this isolated sample is below the MCP S-1 criteria (1,000 mg/kg), so it was not evaluated further. The lead concentration in SB116 is somewhat above the S-1 criterion (300 mg/kg), but below the US EPA soil screening level (400 mg/kg). This location is not considered a significant “hot spot.”
- Sample SB116CD contained lead (171 mg/kg) and acetone (869 µg/kg) that exceeded their respective mean values for samples from Outside the BUD/TSCA by over 10-fold.

In both cases they are below their respective S-1 values (300 mg/kg for lead; 500,000 µg/kg for acetone), and this area is not considered further.

- Sample ST-Maxy-017R (211 µg/kg) and ST-Maxy-026 (437 µg/kg) from the former parking lot area have Aroclor 1248 concentrations greater than ten times the Aroclor 1248 mean concentration (19 µg/kg) for soil samples from the Outside BUD/TSCA area. These concentrations are below the MCP S-1 criteria (2,000 µg/kg), and the many surrounding samples with low PCB concentrations indicate these two samples do not represent significant "hot spots."
- Three samples collected in the general vicinity of the SCFA contained PCB concentrations that were over 10-fold greater than the Outside BUD/TSCA mean concentration (see Figure 7-1 for the sample locations). The maximum concentration (617 µg/kg Aroclor 1260) in these three samples is below the S-1 value for PCBs (2,000µg/kg). Numerous samples surrounding these sample locations confirm these values do not represent a "hot spot" of concern.
- Several samples in the former Furlon House parking area had VPH concentrations over 10-fold greater than their respective mean concentrations (see Figure 7-1). In addition, acetone and 2-butanone also exceeded their respective mean values by more than 10-fold. In each instance, the detected concentrations are well below their respective S-1 values (see Table 7-2), and were not evaluated further.

As summarized in Table 7-2, the only other areas that have individual sample locations 10-fold greater than their respective mean concentrations within a study area, are samples within the BUD/TSCA or SCFA areas on the YAEC property. The majority of these samples had PCBs above 1.0 mg/kg. These areas (which lie beneath soil cover) are restricted under the land use restrictions, and thus do not pose a current or future health risk.

As noted briefly in Section 2, a cluster of soil samples (SB-105 cluster) in the vicinity of a historic railbed running along Sherman Reservoir (see Figure 2-5). A number of these samples contained elevated concentrations of PAHs (sample results in Appendix A), chemicals routinely associated with railroad ties. When the sample cluster of SB-105 samples was collected, the elevated SVOC detections were found to be associated with pieces of railroad ties in the samples (*e.g.*, combined with soils when the samples were collected).³¹ Thus, the majority of the SB-105 samples were not representative of soil conditions, but rather the SVOCs in the buried railroad ties themselves. Samples SB105-J, SB-105-T and SB-105-U also collected in this vicinity, were considered representative of soil conditions in this area, and they did not contain unusually elevated PAH concentrations.

³¹ ERM memorandum to Ken Dow (YAEC) and David Merrill (Gradient), "Railroad bed test pit and sampling – summary of activities and recommendations," August 21, 2006.

Based on the foregoing potential "hot spot" analysis, there are no areas of the site that require further assessment for risk characterization. This analysis indicates that no further examination of the site, using possibly smaller averaging areas, is needed.

7.5 Future Uses Including ISFSI

As has been noted, the ultimate disposition (future owner) and future uses of the site are currently unknown. Land use restrictions will preclude residential development of the Restricted Use Area of the property. The risk assessment has evaluated a range of future uses to evaluate both plausible and hypothetical use scenarios.

YAEC will maintain control of the Owner Controlled Area, which is a 300-meter buffer around the ISFSI, for the foreseeable future. The License Termination Plan will continue to exist as a Yankee Licensed Document and will be maintained until the ISFSI is decommissioned (pending availability of the federal spent fuel storage facility). At that time a Final Status Survey will be performed of the ISFSI area, to satisfy the NRC and MADPH requirements. This procedure will be similar to the recently-completed "site" FSS that supports termination of YAEC's license in all areas other than the remaining ISFSI.

This "ISFSI FSS" will include surveys to confirm that the ISFSI did not introduce contamination to the environment. Because the Fuel Storage System is designed such that there is a negligible possibility of a release of radioactive material from the inner canister, it is not expected that there would be a need to perform any remediation after the ISFSI is removed. The area under the ISFSI was sampled prior to its construction, confirming no detectable radioactivity at that time. The area below the ISFSI will not necessarily be resurveyed during the ISFSI FSS unless contamination has been detected coming at some point in the future from the ISFSI.

The ISFSI and Owner Controlled Area will be guarded 7 days a week, 24 hours a day. The spent fuel materials stored in the ISFSI emits some radiation above local background levels. YAEC has measured the levels of radiation emitted from the ISFSI, at points surrounding the ISFSI fence line, as well as at locations both on- and off-site. These monitoring data are summarized in the NRC required "Annual Radiological Environmental Operating Report (AREOR)," dated March 14, 2007 (YAEC, 2007). The data in the 2007 AREOR report show that the radiation emitted from the ISFSI (~200 to 300 $\mu\text{rem/hr}$ within 10 - 20 meters from ISFSI) drops to background (~5 to 7 $\mu\text{rem/hr}$) within approximately 100 to

200 meters from the ISFSI. At the Sherman Reservoir shoreline, which is approximately 250 meters from the ISFSI at the East Storm Drain embayment, the radiation monitoring results in the AREOR indicate no elevation above background.

7.6 Toxicity Criteria

Another source of uncertainty is the toxicological information used in the risk characterization. The development of toxicity factors (*e.g.*, RfDs and RfCs) often involves extrapolation of results from animal studies to predict potential adverse health effects and the dose at which they occur in humans. Animal studies usually involve very high doses of chemicals, while human exposures to chemicals in the environment are typically much lower. Animal studies also usually involve a homogeneous population, a very consistent exposure regimen, and a distinct period of exposure, while humans have a wide range of sensitivities and potential exposures. In addition, there may be important differences in chemical uptake, metabolism, and distribution of chemicals in the body between animal species and humans. Each of these variables contributes uncertainty to the predicted adverse health effects in humans. Overall, US EPA and MADEP use conservative assumptions in developing toxicity factors; therefore, these factors most likely overestimate rather than underestimate potential health risks. For example, benzo(a)pyrene, while clearly a genotoxic carcinogen (*i.e.*, causes changes in DNA), has a very non-linear dose-response relationship for carcinogenicity. That is, benzo(a)pyrene is relatively more potent at high doses, such as those administered for toxicity testing, than at low doses, such as those experienced from environmental exposures. Nonetheless, the dose-response models assume linearity at low doses as a health-protective assumption.

8 Risk to Public Welfare and Safety

8.1 Risk to Public Welfare

The MCP specifies that the risk to public welfare should be evaluated by considering whether nuisance conditions that might affect public welfare exist at the site. The risk assessment evaluated the possible human health risks relating to residual constituents and radionuclides in environmental media. In addition, the MCP requires a determination of whether average constituent concentrations exceed Upper Concentration Limits (UCLs) prescribed in 310 CMR 40.0996. A comparison of site-wide soil and groundwater EPCs to their applicable UCLs is presented in Tables 8-1 and 8-2, respectively. This comparison demonstrates that all of the soil and groundwater EPCs are below their respective Method 3 UCLs. Therefore, per the MCP, site conditions pose "No Significant Risk" to public welfare.

8.2 Risk to Safety

The purpose of evaluating the risk to safety is to identify any post-closure conditions at the site that may result in a release of hazardous material in the foreseeable future that would pose a threat of physical harm or bodily injury to people. Examples of such conditions include the presence of rusted or corroded drums, weakened berms, threat of fire or explosion, reactive chemicals, unsecured pits, lagoons, ponds, or other dangerous structures, or any uncontained materials which may exhibit the characteristics of corrosivity, reactivity, flammability, or are considered to be infectious materials. Because YNPS is being completely dismantled and the site restored, no such conditions or nuisances will exist. Therefore, it can be concluded that the site poses "No Significant Risk" to safety.

The presence of the ISFSI on the site does not present a safety risk as the ISFSI will be guarded 7 days a week, 24 hours per day. Furthermore, radiation from the ISFSI drops to background levels within 100 to 200 meters of the ISFSI. Safety issues relating to the operation of Sherman Dam (activities within the vicinity of the dam and intake structure, maintenance of flood control requirements, *etc.*) are regulated under the FERC license that addresses public safety.

9 Environmental Risk Characterization

The object of the Environmental Characterization is to establish whether there are any current conditions in the vicinity of the site that may pose a significant risk of harm to the environment. The Environmental Characterization (or Ecological Risk Assessment) consisted of two steps – A Stage I Screening Level ERA and a Stage II Baseline ERA (BERA).

The Environmental Characterization is presented in Appendix I, with a summary of the approach and findings provided in this section.

9.1 Stage I Screening Level Ecological Risk Assessment

A Stage I screening evaluation was performed to identify whether a Stage II assessment would be necessary. For OHM constituents, the median and maximum chemical concentrations in soil, sediment, surface water, and fish were compared to background concentrations of each media. OHM constituents detected in more than 5% of the samples and with concentrations above background levels were selected as COPCs. For OHM constituents, the COPCs included inorganics, semi-volatile organic compounds, volatile organic compounds, PCBs, and petroleum hydrocarbons. Note that while OHM constituents were compared to media toxicity-based "sediment benchmarks," COPCs were not excluded from the Stage II detailed analysis on the basis of this screening step.

For radionuclides, the US DOE Biota Dose Assessment Committee (BDAC) "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (US DOE, 2002) approach was adopted. The first step of the graded approach involves a comparison of the maximum detected concentration for each radionuclide COPC in surface soil and sediment to the radionuclide-specific biota concentration guidelines (BCG). If the maximum concentration of all radionuclides falls below their respective BCGs, there is no need for a site-specific ecological analysis (or "Stage II"). Maximum detected concentrations of radionuclides were in all cases less than their BCG values, and no Stage II evaluation was required for radionuclides.

Only OHM constituents were evaluated in the Stage II BERA. The goal of the BERA is to provide a detailed assessment of the potential of COPCs to result in adverse effects to the ecology of the site. Ecological receptors of concern were selected for assessment based on potential for exposure to

COPCs at the site, the likelihood of their occurrence in habitat areas on the site, their potential sensitivity to COPCs, and to cover a range of ecological function groups.

9.2 Stage II Baseline Ecological Risk Assessment

The first step of a Stage II BERA is the Problem Formulation. The outcome of this step is the selection of assessment endpoints (*e.g.*, endpoints that address biological stress or potential harm) that are subsequently quantified in the risk characterization through specific measurement endpoints (*e.g.*, specific quantitative measures that relate chemical concentration or intake to possible biological harm). An ecological assessment/natural resource inventory of local ecological habitats and communities was conducted to frame the assessment.³²

The Problem Formulation step includes the following components:

- Identification the fate and transport characteristics of COPCs;
- Identification of exposure pathways and receptors of concern; and
- Definition and selection of ecological assessment and measurement endpoints.

Using information developed from these components of the analysis, a conceptual site model (CSM) was developed to guide the site-specific environmental assessments. The CSM represents pathways by which constituents move through the environment to potential exposure points and through the food web to higher trophic level consumers. In addition to providing a basis for identifying key receptors, the conceptual model also provides a reference point for selecting measurement methods that can be used to evaluate the effects of possible concern.

9.2.1 Ecological Habitats and Communities

The ecological risk assessment evaluated risks to receptors from exposure to the Combined Study Areas, which encompass the terrestrial (approximately 80 acres) and aquatic habitats (approximately 20 acres) along the Deerfield River and Sherman Reservoir as described in Appendix I. It should be noted that the ecological assessment included the BUD and SCFA areas as though no soil cover existed in these areas, whereas the soil cover would provide a natural exposure barrier in these areas.

³² YAEC conducted a site-specific natural resource inventory (Woodlot, 2004).

The environmental risk assessment did not include the entire 1,800 acres of the property because the sampling efforts were focused on areas in the vicinity of the former plant operations. Furthermore, as discussed previously in Section 2, the other outlying areas of the YAEC property were not assessed based on the findings of the ASTM Phase I inspection. In addition, site-related OHM and radionuclides were not found at elevated concentrations in the Deerfield River downstream of the site, so no detailed analysis of those locations was required.

9.2.2 Ecological Receptors

Ecological receptors were chosen based species either found at the site, or typical of the site habitats, as well as foraging ranges (some small, some large), and also a mix of herbivorous and carnivorous representative species. The list of species selected for evaluation in the BERA can be grouped by the following receptor categories (refer to Appendix I for details).

- Benthic macroinvertebrates
- Freshwater fish
- Amphibian species
- Higher trophic level mammals and birds
- Terrestrial plant and soil invertebrates

9.2.3 Measurement Endpoints

Three types of measurement endpoints were used in this environmental risk characterization to assess chemical risks: benchmark approach, toxicity quotient method, and tissue residue analysis. The benchmark approach involves comparing water, sediment, or tissue concentrations with respective benchmarks identified in the literature. These benchmarks are protective of specific receptors (*i.e.*, terrestrial plants, fish, amphibians, soil invertebrates) exposed to environmental media. The toxicity quotient method characterizes risk by using food web models to calculate the ratio of the modeled COPC intake from the site exposure to toxicity reference values obtained from the literature. Tissue residue analysis, which is often the method used to evaluate risk for fish species, involves analyzing fish samples to determine whether the contaminants of concern have accumulated in the organism. Fish were collected and analyzed for PCBs because of its bioaccumulation potential and the historic releases at the site. This measure of exposure is then combined with available data on toxic effects, in order to assess the potential

for ecological risk associated with the degree of bioaccumulation or exposure (MADEP, 1996). A summary of the types of measurement endpoints used in the environmental risk characterization is given below.

Assessment Endpoint (Receptor Group)	Measurement Endpoint
Benthic Invertebrates	Compare COPC concentrations in the sediment of Sherman Reservoir, Deerfield River, and Wheeler Brook to sediment benchmarks in MacDonald <i>et al.</i> (2000).
Fish	Compare COPC body burden concentrations of collected fish tissues to toxicity reference values relating effects to tissue-based concentrations (Jarvinen and Ankley, 1999).
Mammals and Birds	Estimate COPC uptake from environmental media and food. Compare COPC uptake to representative toxicity reference values.
Amphibians	Compare surface water quality data for COPCs to toxicity reference values (where available) for amphibian survival (US EPA, 1996).
Terrestrial Plants and Soil Invertebrates	Compare COPC concentrations in soil of terrestrial habitats present at the site to ecological benchmarks present in Efrogmson <i>et al.</i> (1997a,b).

Appendix I contains the ecological toxicity reference values and other reference benchmarks used in the assessment.

9.3 Results and Conclusions

Based on the Stage I screening for radionuclides, the maximum concentrations of radionuclides in sediment and soil were well below their screening values, and no further detailed evaluation was required.

The results of the ecological risk characterization for OHM are presented in terms of chemical Hazard Quotients and Hazard Indices for receptor species, which represent the calculated chemical intake or exposure relative to an acceptable intake, denoted as a Toxicity Reference Value (TRV). TRV values were selected from published literature based on "No Observable Adverse Effects Levels" (NOAELs) and "Lowest Observable Adverse Effects Levels" (LOAELs). A summary of the calculated Hazard Indices is provided below.

Summary of Environmental Risk Characterization				
Receptor	Hazard Index – Site		Hazard Index -- Background	
	NOAEL	LOAEL	NOAEL	LOAEL
Birds				
robin	7	<1	4	<1
king fisher	<1	<1	<1	<1
Bald eagle	<1	<1	<1	<1
Mammals				
shrew	3	1	1	<1
cottontail	1	1	<1	<1
raccoon	<1	<1	<1	<1
fox	<1	<1	<1	<1

None of the LOAEL-based Hazard Indices for ecological receptors exposed *via* the food web exceed 1.0, the Agency benchmark commonly used to evaluate the potential for adverse ecological impact. The NOAEL-based Hazard Indices are above one (1) for the robin and shrew, but in all cases below 10. In addition, the background HI for the robin similarly exceeds one (1) based on exposure to background concentrations of COPCs. Based on these results, there is no indication of potential significant ecological risk involving the food web at the site.

In addition to the food web analysis, COPCs were compared to published ecological benchmarks. The ratio of chemical concentrations in sediment, soil, and surface water relative to benchmarks was expressed as a "Benchmark Quotient." Benchmark Quotients less than one (<1) indicate no ecological concerns are expected; quotients above one do not necessarily imply significant risk, but instead indicate that possible risks cannot be ruled out without further lines of evidence. Although Benchmark Quotients for several metal COPCs at the site exceed benchmarks for benthic macroinvertebrates (summarized below), this is not necessarily an indication of overt adverse risk. For example, organisms can exist in areas with naturally high background metal concentrations by means of modified physiology that results in the acclimation of exposed individuals or even through genetic modification of the population that results in adaptation and increased tolerance. Benchmark values based on laboratory toxicity tests conducted with organisms acclimated to low standard metal concentrations would not represent conditions at sites with naturally high background metal concentrations (US EPA, 2004). Thus, there is

little, if any environmental significance that can be associated with the isolated samples that exceed sediment benchmarks at the site.

Summary of Benchmark Quotients				
	Site		Background	
	Mean ^[a]	Max ^[a]	Mean	Max
Benthic Macroinvertebrates				
mercury	<1	11.7 (TEC) 2.0 (PEC)	<1	1.1
PCBs	7.9 (TEC) <1 (PEC)	56.9 (TEC) 5.0 (PEC)	<1	<1
PAHs ^[b]	18.4 (TEC) 1.2 (PEC)	151 (TEC) 11.1 (PEC)	<1	<1
Soil invertebrates	<1	2.6 (zinc)	<1	<1
Plants	3.2 (selenium)	13 (selenium)	1.6 (selenium)	2.6 (selenium)
	1.3 (zinc)	10.4 (zinc)	1.1 (zinc)	1.5 (zinc)
Amphibians	--	<1	--	<1

[a] Site mean and maximum benchmark quotients are the largest values in any of the study areas.

[b] TEC-based benchmark ratios skewed by single sample (SD-303) in the West Storm Ditch.

Mercury exceeds its benthic benchmark (TEC) on average by 2.6-fold in Sherman Reservoir sediments in the cooling water discharge area, however the average mercury concentration (0.47 mg/kg) is below the PEC benchmark (1.06 mg/kg). Given its small area, proximity to the Sherman intake structure, the lack of food web impacts for mercury, and the fact that mercury is on average below its PEC benchmark, this exceedance of the TEC on average in the Cooling Water Discharge area is not considered an indication of potentially significant adverse environmental impacts.

The Aroclor 1254 benchmark quotient for Sherman sediments in the ESD embayment is on average 4.7, with a maximum quotient of 56.9 (TEC basis). The average Aroclor 1254 concentration is below the PEC benchmark in all of the Sherman Reservoir study areas. Furthermore, the fact that PCBs in fish from Sherman Reservoir were no different than PCBs in fish from the Harriman Reservoir, and the lack of any calculated food web impact due to PCBs, provide further evidence that PCB bioaccumulation (e.g., sediments, to macroinvertebrates, to higher order organisms) is not a significant concern at the site.

As discussed earlier, several PAHs exceed their TEC-based sediment benchmarks on average, but the majority are below their respective PEC benchmarks, and none of the PAHs exceed their respective PEC benchmarks on average in any study areas.

With the exception of the isolated measurements of several COPCs that exceed sediment or soil benchmarks, the results of the ecological assessment indicate the site-related impacts, if any, are not significantly different from background. Based on these results, the site-related residual constituents do not contribute to a significant risk of harm to the environment.

10 Conclusions and Findings

The information presented in this report documents the Method 3 Risk Characterization for the YNPS Site. The risk characterization was conducted in accordance with the requirements set forth in 310 CMR 40.0900 of the MCP. The Method 3 approach was used to characterize the potential risk of harm to human health, the environment, public welfare and safety based on current and foreseeable future uses of the site.

Using MADEP-recommended default exposure assumptions for risk characterization for OHM, and US EPA exposure factors for radionuclide risk characterization, the potential health risks were calculated for plausible current and future use recreational exposure scenarios, in addition to several hypothetical commercial use scenarios.

According to the 310 CMR 40.0993 of the MCP, the results of a Method 3 Risk Characterization support a finding of "No Significant Risk to Human Health" if:

- No exposure point concentration of OHM is greater than an applicable or suitably analogous public health standard;
- No cumulative cancer risk exceeds the MADEP acceptable limit (10^{-5}); and
- No cumulative non-cancer risk (*e.g.*, Hazard Index) exceeds the MADEP acceptable limit (*e.g.*, $HI \leq 1$).

As described in this report, the cumulative potential cancer risk estimates and the cumulative non-cancer Hazard Indices both meet the above Agency guidelines. Because arsenic, acetone, and tritium exceed drinking public health standards for drinking water on the YAEC property, by regulatory definition this poses a condition of "Significant Risk to Human Health" according to the MCP. This condition applies only to groundwater in several monitoring wells within the C&A Fill BUD area. Groundwater from this locally impacted area is not currently used as a source of drinking water, nor is it expected to be used in the future. Furthermore, restrictions imposed by the BUD precluded installation of drinking water wells within the C&A Fill area. Nevertheless, as a Potential Drinking Water Source Area, the potential exists for groundwater to be used as a source of drinking water in the future (from wells installed outside the C&A Fill BUD area), resulting in possible future exposure and potential risk. Thus, the condition of "Significant Risk to Human Health" is not based on current use of groundwater, and only applies to future hypothetical uses. Continued natural attenuation, and risk management controls such as groundwater

monitoring and the prohibition on the installation of drinking water wells within the C&A Fill BUD area, will mitigate this condition.

The results of the risk characterization indicate that cumulative cancer risks for the current and foreseeable uses of the site (open land/recreation), are below the MADEP 10^{-5} risk threshold, and cumulative HI values are also below one ($HI < 1$). The same conclusion holds for hypothetical future commercial uses of the YAEC property both inside and outside the BUD/TSCA restricted areas. These results support the finding of "No Substantial Hazard" to human health as defined in 310 CMR 40.0956 of the MCP. No Activity Use Limitations under the MCP are needed on the YAEC property other than the restriction precluding residential development to be placed on the Restricted Use Area, and the restrictions imposed by the BUD and the TSCA deed restriction.

Neither OHM nor radionuclides exceed public health standards on the TransCanada property. Similarly, cumulative human health risks for recreation and hypothetical commercial uses are below 10^{-5} and no Hazard Index is above one (*e.g.*, $HI < 1$) on the TransCanada property. These results support a finding of No Significant Risk to Human Health on the TransCanada property according to the MCP. No Activity Use Limitations under the MCP are needed on the TransCanada property, other than the current deed restriction precluding residential development.

The results of the Method 3 Environmental Risk Characterization found no evidence of biologically significant harm, no indication of the potential for biologically significant harm, and no concentrations of OHM above applicable or suitably analogous standards in Sherman Reservoir or the Deerfield River. These results support the finding of No Significant Risk of Harm to the Environment according to 310 CMR 40.0995 of the MCP.

11 References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. "Toxicological Profile for Lead (Update)." NTIS PB99-166704, July.

Argonne National Laboratory (ANL). 2001. "User's Manual for RESRAD Version 6." Prepared for US Department of Energy (US DOE). July.

Ayotte, JD; Nolan, BT; Nuckols, JR; Cantor, KP; Robinson, GR; Baris, D; Hayes, L; Karagas, M; Bress, W; Silverman, DT; Lubin, JH. 2006. "Modeling the probability of arsenic in groundwater in New England as a tool for exposure assessment." *Environ. Sci. Technol.* 40(11):3578-3585.

Centers for Disease Control (CDC). 1991. "Preventing Lead Poisoning in Young Children. A Statement by the Centers of Disease Control - October." US Dept. of Health and Human Services, Public Health Service, October.

Cumming, E. 1998. "Review of YNPS REMP Reports for FSS Non-Impacted Area Classification." Memo to File, File RP 98-62. June 16.

Efroymsen, R; Will, M; Suter, G. 1997a. "Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision." Oak Ridge National Laboratory, ES/ER/TM-126/R2.

Efroymsen, R; Will, M; Suter, G; Wooten, A. 1997b. "Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision." Oak Ridge National Laboratory, ES/ER/TM-95/R4.

Environmental Resources Management (ERM). 2003. "Final Groundwater Field Sampling Plan, Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." Report to Yankee Atomic Electric Co.

Environmental Resources Management (ERM). 2004a. "Baseline Environmental Report: Yankee Nuclear Power Station Site Closure Project Rowe, Massachusetts." April 30.

Environmental Resources Management (ERM). 2004b. "TSCA Risk-Based Disposal Approval Application, Yankee Nuclear Power Station Site Closure Project, Rowe, Massachusetts." Report to Yankee Atomic Electric Co, submitted to US EPA Region I, Boston, MA, June 30.

Environmental Resources Management (ERM). 2005. "Phase II Comprehensive Site Assessment Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." RTN 1-13411, January 28.

Environmental Resources Management (ERM). 2006a. "Phase I Environmental Site Assessment. Rowe and Monroe Parcels. Yankee Nuclear Power Station Site Closure Project, Rowe, Massachusetts." February 22.

Environmental Resources Management (ERM). 2006b. "TSCA Sediment Final Report, Yankee Nuclear Power Station, Site Closure Project, Rowe, Massachusetts." Report to Yankee Atomic Electric Co.

Environmental Resources Management (ERM). 2006c. "Supplemental Phase II Comprehensive Site Assessment Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." RTN 1-13411, September 21.

Environmental Resources Management (ERM). 2006d. "TSCA Sediment Final Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts."

Environmental Resources Management (ERM). 2007a. "Addendum to the Phase II Comprehensive Site Assessment Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." February 6.

Environmental Resources Management (ERM). 2007b. "TSCA Soil Final Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts."

Environmental Resources Management (ERM). 2007c. "Phase IV Final Inspection Report. Yankee Nuclear Power Station, 49 Yankee Road, Rowe, Massachusetts." March 16.

Feldman, W; Randel, P. 1994. "Screening children for lead exposure in Canada." In *Canadian Guide to Clinical Preventive Health Care*. (Health Canada, Canadian Task Force on Preventive Health Care). Accessed at http://www.hc-sc.gc.ca/hppb/healthcare/pdf/clinical_preventive/s2c25e.pdf.

Gradient Corporation (Gradient). 2003. "Quality Assurance Project Plan, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts, QAPP YNPS-001 (Volumes 1 and 2)." Revision 1, September 29.

Gradient Corporation (Gradient). 2004a. "Quality Assurance Project Plan, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts. QAPP YNPS-001 (Volumes 1 and 2)." Revision 2, August 6.

Gradient Corporation (Gradient). 2004b. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts. Groundwater Sampling." September 8.

Gradient Corporation (Gradient). 2004c. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts. 2003 Sampling Event." September 8.

Gradient Corporation (Gradient). 2004d. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts, May 2004 Groundwater Sampling." December 22.

Gradient Corporation (Gradient). 2005a. "Quality Assurance Project Plan Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts." December 20.

Gradient Corporation (Gradient). 2005b. "Quality Assurance Project Plan, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts. QAPP YNPS-001. Volumes 1 and 2." Revision 3, December 20.

Gradient Corporation (Gradient). 2005c. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts, June-July 2004 Sediment Sampling." February 2.

Gradient Corporation (Gradient). 2005d. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts, August and November 2004 Groundwater Sampling." March 21.

Gradient Corporation (Gradient). 2005e. "Data Usability Report, Site Closure, Yankee Nuclear Power Station, Rowe, Massachusetts. 2004/2005 Soil; 2004/2005 Sediment; March 2005 Groundwater." October 14.

Gradient Corporation (Gradient). 2006a. "Draft Human Health Risk Assessment Work Plan, Yankee Nuclear Power Station, Rowe, Massachusetts."

Gradient Corporation (Gradient). 2006b. "Draft Massachusetts Contingency Plan Method 3 Ecological Risk Characterization Work Plan, Yankee Nuclear Power Station, Rowe, Massachusetts."

Hilts, SR; Bock, SE; Oke, TL; Yates, CL; Copes, RA. 1998. "Effect of interventions on children's blood lead levels." *Environ. Health Perspect.* 106(2):79-83.

Jarvinen, AW; Ankley, GT. 1999. *Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals*. SETAC Press, Pensacola, FL, 364p.

MacDonald, DD; Ingersoll, CG; Berge, TA. 2000. "Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems." *Arch. Environ. Contam. Toxicol.* 39:20-31.

Massachusetts Dept. of Environmental Protection (MADEP). 1992. "Documentation for the Risk Assessment ShortForm Residential Scenario." Accessed on September 04, 2005 at <http://www.mass.gov/dep/service/compliance/riskasmt.htm>.

Massachusetts Dept. of Environmental Protection (MADEP). 1994. "Background Documentation for the Development of the MCP Numerical Standards." Bureau of Waste Site Cleanup and Office of Research and Standards.

Massachusetts Dept. of Environmental Protection (MADEP). 1995a. "Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan (Interim Final Policy)." Bureau of Waste Site Cleanup and Office of Research and Standards, BWSC/ORS-95-141, July.

Massachusetts Dept. of Environmental Protection (MADEP). 1995b. "Massachusetts Allowable Threshold Concentrations (ATCs)." DEP Office of Research and Standards, December.

Massachusetts Dept. of Environmental Protection (MADEP). 1996. "MCP Environmental Risk Characterization Guidelines." WSC/ORS-95-141, April.

Massachusetts Dept. of Environmental Protection (MADEP). 2002a. "Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of MADEP VPH/EPH Approach." Final Policy WSC-02-411, October.

Massachusetts Dept. of Environmental Protection (MADEP). 2002b. "Technical Update: Calculation of an Enhanced Soil Ingestion Rate." Bureau of Waste Site Cleanup and Office of Research and Standards, April.

Massachusetts Dept. of Environmental Protection (MADEP). 2002c. "Technical Update: Weighted Skin-Soil Adherence Factors." Bureau of Waste Site Cleanup and Office of Research and Standards, April.

Massachusetts Dept. of Environmental Protection (MADEP). 2002d. "Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil." Bureau of Waste Site Cleanup and Office of Research and Standards, May.

Massachusetts Dept. of Environmental Protection (MADEP). 2004a. "Draft Interim Guidance Document for Beneficial Use Determination Regulations, 310CMR19.060." Bureau of Waste Prevention, March 18.

Massachusetts Dept. of Environmental Protection (MADEP). 2004b. "The Compendium of Quality Assurance and Quality Control Requirements and Performance Standards for Selected Analytical Methods Used in Support of Response Actions for the Massachusetts Contingency Plan (MCP). WSC-02-320." Bureau of Waste Site Cleanup, May 21.

Massachusetts Dept. of Environmental Protection (MADEP). 2004c. "Revisions to Dose-Response Values used in Human Health Risk Assessment." DEP Office of Research and Standards. Accessed at <http://www.mass.gov/dep/cleanup/sformdoc.pdf>.

Massachusetts Department of Environmental Protection (MADEP). 2006a. Massachusetts Contingency Plan. MCP 310 CMR 40.0006

Massachusetts Dept. of Environmental Protection (MADEP). 2006b. "Spreadsheets Detailing the Development of the MCP Numerical Standards. MCP Toxicity workbook. January 12, 2006." Accessed at <http://www.mass.gov/dep/cleanup/laws/pubnot04.htm>.

Robinson, GR; Ayotte, JD. 2006. "The influence of geology and land use on arsenic in stream sediments and ground waters in New England, USA." *Applied Geochemistry* 21:1482-1497.

Stratex. 2006. "Addendum to ERM Phase I Site Assessment of YNPS." May 25.

US Dept. of Energy (US DOE). 2002. "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota. Module I: Principles and Application. Module 2: Detailed Guidance. Module 3: Methods Derivation." DOE-STD-1153-2002, July

US EPA. 1986. "Test Methods for Evaluating Solid Waste: Laboratory Manual, Physical/Chemical Methods, Volumes 1A, 1B and 1C [SW-846]." Office of Solid Waste, Washington, DC, EPA SW-846, November.

US EPA. 1989. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part A)." Office of Emergency and Remedial Response, Washington, DC, NTIS PB90-155581, EPA-540/1-89-002, December.

US EPA. 1991. "Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part B)". EPA/540/R-92/003.

US EPA. 1993. "Provisional Guidance for Quantitative Risk Assessment for Polycyclic Aromatic Hydrocarbons." Office of Research and Development, EPA/600/R-93/C89, July.

US EPA. 1994. "Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children." Prepared for US EPA, Office of Emergency and Remedial Response, Technical Review Workgroup for Lead, Research Triangle Park, NC, OERR Publication 9285.7-15-1, EPA 540-R-93-081, NTIS PB93-963510, February.

US EPA. 1996. "Amphibian Toxicity Data for Water Quality Criteria Chemicals." Report to US EPA, Office of Research and Development, Corvallis, OR, National Technical Information Service (NTIS), Springfield, VA, NTIS PB97-109458, EPA/600/R-96/124, 215p., August.

US EPA. 1997. "Health Effects Assessment Summary Tables." FY-1995 Annual. Office of Solid Waste and Emergency Response, Washington, DC, EPA/540/R-95/036, PB95-921199, May.

US EPA. 2000. "Soil Screening Guidance for Radionuclides: Technical Background Document." Office of Radiation and Indoor Air, Office of Solid Waste and Emergency Response, Washington, DC, EPA/540-R-00-006.

US EPA. 2001a. "Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part EE, Supplemental Guidance for Dermal Risk Assessment)." Interim, Office of Emergency and Remedial Response, Washington DC, EPA/540/R/99/005.

US EPA. 2001b. "40 CFR Part 745: Lead; Identification of Dangerous Levels of Lead (Final Rule.)" *Fed. Reg.* 66:1205-1240. January 5.

US EPA. 2002a. "National Recommended Water Quality Criteria: 2002." Office of Water, EPA-822-R-02-047.

US EPA. 2002b. "User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Windows Version." Prepared by Syracuse Research Corp., North Syracuse, NY, for US EPA, Technical Review Workgroup for Lead, Office of Emergency and Remedial Response, EPA 9285.7-42, EPA 540-K-01-005, 44p., May.

US EPA. 2004. "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment Interim" Office of Emergency and Remedial Response, EPA/540/R/99/005.

US EPA. 2006. "Integrated Risk Information System (IRIS) Online database." Office of Health and Environmental Assessment, Cincinnati, OH.

US EPA, Region I. 1988a. "Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses." June.

US EPA, Region I. 1988b. "Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses."

US EPA, Region I. 1993. "Region I Tiered Organic and Inorganic Data Validation Guidelines." July 1.

US EPA, Region I. 1996. "Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses." Accessed at <http://www.epa.gov/region01/oeme/index.html>, July.

US EPA, Region I. 2004. "Pesticide/PCB Data Validation Functional Guidelines." Accessed at <http://www.epa.gov/region01/oeme/index.html>, February.

US EPA, Region IX. 2004. "EPA Region 9 Preliminary Remediation Goals." Accessed at <http://www.epa.gov/region9/waste/sfund/prg/index.html>

Woodlot Alternatives, Inc. (Woodlot). 2004. "Natural Resources Inventory and Management Plan, Yankee Rowe Nuclear Power Station, Rowe and Monroe, Massachusetts." Report to Yankee Rowe Nuclear Power Station, Rowe, MA, April.

Yankee Atomic Electric Company (YAEC). 2002. "Annual Radiological Environmental Operating Report (AREOR), Yankee Rowe Station Radiological Environmental Monitoring Program, January 1, 2002 – December 31, 2002."

Yankee Atomic Electric Company (YAEC). 2003a. "Yankee Nuclear Plant Site License Termination Plan." Revision 0, November.

Yankee Atomic Electric Company (YAEC). 2003b. "Radionuclide Selection for DCGL Determination." YA-REPT-00-001-03.

Yankee Atomic Electric Company (YAEC). 2006a. "Annual Radiological Environmental Operating Report (AREOR), Yankee Nuclear Power Station, Radiological Environmental Monitoring Program. January 1, 2006 – December 31, 2006."

Yankee Atomic Electric Company (YAEC). 2006b. "Ground Water Level Measurement and Sample Collection in Observation Wells." YNPS Procedure DP-9745.

Yankee Atomic Electric Company (YAEC). 2007. "Annual Radiological Environmental Operating Report (AREOR)." March 14.