

**Table 12a**  
**Summary of Surface Water SVOC Analytical Results**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter	Sample I.D. Date Sampled Comments	T-2-8 9-May-00 Grab high flow	T-3-7 1-Nov-99 Grab low flow	T-3-7 9-May-00 Grab high flow	T-5-6 1-Nov-99 Grab low flow	T-5-7 9-May-00 Grab high flow	T-12-4 9-May-00 Grab high flow	T-14-6 9-May-00 Grab high flow
	<b>Organics</b>							
<i>Semi-Volatile Organic Compounds (sVOCs)(µg/l)</i>								
Acenaphthene		-	0.10	0.027	0.013	-	-	-
Fluoranthene		0.040	0.74	1.2	0.18	0.070	0.010 J	0.009 J
Naphthalene		0.035	0.008 J	0.022	0.006 J	0.051	0.071	0.044
Benzo(a)anthracene		0.009 J	0.22	0.23	0.065	0.014	-	-
Benzo(a)pyrene		0.013	0.29	0.37	0.057	0.020	-	-
Benzo(b)fluoranthene		0.021	0.46	0.56	0.097	0.031	-	-
Benzo(k)fluoranthene		0.015	0.17	0.39	0.036	0.025	-	-
Chrysene		0.019	0.35	0.49	0.071	0.028	-	-
Acenaphthylene		-	0.015	0.010 J	0.006 J	-	-	-
Anthracene		-	0.064	0.034	0.023	-	-	-
Benzo(g,h,i)perylene		0.015	0.27	0.36	0.054	0.021	-	-
Fluorene		-	0.030	0.029	0.010 J	-	-	-
Phenanthrene		0.021	0.32	0.66	0.077	0.039 J	0.008 J	0.008 J
Dibenzo(a,h)anthracene		-	0.043	0.042	0.009 J	-	-	-
Indeno(1,2,3-cd)pyrene		0.013	0.30	0.37	0.061	0.020	-	-
Pyrene		0.029	0.48	0.84	0.11	0.049	0.006 J	0.006 J
2-Methylnaphthalene		-	0.005 J	0.007 J	0.003 J	0.006 J	0.006 J	-
bis(2-ethylhexyl)phthalate		NA	NA	NA	NA	NA	NA	NA
bis(2-ethylhexyl)adipate		NA	NA	NA	NA	NA	NA	NA
<b>Total PCBs (µg/l)</b>		<i>0.011</i>	<i>0.043</i>	<i>0.008</i>	<i>0.016</i>	<i>0.004</i>	<i>NA</i>	<i>NA</i>

**Notes:**

- = Analytical result below the method detection limit.

J = Estimated Value.

NA = Not Analyzed.

µg/l = microgram per liter (parts per billion (ppb)).

**Table 12b**  
**Summary of Surface Water Metals Analytical Results**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter	Sample I.D. Date Sampled Comments	SW-1 March-90 Downstream River	SW-2 March-90 Upstream River	SW-2D March-90 Upstream DUP	SW-3 March-90 Outfall	SW-4 March-90 Wetland	SW-5 March-90 Facility Supply	OF-01 26-Oct-00 Grab low flow
<b>Inorganics</b>								
<i>Total Metals (µg/l)</i>								
Copper		<20	<20	<20	130	<20	2560	NA
Zinc		<10	<10	<10	60	10	70	
<i>Hexavalent Chromium (µg/l)</i>								
		NA	NA	NA	NA	NA	NA	-
<i>Dissolved Metals (µg/l)</i>								
Aluminum								310
Antimony								-
Arsenic								0.71
Barium								82
Beryllium								-
Cadmium								0.56
Calcium								53,000
Chromium								-
Cobalt								1.5
Copper								90
Iron								200
Lead								1.8
Magnesium								11,000
Manganese								110
Mercury								-
Nickel								18.0
Potassium								69,000
Selenium								-
Silver								-
Thallium								-
Tin								-
Vanadium								-
Zinc								360

**Notes:**  
- = Analytical result below the method detection limit.  
NA = Not Analyzed  
µg/l=microgram per liter (parts per billion (ppb))

**Table 12b**  
**Summary of Surface Water Metals Analytical Results**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter	Sample I.D. Date Sampled Comments	T-2-6	T-2-6	T-2-8	T-3-6	T-3-7	T-3-7	T-5-4	T-5-6
		1-Nov-99 Grab low flow	26-Oct-00 Grab low flow	9-May-00 Grab high flow	26-Oct-00 Grab low flow	1-Nov-99 Grab low flow	9-May-00 Grab high flow	26-Oct-00 Grab low flow	1-Nov-99 Grab low flow
<b>Inorganics</b>									
<i>Total Metals (µg/l)</i>		NA	NA	NA	NA	NA	NA	NA	NA
Copper									
Zinc									
<i>Hexavalent Chromium (µg/l)</i>		-	-	-	-	-	-	-	-
<i>Dissolved Metals (µg/l)</i>									
Aluminum		11.7	210	-	130	10.0	-	-	43.2
Antimony		0.62	-	0.39	-	1.7	0.64	-	0.55
Arsenic		3.2	0.72	1.7	0.77	2.0	1.0	2.9	20.5
Barium		21.9	76	30	74	28.7	24.4	29	24.9
Beryllium		-	-	0.22	-	0.06	0.25	-	0.029
Cadmium		0.56	0.56	0.19	0.54	0.85	0.16	3.7	4.0
Calcium		28,300	52,000	16,800	52,000	27,300	14,600	41,000	28,600
Chromium		2.9	-	4.8	-	1.6	2.5	15	5.4
Cobalt		1.7	1.3	0.52	1.2	2.3	0.28	4.0	5.9
Copper		61.2	80	68.2	72	47.5	50.0	310	112
Iron		196	190	385	170	90.1	226	600	1,410
Lead		1.4	1.6	0.68	1.3	3.1	1.0	-	2.6
Magnesium		5,900	11,000	3,090	10,000	5,520	3,080	6,500	5,070
Manganese		298	110	207	110	206	114	1,100	1,100
Mercury		-	-	-	-	-	-	-	-
Nickel		11.7	16.0	2.8	16.0	11.2	2.1	13.0	19.6
Potassium		29,900	67,000	2,440	67,000	36,000	2,340	3,000	10,600
Selenium		0.24	-	-	-	0.56	-	-	0.22
Silver		0.077	0.75	0.17	-	0.3	0.13	-	0.52
Thallium		-	-	-	-	0.07	-	-	-
Tin		-	-	-	-	6.5	-	-	5.6
Vanadium		1.3	-	0.99	-	2.1	1.0	-	1.3
Zinc		264	340	20	340	384	19.3	190	447

**Notes:**  
 - = Analytical result below the method detection limit.  
 NA = Not Analyzed  
 µg/l=microgram per liter (parts per billion (ppb))

**Table 12b**  
**Summary of Surface Water Metals Analytical Results**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter	Sample I.D. Date Sampled Comments	T-5-7 9-May-00 Grab high flow	T-12-1 26-Oct-00 Grab low flow	T-12-4 9-May-00 Grab high flow	T-14-6 9-May-00 Grab high flow	T-14-6 26-Oct-00 Grab low flow
<b>Inorganics</b>						
<i>Total Metals (µg/l)</i>		NA	NA	NA	NA	NA
Copper						
Zinc						
<i>Hexavalent Chromium (µg/l)</i>		-	-	-	-	-
<i>Dissolved Metals (µg/l)</i>						
Aluminum		-	-	-	22.9	66
Antimony		-	-	0.31	0.38	-
Arsenic		0.99	2.0	0.75	0.72	1.6
Barium		23.6	44	22.6	22	50
Beryllium		0.25	-	0.50	0.50	-
Cadmium		0.089	0.71	0.093	0.064	1.6
Calcium		14,500	40,000	14,200	14,100	39,000
Chromium		2.5	5.4	0.86	0.84	4.7
Cobalt		0.18	2.2	0.12	0.16	4.7
Copper		26.3	39	4.5	3.2	21
Iron		281	370	166	170	580
Lead		0.89	0.54	0.72	0.43	1.1
Magnesium		3,100	7,700	3,160	3,190	6,600
Manganese		93.1	540	73.5	83.8	1,000
Mercury		-	-	-	-	-
Nickel		1.8	8.0	2.1	1.6	8.6
Potassium		2,240	3,100	2,180	2,300	16,000
Selenium		-	-	-	-	-
Silver		0.17	-	0.28	0.074	-
Thallium		-	-	-	-	-
Tin		-	-	-	-	-
Vanadium		0.89	-	0.72	0.83	-
Zinc		12.8	170	23.4	12.6	210

**Notes:**  
 - = Analytical result below the method detection limit.  
 NA = Not Analyzed  
 µg/l=microgram per liter (parts per billion (ppb))

**Table 12c**  
**Summary of Surface Water Miscellaneous Analytical Results**  
**Raytheon Company**  
**Wayland, Massachusetts**

Sample I.D. Date Sampled Comments	OF-01 26-Oct-00 Grab low flow	T-2-6 1-Nov-99 Grab low flow	T-2-6 26-Oct-00 Grab low flow	T-2-8 9-May-00 Grab high flow
<i>Hardness (mg/l)</i>	160	95	160	55
<i>Dissolved Organic Carbon (mg/l)</i>	6.5	NA	6.2	NA

Sample I.D. Date Sampled Comments	T-3-6 26-Oct-00 Grab low flow	T-3-7 1-Nov-99 Grab low flow	T-3-7 9-May-00 Grab high flow	T-5-4 26-Oct-00 Grab low flow	T-5-6 1-Nov-99 Grab low flow
<i>Hardness (mg/l)</i>	160	91	49	130	93
<i>Dissolved Organic Carbon (mg/l)</i>	8.4	NA	NA	11	NA

Sample I.D. Date Sampled Comments	T-5-7 9-May-00 Grab high flow	T-12-1 26-Oct-00 Grab low flow	T-12-4 9-May-00 Grab high flow	T-14-6 9-May-00 Grab high flow	T-14-6 26-Oct-00 Grab low flow
<i>Hardness (mg/l)</i>	49	130	46	48	120
<i>Dissolved Organic Carbon (mg/l)</i>	NA	5.4	NA	NA	7.1

**Notes:**

NA = Not Analyzed.

mg/l=milligram per liter (parts per million (ppm)).

**Table 13**  
**Summary of Physical and Chemical Properties**  
**Raytheon Company**  
**Wayland, Massachusetts**

Site Compounds	Molecular Weight g/mole	Vapor Pressure 25°C mm Hg	Solubility 25°C mg/L	Henry's Law Constant 25°C 10 <sup>3</sup> atm m <sup>3</sup> /mol	Log Kow	Log Koc	Density 25°C g/cm <sup>3</sup>
<i>Volatile Organic Compounds (VOCs)</i>							
Tetrachloroethene	165.83	20	240	16	2.5	2.3	1.62
Trichloroethene	131.39	74	1,400	10	2.4	1.8	1.46
cis-1,2-Dichloroethene	96.94	210	800	4	0.7	1.7	
1,1-Dichloroethene	96.94	591	2,200	2.5	1.5	1.8	1.21
Vinyl Chloride	62.50	2,660	1,100	5.6	0.6	0.4	0.91
1,1,1-Trichloroethane	133.40	30	4,400	9.1	2.2	1.8	1.43
1,1-Dichloroethane	98.96	230	5,060	5.9	1.8	1.5	1.18
Chloroform	119.38	246	7,220	3.4	1.9	1.6	1.48
Trichlorofluoromethane	137.37	790	1,240	110	2.5	2.2	1.47
Toluene	92.14	28	520	6.5	2.7	2.1	0.86
Ethylbenzene	106.17	10	180	7.8	3.1	2.4	0.86
Xylenes	106.17	7.7	180	6.2	3.1	2.3	0.87
1,2,3-Trichlorobenzene	181.45	2.1	18	71	4.0	3.8	1.69
1,2-Dichlorobenzene	147.00	1.5	140	1.9	3.4	2.4	1.30
1,3-Dichlorobenzene	147.00	2.2	140	2.8	3.4	2.2	1.29
1,4-Dichlorobenzene	147.00	0.7	74	3.1	3.4	2.2	1.25
Chlorobenzene	112.56	12	500	3.9	2.8	1.9	1.10
Isopropylbenzene	120.19	4.6	50	5.6	3.6	3.4	0.86
sec-Butylbenzene	134.22	1.8	17	11	4.2	3.0	0.86
1,3,5-Trimethylbenzene	120.19	2.4	100	6.7	3.4	2.8	0.87
1,2,4-Trimethylbenzene	120.19	2.0	60	5.7	3.7	3.6	0.88

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**Raytheon Company**  
**Wayland, Massachusetts**

Site Compounds	Molecular Weight g/mole	Vapor Pressure 25°C mm Hg	Solubility 25°C mg/L	Henry's Law Constant 25°C 10 <sup>3</sup> atm m <sup>3</sup> /mol	Log Kow	Log Koc	Density 25°C g/cm <sup>3</sup>
<i>Semi-Volatile Organic Compounds (SVOCs)</i>							
Acenaphthene	154.21	2 x 10 <sup>-3</sup>	4.0	0.15	3.9	5.4	1.02
Acenaphthylene	152.20	7 x 10 <sup>-3</sup>	3.9	0.11	4.0	3.7	0.90
Anthracene	178.24	6 x 10 <sup>-6</sup>	0.07	0.02	4.4	4.4	1.28
Benzo(a)anthracene	228.30	1 x 10 <sup>-7</sup>	0.01	8 x 10 <sup>-3</sup>	5.9	5.0	1.25
Benzo(a)pyrene	252.32	5 x 10 <sup>-9</sup>	3 x 10 <sup>-3</sup>	4 x 10 <sup>-4</sup>	6.0	5.9	1.35
Benzo(b)fluoranthene	252.32	5 x 10 <sup>-7</sup>	0.01	8 x 10 <sup>-4</sup>	6.4	5.7	NA
Benzo(k)fluoranthene	252.32	1 x 10 <sup>-10</sup>	5.5 x 10 <sup>-4</sup>	5 x 10 <sup>-4</sup>	6.4	6.0	NA
Chrysene	228.30	6 x 10 <sup>-9</sup>	2 x 10 <sup>-3</sup>	7 x 10 <sup>-17</sup>	5.6	6.3	1.27
Dibenzo(a,h)anthracene	278.36	3 x 10 <sup>-12</sup>	3 x 10 <sup>-3</sup>	2 x 10 <sup>-3</sup>	6.5	6.2	1.28
Fluoranthene	202.26	9 x 10 <sup>-6</sup>	0.2	2 x 10 <sup>-3</sup>	5.2	6.4	1.25
Fluorene	166.22	6 x 10 <sup>-4</sup>	2	0.06	4.2	5.5	1.20
Naphthalene	128.18	0.08	30	0.4	3.3	3.1	1.14
2-Methylnaphthalene	142.20	0.05	25	0.3	3.9	3.8	1.01
Phenanthrene	140.28	6 x 10 <sup>-4</sup>	1	0.02	4.5	4.4	1.18
Pyrene	202.26	3 x 10 <sup>-6</sup>	0.1	0.01	5.1	4.9	1.27
<i>Extractable Petroleum Hydrocarbons (EPH)</i>							
C9-C18 Aliphatics	180	0	1 x 10 <sup>-3</sup>	7 x 10 <sup>-3</sup>	7.5	6.0	0.75
C19-C36 Aliphatics	270	0	1 x 10 <sup>-6</sup>	0.2	11.3	9.0	0.78
C11-C22 Aromatics	190	0	0.5	3 x 10 <sup>-7</sup>	5.0	4.2	NA

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**Raytheon Company**  
**Wayland, Massachusetts**

Site Compounds	Molecular Weight g/mole	Vapor Pressure 25°C mm Hg	Solubility 25°C mg/L	Henry's Law Constant 25°C 10 <sup>3</sup> atm m <sup>3</sup> /mol	Log Kow	Log Koc	Density 25°C g/cm <sup>3</sup>
<i>Polychlorinated Biphenyls (PCBs)</i>							
<i>Arochlor 1260</i>	290	4 x 10 <sup>-5</sup>	3 x 10 <sup>-3</sup>	3 x 10 <sup>-7</sup>	7.1	5.7	NA
<i>Dissolved Metals</i>							
Barium	137.36	NA	380,000	NA	NA	NA	NA
Chromium	52.00	NA	167,000	NA	NA	NA	NA
Silver	107.90	NA	1,00,000	NA	NA	NA	NA

**Notes:**

NA: No Information Available

**Sources:**

Montgomery, John H., *Groundwater Chemicals Desk Reference*, second edition, CRC Lewis Publishers, 1996.  
 RBCA Tool Kit for Chemical Releases, Version 1.0a



**Table 14**  
**Summary Statistics for Soil**  
**Raytheon Company**  
**Wayland, Massachusetts**

	Method Detection Limit	All Remaining Soils				MADEP Background	Reportable Concentration S-1	Method 3 Standards UCLs
		No. Samples	No. Observations	Minimum Concentration	Average Concentration			
<i>Volatile Organic Compounds (VOCs) (µg/kg)</i>								
Naphthalene	25	47	0	-	-	-	4,000	10,000,000
Ethylbenzene	5	47	6	170	510	9,400	80,000	10,000,000
Xylenes	5	47	10	15	1,792	38,700	500,000	10,000,000
Methylene chloride	25	47	0	-	-	-	100	7,000,000
Tetrachloroethene	7.5	47	1	34	4.4	34	500	1,000,000
1,2,4-Trichlorobenzene	25	47	0	-	-	-	100,000	10,000,000
1,2-Dichlorobenzene	50	47	0	-	-	-	100,000	5,000,000
Isopropylbenzene	25	47	0	-	-	-	1,000,000	NI
n-Propylbenzene	25	47	0	-	-	-	100,000	NI
p-Isopropyltoluene	25	47	0	-	-	-	NI	NI
n-Butylbenzene	25	47	0	-	-	-	NI	NI
sec-Butylbenzene	25	47	0	-	-	-	NI	NI
1,3,5-Trimethylbenzene	25	47	0	-	-	-	10,000	NI
1,2,4-Trimethylbenzene	25	47	0	-	-	-	1,000,000	NI
<i>Semi-Volatile Organic Compounds (SVOs)(µg/kg)</i>								
Acenaphthene	350	44	7	770	1,418	18,000	20,000	10,000,000
Acenaphthylene	350	44	3	2,700	540	5,900	100,000	10,000,000
Anthracene	350	44	3	3,000	950	14,000	1,000,000	10,000,000
Benzo (a) anthracene	350	44	8	430	384	3,500	700	100,000
Benzo (a) pyrene	350	44	7	450	373	3,300	700	100,000
Benzo (b) fluoranthene	350	44	9	550	465	5,800	700	100,000
Benzo (g,h,i) perylene	350	44	2	450	200	900	1,000,000	10,000,000
Benzo (k) fluoranthene	350	44	4	450	438	5,600	7,000	400,000
Chrysene	350	44	10	360	796	11,000	7,000	400,000
Dibenzo (a,h) anthracene	350	44	1	2,300	232	2,300	700	100,000
Fluoranthene	350	44	10	780	816	7,700	1,000,000	10,000,000
Fluorene	350	44	8	1,100	1,898	20,000	400,000	10,000,000
Indeno(1,2,3-cd) pyrene	350	44	1	480	183	480	700	100,000
Naphthalene	350	44	8	910	1,707	20,000	4,000	10,000,000
2-Methylnaphthalene	350	44	9	870	8,772	130,000	4,000	10,000,000
Phenanthrene	350	44	11	450	1,885	20,000	100,000	10,000,000
Pyrene	350	44	10	720	979	13,000	700,000	10,000,000
Pentachlorobenzene	350	44	0	-	-	-	50,000	NI
Tetrachlorobenzene	350	44	0	-	-	-	NI	NI
1,2,4-Trichlorobenzene	350	44	0	-	-	-	100,000	10,000,000
<i>Polychlorinated Biphenyls (PCBs)(µg/kg)</i>								
Arochlor 1254	250	108	1	510	121	510	2,000	100,000
Arochlor 1260	250	108	9	140	158	1,800	2,000	100,000
<i>Organochlorine Pesticides (µg/kg)</i>								
		6	0	-	-	-	NI	NI
<i>Total Petroleum Hydrocarbons (TPH)(mg/kg)</i>								
Unknown Hydrocarbor	100	28	0	-	-	-	200	10,000
Fuel Oil #6	100	28	2	8,900	850	12,000	200	10,000
<i>Extractable Petroleum Hydrocarbons (EPH)(mg/kg)</i>								
C9-C18 Aliphatics	32	39	11	17	495	5,500	1,000	20,000
C19-C36 Aliphatics	32	39	24	39	1,081	11,000	2,500	20,000
C11-C22 Aromatics	32	39	20	40	1,353	13,000	200	10,000
<i>Oil and Grease (mg/kg)</i>								
	50	0	0	-	-	-	NI	NI
<i>Total Metals (mg/kg)</i>								
Arsenic	0.5	28	18	2.8	4.5	13	17	300
Barium	10	28	13	12	13	43	45	1,000
Cadmium	1	28	4	0.56	0.49	2.2	2	300
Chromium	3	28	14	6.3	19	110	29	1,000
Copper	22	28	4	25	13	27	38	1,000
Lead	0.5	28	21	2.5	11	80	99	300
Mercury	0.25	28	3	0.09	0.09	0.18	0.3	20
Nickel	12	28	3	11	6.7	16	17	300
Selenium	0.5	28	1	0.84	0.27	0.84	0.5	400
Silver	2	28	1	5.9	1.1	5.9	0.6	100
Zinc	55	28	5	61	34	85	116	2,500

**Notes:**

- = Analytical result is below the method detection limit
- NI = No Information Available
- µg/kg = microgram per kilogram (parts per billion (ppb))
- mg/kg = milligram per kilogram (parts per million (ppm))
- Soils removed in prior remedial response actions not included in summary statistic.
- For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for NI
- Split/duplicate/confirmatory samples averaged

**Table 14**  
**Summary Statistics for Soil**  
**Raytheon Company**  
**Wayland, Massachusetts**

	Method Detection Limit	Remaining Soils, Excluding WAY-02 Soils					MADEP Background	Reportable Concentration S-1	Method 3 Standards UCLs
		No. Samples	No. Observations	Minimum Concentration	Average Concentration	Maximum Concentration			
<i>Volatile Organic Compounds (VOCs) (µg/kg)</i>									
Naphthalene	25	23	0	-	-	-	-	4,000	10,000,000
Ethylbenzene	5	23	0	-	-	-	-	80,000	10,000,000
Xylenes	5	23	0	-	-	-	-	500,000	10,000,000
Methylene chloride	25	23	0	-	-	-	-	100	7,000,000
Tetrachloroethene	7.5	23	0	-	-	-	-	500	1,000,000
1,2,4-Trichlorobenzene	25	23	0	-	-	-	-	100,000	10,000,000
1,2-Dichlorobenzene	50	23	0	-	-	-	-	100,000	5,000,000
Isopropylbenzene	25	23	0	-	-	-	-	1,000,000	NI
n-Propylbenzene	25	23	0	-	-	-	-	100,000	NI
p-Isopropyltoluene	25	23	0	-	-	-	-	NI	NI
n-Butylbenzene	25	23	0	-	-	-	-	NI	NI
sec-Butylbenzene	25	23	0	-	-	-	-	NI	NI
1,3,5-Trimethylbenzene	25	23	0	-	-	-	-	10,000	NI
1,2,4-Trimethylbenzene	25	23	0	-	-	-	-	1,000,000	NI
<i>Semi-Volatile Organic Compounds (SVOCs) (µg/kg)</i>									
Acenaphthene	350	27	0	-	-	-	-	20,000	10,000,000
Acenaphthylene	350	27	0	-	-	-	-	100,000	10,000,000
Anthracene	350	27	0	-	-	-	-	1,000,000	10,000,000
Benzo (a) anthracene	350	27	2	430	211	920	-	700	100,000
Benzo (a) pyrene	350	27	2	450	215	1,000	-	700	100,000
Benzo (b) fluoranthene	350	27	2	550	225	1,200	-	700	100,000
Benzo (g,h,i) perylene	350	27	1	450	187	450	-	1,000,000	10,000,000
Benzo (k) fluoranthene	350	27	1	450	187	450	-	7,000	400,000
Chrysene	350	27	2	360	202	740	-	7,000	400,000
Dibenzo (a,h) anthracene	350	27	0	-	-	-	-	700	100,000
Fluoranthene	350	27	2	960	257	1,800	-	1,000,000	10,000,000
Fluorene	350	27	0	-	-	-	-	400,000	10,000,000
Indeno(1,2,3-cd) pyrene	350	27	1	480	188	480	-	700	100,000
Naphthalene	350	27	0	-	-	-	-	4,000	10,000,000
2-Methylnaphthalene	350	27	0	-	-	-	-	4,000	10,000,000
Phenanthrene	350	27	2	450	191	480	-	100,000	10,000,000
Pyrene	350	27	2	720	236	1,400	-	700,000	10,000,000
Pentachlorobenzene	350	27	0	-	-	-	-	50,000	NI
Tetrachlorobenzene	350	27	0	-	-	-	-	NI	NI
1,2,4-Trichlorobenzene	350	27	0	-	-	-	-	100,000	10,000,000
<i>Polychlorinated Biphenyls (PCBs) (µg/kg)</i>									
Arochlor 1254	250	105	1	510	121	510	-	2,000	100,000
Arochlor 1260	250	105	9	140	159	1,800	-	2,000	100,000
<i>Organochlorine Pesticides (µg/kg)</i>									
		6	0	-	-	-	-	NI	NI
<i>Total Petroleum Hydrocarbons (TPH) (mg/kg)</i>									
Unknown Hydrocarbor	100	23	0	-	-	-	-	200	10,000
Fuel Oil #6	100	23	0	-	-	-	-	200	10,000
<i>Extractable Petroleum Hydrocarbons (EPH) (mg/kg)</i>									
C9-C18 Aliphatics	32	19	0	-	-	-	-	1,000	20,000
C19-C36 Aliphatics	32	19	9	39	51	250	-	2,500	20,000
C11-C22 Aromatics	32	19	6	40	79	2,400	-	200	10,000
<i>Oil and Grease (mg/kg)</i>									
	50	0	0	-	-	-	-	NI	NI
<i>Total Metals (mg/kg)</i>									
Arsenic	0.5	28	17	2.8	4.5	13	17	30	300
Barium	10	28	12	12	13	43	45	1,000	10,000
Cadmium	1	28	3	0.56	0.49	2.2	2	30	800
Chromium	3	28	13	6.3	19	110	29	1,000	10,000
Copper	22	28	4	25	13	27	38	1,000	NI
Lead	0.5	28	20	2.5	11	80	99	300	6,000
Mercury	0.25	28	3	0.09	0.09	0.18	0.3	20	600
Nickel	12	28	3	11	6.7	16	17	300	7,000
Selenium	0.5	28	1	0.84	0.27	0.84	0.5	400	10,000
Silver	2	28	1	5.9	1.1	5.9	0.6	100	2,000
Zinc	55	28	5	61	34	85	116	2,500	10,000

**Notes:**

- = Analytical result is below the method detection limit
- NI = No Information Available
- µg/kg = microgram per kilogram (parts per billion (ppb))
- mg/kg = milligram per kilogram (parts per million (ppm))
- Soils removed in prior remedial response actions not included in summary statistic
- For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for NI
- Split/duplicate/confirmatory samples averaged

**Table 15**  
**Summary Statistics for Groundwater**  
**Raytheon Company**  
**Wayland, Massachusetts**

	Method Detection Limit	No. Samples	No. Observations	Minimum Concentration	Average Concentration	Maximum Concentration	Reportable Concentration GW-1	MA Drinking Water Quality Standards	Method 3 Standards UCLs
<i>Volatile Organic Compounds (VOCs) (µg/l)</i>									
Naphthalene	1	182	1	30	30	30	20	140	60,000
Benzene	1	182	4	1.2	10	25	5	5	70,000
Toluene	1.5	182	1	4.1	4.1	4.1	1,000	1,000	100,000
Ethylbenzene	1	182	1	31	31	31	700	700	100,000
Xylenes	1	182	1	95	95	95	6,000	10,000	100,000
Tetrachloroethene	1.5	182	51	0.65	5.0	39	5	5	50,000
Trichloroethene	1	182	104	1.0	63	545	5	5	100,000
cis-1,2-Dichloroethene	1	182	33	0.50	12	77	70	70	100,000
Vinyl Chloride	2	182	2	2.6	3.5	4.5	2	2	100,000
1,1,1-Trichloroethane	1	182	20	0.50	40	160	200	200	100,000
1,1-Dichloroethane	1.5	182	5	1.0	1.4	1.6	70	70	100,000
1,1-Dichloroethene	1	182	14	1.1	3.7	8.6	1	7	100,000
Chloroform	1.5	182	2	0.59	1.5	2.5	5	5	100,000
1,1,2,2-Tetrachloroethane	1	182	0	-	-	-	2	NI	100,000
Trichlorofluoromethane	5	182	4	0.80	2.8	5.8	10,000	NI	NI
1,2,3-Trichlorobenzene	1	182	3	2.8	71	130	NI	NI	NI
1,2-Dichlorobenzene	10	182	4	1.1	7.3	14	600	600	100,000
1,3-Dichlorobenzene	10	182	1	3.4	3.4	3.4	600	NI	100,000
1,4-Dichlorobenzene	10	182	2	1.1	2.5	4.0	5	5	100,000
Chlorobenzene	3.5	182	1	2.1	2.1	2.1	100	100	10,000
Isopropylbenzene	1	182	2	3.4	6.0	8.6	10,000	NI	NI
sec-Butylbenzene	1	182	2	1.2	1.8	2.3	NI	NI	NI
1,3,5-Trimethylbenzene	1	182	1	31	31	31	100	NI	NI
1,2,4-Trimethylbenzene	1	182	1	120	120	120	10,000	NI	NI
<i>Semi-Volatile Organic Compounds (SVOCs)(µg/l)</i>	0.15	6	0	-	-	-	NI	NI	NI
<i>Polychlorinated Biphenyls (PCBs)(µg/l)</i>	2.5	4	0	-	-	-	0.5	0.5	5.0
<i>Organochlorine Pesticides (µg/l)</i>	0.5	1	0	-	-	-	NI	NI	NI
<i>Total Petroleum Hydrocarbons (TPH)(mg/l)</i>	1	1	0	-	-	-	0.2	0.2	100
<i>Extractable Petroleum Hydrocarbons (EPH)(µg/l)</i>									
C9-C18 Aliphatics	100	5	0	-	-	-	1,000	4,000	100,000
C19-C36 Aliphatics	100	5	0	-	-	-	5,000	40,000	100,000
C11-C22 Aromatics	100	5	0	-	-	-	200	200	100,000
<i>Dissolved Metals (mg/l)</i>									
Arsenic	0.005	9	0	-	-	-	0.05	0.05	4.0
Barium	0.01	9	3	0.01	0.10	0.28	2	2	100
Cadmium	0.005	9	0	-	-	-	0.005	0.005	0.1
Chromium	0.01	9	1	0.01	0.01	0.01	0.1	0.1	20
Lead	0.05	9	0	-	-	-	0.02	0.015	0.3
Mercury	0.0005	9	0	-	-	-	0.001	0.002	0.02
Selenium	0.005	9	0	-	-	-	0.05	0.05	0.8
Silver	0.01	9	0	-	-	-	0.007	0.10	0.4

**Notes:**

- = Analytical results below the method detection limit  
NI = No Information Available  
µg/l = microgram per liter (parts per billion (ppb))  
mg/l = milligram per liter (parts per million (ppm))  
Results from step-drawdown tests not included in summary statistics  
For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for NI  
Split/duplicate samples averaged

**Table 16**  
**Summary Statistics for Sediment**  
**Raytheon Company**  
**Wayland, Massachusetts**

	Method Detection Limit	Number of Samples		Number of Observations		Average Concentration			Maximum Concentration			
		Area of Readily Apparent Harm	Surrounding Area	Area of Readily Apparent Harm	Surrounding Area	Area of Readily Apparent Harm	Surrounding Area	Background	Area of Readily Apparent Harm	Surrounding Area	Background	
<b>Semi-Volatile Organic Compounds (SVOCs) (ug/kg)</b>											5,813	9,000
Acenaphthene	20	31	47	10	4	985	17		22,000	140		
Fluoranthene	20	31	47	29	42	13,644	1,678		180,000	15,000		
Naphthalene	20	31	47	6	2	973	15		22,400	200		
Benzo(a)anthracene	20	31	47	30	39	6,217	742		78,000	7,800		
Benzo(a)pyrene	20	31	47	30	40	7,146	989		80,000	8,700		
Benzo(b)fluoranthene	20	31	47	30	41	8,470	1,316		84,000	10,000		
Benzo(k)fluoranthene	20	31	47	30	41	7,012	1,023		68,000	7,300		
Chrysene	20	31	47	30	41	8,570	1,246		95,000	9,000		
Acenaphthylene	20	31	47	7	9	170	49		2,300	1,200		
Anthracene	20	31	47	18	13	2,149	92		35,000	1,400		
Benzo(g,h,i)perylene	20	31	47	30	39	5,895	812		56,000	6,800		
Fluorene	20	31	47	10	4	868	20		19,000	250		
Phenanthrene	20	31	47	30	39	8,710	535		140,000	6,000		
Dibenzo(a,h)anthracene	20	31	47	23	23	1,928	216		18,000	2,000		
Indeno(1,2,3-cd)pyrene	20	31	47	29	39	5,822	852		58,000	6,900		
Pyrene	20	31	47	30	41	11,514	1,463		140,000	13,000		
Methylnaphthalene, 1-	20	31	47	2	0	166	-		4,400	-		
Methylnaphthalene, 2-	20	31	47	2	0	211	-		5,700	-		
Perylene	20	31	47	17	22	1,298	159		16,000	1,800		
1-Methylphenanthrene	20	31	47	0	10	NDA	31		NA	100		
Biphenyl	20	31	47	1	0	61	-		1,600	-		
<b>Polychlorinated Biphenyls (PCBs) (ug/kg)</b>											1,084	1,800
Aroclor 1254	270	72	118	7	39	776	1,086		19,000	10,000		
Aroclor 1260	270	72	118	65	42	39,667	2,806		540,000	67,000		
<b>Extractable Petroleum Hydrocarbons (EPH) (ug/kg)</b>											NDA	NDA
C <sub>9</sub> - C <sub>18</sub> Aliphatics	10,000	23	24	19	9	721,957	47,168		6,080,000	316,000		
C <sub>19</sub> - C <sub>36</sub> Aliphatics	10,000	23	24	22	16	2,594,557	210,892		19,400,000	1,340,000		
C <sub>11</sub> - C <sub>22</sub> Aromatics	10,000	23	24	21	22	1,237,713	145,540		10,600,000	626,000		
<b>Total Metals (mg/kg)</b>												
Aluminum	4.0	68	113	41	86	5,961	6,686	10,033	26,000	25,000	18,000	
Antimony	2.0	68	113	19	1	10	1.1	1.0	100	17	1.0	
Arsenic	0.40	68	113	42	87	13	12	15	120	160	24	
Barium	0.40	68	113	41	86	99	62	174	490	308	266	
Beryllium	0.20	68	113	19	65	0.3	0.5	0.8	1.5	1.8	1.1	
Cadmium	0.40	68	113	41	80	4.3	2.6	6.2	44	12	9.1	
Calcium	20	68	113	36	81	1,813	2,279	NDA	11,000	5,600	NDA	
Chromium	0.40	68	113	69	112	5,752	493	98	37,000	4,300	167	
Chromium, Hexavalent	0.40	68	113	9	0	55	2	NDA	1,600	230	NDA	
Cobalt	0.80	68	113	19	59	2.2	3.2	NDA	14	13	NDA	
Copper	0.40	68	113	69	112	4,054	537	133	22,000	3,300	231	
Iron	2.0	68	113	41	86	10,896	6,333	15,533	73,000	24,000	21,300	
Lead	2.0	68	113	69	112	642	244	340	2,300	1,210	580	
Magnesium	4.0	68	113	41	86	1,849	1,243	3,237	7,100	6,400	3,910	
Manganese	0.40	68	113	41	86	132	263	739	870	2,460	970	
Mercury	0.25	68	113	32	58	2.4	1.2	3.8	18	7.2	9.3	
Nickel	1.0	68	113	41	86	15	13	25	96	35	33	
Potassium	100	68	113	17	31	317	217	NDA	2,300	1,400	NDA	
Selenium	0.80	68	113	2	0	0.45	-	3.5	2.8	-	5.0	
Silver	0.40	68	113	42	67	102	19	1.6	560	270	3.0	
Sodium	20	68	113	36	80	151	196	NDA	560	580	NDA	
Thallium	0.80	68	113	3	0	0.71	-	2.1	11	-	3.0	
Tin	2.0	68	113	22	45	80	14	NDA	660	200	NDA	
Vanadium	0.40	68	113	41	86	70	29	35	330	130	50	
Zinc	2.0	68	113	42	88	188	102	294	1,700	530	396	

**Notes:**  
NDA = Not data available.  
µg/kg = microgram per kilogram (parts per billion (ppb)).  
mg/kg = milligram per kilogram (parts per million (ppm)).  
For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for ND.  
Duplicate samples averaged.

**Table 17**  
**Summary Statistics for Surface Water**  
**Raytheon Company**  
**Wayland, Massachusetts**

	No. Samples	No. Observations	Minimum Concentration	Average Concentration	Maximum Concentration
<i>Semi-Volatile Organic Compounds (sVOCs)(µg/l)</i>					
Acenaphthene	8	4	0.013	0.057	0.10
Fluoranthene	8	8	0.009	0.34	1.2
Naphthalene	8	8	0.006	0.032	0.071
Benzo(a)anthracene	8	6	0.009	0.11	0.23
Benzo(a)pyrene	8	6	0.013	0.15	0.37
Benzo(b)fluoranthene	8	6	0.021	0.24	0.56
Benzo(k)fluoranthene	8	6	0.015	0.12	0.39
Chrysene	8	6	0.019	0.20	0.49
Acenaphthylene	8	4	0.006	0.014	0.024
Anthracene	8	4	0.023	0.043	0.064
Benzo(g,h,i)perylene	8	6	0.015	0.15	0.36
Fluorene	8	4	0.010	0.030	0.050
Phenanthrene	8	8	0.008	0.18	0.66
Dibenzo(a,h)anthracene	8	4	0.009	0.035	0.046
Indeno(1,2,3-cd)pyrene	8	6	0.013	0.16	0.37
Pyrene	8	8	0.006	0.23	0.84
2-Methylnaphthalene	8	6	0.003	0.006	0.009
bis(2-ethylhexyl)phthalate	8	2	48	78	108
bis(2-ethylhexyl)adipate	8	0	-	-	-
<b>Total PCBs (µg/l)</b>	<b>8</b>	<b>6</b>	<b>0.004</b>	<b>0.02</b>	<b>0.04</b>
<b>Hexavalent Chromium (µg/l)</b>	<b>18</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
<i>Dissolved Metals (µg/l)</i>					
Aluminum	20	8	10	100	310
Antimony	20	7	0.31	0.66	1.7
Arsenic	20	14	0.71	2.8	21
Barium	20	14	22	40	82
Beryllium	20	7	0.029	0.26	0.50
Cadmium	20	14	0.064	0.98	4.0
Calcium	20	14	14,100	31,100	53,000
Chromium	20	11	0.84	4.2	15
Cobalt	20	14	0.12	1.9	5.9
Copper	20	14	3.2	70	310
Iron	20	14	90	360	1,410
Lead	20	13	0.43	1.3	3.1
Magnesium	20	14	3,080	6,065	11,000
Manganese	20	14	74	368	1,100
Mercury	20	0	-	-	-
Nickel	20	14	1.6	9.5	19.6
Potassium	20	14	2,180	22,364	69,000
Selenium	20	3	0.22	0.34	0.56
Silver	20	9	0.074	0.27	0.75
Thallium	20	1	0.070	0.070	0.070
Tin	20	2	5.6	6.1	6.5
Vanadium	20	8	0.72	1.1	2.1
Zinc	20	14	13	200	447

**Notes:**

µg/l = microgram per liter (parts per billion (ppb))

Surface water samples taken from Sudbury River and Facility Installation not included in summary statistics.

For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for ND.

Split/duplicate samples averaged.

**Table 18**  
**Background Sediment Concentrations - Calculated from Upstream Samples**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter	Sample I.D.	SU-3	SU-4	GMS-7	SS-2*	Background			SS-2	SS-2D
	Depth Date Sampled Comments	1987	1987	Jul-89	Mar-90	Minimum Concentration	Average Concentration	Maximum Concentration	Mar-90	Mar-90 DUP
<i>Polyaromatic Hydrocarbons (PAHs) (ug/kg)</i>		9000	2470	5970	NA	2,470	5,813	9,000	NA	NA
<i>Polychlorinated Biphenyls (PCBs) (ug/kg)</i>										
<i>Total PCBs</i>		1,100	1,310	1,800	<250	125	1,084	1,800	<250	<250
<i>Total Metals (mg/kg)</i>										
Aluminum		11,100	1,000	18,000	NA	1,000	10,033	18,000	NA	NA
Antimony		NA	NA	NA	<2.0	1.0	1.0	1.0	<2.0	<2.0
Arsenic		<8.0	10	22.4	24	4.0	15	24	25.0	22.9
Barium		151	106	266	NA	106	174	266	NA	NA
Beryllium		0.86	1.1	1.1	<0.04	0.02	0.77	1.1	<0.04	<0.04
Cadmium		6.5	4.9	4.4	9	4.4	6.2	9.1	9.3	8.8
Calcium		NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		85	39	100	167	39	98	167	167	167
Chromium , Hexavalent		NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt		NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		97.2	69.6	136	231	70	133	231	241	220
Iron		14,100	11,200	21,300	NA	11,200	15,533	21,300	NA	NA
Lead		280	150	350	580	150	340	580	631	528
Magnesium		3,910	1,900	3,900	NA	1,900	3,237	3,910	NA	NA
Manganese		304	970	943	NA	304	739	970	NA	NA
Mercury		2.04	1.4	2.38	9	1.4	3.8	9.3	10.3	8.4
Nickel		24	20	33	22	20	25	33	<1.0	44
Potassium		NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		<9.0	<8.0	<10	<0.80	0.40	3.5	5.0	<0.80	<0.80
Silver		2.0	<2.0	<6.0	<0.40	0.20	1.6	3.0	<0.40	<0.40
Sodium		NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		<5.0	<5.0	<6.0	<0.80	0.40	2.1	3.0	<0.80	<0.80
Tin		NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		29	26	49.5	NA	26	35	50	NA	NA
Zinc		396	248	200	331	200	294	396	389	273

**Notes:**

NA = Not Analyzed.

µg/kg=microgram per kilogram (parts per billion (ppb)).

mg/kg=milligram per kilogram (parts per million (ppm)).

For detected compounds, averages calculated using 0.5 \* Method Detection Limit (MDL) for ND.

SS-2\* estimated as average of SS-2 and SS-2D (duplicate).

**Table 19**  
**Compounds of Concern**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Media			
	Soil	Groundwater	Sediment	Surface Water
<b>Volatile Organic Compounds (VOCs)</b>				
Benzene		X		
Tetrachloroethene		X		
Trichloroethene		X		
1,1-Dichloroethene		X		
cis-1,2-Dichloroethene		X		
Vinyl Chloride		X		
1,1,1-Trichloroethane		X		
1,1-Dichloroethane		X		
Trichlorofluoromethane		X		
1,2,3-Trichlorobenzene		X		
1,2-Dichlorobenzene		X		
1,3-Dichlorobenzene		X		
1,4-Dichlorobenzene		X		
Chlorobenzene		X		
<b>Semi-Volatile Organic Compounds (SVOCs)</b>				
Acenaphthene			X	X
Fluoranthene	X		X	X
Naphthalene			X	X
Benzo(a)anthracene	X		X	X
Benzo(a)pyrene	X		X	X
Benzo(b)fluoranthene	X		X	X
Benzo(k)fluoranthene			X	X
Chrysene	X		X	X
Acenaphthylene			X	X
Anthracene			X	X
Benzo(g,h,i)perylene			X	X
Fluorene			X	X
Phenanthrene			X	X
Dibenzo(a,h)anthracene			X	X
Indeno(1,2,3-cd)pyrene			X	X
Pyrene	X		X	X
Methylnaphthalene, 1-			X	
Methylnaphthalene, 2-			X	X
Perylene			X	
1-Methylphenanthrene			X	
Biphenyl			X	
bis (2-ethylhexyl)phthalate				X
<b>Polychlorinated Biphenyls (PCBs)</b>				
Arochlor 1254	X		X	
Arochlor 1260			X	
<b>Extractable Petroleum Hydrocarbons (EPH)</b>				
C9-C18 Aliphatics			X	
C19-C36 Aliphatics	X		X	
C11-C22 Aromatics	X		X	
<b>Metals</b>				
Aluminum				X
Antimony			X	X
Arsenic			X	X
Barium		X	X	X
Beryllium				X
Cadmium			X	X
Chromium	X	X	X	X
Cobalt			X	X
Copper			X	X
Iron			X	X
Lead			X	X
Manganese			X	X
Mercury			X	
Nickel			X	X
Selenium	X			X
Silver	X		X	X
Thallium			X	X
Tin			X	X
Vanadium			X	X
Zinc			X	X

**Table 20**  
**Summary of Relative Absorption Factors and Toxicity Values**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Relative Absorption Factors			Permeability		Toxicity Values								
	Dermal DAF (-)	Ingestion IAF (-)	Ref	Kp (cm/hr)	Ref	Carcinogenic				Non-Carcinogenic				
						CSF <sub>o</sub> (mg/kg/day) <sup>-1</sup>	Ref	CSF <sub>inh</sub> (mg/kg/day) <sup>-1</sup>	Ref	Class	RfD <sub>o</sub> (mg/kg/day)	Ref	RfD <sub>inh</sub> (mg/kg/day)	Ref
<i>Volatile Organic Compounds (VOCs)</i>														
Benzene	0.08	1.0	S2	1.1E-01	S3	5.50E-02	I	2.90E-02	I	A	3.00E-03	E	1.70E-03	E
Tetrachloroethene	0.10	1.0	S2	3.7E-01	S3	5.20E-02	E	2.00E-03	E	C-B2	1.00E-02	I	1.40E-01	E
Trichloroethene	0.10	1.0	S2	2.3E-01	S3	1.10E-02	E	6.00E-03	E	C-B2	6.00E-03	E	5.14E-02	S2
cis-1,2-Dichloroethene	0.10	1.0	S2	1.0E-02	S3(4)	-	-	-	-	D	1.00E-02	H	-	-
Vinyl Chloride	0.16	1.5	S2	7.3E-03	S3	1.90E+00	H	3.00E-01	H	A	1.00E-03	S2	4.86E-03	S2
1,1,1-Trichloroethane	0.10	1.0	S2	1.7E-02	S3	-	-	-	-	D	2.80E-01	E	6.30E-01	E
1,1-Dichloroethane	0.13	1.3	S2	8.9E-03	S3	-	-	-	-	C	1.00E-01	H	1.40E-01	HA
1,1-Dichloroethene	0.10	1.0	S2	1.6E-02	S3	6.00E-01	I	1.75E-01	I	C	9.00E-03	I	1.43E-03	S2
Trichlorofluoromethane	0.11	0.99	S3	1.7E-02	S3	-	-	-	-	C	3.00E-01	I	2.00E-01	HA
1,2,3-Trichlorobenzene	0.08	1.0	S2(1)	1.0E-01	S3(1)	-	-	-	-	-	1.00E-02	I(1)	5.70E-02	H(1)
1,2-Dichlorobenzene	0.10	1.0	S2	6.1E-02	S3	-	-	-	-	D	9.00E-02	I	5.71E-02	S2
1,3-Dichlorobenzene	0.10	1.0	S2	8.7E-02	S3	-	-	-	-	D	9.00E-04	E	-	-
1,4-Dichlorobenzene	0.10	1.0	S2	6.2E-02	S3	2.40E-02	H	2.20E-02	E	C	3.00E-02	E	2.29E-01	I
Chlorobenzene	0.10	1.0	S2	4.1E-02	S3	-	-	-	-	D	2.00E-02	I	1.70E-02	E
<i>Semi-Volatile Organic Compounds (SVOCs)</i>														
Acenaphthene	0.20	1.0	S2	1.0E-03	S3	-	-	-	-	D	6.00E-02	I	-	-
Fluoranthene	0.20	1.0	S2	3.6E-01	S3	-	-	-	-	D	4.00E-02	I	-	-
Naphthalene	0.10	1.0	S2	6.9E-02	S3	-	-	-	-	D	2.00E-02	I	9.00E-04	I
Benzo(a)anthracene	0.20	1.0	S2	8.1E-01	S3	7.30E-01	E	-	-	B2	2.00E-02	S2(2)	-	-
Benzo(a)pyrene	0.20	1.0	S2	1.2E+00	S3	7.30E+00	I	3.10E+00	E	B2	2.00E-02	S2(2)	-	-
Benzo(b)fluoranthene	0.20	1.0	S2	1.2E+00	S3	7.30E-01	E	-	-	B2	2.00E-02	S2(2)	-	-
Benzo(k)fluoranthene	0.20	1.0	S2	1.0E-03	S3	7.30E-02	E	-	-	B2	2.00E-02	S2(2)	-	-
Chrysene	0.20	1.0	S2	8.1E-01	S3	7.30E-03	E	-	-	B2	2.00E-02	S2(2)	-	-
Acenaphthylene	0.18	0.91	S2	1.0E-03	S3	-	-	-	-	D	2.00E-02	S2(2)	-	-
Anthracene	0.29	1.0	S2	1.0E-03	S3	-	-	-	-	D	3.00E-01	I	-	-
Benzo(g,h,i)perylene	0.18	0.91	S2	1.0E-03	S3	-	-	-	-	D	2.00E-02	S2(2)	-	-
Fluorene	0.20	1.0	S2	1.0E-03	S3	-	-	-	-	D	4.00E-02	I	-	-
Phenanthrene	0.18	0.91	S2	2.3E-01	S3	-	-	-	-	D	2.00E-02	S2(2)	-	-
Dibenz(a,h)anthracene	0.09	1.0	S2	2.7E+00	S3	7.30E+00	E	-	-	B2	2.00E-02	S2(2)	-	-
Indeno(1,2,3-cd)pyrene	0.20	1.0	S2	1.9E+00	S3	7.30E-01	E	-	-	B2	2.00E-02	S2(2)	-	-
Pyrene	0.20	1.0	S2	1.0E-03	S3	-	-	-	-	D	3.00E-02	I	-	-
Methylnaphthalene, 1-	0.10	1.0	S2(3)	1.0E-03	S3	-	-	-	-	-	2.00E-02	E(3)	2.03E-02	S2(3)
Methylnaphthalene, 2-	0.10	1.0	S2	1.0E-03	S3	-	-	-	-	-	2.00E-02	E	2.03E-02	S2
Perylene	0.10	1.0	S2(2)	1.0E-03	S3	-	-	-	-	-	2.00E-02	S2(2)	-	-
1-Methylphenanthrene	0.10	1.0	S2(2)	1.0E-03	S3	-	-	-	-	-	2.00E-02	S2(2)	-	-
Biphenyl	0.08	1.0	S2	1.0E-03	S3	-	-	-	-	-	5.00E-02	I	-	-
bis(2-ethylhexyl)phthalate	0.02	1.0	S2	1.0E-03	S3	1.40E-02	I	1.40E-02	I	-	2.00E-02	I	-	-
<i>Polychlorinated Biphenyls (PCBs)</i>														
Arochlor 1254	0.067	1.0	S2	1.0E-03	S3	2.00E+00	I	2.00E+00	I	B2	2.00E-05	I	5.71E-06	S2
Arochlor 1260	0.067	1.0	S2	1.0E-03	S3	2.00E+00	I	2.00E+00	I	B2	2.00E-05	I	5.71E-06	S2
<i>Extractable Petroleum Hydrocarbons (EPH)</i>														
C9-C18 Aliphatics	0.20	1.0	S1	1.0E-03	S3	-	-	-	-	D	6.00E-01	S1	5.71E-01	S1
C19-C36 Aliphatics	0.10	1.0	S1	1.0E-03	S3	-	-	-	-	D	6.00E+00	S1	-	-
C11-C22 Aromatics	0.18	1.0	S1	1.0E-03	S3	-	-	-	-	D	3.00E-02	S1	2.03E-02	S1
<i>Metals</i>														
Aluminum	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	1.00E+00	E	1.00E-03	E
Antimony	0.10	1.0	S2	1.0E-03	S3	-	-	-	-	D	4.00E-04	I	-	-
Arsenic	0.03	1.0	S2	1.0E-03	S3	1.50E+00	I	1.51E+01	I	A	3.00E-04	I	-	-
Barium	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	7.00E-02	I	1.40E-04	HA
Beryllium	0.03	1.0	S2	1.0E-03	S3	4.30E+00	S2	8.40E+00	I	D	2.00E-03	I	8.40E+00	I
Cadmium	0.14	1.0	S2	1.0E-03	S3	-	-	-	-	D	5.00E-04	S2	-	-
Chromium	0.04	1.0	S2	1.0E-03	S3	-	-	-	-	D	1.50E+00	I	-	-
Chromium, Hexavalent	0.09	1.0	S2	1.0E-03	S3	-	-	4.10E+01	H	D	3.00E-03	I	3.00E-05	I
Cobalt	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	6.00E-02	E	-	-
Copper	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	4.00E-02	H	-	-
Iron	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	3.00E-01	E	-	-
Lead	0.006	0.50	S2	1.0E-03	S3	-	-	-	-	-	7.50E-04	S2	-	-
Manganese	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	2.00E-02	I	1.43E-05	I
Mercury	0.05	1.0	S2	1.0E-03	S3	-	-	-	-	D	3.00E-04	S2	8.60E-05	I
Nickel	0.35	1.0	S2	1.0E-03	S3	-	-	-	-	D	2.00E-02	I	-	-
Selenium	0.002	1.0	S2	1.0E-03	S3	-	-	-	-	D	5.00E-03	I	-	-
Silver	0.25	1.0	S2	1.0E-03	S3	-	-	-	-	D	5.00E-03	I	-	-
Thallium	0.01	1.0	S2	1.0E-03	S3	-	-	-	-	D	7.00E-05	HA	-	-
Tin	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	6.00E-01	H	-	-
Vanadium	0.03	0.40	S3	1.0E-03	S3	-	-	-	-	D	7.00E-03	H	-	-
Zinc	0.02	1.0	S2	1.0E-03	S3	-	-	-	-	D	3.00E-01	I	-	-

**Notes:**

CSF: Cancer Slope Factor; CSF<sub>o</sub> = oral/ingestion, CSF<sub>inh</sub> = inhalation

RfD: Chronic Reference Dose; RfD<sub>o</sub> = oral/ingestion, RfD<sub>inh</sub> = inhalation

Class: A = Human Carcinogen; B = Probable Human Carcinogen; C = Possible Human Carcinogen; D = Not Classified

I: IRIS (Integrated Risk Information System)

H: HEAST (Health Effects Assessment Summary Tables)

HA: HEAST Alternate (EPA Region III)

E: EPA/NCEA Provisional Value

S1: MADEP, Revisions to the MCP - Proposed Changes Related to the VPH/EPH Approach (Public Hearing Draft, 17 January 1997)

S2: MADEP, Background Documentation for the Development of the MCP Numerical Standards (April 1994)

S3: MADEP, Guidance for Disposal Site Risk Characterization (Interim Final Policy, July 1995)

(1) 1,2,4-Trichlorobenzene used as surrogate from noted references.

(2) Relative Absorption Factors and Toxicity Values for Naphthalene (from noted references) have been used for all PAHs where this information was not available.

(3) 2-Methylnaphthalene used as surrogate from noted references.

(4) trans-1,2-DCE used as surrogate from noted reference.



**Table 21**  
**Exposure Scenarios**  
**Raytheon Company**  
**Wayland, Massachusetts**

<b>Media</b>	<b>Pathway</b>	<b>Facility Worker</b>	<b>Construction Worker</b>	<b>Trespasser (Older Child)</b>	<b>On-Site Resident (Young Child/Adult)</b>
Soil	Dermal Contact with Soil	X	X		X
	Incidental Ingestion of Soil	X	X		X
	Inhalation of Fugitive Dust	X	X		X
Groundwater	Direct Ingestion of Tap Water				X
	Inhalation of Groundwater Vapors	X			X
Sediment	Dermal Contact with Sediment			X	
	Incidental Ingestion of Sediment			X	
Surface Water	Dermal Contact with Surface Water			X	
	Incidental Ingestion of Surface Water			X	

**Notes:**

*Visitor* - Not considered, worst-case exposure for relevant pathways considered in assessment for Facility Worker.

*Utility Worker* - Not considered, worst-case exposure for relevant pathways considered in assessment for Construction Worker.

*Trespasser (Adult)* - Not considered, worst-case exposure for relevant pathways considered in assessment for Trespasser (Older Child).

*Off-Site Resident* - Not considered, worst-case exposure for relevant pathways considered in assessment for On-Site Resident.

**Table 22**  
**Exposure Parameters**  
**Raytheon Company**  
**Wayland, Massachusetts**

Parameter, Abbreviation	Units	Facility Worker	Construction Worker	Trespasser (Older Child)	On-Site Resident (Child)	On-Site Resident (Adult)	Reference
<b>Common:</b>							
Receptor Age	years	18-45	18-45	6-18	0-6	6-31	1, 2
Body Weight, BW	kg	70	70	40	10	70	1
Exposure Frequency							
Soil, EF <sub>soil</sub>	days/year	150	125	30	150	150	1, 2
Particulates, EF <sub>part</sub>	days/year	50	42	-	150	150	1, 2
Groundwater, EF <sub>gw</sub>	days/year	-	-	-	350	350	1
Volatiles, EF <sub>vol</sub>	days/year	83	-	-	350	350	1, 2
Surface Water, EF <sub>sw</sub>	days/year	-	-	5	-	-	1
Exposure Duration, ED	years	27	1	12	6	24	1, 2, 3
Averaging Period, AP							
Carcinogenic Compounds	days	27,375	27,375	27,375	27,375	27,375	1
Non-Carcinogenic Compounds	days	9,855	365	4,380	2,190	8,760	1
<b>Dermal Contact:</b>							
Exposed Skin Area, SA	cm <sup>2</sup>	5,070	5,070	3,926	2,101	5,070	1, 4
Skin Adherence Factor, SAF	mg/cm <sup>2</sup> day	0.51	0.51	0.51	0.51	0.51	1
<b>Ingestion:</b>							
Ingestion Rate							
Soil, SIR	mg/day	50	500	-	100	50	1
Groundwater, GWIR	l/day	-	-	-	1	2	1
Sediment, SedIR	mg/day	-	-	50	-	-	1
Surface Water, SWIR	l/day	-	-	0.05	-	-	1
<b>Inhalation:</b>							
Respiration Volume, RV	m <sup>3</sup> /day	28.8	86.4	-	9.13	28.8	1
Inhalation Absorption Factor, InhAF	unitless	1	1	-	1	1	1
<b>Conversion Factors:</b>							
CF.1	days/year	365	365	365	365	365	
CF.2	hrs/day	24	24	24	24	24	
CF.3	kg/mg	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	
CF.4	mg/μg	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	
CF.5	L/cm <sup>3</sup>	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	

**Notes:**

- : Pathway not applicable.
- Body Weight: Adult based on 18-25 yr male; Older Child based on 12 yr male; Child based on < 1 yr male.
- Exposure Frequency, Soil: Facility Worker/Resident = 5 d/wk (Apr-Oct); Construction = 5 d/wk (6 mo).
- Exposure Frequency, Groundwater: Resident = 5 d/wk (away 2 wks/yr).
- Exposure Frequency, Particulates: Facility/Construction Worker = 8 hrs/d \* EF<sub>soil</sub> \* 1/CF.2; Resident = 24 hrs/d \* EF<sub>soil</sub> \* 1/CF.2.
- Exposure Frequency, Volatiles: FacWork = 8hrs/d \* 250d/yr \* 1/CF.2; ConstWork = 8 hrs/d \* 125 d/yr \* 1/CF.2; Resident = 24 hrs/d \* 350 d/yr \* 1/CF.2.
- Exposure Frequency, Surface Water: Trespasser = 4hrs/day \* 1 d/wk (Apr-Oct) \* 1/CF.2.
- Averaging Period: Carcinogenic Compounds = 75 years; Non-Carcinogenic Compounds = Exposure Duration.
- Exposed Skin Area: Facility Worker/Construction Worker/Resident (Adult) based on 30% total body surface area; Trespasser/Resident (Child) based on head/forearms/hands.
- Soil/Sediment Ingestion Rate: Facility Worker/Trespasser/Resident based on regular exposure; Construction Worker based on enhanced exposure.
- Respiration Volume: Facility Worker/Resident based on light exertion; Construction Worker based on heavy exertion.

**References:**

1. MA DEP, Guidance for Disposal Site Risk Characterization, Appendix B (Interim Final Policy, July 1995).
2. MA DEP, Human Exposures at Industrial/Commercial Properties (Draft, January 1996).
3. US EPA, Risk Assessment Guidance for Superfund, Supplemental Guidance (March 1991).
4. MA DEP, Background Documentation for the Development of the MCP Numerical Standards (April 1994).

**Table 23**  
**Exposure Point Concentrations - Soil**  
**Raytheon Company**  
**Wayland, Massachusetts**

Exposure Pathway Comments	Dermal Contact, Ingestion Surface/Subsurface	Inhalation Open Field	Inhalation Excavation
Compound of Concern	EPC <sub>s</sub> (mg/kg)	EPC <sub>s,air</sub> (µg/m <sup>3</sup> )	EPC <sub>s,air</sub> (µg/m <sup>3</sup> )
<i>Semi-Volatile Organic Compounds (SVOCs)</i>			
Benzo(a)anthracene	0.21	6.76E-06	1.27E-05
Benzo(a)pyrene	0.22	6.89E-06	1.29E-05
Benzo(b)fluoranthene	0.23	7.21E-06	1.35E-05
Chrysene	0.20	6.48E-06	1.21E-05
Fluroanthene	0.26	8.24E-06	1.54E-05
Pyrene	0.24	7.57E-06	1.42E-05
<i>Polychlorinated Biphenyls (PCBs)</i>			
Arochlor 1254	0.12	3.87E-06	7.25E-06
Arochlor 1260	0.16	5.09E-06	9.54E-06
<i>Extractable Petroleum Hydrocarbons (EPH)</i>			
C19-C36 Aliphatics	51	1.63E-03	3.05E-03
C11-C22 Aromatics	79	2.52E-03	4.73E-03
<i>Total Metals</i>			
Chromium	19	6.04E-04	1.13E-03
Selenium	0.27	8.50E-06	1.59E-05
Silver	1.1	3.42E-05	6.41E-05

**Notes:**

EPC<sub>s</sub>: Calculated as arithmetic mean (i.e., average) across site soils, ND as 0.5 MDL.

EPC<sub>s,air</sub>: Calculated from the following equation:

$$EPC_{s,air} = [OHM]_s * PM10 * CF$$

[OHM]<sub>s</sub>: Soil Concentration = EPC<sub>s</sub> (mg/kg)

PM10: Respirable Particulates = 32 µg/m<sup>3</sup> (open field); 60 µg/m<sup>3</sup> (excavation)

CF: Conversion Factor = 10<sup>6</sup> kg/mg

**Table 24a**  
**Exposure Point Concentrations - Groundwater (Private Wells)**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Monitoring Well Location	EPC <sub>gw</sub> (µg/l)	MA DWQS (µg/l)
<i>Volatile Organic Compounds (VOCs)</i>			
Benzene	MW-13	1.6 (1)	5
Tetrachloroethene	HA-104	28	5
Trichloroethene	MW-43S	323	5
cis-1,2-Dichloroethene	MW-13	65	70
Vinyl Chloride	MW-13	4.5 (2)	2
1,1,1-Trichloroethane	MW-33S	90	200
1,1-Dichloroethane	MW-13	1.3	70 (4)
1,1-Dichloroethene	MW-45M	5.7	7
Trichlorofluoromethane	MW-43S	1.7	NI
1,2,3-Trichlorobenzene	MW-TP3	43	NI
1,2-Dichlorobenzene	MW-TP3	5.8	600
1,3-Dichlorobenzene	MW-43S	1.2	NI
1,4-Dichlorobenzene	MW-TP3	4.0 (2)	5
Chlorobenzene	MW-TP3	2.1(2)	100
<i>Dissolved Metals</i>			
Barium	MW-4	280 (3)	2,000
Chromium	MR-43S	10 (3)	100

**Notes:**

NI = No Information Available

EPC<sub>gw</sub>: Calculated from noted monitor well as average concentration detected over period of sampling, unless otherwise noted. ND as 0.5 \* MDL.

(1) Concentrations decreasing over time, EPC<sub>gw</sub> estimated as most recent detected value.

(2) Concentrations increasing over time, EPC<sub>gw</sub> estimated as most recent detected value.

(3) Insufficient data available to identify trend, EPC<sub>gw</sub> estimated as maximum detected value.

(4) Estimated as secondary MCL.

MA DWQS: Massachusetts Drinking Water Quality Standard (DWQS) based on Maximum Contaminant Levels (MCLs), unless otherwise noted.

Shaded cells denote EPC<sub>gw</sub> values greater than MA Drinking Water Quality Standards.

**Table 24b**  
**Exposure Point Concentrations - Groundwater (Indoor Air)**  
**Raytheon Company**  
**Wayland, Massachusetts**

<b>Compound of Concern</b>	<b>Groundwater Concentration (µg/L)</b>	<b>Henry's Law Constant (-)</b>	<b>EPC<sub>gw,air</sub> (µg/m<sup>3</sup>)</b>
<i>Volatile Organic Compounds (VOCs)</i>			
Benzene	1.7	0.20	0.02
Tetrachloroethene	3.3	0.08	0.01
Trichloroethene	122	0.40	2.4
cis-1,2-Dichloroethene	16	0.14	0.11
Vinyl Chloride	2.2	1.0	0.11
1,1,1-Trichloroethane	0.89	0.90	0.04
1,1-Dichloroethane	0.84	0.20	0.01
1,1-Dichloroethene	0.74	0.60	0.02
Trichlorofluoromethane	0.75	4.0	0.15
1,2,3-Trichlorobenzene	-	-	-
1,2-Dichlorobenzene	5.0	0.08	0.02
1,3-Dichlorobenzene	5.0	0.07	0.02
1,4-Dichlorobenzene	-	-	-
Chlorobenzene	-	-	-

**Notes:**

- : Analytical results below the method detection limit, data not carried further in this analysis.

EPC<sub>gw,air</sub>: Calculated from the Johnson-Ettinger Model as follows:

$$EPC_{gw,air} = [OHM]_{gw} * \alpha * d * H * CF$$

[OHM]<sub>gw</sub>: Groundwater Concentration (µg/l), groundwater concentrations calculated as average across monitoring wells located within 30 ft from main buildings and screened across 15 ft depth. ND as 0.5 \* MDL.

α: Attenuation Factor = 0.0005 (unitless), identified from Johnson-Ettinger Model for highly permeable soils (fine to medium sand).

d: Dilution Factor = 0.1 (unitless), based on MA DEP Guidance (Interim Final Policy, July 1995).

H: Henry's Law Constant (µg<sub>air</sub>/µg<sub>gw</sub>), taken from DEP Background Documentation (April 1994) except for cis-1,2-DCE, Trichlorofluoromethane and 1,3-DCB which were taken from Howard (1993).

CF: Conversion Factor = 1000 l/m<sup>3</sup>

**Table 25**  
**Exposure Point Concentrations - Sediment**  
**Raytheon Company**  
**Wayland, Massachusetts**

Exposure Pathway Comments	Dermal Contact, Ingestion Area of Readily Apparent Harm	Dermal Contact, Ingestion Surrounding Area
Compound of Concern	EPC <sub>sed</sub> (mg/kg)	EPC <sub>sed</sub> (mg/kg)
<i>Semi-Volatile Organics (SVOCs)</i>		
Acenaphthene	1.0	0.02
Fluoranthene	14	1.7
Naphthalene	0.97	0.01
Benzo(a)anthracene	6.2	0.74
Benzo(a)pyrene	7.1	0.99
Benzo(b)fluoranthene	8.5	1.3
Benzo(k)fluoranthene	7.0	1.0
Chrysene	8.6	1.2
Acenaphthylene	0.17	0.05
Anthracene	2.1	0.09
Benzo(g,h,i)perylene	5.9	0.81
Fluorene	0.87	0.02
Phenanthrene	8.7	0.54
Dibenzo(a,h)anthracene	1.9	0.22
Indeno(1,2,3-cd)pyrene	5.8	0.85
Pyrene	12	1.5
Methylnaphthalene, 1-	0.17	-
Methylnaphthalene, 2-	0.21	-
Perylene	1.3	0.16
1-Methylphenanthrene	NDA	0.03
Biphenyl	0.06	-
<i>Polychlorinated Biphenyls (PCBs)</i>		
Aroclor 1254	0.78	1.1
Aroclor 1260	40	2.8
<i>Extractable Petroleum Hydrocarbons (EPH)</i>		
C <sub>9</sub> - C <sub>18</sub> Aliphatics	722	47
C <sub>19</sub> - C <sub>36</sub> Aliphatics	2,595	211
C <sub>11</sub> - C <sub>22</sub> Aromatics	1,238	146
<i>Total Metals</i>		
Antimony	10	1.1
Arsenic	13	12
Barium	99	62
Cadmium	4.3	2.6
Chromium	5,752	493
Chromium , Hexavalent	55	2
Cobalt	2.2	3.2
Copper	4,054	537
Iron	10,896	6,333
Lead	642	244
Manganese	132	263
Mercury	2.4	1.2
Nickel	15	13
Silver	102	19
Thallium	0.71	-
Tin	80	14
Vanadium	70	29
Zinc	188	102

**Notes:**

EPC<sub>sed</sub> (ARAH): Calculated as average across site sediments located in Area of Readily Apparent Harm.

EPC<sub>sed</sub> (SA): Calculated as average across site sediments located in Surrounding Area.

**Table 26**  
**Exposure Point Concentrations - Surface Water**  
**Raytheon Company**  
**Wayland, Massachusetts**

Exposure Pathway Comments	Dermal Contact, Ingestion Wetland Swale
	EPC <sub>sw</sub> (ug/L)
<i>Semi-Volatile Organics (SVOCs)</i>	
Acenaphthene	0.057
Fluoranthene	0.34
Naphthalene	0.032
Benzo(a)anthracene	0.11
Benzo(a)pyrene	0.15
Benzo(b)fluoranthene	0.24
Benzo(k)fluoranthene	0.12
Chrysene	0.20
Acenaphthylene	0.014
Anthracene	0.043
Benzo(g,h,i)perylene	0.15
Fluorene	0.030
Phenanthrene	0.18
Dibenzo(a,h)anthracene	0.035
Indeno(1,2,3-cd)pyrene	0.16
Pyrene	0.23
2-Methylnaphthalene	0.006
bis(2-ethylhexyl)phthalate	78
<i>Total Polychlorinated Biphenyls (PCBs)</i>	
0.015	
<i>Dissolved Metals</i>	
Aluminum	100
Antimony	0.66
Arsenic	2.8
Barium	40
Beryllium	0.26
Cadmium	1.0
Chromium	4.2
Cobalt	1.9
Copper	70
Iron	360
Lead	1.3
Manganese	368
Nickel	9.5
Selenium	0.34
Silver	0.27
Thallium	0.070
Tin	6.1
Vanadium	1.1
Zinc	200

**Notes:**

EPC<sub>sw</sub>: Calculated as average across surface water samples collected from wetland swale.

**Table 27**  
**Soil/Groundwater Exposure Dose - Facility Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>s</sub> (mg/kg)	EPC <sub>s,air</sub> (µg/m <sup>3</sup> )	Carcinogenic Exposure Dose (mg/kg-day)			Non-Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	0.21	6.76E-06	2.31E-07	2.23E-08	1.37E-10	6.42E-07	6.20E-08	3.81E-10
Benzo(a)pyrene	0.22	6.89E-06	2.35E-07	2.27E-08	1.40E-10	6.53E-07	6.32E-08	3.88E-10
Benzo(b)fluoranthene	0.23	7.21E-06	2.46E-07	2.38E-08	1.46E-10	6.84E-07	6.62E-08	4.07E-10
Chrysene	0.20	6.48E-06	2.21E-07	2.14E-08	1.31E-10	6.14E-07	5.94E-08	3.65E-10
Fluroanthene	0.26	8.24E-06	2.81E-07	2.72E-08	1.67E-10	7.81E-07	7.56E-08	4.64E-10
Pyrene	0.24	7.57E-06	2.58E-07	2.50E-08	1.54E-10	7.18E-07	6.94E-08	4.26E-10
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	0.12	3.87E-06	4.43E-08	1.28E-08	7.85E-11	1.23E-07	3.55E-08	2.18E-10
Arochlor 1260	0.16	5.09E-06	5.82E-08	1.68E-08	1.03E-10	1.62E-07	4.67E-08	2.87E-10
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	51	1.63E-03	2.78E-05	5.37E-06	3.30E-08	7.72E-05	1.49E-05	9.17E-08
C11-C22 Aromatics	79	2.52E-03	7.75E-05	8.33E-06	5.12E-08	2.15E-04	2.31E-05	1.42E-07
<i>Total Metals</i>								
Chromium	19	6.04E-04	4.12E-06	1.99E-06	1.22E-08	1.15E-05	5.54E-06	3.40E-08
Selenium	0.27	8.50E-06	2.90E-09	2.81E-08	1.72E-10	8.06E-09	7.80E-08	4.79E-10
Silver	1.1	3.42E-05	1.46E-06	1.13E-07	6.93E-10	4.05E-06	3.14E-07	1.93E-09

**Notes:**

- = Not applicable due to incomplete exposure pathway.

**Soil**

$$\text{Dermal Dose} = (EPC_s * SA * SAF * DAF * EF_{soil} * ED / BW * AP) * CF.3$$

$$\text{Ingestion Dose} = (EPC_s * SIR * IAF * EF_{soil} * ED / BW * AP) * CF.3$$

$$\text{Inhalation Dose} = (EPC_{s,air} * RV * InhAF * EF_{part} * ED / BW * AP) * CF.4$$



**Table 27**  
**Soil/Groundwater Exposure Dose - Facility Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>gw</sub> (µg/l)	EPC <sub>gw,air</sub> (µg/m <sup>3</sup> )	Carcinogenic Exposure Dose (mg/kg-day)			Non-Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Groundwater</b>	-							
<i>Volatile Organic Compounds (VOCs)</i>								
Benzene		0.02	-	-	5.90E-07	-	-	1.64E-06
Tetrachloroethene		0.01	-	-	4.47E-07	-	-	1.24E-06
Trichloroethene		2.4	-	-	8.22E-05	-	-	2.28E-04
cis-1,2-Dichloroethene		0.11	-	-	3.80E-06	-	-	1.05E-05
Vinyl Chloride		0.11	-	-	3.64E-06	-	-	1.01E-05
1,1,1-Trichloroethane		0.04	-	-	1.35E-06	-	-	3.76E-06
1,1-Dichloroethane		0.01	-	-	2.86E-07	-	-	7.93E-07
1,1-Dichloroethene		0.02	-	-	7.55E-07	-	-	2.10E-06
Trichlorofluoromethane		0.15	-	-	5.07E-06	-	-	1.41E-05
1,2,3-Trichlorobenzene		-	-	-	-	-	-	-
1,2-Dichlorobenzene		0.02	-	-	6.76E-07	-	-	1.88E-06
1,3-Dichlorobenzene		0.02	-	-	5.92E-07	-	-	1.64E-06
1,4-Dichlorobenzene		-	-	-	-	-	-	-
Chlorobenzene		-	-	-	-	-	-	-
<i>Dissolved Metals</i>								
Barium		-	-	-	-	-	-	-
Chromium		-	-	-	-	-	-	-

**Notes:**

- = Not applicable due to incomplete exposure pathway.

Groundwater

$$\text{Ingestion Dose} = (\text{EPC}_{\text{gw}} * \text{GWIR} * \text{IAF} * \text{EF}_{\text{gw}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}.4$$

$$\text{Inhalation Dose} = (\text{EPC}_{\text{gw,air}} * \text{RV} * \text{InhAF} * \text{EF}_{\text{vol}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}.4$$

**Table 28**  
**Soil Exposure Dose - Construction Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>s</sub> (mg/kg)	EPC <sub>s,air</sub> (µg/m <sup>3</sup> )	Carcinogenic Exposure Dose (mg/kg-day)			Non-Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	0.21	1.27E-05	7.13E-09	6.89E-09	2.38E-11	5.35E-07	5.17E-07	1.79E-09
Benzo(a)pyrene	0.22	1.29E-05	7.26E-09	7.02E-09	2.43E-11	5.45E-07	5.26E-07	1.82E-09
Benzo(b)fluoranthene	0.23	1.35E-05	7.61E-09	7.35E-09	2.54E-11	5.70E-07	5.52E-07	1.91E-09
Chrysene	0.20	1.21E-05	6.83E-09	6.60E-09	2.28E-11	5.12E-07	4.95E-07	1.71E-09
Fluroanthene	0.26	1.54E-05	8.68E-09	8.39E-09	2.90E-11	6.51E-07	6.30E-07	2.18E-09
Pyrene	0.24	1.42E-05	7.98E-09	7.71E-09	2.67E-11	5.98E-07	5.78E-07	2.00E-09
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	0.12	7.26E-06	1.37E-09	3.94E-09	1.36E-11	1.03E-07	2.96E-07	1.02E-09
Arochlor 1260	0.19	1.13E-05	1.80E-09	5.19E-09	1.79E-11	1.35E-07	3.89E-07	1.34E-09
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	51	3.05E-03	8.58E-07	1.66E-06	5.73E-09	6.43E-05	1.24E-04	4.30E-07
C11-C22 Aromatics	79	4.73E-03	2.39E-06	2.57E-06	8.88E-09	1.79E-04	1.93E-04	6.66E-07
<i>Total Metals</i>								
Chromium	19	1.13E-03	1.27E-07	6.15E-07	2.13E-09	9.55E-06	4.61E-05	1.59E-07
Selenium	0.27	1.59E-05	8.96E-11	8.66E-09	2.99E-11	6.72E-09	6.50E-07	2.25E-09
Silver	1.1	6.41E-05	4.50E-08	3.48E-08	1.20E-10	3.38E-06	2.61E-06	9.03E-09

**Notes:**

- = Not applicable due to incomplete exposure pathway.

**Soil**

$$\text{Dermal Dose} = (\text{EPCs} * \text{SA} * \text{SAF} * \text{DAF} * \text{EFsoil} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.3}$$

$$\text{Ingestion Dose} = (\text{EPCs} * \text{SIR} * \text{IAF} * \text{EFsoil} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.3}$$

$$\text{Inhalation Dose} = (\text{EPCs,air} * \text{RV} * \text{InhAF} * \text{EFpart} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.4}$$

**Table 29**  
**Sediment/Surface Water Exposure Dose - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>sed</sub> (mg/kg)	Area of Readily Apparent Harm			
		Carcinogenic Exposure Dose (mg/kg-day)		Non-Carcinogenic Exposure Dose (mg/kg-day)	
		Dermal	Ingestion	Dermal	Ingestion
<b>Sediment</b>					
<i>Semi-Volatile Organic Compounds (SVOCs)</i>					
Acenaphthene	1.0	1.32E-07	1.64E-08	8.23E-07	1.03E-07
Fluoranthene	14	1.84E-06	2.30E-07	1.15E-05	1.44E-06
Naphthalene	1.0	6.39E-08	1.59E-08	3.99E-07	9.97E-08
Benzo(a)anthracene	6.2	8.16E-07	1.02E-07	5.10E-06	6.37E-07
Benzo(a)pyrene	7.1	9.35E-07	1.17E-07	5.84E-06	7.29E-07
Benzo(b)fluoranthene	8.5	1.12E-06	1.40E-07	6.99E-06	8.73E-07
Benzo(k)fluoranthene	7.2	9.54E-07	1.19E-07	5.96E-06	7.44E-07
Chrysene	8.6	1.13E-06	1.41E-07	7.08E-06	8.84E-07
Acenaphthylene	0.17	2.01E-08	2.54E-09	1.26E-07	1.59E-08
Anthracene	2.1	4.01E-07	3.45E-08	2.51E-06	2.16E-07
Benzo(g,h,i)perylene	5.9	6.99E-07	8.83E-08	4.37E-06	5.52E-07
Fluorene	0.9	1.15E-07	1.43E-08	7.16E-07	8.94E-08
Phenanthrene	8.7	1.03E-06	1.30E-07	6.44E-06	8.13E-07
Dibenzo(a,h)anthracene	1.9	1.13E-07	3.12E-08	7.04E-07	1.95E-07
Indeno(1,2,3-cd)pyrene	5.8	7.64E-07	9.53E-08	4.77E-06	5.96E-07
Pyrene	12	1.58E-06	1.97E-07	9.87E-06	1.23E-06
Methylnaphthalene, 1-	0.2	1.12E-08	2.79E-09	6.99E-08	1.75E-08
Methylnaphthalene, 2-	0.2	1.38E-08	3.45E-09	8.64E-08	2.16E-08
Perylene	1.3	8.56E-08	2.14E-08	5.35E-07	1.34E-07
1-Methylphenanthrene	NDA	-	-	-	-
Biphenyl	0.1	3.16E-09	9.86E-10	1.97E-08	6.16E-09
<i>Polychlorinated Biphenyls (PCBs)</i>					
Arochlor 1254	0.8	3.44E-08	1.28E-08	2.15E-07	8.01E-08
Arochlor 1260	40	1.76E-06	6.58E-07	1.10E-05	4.11E-06
<i>Extractable Petroleum Hydrocarbons (EPH)</i>					
C9 - C18 Aliphatics	722	9.51E-05	1.19E-05	5.94E-04	7.42E-05
C19-C36 Aliphatics	2,595	1.71E-04	4.27E-05	1.07E-03	2.67E-04
C11-C22 Aromatics	1,238	1.47E-04	2.04E-05	9.17E-04	1.27E-04
<i>Total Metals</i>					
Antimony	10	6.58E-07	1.64E-07	4.11E-06	1.03E-06
Arsenic	13	2.57E-07	2.14E-07	1.60E-06	1.34E-06
Barium	99	1.96E-06	6.51E-07	1.22E-05	4.07E-06
Cadmium	4.3	3.96E-07	7.07E-08	2.48E-06	4.42E-07
Chromium	5,752	1.51E-04	9.45E-05	9.47E-04	5.91E-04
Chromium , Hexavalent	55	3.26E-06	9.04E-07	2.04E-05	5.65E-06
Cobalt	2.2	4.34E-08	1.45E-08	2.72E-07	9.04E-08
Copper	4,054	8.01E-05	2.67E-05	5.00E-04	1.67E-04
Iron	10,896	2.15E-04	7.16E-05	1.34E-03	4.48E-04
Lead	642	2.54E-06	5.28E-06	1.59E-05	3.30E-05
Manganese	132	2.61E-06	8.68E-07	1.63E-05	5.42E-06
Mercury	2.4	7.90E-08	3.95E-08	4.94E-07	2.47E-07
Nickel	15	3.46E-06	2.47E-07	2.16E-05	1.54E-06
Silver	102	1.68E-05	1.68E-06	1.05E-04	1.05E-05
Thallium	0.7	4.67E-09	1.17E-08	2.92E-08	7.29E-08
Tin	80	1.58E-06	5.26E-07	9.87E-06	3.29E-06
Vanadium	70	1.38E-06	4.60E-07	8.64E-06	2.88E-06
Zinc	188	2.48E-06	3.09E-06	1.55E-05	1.93E-05

**Notes:**

Sediment

$$\text{Dermal Dose} = (\text{EPC}_{\text{sed}} * \text{SA} * \text{SAF} * \text{DAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_3$$

$$\text{Ingestion Dose} = (\text{EPC}_{\text{sed}} * \text{SIR} * \text{IAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_3$$

**Table 29**  
**Sediment/Surface Water Exposure Dose - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Surrounding Area				
	EPC <sub>sed</sub> (mg/kg)	Carcinogenic Exposure Dose (mg/kg-day)		Non-Carcinogenic Exposure Dose (mg/kg-day)	
		Dermal	Ingestion	Dermal	Ingestion
<b>Sediment</b>					
<i>Semi-Volatile Organic Compounds (SVOCs)</i>					
Acenaphthene	0.02	2.30E-09	2.87E-10	1.44E-08	1.79E-09
Fluoranthene	1.7	2.21E-07	2.76E-08	1.38E-06	1.72E-07
Naphthalene	0.01	9.59E-10	2.40E-10	6.00E-09	1.50E-09
Benzo(a)anthracene	0.74	9.77E-08	1.22E-08	6.11E-07	7.62E-08
Benzo(a)pyrene	1.0	1.30E-07	1.63E-08	8.14E-07	1.02E-07
Benzo(b)fluoranthene	1.3	1.73E-07	2.16E-08	1.08E-06	1.35E-07
Benzo(k)fluoranthene	1.0	1.35E-07	1.68E-08	8.42E-07	1.05E-07
Chrysene	1.2	1.64E-07	2.05E-08	1.03E-06	1.28E-07
Acenaphthylene	0.05	5.77E-09	7.28E-10	3.60E-08	4.55E-09
Anthracene	0.09	1.75E-08	1.51E-09	1.09E-07	9.41E-09
Benzo(g,h,i)perylene	0.8	9.62E-08	1.21E-08	6.01E-07	7.59E-08
Fluorene	0.02	2.63E-09	3.28E-10	1.64E-08	2.05E-09
Phenanthrene	0.54	6.34E-08	8.01E-09	3.96E-07	5.00E-08
Dibenzo(a,h)anthracene	0.22	1.28E-08	3.56E-09	8.01E-08	2.22E-08
Indeno(1,2,3-cd)pyrene	0.9	1.12E-07	1.40E-08	7.01E-07	8.75E-08
Pyrene	1.5	1.93E-07	2.40E-08	1.20E-06	1.50E-07
Methylnaphthalene, 1-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-
Perylene	0.16	1.05E-08	2.61E-09	6.54E-08	1.63E-08
1-Methylphenanthrene	0.03	2.05E-09	5.13E-10	1.28E-08	3.20E-09
Biphenyl	-	-	-	-	-
<i>Polychlorinated Biphenyls (PCBs)</i>					
Arochlor 1254	1.1	4.79E-08	1.78E-08	2.99E-07	1.12E-07
Arochlor 1260	2.8	1.24E-07	4.61E-08	7.74E-07	2.88E-07
<i>Extractable Petroleum Hydrocarbons (EPH)</i>					
C9 - C18 Aliphatics	47	6.21E-06	7.76E-07	3.88E-05	4.85E-06
C19-C36 Aliphatics	211	1.39E-05	3.47E-06	8.68E-05	2.17E-05
C11-C22 Aromatics	146	1.72E-05	2.39E-06	1.08E-04	1.49E-05
<i>Total Metals</i>					
Antimony	1	6.58E-08	1.64E-08	4.11E-07	1.03E-07
Arsenic	12	2.37E-07	1.97E-07	1.48E-06	1.23E-06
Barium	62	1.22E-06	4.08E-07	7.65E-06	2.55E-06
Cadmium	2.6	2.40E-07	4.27E-08	1.50E-06	2.67E-07
Chromium	493	1.30E-05	8.10E-06	8.11E-05	5.07E-05
Chromium , Hexavalent	2	1.18E-07	3.29E-08	7.41E-07	2.05E-07
Cobalt	3.2	6.32E-08	2.10E-08	3.95E-07	1.32E-07
Copper	537	1.06E-05	3.53E-06	6.63E-05	2.21E-05
Iron	6,333	1.25E-04	4.16E-05	7.82E-04	2.60E-04
Lead	244	9.64E-07	2.01E-06	6.02E-06	1.25E-05
Manganese	263	5.19E-06	1.73E-06	3.25E-05	1.08E-05
Mercury	1.2	3.95E-08	1.97E-08	2.47E-07	1.23E-07
Nickel	13	3.00E-06	2.14E-07	1.87E-05	1.34E-06
Silver	19	3.13E-06	3.12E-07	1.95E-05	1.95E-06
Thallium	-	-	-	-	-
Tin	14	2.76E-07	9.21E-08	1.73E-06	5.75E-07
Vanadium	29	5.73E-07	1.91E-07	3.58E-06	1.19E-06
Zinc	102	1.34E-06	1.68E-06	8.39E-06	1.05E-05

**Notes:**

Sediment

$$\text{Dermal Dose} = (\text{EPC}_{\text{sed}} * \text{SA} * \text{SAF} * \text{DAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_3$$

$$\text{Ingestion Dose} = (\text{EPC}_{\text{sed}} * \text{SIR} * \text{IAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_3$$

**Table 29**  
**Sediment/Surface Water Exposure Dose - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>sw</sub> (ug/L)	Carcinogenic Exposure Dose (mg/kg-day)		Non-Carcinogenic Exposure Dose (mg/kg-day)	
		Dermal	Ingestion	Dermal	Ingestion
<b>Surface Water</b>					
<i>Semi-Volatile Organic Compounds (SVOCs)</i>					
Acenaphthene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Fluoranthene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Naphthalene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Benzo(a)anthracene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Benzo(a)pyrene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Benzo(b)fluoranthene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Benzo(k)fluoranthene	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Chrysene	0.06	5.86E-11	1.55E-10	3.66E-10	9.72E-10
Acenaphthylene	0.345	1.28E-07	9.45E-10	8.01E-07	5.91E-09
Anthracene	0.032	1.14E-09	8.77E-11	7.12E-09	5.48E-10
Benzo[g,h,i]perylene	0.11	9.59E-08	3.14E-10	5.99E-07	1.96E-09
Fluorene	0.153	1.90E-07	4.20E-10	1.19E-06	2.63E-09
Phenanthrene	0.24	3.01E-07	6.66E-10	1.88E-06	4.16E-09
Dibenzo[a,h]anthracene	0.124	1.28E-10	3.41E-10	8.02E-10	2.13E-10
Indeno[1,2,3-cd]pyrene	0.20	1.66E-07	5.42E-10	1.04E-06	3.39E-09
Pyrene	0.01	1.28E-11	3.43E-11	7.99E-11	2.14E-10
2-Methylnaphthalene	0.043	6.48E-11	1.18E-10	4.05E-10	7.41E-10
bis (2-ethylhexyl) phthalate	0	1.38E-10	3.70E-10	8.62E-10	2.31E-09
<i>Total Polychlorinated Biphenyls (PCBs)</i>	0.015	5.30E-12	4.20E-11	3.32E-11	2.63E-10
<i>Dissolved Metals</i>					
Aluminum	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Antimony	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Arsenic	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Barium	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Beryllium	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Cadmium	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Chromium	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Cobalt	100.5	1.56E-08	1.10E-07	9.73E-08	6.88E-07
Copper	1	3.39E-10	1.80E-09	2.12E-09	1.12E-08
Iron	3	4.38E-10	7.74E-09	2.74E-09	4.84E-08
Lead	39.5	6.12E-09	4.33E-08	3.82E-08	2.71E-07
Manganese	0	4.00E-11	7.08E-10	2.50E-10	4.43E-09
Nickel	1.0	7.06E-10	2.68E-09	4.41E-09	1.67E-08
Selenium	4.23	8.73E-10	1.16E-08	5.46E-09	7.24E-08
Silver	1.86	2.88E-10	2.04E-09	1.80E-09	1.27E-08
Thallium	70.350	1.09E-08	7.71E-08	6.81E-08	4.82E-07
Tin	359.6	5.57E-08	3.94E-07	3.48E-07	2.46E-06
Vanadium	1.3	4.09E-11	1.81E-09	2.56E-10	1.13E-08
Zinc	368	5.69E-08	4.03E-07	3.56E-07	2.52E-06

**Notes:**

Surface Water

$$Dermal\ Dose = (EPC_{sw} * SA * K_p * DAF * EF_{sw} * ED / BW * AP) * (CF.2 * CF.4 * CF.5)$$

$$Ingestion\ Dose = (EPC_{sw} * SWIR * IAF * EF_{sw} * ED / BW * AP) * CF.4$$

**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>s</sub> (mg/kg)	EPC <sub>s,air</sub> (mg/m <sup>3</sup> )	Child			Adult			Lifetime		
			Carcinogenic Exposure Dose (mg/kg-day)			Carcinogenic Exposure Dose (mg/kg-day)			Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Soil</b>											
<i>Semi-Volatile Organic Compounds (SVOCs)</i>											
Benzo(a)anthracene	0.21	6.76E-06	1.49E-07	6.95E-08	2.03E-10	2.05E-07	1.99E-08	3.66E-10	3.54E-07	8.93E-08	5.69E-10
Benzo(a)pyrene	0.22	6.89E-06	1.52E-07	7.08E-08	2.07E-10	2.09E-07	2.02E-08	3.73E-10	3.61E-07	9.10E-08	5.79E-10
Benzo(b)fluoranthene	0.23	7.21E-06	1.59E-07	7.41E-08	2.17E-10	2.19E-07	2.12E-08	3.90E-10	3.78E-07	9.53E-08	6.07E-10
Chrysene	0.20	6.48E-06	1.43E-07	6.65E-08	1.94E-10	1.97E-07	1.90E-08	3.50E-10	3.39E-07	8.55E-08	5.45E-10
Fluoranthene	0.26	8.24E-06	1.81E-07	8.46E-08	2.47E-10	2.50E-07	2.42E-08	4.46E-10	4.31E-07	1.09E-07	6.93E-10
Pyrene	0.24	7.57E-06	1.67E-07	7.77E-08	2.27E-10	2.30E-07	2.22E-08	4.09E-10	3.96E-07	1.00E-07	6.37E-10
<i>Polychlorinated Biphenyls (PCBs)</i>											
Arochlor 1254	0.12	3.87E-06	2.85E-08	3.98E-08	1.16E-10	3.94E-08	1.14E-08	2.09E-10	6.79E-08	5.11E-08	3.26E-10
Arochlor 1260	0.19	6.04E-06	3.75E-08	5.23E-08	1.53E-10	5.17E-08	1.49E-08	2.75E-10	8.93E-08	6.72E-08	4.28E-10
<i>Extractable Petroleum Hydrocarbons (EPH)</i>											
C19-C36 SVOCsatics	51	1.63E-03	1.79E-05	1.67E-05	4.88E-08	2.47E-05	4.78E-06	8.81E-08	4.26E-05	2.15E-05	1.37E-07
C11-C22 Aromatics	79	2.52E-03	5.00E-05	2.59E-05	7.57E-08	6.89E-05	7.40E-06	1.36E-07	1.19E-04	3.33E-05	2.12E-07
<i>Total Metals</i>											
Chromium	19	6.04E-04	2.66E-06	6.20E-06	1.81E-08	3.67E-06	1.77E-06	3.27E-08	6.32E-06	7.97E-06	5.08E-08
Selenium	0.27	8.50E-06	1.87E-09	8.73E-08	2.55E-10	2.58E-09	2.49E-08	4.60E-10	4.45E-09	1.12E-07	7.15E-10
Silver	1.1	3.42E-05	9.41E-07	3.51E-07	1.03E-09	1.30E-06	1.00E-07	1.85E-09	2.24E-06	4.51E-07	2.87E-09

**Notes:**

Soil

$$\text{Dermal Dose} = (\text{EPC}_s * \text{SA} * \text{SAF} * \text{DAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.3}$$

$$\text{Ingestion Dose} = (\text{EPC}_s * \text{SIR} * \text{IAF} * \text{EF}_{\text{soil}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.3}$$

$$\text{Inhalation Dose} = (\text{EPC}_{s,\text{air}} * \text{RV} * \text{InhAF} * \text{EF}_{\text{part}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF.4}$$

$$\text{Lifetime Dose} = \text{Child Dose} + \text{Adult Dose}$$

**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Non-Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>s</sub> (mg/kg)	EPC <sub>s,air</sub> (mg/m <sup>3</sup> )	Child			Adult		
			Non-Carcinogenic Exposure Dose (mg/kg-day)			Non-Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	0.21	6.76E-06	1.86E-06	8.69E-07	2.54E-09	6.42E-07	6.20E-08	1.14E-09
Benzo(a)pyrene	0.22	6.89E-06	1.90E-06	8.84E-07	2.58E-09	6.53E-07	6.32E-08	1.16E-09
Benzo(b)fluoranthene	0.23	7.21E-06	1.99E-06	9.27E-07	2.71E-09	6.84E-07	6.62E-08	1.22E-09
Chrysene	0.20	6.48E-06	1.78E-06	8.32E-07	2.43E-09	6.14E-07	5.94E-08	1.10E-09
Fluoranthene	0.26	8.24E-06	2.27E-06	1.06E-06	3.09E-09	7.81E-07	7.56E-08	1.39E-09
Pyrene	0.24	7.57E-06	2.08E-06	9.72E-07	2.84E-09	7.18E-07	6.94E-08	1.28E-09
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	0.12	3.87E-06	3.57E-07	4.97E-07	1.45E-09	1.23E-07	3.55E-08	6.54E-10
Arochlor 1260	0.19	6.04E-06	4.69E-07	6.53E-07	1.91E-09	1.62E-07	4.67E-08	8.60E-10
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	51	1.63E-03	2.24E-04	2.09E-04	6.11E-07	7.72E-05	1.49E-05	2.75E-07
C11-C22 Aromatics	79	2.52E-03	6.25E-04	3.24E-04	9.46E-07	2.15E-04	2.31E-05	4.26E-07
<i>Total Metals</i>								
Chromium	19	6.04E-04	3.32E-05	7.75E-05	2.26E-07	1.15E-05	5.54E-06	1.02E-07
Selenium	0.27	8.50E-06	2.34E-08	1.09E-06	3.19E-09	8.06E-09	7.80E-08	1.44E-09
Silver	1.1	3.42E-05	1.18E-05	4.39E-06	1.28E-08	4.05E-06	3.14E-07	5.78E-09

**Notes:**

Soil

$$\text{Dermal Dose} = (EPC_s * SA * SAF * DAF * EF_{soil} * ED / BW * AP) * CF.3$$

$$\text{Ingestion Dose} = (EPC_s * SIR * IAF * EF_{soil} * ED / BW * AP) * CF.3$$

$$\text{Inhalation Dose} = (EPC_{s,air} * RV * InhAF * EF_{part} * ED / BW * AP) * CF.4$$

**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Non-Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>gw</sub> (mg/l)	EPC <sub>gw,air</sub> (mg/m <sup>3</sup> )	Child			Adult			Lifetime		
			Carcinogenic Exposure Dose (mg/kg-day)			Carcinogenic Exposure Dose (mg/kg-day)			Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Groundwater</b>											
<i>Volatile Organic Compounds (VOCs)</i>											
Benzene	1.6	0.02	-	1.23E-05	1.22E-06	-	1.40E-05	2.20E-06	-	2.63E-05	3.42E-06
Tetrachloroethene	28	0.01	-	2.15E-04	9.26E-07	-	2.45E-04	1.67E-06	-	4.60E-04	2.60E-06
Trichloroethene	323	2.4	-	2.48E-03	1.70E-04	-	2.83E-03	3.07E-04	-	5.31E-03	4.77E-04
cis-1,2-Dichloroethene	65	0.11	-	4.99E-04	7.86E-06	-	5.70E-04	1.42E-05	-	1.07E-03	2.20E-05
Vinyl Chloride	4.5	0.11	-	5.28E-05	7.53E-06	-	6.04E-05	1.36E-05	-	1.13E-04	2.11E-05
1,1,1-Trichloroethane	90	0.04	-	6.90E-04	2.80E-06	-	7.89E-04	5.05E-06	-	1.48E-03	7.85E-06
1,1-Dichloroethane	1.3	0.01	-	1.30E-05	5.91E-07	-	1.48E-05	1.07E-06	-	2.78E-05	1.66E-06
1,1-Dichloroethene	5.7	0.02	-	4.37E-05	1.56E-06	-	5.00E-05	2.82E-06	-	9.37E-05	4.38E-06
Trichlorofluoromethane	1.7	0.15	-	1.29E-05	1.05E-05	-	1.48E-05	1.89E-05	-	2.77E-05	2.94E-05
1,2,3-Trichlorobenzene	43	-	-	3.30E-04	-	-	3.77E-04	-	-	7.07E-04	-
1,2-Dichlorobenzene	5.8	0.02	-	4.45E-05	1.40E-06	-	5.08E-05	2.52E-06	-	9.53E-05	3.93E-06
1,3-Dichlorobenzene	1.2	0.02	-	9.21E-06	1.23E-06	-	1.05E-05	2.21E-06	-	1.97E-05	3.43E-06
1,4-Dichlorobenzene	4.0	-	-	3.07E-05	-	-	3.51E-05	-	-	6.58E-05	-
Chlorobenzene	2.1	-	-	1.61E-05	-	-	1.84E-05	-	-	3.45E-05	-
<i>Dissolved Metals</i>											
Barium	280	-	-	8.59E-04	-	-	9.82E-04	-	-	1.84E-03	-
Chromium	10	-	-	7.67E-05	-	-	8.77E-05	-	-	1.64E-04	-

**Notes:**

- = Not applicable due to incomplete exposure pathway.

Groundwater

$$\text{Ingestion Dose} = (\text{EPC}_{\text{gw}} * \text{GWIR} * \text{IAF} * \text{EF}_{\text{gw}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_4$$

$$\text{Inhalation Dose} = (\text{EPC}_{\text{gw,air}} * \text{RV} * \text{InhAF} * \text{EF}_{\text{vol}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_4$$

$$\text{Lifetime Dose} = \text{Child Dose} + \text{Adult Dose}$$



**Table 30**  
**Soil/Groundwater Exposure Dose - On-Site Resident (Carcinogenic)**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	EPC <sub>gw</sub> (mg/l)	EPC <sub>gw,air</sub> (mg/m <sup>3</sup> )	Child			Adult		
			Non-Carcinogenic Exposure Dose (mg/kg-day)			Non-Carcinogenic Exposure Dose (mg/kg-day)		
			Dermal	Ingestion	Inhalation	Dermal	Ingestion	Inhalation
<b>Groundwater</b>								
<i>Volatile Organic Compounds (VOCs)</i>								
Benzene	1.6	0.02	-	1.53E-04	1.53E-05	-	4.38E-05	6.88E-06
Tetrachloroethene	28	0.01	-	2.68E-03	1.16E-05	-	7.67E-04	5.22E-06
Trichloroethene	323	2.4	-	3.10E-02	2.13E-03	-	8.85E-03	9.59E-04
cis-1,2-Dichloroethene	65	0.11	-	6.23E-03	9.83E-05	-	1.78E-03	4.43E-05
Vinyl Chloride	4.5	0.11	-	6.60E-04	9.41E-05	-	1.89E-04	4.24E-05
1,1,1-Trichloroethane	90	0.04	-	8.63E-03	3.50E-05	-	2.47E-03	1.58E-05
1,1-Dichloroethane	1.3	0.01	-	1.62E-04	7.39E-06	-	4.63E-05	3.33E-06
1,1-Dichloroethene	5.7	0.02	-	5.47E-04	1.96E-05	-	1.56E-04	8.81E-06
Trichlorofluoromethane	1.7	0.15	-	1.61E-04	1.31E-04	-	4.61E-05	5.92E-05
1,2,3-Trichlorobenzene	43	-	-	4.12E-03	-	-	1.18E-03	-
1,2-Dichlorobenzene	5.8	0.02	-	5.56E-04	1.75E-05	-	1.59E-04	7.89E-06
1,3-Dichlorobenzene	1.2	0.02	-	1.15E-04	1.53E-05	-	3.29E-05	6.90E-06
1,4-Dichlorobenzene	4.0	-	-	3.84E-04	-	-	1.10E-04	-
Chlorobenzene	2.1	-	-	2.01E-04	-	-	5.75E-05	-
<i>Dissolved Metals</i>								
Barium	280	-	-	1.07E-02	-	-	3.07E-03	-
Chromium	10	-	-	9.59E-04	-	-	2.74E-04	-

**Notes:**

- = Not applicable due to incomplete exposure pathway.

Groundwater

$$\text{Ingestion Dose} = (\text{EPC}_{\text{gw}} * \text{GWIR} * \text{IAF} * \text{EF}_{\text{gw}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_4$$

$$\text{Inhalation Dose} = (\text{EPC}_{\text{gw,air}} * \text{RV} * \text{InhAF} * \text{EF}_{\text{vol}} * \text{ED} / \text{BW} * \text{AP}) * \text{CF}_4$$

**Table 31**  
**Soil/Groundwater Risk Characterization - Facility Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	ELCR			Total ELCR <sub>chem-specific</sub>	HI			Total HI <sub>chem-specific</sub>
	Dermal	Ingestion	Inhalation		Dermal	Ingestion	Inhalation	
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	1.69E-07	1.63E-08	-	1.8E-07	3.21E-05	3.10E-06	-	3.5E-05
Benzo(a)pyrene	1.72E-06	1.66E-07	4.33E-10	1.9E-06	3.27E-05	3.16E-06	-	3.6E-05
Benzo(b)fluoranthene	1.80E-07	1.74E-08	-	2.0E-07	3.42E-05	3.31E-06	-	3.8E-05
Chrysene	1.61E-09	1.56E-10	-	1.8E-09	3.07E-05	2.97E-06	-	3.4E-05
Fluroanthene	-	-	-	-	1.95E-05	1.89E-06	-	2.1E-05
Pyrene	-	-	-	-	2.39E-05	2.31E-06	-	2.6E-05
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	8.86E-08	2.56E-08	1.57E-10	1.1E-07	6.15E-03	1.78E-03	3.82E-05	8.0E-03
Arochlor 1260	1.16E-07	3.36E-08	2.06E-10	1.5E-07	8.09E-03	2.33E-03	5.02E-05	1.0E-02
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	-	-	-	-	1.29E-05	2.49E-06	-	1.5E-05
C11-C22 Aromatics	-	-	-	-	7.18E-03	7.71E-04	7.01E-06	8.0E-03
<i>Total Metals</i>								
Chromium	-	-	-	-	7.64E-06	3.69E-06	-	1.1E-05
Selenium	-	-	-	-	1.61E-06	1.56E-05	-	1.7E-05
Silver	-	-	-	-	8.11E-04	6.27E-05	-	8.7E-04
	2.3E-06	2.6E-07	8.0E-10	<b>2.5E-06</b>	2.2E-02	5.0E-03	9.5E-05	<b>2.7E-02</b>
	<b>Total ELCR<sub>route-specific</sub></b>			<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>			<b>HI<sub>media-specific</sub></b>

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF

HI: Hazard Index = Exposure Dose / RfD

**Table 31**  
**Soil/Groundwater Risk Characterization - Facility Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	ELCR			Total ELCR <sub>chem-specific</sub>	HI			Total HI <sub>chem-specific</sub>
	Dermal	Ingestion	Inhalation		Dermal	Ingestion	Inhalation	
<b>Groundwater</b>								
<i>Volatile Organic Compounds (VOCs)</i>								
Benzene	-	-	1.71E-08	1.7E-08	-	-	9.64E-04	9.6E-04
Tetrachloroethene	-	-	8.94E-10	8.9E-10	-	-	8.87E-06	8.9E-06
Trichloroethene	-	-	4.93E-07	4.9E-07	-	-	4.44E-03	4.4E-03
cis-1,2-Dichloroethene	-	-	-	-	-	-	1.47E-03	1.5E-03
Vinyl Chloride	-	-	1.09E-06	1.1E-06	-	-	2.08E-03	2.1E-03
1,1,1-Trichloroethane	-	-	-	-	-	-	5.96E-06	6.0E-06
1,1-Dichloroethane	-	-	-	-	-	-	5.67E-06	5.7E-06
1,1-Dichloroethene	-	-	1.32E-07	1.3E-07	-	-	-	-
Trichlorofluoromethane	-	-	-	-	-	-	7.05E-05	7.0E-05
1,2,3-Trichlorobenzene	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-	-	-	3.29E-05	3.3E-05
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-
<i>Dissolved Metals</i>								
Barium	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-
	0.0E+00	0.0E+00	1.7E-06	<b>1.7E-06</b>	0.0E+00	0.0E+00	9.1E-03	<b>9.1E-03</b>
	<b>Total ELCR<sub>route-specific</sub></b>			<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>			<b>HI<sub>media-specific</sub></b>
	<b>Cumulative ELCR</b>			<b>4.3E-06</b>	<b>Cumulative HI</b>			<b>3.7E-02</b>
	<b>DEP Risk Limit</b>			<b>1.0E-05</b>	<b>DEP Risk Limit</b>			<b>1.0E+00</b>

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF

$$\text{Cumulative ELCR} = \sum \text{ELCR}_{\text{media-specific}}$$

HI: Hazard Index = Exposure Dose / RfD

$$\text{Cumulative HI} = \sum \text{HI}_{\text{media-specific}}$$

**Table 32**  
**Soil Risk Characterization - Construction Worker**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	ELCR			Total ELCR <sub>chem-specific</sub>	HI			Total HI <sub>chem-specific</sub>
	Dermal	Ingestion	Inhalation		Dermal	Ingestion	Inhalation	
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	5.20E-09	5.03E-09	-	1.0E-08	2.67E-05	2.59E-05	-	5.3E-05
Benzo(a)pyrene	5.30E-08	5.12E-08	7.52E-11	1.0E-07	2.72E-05	2.63E-05	-	5.4E-05
Benzo(b)fluoranthene	5.55E-09	5.37E-09	-	1.1E-08	2.85E-05	2.76E-05	-	5.6E-05
Chrysene	4.98E-11	4.82E-11	-	9.8E-11	2.56E-05	2.48E-05	-	5.0E-05
Fluroanthene	-	-	-	-	1.63E-05	1.57E-05	-	3.2E-05
Pyrene	-	-	-	-	1.99E-05	1.93E-05	-	3.9E-05
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	2.73E-09	7.89E-09	2.73E-11	1.1E-08	5.13E-03	1.48E-02	1.79E-04	2.0E-02
Arochlor 1260	3.59E-09	1.04E-08	3.58E-11	1.4E-08	6.74E-03	1.94E-02	2.35E-04	2.6E-02
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	-	-	-	-	1.07E-05	2.07E-05	-	3.1E-05
C11-C22 Aromatics	-	-	-	-	5.98E-03	6.43E-03	3.28E-05	1.2E-02
<i>Total Metals</i>								
Chromium	-	-	-	-	6.36E-06	3.08E-05	-	3.7E-05
Selenium	-	-	-	-	1.34E-06	1.30E-04	-	1.3E-04
Silver	-	-	-	-	6.76E-04	5.23E-04	-	1.2E-03
	7.0E-08	8.0E-08	1.4E-10	<b>1.5E-07</b>	1.9E-02	4.2E-02	4.5E-04	<b>6.1E-02</b>
	<b>Total ELCR<sub>route-specific</sub></b>			<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>			<b>HI<sub>media-specific</sub></b>
<b>Cumulative ELCR</b>				<b>1.5E-07</b>	<b>Cumulative HI</b>			
<b>DEP Risk Limit</b>				<b>1.0E-05</b>	<b>DEP Risk Limit</b>			
					<b>1.0E+00</b>			

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF

$$\text{Cumulative ELCR} = \sum \text{ELCR}_{\text{media-specific}}$$

**Table 33**  
**Sediment/Surface Water Risk Characterization - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Area of Readily Apparent Harm					
	ELCR		Total	HI		Total
	Dermal	Ingestion	ELCR <sub>chem-specific</sub>	Dermal	Ingestion	HI <sub>chem-specific</sub>
<b>Sediment</b>						
<i>Semi-Volatile Organic Compounds (sVOCs)</i>						
Acenaphthene	-	-	-	1.37E-05	1.71E-06	1.5E-05
Fluoranthene	-	-	-	2.88E-04	3.60E-05	3.2E-04
Naphthalene	-	-	-	2.00E-05	4.98E-06	2.5E-05
Benzo(a)anthracene	5.96E-07	7.44E-08	6.7E-07	2.55E-04	3.18E-05	2.9E-04
Benzo(a,e)pyrene	6.82E-06	8.52E-07	7.7E-06	2.92E-04	3.65E-05	3.3E-04
Benzo(b)fluoranthene	8.17E-07	1.02E-07	9.2E-07	3.50E-04	4.37E-05	3.9E-04
Benzo(k)fluoranthene	6.96E-08	8.69E-09	7.8E-08	2.98E-04	3.72E-05	3.4E-04
Chrysene	8.27E-09	1.03E-09	9.3E-09	3.54E-04	4.42E-05	4.0E-04
Acenaphthylene	-	-	-	6.29E-06	7.95E-07	7.1E-06
Anthracene	-	-	-	8.35E-06	7.19E-07	9.1E-06
Benzo(g,h,i)perylene	-	-	-	2.18E-04	2.76E-05	2.5E-04
Fluorene	-	-	-	1.79E-05	2.23E-06	2.0E-05
Phenanthrene	-	-	-	3.22E-04	4.07E-05	3.6E-04
Dibenzo(a,h)anthracene	8.22E-07	2.28E-07	1.0E-06	3.52E-05	9.76E-06	4.5E-05
Indeno(1,2,3-cd)pyrene	5.57E-07	6.96E-08	6.3E-07	2.39E-04	2.98E-05	2.7E-04
Pyrene	-	-	-	3.29E-04	4.11E-05	3.7E-04
Methylnaphthalene, 1-	-	-	-	3.50E-06	8.73E-07	4.4E-06
Methylnaphthalene, 2-	-	-	-	4.32E-06	1.08E-06	5.4E-06
Perylene	-	-	-	2.67E-05	6.68E-06	3.3E-05
1-Methylphenanthrene	-	-	-	-	-	-
Biphenyl	-	-	-	3.95E-07	1.23E-07	5.2E-07
<i>Polychlorinated Biphenyls (PCBs)</i>						
Arochlor 1254	6.88E-08	2.56E-08	9.4E-08	1.08E-02	4.01E-03	1.5E-02
Arochlor 1260	3.53E-06	1.32E-06	4.8E-06	5.51E-01	2.05E-01	7.6E-01
<i>Extractable Petroleum Hydrocarbons (EPH)</i>						
C9 - C18 Aliphatics	-	-	-	9.90E-04	1.24E-04	1.1E-03
C19-C36 Aliphatics	-	-	-	1.78E-04	4.44E-05	2.2E-04
C11-C22 Aromatics	-	-	-	3.06E-02	4.24E-03	3.5E-02
<i>Total Metals</i>						
Antimony	-	-	-	1.03E-02	2.57E-03	1.3E-02
Arsenic	3.85E-07	3.21E-07	7.1E-07	5.35E-03	4.45E-03	9.8E-03
Barium	-	-	-	1.75E-04	5.81E-05	2.3E-04
Cadmium	-	-	-	4.95E-03	8.84E-04	5.8E-03
Chromium	-	-	-	6.31E-04	3.94E-04	1.0E-03
Chromium , Hexavalent	-	-	-	6.79E-03	1.88E-03	8.7E-03
Cobalt	-	-	-	4.53E-06	1.51E-06	6.0E-06
Copper	-	-	-	1.25E-02	4.16E-03	1.7E-02
Iron	-	-	-	4.48E-03	1.49E-03	6.0E-03
Lead	-	-	-	2.11E-02	4.40E-02	6.5E-02
Manganese	-	-	-	8.15E-04	2.71E-04	1.1E-03
Mercury	-	-	-	1.65E-03	8.22E-04	2.5E-03
Nickel	-	-	-	1.08E-03	7.71E-05	1.2E-03
Silver	-	-	-	2.10E-02	2.10E-03	2.3E-02
Thallium	-	-	-	4.17E-04	1.04E-03	1.5E-03
Tin	-	-	-	1.65E-05	5.48E-06	2.2E-05
Vanadium	-	-	-	1.23E-03	4.11E-04	1.6E-03
Zinc	-	-	-	5.16E-05	6.44E-05	1.2E-04
	1.4E-05	3.0E-06	<b>1.7E-05</b>	6.9E-01	2.8E-01	<b>9.7E-01</b>
	<b>Total ELCR<sub>route-specific</sub></b>		<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>

**Notes:**  
 - = Not applicable due to incomplete exposure pathway or no available toxicity value.  
 ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF  
 HI: Hazard Index = Exposure Dose / RfD

**Table 33**  
**Sediment/Surface Water Risk Characterization - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	ELCR		Total	HI		Total
	Dermal	Ingestion	ELCR <sub>chem-specific</sub>	Dermal	Ingestion	HI <sub>chem-specific</sub>
<b>Surface Water</b>						
<i>Semi-Volatile Organic Compounds (SVOCs)</i>						
Acenaphthene	-	-	-	6.10E-09	1.62E-08	2.2E-08
Fluoranthene	-	-	-	2.00E-05	1.48E-07	2.0E-05
Naphthalene	-	-	-	3.56E-07	2.74E-08	3.8E-07
Benzo(a)anthracene	7.00E-08	2.29E-10	7.0E-08	3.00E-05	9.82E-08	3.0E-05
Benzo(a)pyrene	1.39E-06	3.07E-09	1.4E-06	5.94E-05	1.31E-07	6.0E-05
Benzo(b)fluoranthene	2.20E-07	4.86E-10	2.2E-07	9.42E-05	2.08E-07	9.4E-05
Benzo(k)fluoranthene	9.37E-12	2.49E-11	3.4E-11	4.01E-08	1.06E-07	1.5E-07
Chrysene	1.21E-09	3.96E-12	1.2E-09	5.18E-05	1.70E-07	5.2E-05
Acenaphthylene	-	-	-	3.99E-09	1.07E-08	1.5E-08
Anthracene	-	-	-	1.35E-09	2.47E-09	3.8E-09
Benzo[g,h,i]perylene	-	-	-	4.31E-08	1.16E-07	1.6E-07
Fluorene	-	-	-	4.80E-09	1.27E-08	1.8E-08
Phenanthrene	-	-	-	1.19E-05	1.39E-07	1.2E-05
Dibenzo[a,h]anthracene	3.21E-07	7.00E-10	3.2E-07	1.37E-05	3.00E-08	1.4E-05
Indeno[1,2,3-cd]pyrene	2.28E-07	3.18E-10	2.3E-07	9.75E-05	1.36E-07	9.8E-05
Pyrene	-	-	-	4.95E-08	1.31E-07	1.8E-07
2-Methylnaphthalene	-	-	-	9.68E-10	5.14E-09	6.1E-09
bis (2-ethylhexyl) phthalate	1.13E-10	2.99E-09	3.1E-09	2.52E-06	6.68E-05	6.9E-05
<i>Total Polychlorinated Biphenyls</i>	1.06E-11	8.40E-11	9.5E-11	1.66E-06	1.31E-05	1.5E-05
<i>Dissolved Metals</i>						
Aluminum	-	-	-	9.73E-08	6.88E-07	7.9E-07
Antimony	-	-	-	5.29E-06	2.81E-05	3.3E-05
Arsenic	6.57E-10	1.16E-08	1.2E-08	9.12E-06	1.61E-04	1.7E-04
Barium	-	-	-	5.46E-07	3.87E-06	4.4E-06
Beryllium	-	-	-	1.25E-07	2.21E-06	2.3E-06
Cadmium	-	-	-	8.83E-06	3.35E-05	4.2E-05
Chromium	-	-	-	3.64E-09	4.83E-08	5.2E-08
Cobalt	-	-	-	3.00E-08	2.12E-07	2.4E-07
Copper	-	-	-	1.70E-06	1.20E-05	1.4E-05
Iron	-	-	-	1.16E-06	8.21E-06	9.4E-06
Lead	-	-	-	3.41E-07	1.51E-05	1.5E-05
Manganese	-	-	-	1.78E-05	1.26E-04	1.4E-04
Nickel	-	-	-	5.34E-06	8.10E-06	1.3E-05
Selenium	-	-	-	4.39E-09	1.16E-06	1.2E-06
Silver	-	-	-	4.43E-07	9.40E-07	1.4E-06
Thallium	-	-	-	3.23E-07	1.71E-05	1.7E-05
Tin	-	-	-	9.76E-09	6.91E-08	7.9E-08
Vanadium	-	-	-	1.58E-07	1.12E-06	1.3E-06
Zinc	-	-	-	4.29E-07	1.14E-05	1.2E-05
	2.2E-06	2.0E-08	<b>2.2E-06</b>	4.3E-04	5.1E-04	<b>9.5E-04</b>
	<b>Total ELCR<sub>route-specific</sub></b>		<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>
	<b>Cumulative ELCR (ARAH)</b>		<b>1.9E-05</b>	<b>Cumulative HI (ARAH)</b>		<b>9.7E-01</b>
	<b>DEP Risk Limit</b>		1.0E-05	<b>DEP Risk Limit</b>		1.0E+00
	<b>Cumulative ELCR (SA)</b>		<b>4.9E-06</b>	<b>Cumulative HI (SA)</b>		<b>1.3E-01</b>
	<b>DEP Risk Limit</b>		1.0E-05	<b>DEP Risk Limit</b>		1.00E+00

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF

$$\text{Cumulative ELCR} = \sum \text{ELCR}_{\text{media-specific}}$$

HI: Hazard Index = Exposure Dose / RfD

$$\text{Cumulative HI} = \sum \text{HI}_{\text{media-specific}}$$

Shaded cells denote Cumulative Risks greater than DEP Risk Limits.

**Table 33**  
**Sediment/Surface Water Risk Characterization - Trespasser**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Surrounding Area					
	ELCR		Total	HI		Total
	Dermal	Ingestion	ELCR <sub>chem-specific</sub>	Dermal	Ingestion	HI <sub>chem-specific</sub>
<b>Sediment</b>						
<i>Semi-Volatile Organic Compounds (sVOCs)</i>						
Acenaphthene	-	-	-	2.39E-07	2.99E-08	2.7E-07
Fluoranthene	-	-	-	3.45E-05	4.31E-06	3.9E-05
Naphthalene	-	-	-	3.00E-07	7.49E-08	3.7E-07
Benzo(a)anthracene	7.13E-08	8.90E-09	8.0E-08	3.05E-05	3.81E-06	3.4E-05
Benzo(a,e)pyrene	9.51E-07	1.19E-07	1.1E-06	4.07E-05	5.08E-06	4.6E-05
Benzo(b)fluoranthene	1.26E-07	1.58E-08	1.4E-07	5.42E-05	6.76E-06	6.1E-05
Benzo(k)fluoranthene	9.84E-09	1.23E-09	1.1E-08	4.21E-05	5.26E-06	4.7E-05
Chrysene	1.20E-09	1.50E-10	1.3E-09	5.13E-05	6.40E-06	5.8E-05
Acenaphthylene	-	-	-	1.80E-06	2.27E-07	2.0E-06
Anthracene	-	-	-	3.64E-07	3.14E-08	4.0E-07
Benzo(g,h,i)perylene	-	-	-	3.01E-05	3.79E-06	3.4E-05
Fluorene	-	-	-	4.11E-07	5.13E-08	4.6E-07
Phenanthrene	-	-	-	1.98E-05	2.50E-06	2.2E-05
Dibenzo(a,h)anthracene	9.36E-08	2.60E-08	1.2E-07	4.00E-06	1.11E-06	5.1E-06
Indeno(1,2,3-cd)pyrene	8.19E-08	1.02E-08	9.2E-08	3.51E-05	4.38E-06	3.9E-05
Pyrene	-	-	-	4.01E-05	5.01E-06	4.5E-05
Methylnaphthalene, 1-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-
Perylene	-	-	-	3.27E-06	8.16E-07	4.1E-06
1-Methylphenanthrene	-	-	-	6.42E-07	1.60E-07	8.0E-07
Biphenyl	-	-	-	-	-	-
<i>Polychlorinated Biphenyls (PCBs)</i>						
Arochlor 1254	9.58E-08	3.57E-08	1.3E-07	1.50E-02	5.58E-03	2.1E-02
Arochlor 1260	2.48E-07	9.23E-08	3.4E-07	3.87E-02	1.44E-02	5.3E-02
<i>Extractable Petroleum Hydrocarbons (EPH)</i>						
C9 - C18 Aliphatics	-	-	-	6.47E-05	8.08E-06	7.3E-05
C19-C36 Aliphatics	-	-	-	1.45E-05	3.61E-06	1.8E-05
C11-C22 Aromatics	-	-	-	3.59E-03	4.98E-04	4.1E-03
<i>Total Metals</i>						
Antimony	-	-	-	1.03E-03	2.57E-04	1.3E-03
Arsenic	3.55E-07	2.96E-07	6.5E-07	4.94E-03	4.11E-03	9.0E-03
Barium	-	-	-	1.09E-04	3.64E-05	1.5E-04
Cadmium	-	-	-	3.00E-03	5.34E-04	3.5E-03
Chromium	-	-	-	5.41E-05	3.38E-05	8.8E-05
Chromium , Hexavalent	-	-	-	2.47E-04	6.85E-05	3.2E-04
Cobalt	-	-	-	6.58E-06	2.19E-06	8.8E-06
Copper	-	-	-	1.66E-03	5.52E-04	2.2E-03
Iron	-	-	-	2.61E-03	8.68E-04	3.5E-03
Lead	-	-	-	8.03E-03	1.67E-02	2.5E-02
Manganese	-	-	-	1.62E-03	5.40E-04	2.2E-03
Mercury	-	-	-	8.23E-04	4.11E-04	1.2E-03
Nickel	-	-	-	9.36E-04	6.68E-05	1.0E-03
Silver	-	-	-	3.91E-03	3.90E-04	4.3E-03
Thallium	-	-	-	-	-	-
Tin	-	-	-	2.88E-06	9.59E-07	3.8E-06
Vanadium	-	-	-	5.11E-04	1.70E-04	6.8E-04
Zinc	-	-	-	2.80E-05	3.49E-05	6.3E-05
	2.0E-06	6.0E-07	<b>2.6E-06</b>	8.7E-02	4.5E-02	<b>1.3E-01</b>
	<b>Total ELCR<sub>route-specific</sub></b>		<b>ELCR<sub>media-specific</sub></b>	<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>

**Notes:**  
 - = Not applicable due to incomplete exposure pathway or no available toxicity value.  
 ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF  
 HI: Hazard Index = Exposure Dose / RfD

**Table 34**  
**Soil/Groundwater Risk Characterization - On-Site Resident**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	ELCR			Total ELCR <sub>chem-specific</sub>
	Dermal	Ingestion	Inhalation	
<b>Soil</b>				
<i>Semi-Volatile Organic Compounds (SVOCs)</i>				
Benzo(a)anthracene	2.59E-07	6.52E-08	-	3.2E-07
Benzo(a)pyrene	2.63E-06	6.64E-07	1.80E-09	3.3E-06
Benzo(b)fluoranthene	2.76E-07	6.96E-08	-	3.5E-07
Chrysene	2.48E-09	6.25E-10	-	3.1E-09
Fluroanthene	-	-	-	-
Pyrene	-	-	-	-
<i>Polychlorinated Biphenyls (PCBs)</i>				
Arochlor 1254	1.36E-07	1.02E-07	6.51E-10	2.4E-07
Arochlor 1260	1.79E-07	1.34E-07	8.56E-10	3.1E-07
<i>Extractable Petroleum Hydrocarbons (EPH)</i>				
C19-C36 Aliphatics	-	-	-	-
C11-C22 Aromatics	-	-	-	-
<i>Total Metals</i>				
Chromium	-	-	-	-
Selenium	-	-	-	-
Silver	-	-	-	-
	3.5E-06	1.0E-06	3.3E-09	<b>4.5E-06</b>
	<b>Total ELCR<sub>route-specific</sub></b>			<b>ELCR<sub>media-specific</sub></b>

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF

Cumulative ELCR =  $\Sigma$  ELCR<sub>media-specific</sub>



**Table 34**  
**Soil/Groundwater Risk Characterization - On-Site Resident**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Child				Adult			
	Dermal	HI Ingestion	Inhalation	Total HI <sub>chem-specific</sub>	Dermal	HI Ingestion	Inhalation	Total HI <sub>chem-specific</sub>
<b>Soil</b>								
<i>Semi-Volatile Organic Compounds (SVOCs)</i>								
Benzo(a)anthracene	9.31E-05	4.34E-05	-	1.4E-04	3.21E-05	3.10E-06	-	3.5E-05
Benzo(a)pyrene	9.48E-05	4.42E-05	-	1.4E-04	3.27E-05	3.16E-06	-	3.6E-05
Benzo(b)fluoranthene	9.93E-05	4.63E-05	-	1.5E-04	3.42E-05	3.31E-06	-	3.8E-05
Chrysene	8.91E-05	4.16E-05	-	1.3E-04	3.07E-05	2.97E-06	-	3.4E-05
Fluroanthene	5.67E-05	2.64E-05	-	8.3E-05	1.95E-05	1.89E-06	-	2.1E-05
Pyrene	6.94E-05	3.24E-05	-	1.0E-04	2.39E-05	2.31E-06	-	2.6E-05
<i>Polychlorinated Biphenyls (PCBs)</i>								
Arochlor 1254	1.78E-02	2.49E-02	2.54E-04	4.3E-02	6.15E-03	1.78E-03	1.15E-04	8.0E-03
Arochlor 1260	2.35E-02	3.27E-02	3.34E-04	5.6E-02	8.09E-03	2.33E-03	1.51E-04	1.1E-02
<i>Extractable Petroleum Hydrocarbons (EPH)</i>								
C19-C36 Aliphatics	3.73E-05	3.48E-05	-	7.2E-05	1.29E-05	2.49E-06	-	1.5E-05
C11-C22 Aromatics	2.08E-02	1.08E-02	4.66E-05	3.2E-02	7.18E-03	7.71E-04	2.10E-05	8.0E-03
<i>Total Metals</i>								
Chromium	2.22E-05	5.17E-05	-	7.4E-05	7.64E-06	3.69E-06	-	1.1E-05
Selenium	4.68E-06	2.18E-04	-	2.2E-04	1.61E-06	1.56E-05	-	1.7E-05
Silver	2.35E-03	8.78E-04	-	3.2E-03	8.11E-04	6.27E-05	-	8.7E-04
	6.5E-02	7.0E-02	6.3E-04	<b>1.4E-01</b>	2.2E-02	5.0E-03	2.9E-04	<b>2.8E-02</b>
		<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>		<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

HI: Hazard Index = Exposure Dose / RfD

Cumulative ELCR =  $\Sigma$  ELCR<sub>media-specific</sub>

**Table 34**  
**Soil/Groundwater Risk Characterization - On-Site Resident**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Dermal	ELCR Ingestion	Inhalation	Total ELCR <sub>chem-specific</sub>
<b>Groundwater</b>				
<i>Volatile Organic Compounds (VOCs)</i>				
Benzene	-	1.45E-06	9.93E-08	1.5E-06
Tetrachloroethene	-	2.39E-05	5.19E-09	2.4E-05
Trichloroethene	-	5.84E-05	2.86E-06	6.1E-05
cis-1,2-Dichloroethene	-	-	-	-
Vinyl Chloride	-	2.15E-04	6.33E-06	2.2E-04
1,1,1-Trichloroethane	-	-	-	-
1,1-Dichloroethane	-	-	-	-
1,1-Dichloroethene	-	5.62E-05	7.67E-07	5.7E-05
Trichlorofluoromethane	-	-	-	-
1,2,3-Trichlorobenzene	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-
1,4-Dichlorobenzene	-	1.58E-06	-	1.6E-06
Chlorobenzene	-	-	-	-
<i>Dissolved Metals</i>				
Barium	-	-	-	-
Chromium	-	-	-	-
	0.0E+00	3.6E-04	1.0E-05	<b>3.7E-04</b>
		<b>Total ELCR<sub>route-specific</sub></b>		<b>ELCR<sub>media-specific</sub></b>
		<b>Cumulative ELCR</b>		<b>3.7E-04</b>
		<b>DEP Risk Limit</b>		<b>1.0E-05</b>

**Notes:**  
 - = Not applicable due to incomplete exposure pathway or no available toxicity value.  
 ELCR: Excess Lifetime Carcinogenic Risk = Exposure Dose \* CSF  
 Cumulative ELCR =  $\sum$  ELCR<sub>media-specific</sub>  
 Shaded cells denote Cumulative Risks greater than DEP Risk Limits.

**Table 34**  
**Soil/Groundwater Risk Characterization - On-Site Resident**  
**Raytheon Company**  
**Wayland, Massachusetts**

Compound of Concern	Child				Adult			
	Dermal	HI Ingestion	Inhalation	Total HI <sub>chem-specific</sub>	Dermal	HI Ingestion	Inhalation	Total HI <sub>chem-specific</sub>
<b>Groundwater</b>								
<i>Volatile Organic Compounds (VOCs)</i>								
Benzene	-	5.11E-02	8.98E-03	6.0E-02	-	1.46E-02	4.05E-03	1.9E-02
Tetrachloroethene	-	2.68E-01	8.27E-05	2.7E-01	-	7.67E-02	3.73E-05	7.7E-02
Trichloroethene	-	5.16E+00	4.14E-02	5.2E+00	-	1.47E+00	1.86E-02	1.5E+00
cis-1,2-Dichloroethene	-	6.23E-01	1.37E-02	6.4E-01	-	1.78E-01	6.17E-03	1.8E-01
Vinyl Chloride	-	6.60E-01	1.94E-02	6.8E-01	-	1.89E-01	8.73E-03	2.0E-01
1,1,1-Trichloroethane	-	3.08E-02	5.56E-05	3.1E-02	-	8.81E-03	2.50E-05	8.8E-03
1,1-Dichloroethane	-	1.62E-03	5.28E-05	1.7E-03	-	4.63E-04	2.38E-05	4.9E-04
1,1-Dichloroethene	-	6.07E-02	-	6.1E-02	-	1.74E-02	-	1.7E-02
Trichlorofluoromethane	-	5.38E-04	6.57E-04	1.2E-03	-	1.54E-04	2.96E-04	4.5E-04
1,2,3-Trichlorobenzene	-	4.12E-01	-	4.1E-01	-	1.18E-01	-	1.2E-01
1,2-Dichlorobenzene	-	6.18E-03	3.06E-04	6.5E-03	-	1.77E-03	1.38E-04	1.9E-03
1,3-Dichlorobenzene	-	1.28E-01	-	1.3E-01	-	3.65E-02	-	3.7E-02
1,4-Dichlorobenzene	-	1.28E-02	-	1.3E-02	-	3.65E-03	-	3.7E-03
Chlorobenzene	-	1.01E-02	-	1.0E-02	-	2.88E-03	-	2.9E-03
<i>Dissolved Metals</i>								
Barium	-	1.53E-01	-	1.5E-01	-	4.38E-02	-	4.4E-02
Chromium	-	6.39E-04	-	6.4E-04	-	1.83E-04	-	1.8E-04
	0.0E+00	7.6E+00	8.5E-02	<b>7.7E+00</b>	0.0E+00	2.2E+00	3.8E-02	<b>2.2E+00</b>
		<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>		<b>Total HI<sub>route-specific</sub></b>		<b>HI<sub>media-specific</sub></b>
		<b>Cumulative HI</b>		<b>7.8E+00</b>		<b>Cumulative HI</b>		<b>2.2E+00</b>
		<b>DEP Risk Limit</b>		<b>1.0E+00</b>		<b>DEP Risk Limit</b>		<b>1.0E+00</b>

**Notes:**

- = Not applicable due to incomplete exposure pathway or no available toxicity value.

HI: Hazard Index = Exposure Dose / RfD

Cumulative ELCR =  $\sum$  ELCR<sub>media-specific</sub>

Shaded cells denote Cumulative Risks greater than DEP Risk Limits.