

**APPENDIX 26**  
**Human Health Risk Assessment**

Drawings



**LEGEND**

**NOTE:** THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:  
  
NEWFOUNDLAND AND LABRADOR  
DEPARTMENT OF ENVIRONMENT  
AND CONSERVATION

PROJECT TITLE:  
  
PHASE III ENVIRONMENTAL SITE  
ASSESSMENTS, HUMAN HEALTH AND  
ECOLOGICAL RISK ASSESSMENT AND  
REMEDIAL ACTION / RISK MANAGEMENT PLAN  
FOR THE FORMER U.S. MILITARY SITE AND  
RESIDENTIAL SUBDIVISION, HOPEDALE, NL

DRAWING TITLE:  
  
AREAS ASSESSED IN HUMAN  
HEALTH RISK ASSESSMENT

**Stantec Consulting Ltd.**



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## Screening Tables

Table 26.1 Human Health Screening for Chemicals in Soil - Former Radar Site  
 Human Health and Ecological Risk Assessment  
 Former Radar Site, Hopedale, NL  
 Stantec Project No. 1214.10103

Constituent	Maximum Concentration in Surface Soil (mg/kg) (Sample ID)	Selected Soil Quality Guidelines - Residential/Parkland (mg/kg)	Max > Guideline (or was a substance with no guideline detected)?	Background Soil Concentrations (mg/kg)	MAX > Background?	EPC	Is EPC > Screening Guideline (or was a substance with no guideline detected)?	Is element major mineral forming element or nutrient of low inherent toxicity?	Carried forward in HHRA?
<b>BTEX/TPH</b>									
Benzene	0.04 BS104 (Main Base)	390	NO	-	-	-	-	-	-
Toluene	4.7 TP20BS2 (Main Base)	12000	NO	-	-	-	-	-	-
Ethylbenzene	0.4 TP17BS2 (BMEWS)	7000	NO	-	-	-	-	-	-
Xylenes	12 TP17BS2 (BMEWS)	120000	NO	-	-	-	-	-	-
TPH (Fuel Oil)	94,000 BS20 (BMEWS)	5300	YES	-	-	17211	YES	NO	YES
TPH (Lube Oil)	25,000 TP1414BS1 (POL)	8300	YES	-	-	8767	YES	NO	YES
<b>PAHs</b>									
<b>Non-Carcinogenic</b>									
1-Methylnaphthalene	43 TP117BS2 (BMEWS)	1300	NO	-	-	-	-	-	-
2-Methylnaphthalene	48 TP117BS2 (BMEWS)	5300	NO	-	-	-	-	-	-
Acenaphthene	7.8 TP7BS2 (Main Base)	1000	NO	-	-	-	-	-	-
Acenaphthylene	0.9 TP7BS2 (Main Base)	24000	NO	-	-	-	-	-	-
Anthracene	2 TP43BS2 (Main Base)	3500	NO	-	-	-	-	-	-
Fluoranthene	7 TP43BS2 (Main Base)	2700	NO	-	-	-	-	-	-
Fluorene	7.3 TP7BS2 (Main Base)	1800	NO	-	-	-	-	-	-
Naphthalene	21 TP7BS2 (Main Base)	1000	NO	-	-	-	-	-	-
Benzo[a]anthracene	0.66 TP43BS2 (Main Base)	1000	NO	-	-	-	-	-	-
Benzo[b]fluoranthene	16 TP7BS2 (Main Base)	1000	NO	-	-	-	-	-	-
Benzo[k]fluoranthene	5.2 TP43BS2 (Main Base)	2100	NO	-	-	-	-	-	-
Benzo[e]pyrene	2 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Benzo[a]pyrene	2.2 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Benzo[b]fluoranthene	2 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Benzo[k]fluoranthene	2 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Benzo[ghi]perylene	1.8 TP43BS2 (Main Base)	N/A	NO	-	-	-	-	-	-
Chrysene	2.3 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Dibenz[a,h]anthracene	0.5 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Indeno[1,2,3-cd]pyrene	2.1 TP43BS2 (Main Base)	N/A	-	-	-	-	-	-	-
Benzo[a]pyrene (TPE)	4 calculated	5.3	-	-	-	-	-	-	-
<b>Other</b>									
PCBs	230 BS12S (Main Base)	22	YES	-	-	29	YES	NO	YES
1,1,2,2-Tetrachloroethane	0.16 TP43BS2 (Main Base)	0.47	NO	-	-	-	-	-	-
<b>Inorganics</b>									
Aluminum	29,000 BS153 (Sewage Outfall)	15,400	YES	1400 - 7300	YES	7417	NO	YES	NO <sup>6</sup>
Antimony	120 BS41 (POL)	13	YES	nd	YES	7.7	NO	NO	NO
Arsenic	76 TP62BS1 (Main Base)	12	YES	nd	YES	4.4	NO	NO	NO
Barium	2700 TP62BS1 (Main Base)	3,700	NO	10 - 67	-	-	-	-	-

**Notes:**  
 1. Atlantic PIRI PSSL for residential sites with non-potable groundwater, coarse grained soil and fuel oil or lube oil impacts (Soil Ingestion)  
 2. Ontario Ministry of Environment (OMOE) Soil Standards for Use Under Part XV.1 of the Environmental Protection Act, Table 3 - Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition, Residential Land Use, soil contact human health guideline  
 3. Alberta Tier 1 Surface Soil Guidelines for Residential Land Use - Direct soil contact human health guidelines  
 4. There are no applicable guidelines for perylene or phenanthrene; therefore, the most stringent of all non-carcinogenic PAH guidelines (Acenaphthylene) has been selected for comparison purposes.  
 5. CCME Soil Quality Guidelines for the Protection of Environmental and Human Health - Residential land use, non-potable groundwater, direct contact human health guidelines (note: where no CCME human health guideline exists, AENV, then OMOE, then US EPA have been consulted).  
 6. As per current CCME guidance, all carcinogenic PAHs are assumed to act cumulatively and; therefore, the entire group is carried forward and is assessed based on a Total Potency Equivalents (TPE) basis, relative to B[a]P.  
 7. US EPA (Oak Ridge National Laboratory) Regional Screening Levels for Chemical Contaminants at Superfund Sites (December 2009) Residential land use. As per current Health Canada guidance, concentrations have been multiplied by 0.2  
 8. Iron and Aluminum are considered to be elements of low inherent toxicity.  
 9. There are no applicable guidelines (i.e., CCME, OMOE, US EPA) for rubidium or bismuth. Both are typically associated with seawater spray and could be expected to be present at the site due to its proximity to the ocean, and not as a result of historical site activities  
 nd = no detected above laboratory detection limits  
 N/A = no human-health-based guideline available

Table 26.1 Human Health Screening for Chemicals in Soil - Former Radar Site  
 Human Health and Ecological Risk Assessment  
 Former Radar Site, Hopedale, NL  
 Stantec Project No. 123470103

Constituent	Maximum Concentration in Surface Soil (mg/kg) (Sample ID)	Selected Soil Quality Guidelines - Residential/ Parkland (mg/kg)	Max > Guideline (or was a substance with no guideline detected)?	Background Soil Concentrations (mg/kg)	MAX > Background?	EPC	Is EPC > Screening Guideline for a substance with no guideline detected?	Is element major mineral forming element or nutrient of low inherent toxicity?	Carried forward in HHRA?
Beryllium	nd	0.37 <sup>2</sup>	NO	nd	-	-	-	-	-
Bismuth	2 BS152 (Sewage Outfall)	N/A	YES	nd	YES	2	YES	NO	NO <sup>6</sup>
Boron	40 BS84 (Main Base)	3,200	NO	6 - 15	-	-	-	-	-
Cadmium	29 BS126 (Old Base 1)	14	YES	0.4 - 0.6	YES	4.1	NO	NO	NO
Chromium (Total)	1200 BS135 (Mid Canada Line)	220	YES	3-22	YES	74	NO	NO	NO
Cobalt	47 BS153 (Sewage Outfall)	2,700	NO	1 - 3	-	-	-	-	-
Copper	2200 BS84 (Main Base)	1,100	YES	6 - 65	YES	168	NO	NO	NO
Iron	100,000 BS39 (POL)	11,000	YES	1300 - 1700	YES	15766	YES	YES	NO <sup>8</sup>
Lead	3,200 BS135 (Mid Canada Line)	140	YES	4.4 - 43	YES	372	YES	NO	YES
Lithium	19 BS121 (Old Base 1)	32	NO	4.0	-	-	-	-	-
Manganese	2,800 BS153 (Sewage Outfall)	360	YES	5 - 79	YES	293	NO	NO	NO
Mercury	1 BS152 (Sewage Outfall)	6.6	NO	0.1 - 0.5	-	-	-	-	-
Molybdenum	81 BS139 (Mid Canada Line)	170	NO	2 - 4	-	-	-	-	-
Nickel	110 BS41 (POL)	310	NO	3 - 28	-	-	-	-	-
Rubidium	28 MW2SS1 (Main Base)	N/A	YES	nd	YES	9.3	YES	NO	NO <sup>6</sup>
Selenium	2 BS126 (Old Base 1)	80	NO	nd	-	-	-	-	-
Silver	6 TP23BS2 (Main Base)	98	NO	nd	-	-	-	-	-
Strontium	170 BS124 (Old Base 1)	9,400	NO	nd	-	-	-	-	-
Thallium	0.5 TP62SS1 (Main Base)	1 <sup>5</sup>	NO	10 - 35	-	-	-	-	-
Tin	550 BS41 (POL)	9,400	NO	nd	-	-	-	-	-
Uranium	4 BS153 (Sewage Outfall)	23	NO	3	-	-	-	-	-
Vanadium	82 BS153 (Sewage Outfall)	470	NO	0.5 - 26	-	-	-	-	-
Zinc	22,000 BS135 (Mid Canada Line)	16,000	YES	2 - 12	-	-	-	-	-
				11 - 24	YES	1489	NO	NO	NO

Notes:

- Atlantic PIRI PSSL for residential sites with non-potable groundwater, coarse grained soil and fuel oil or tube oil impacts (Soil Ingestion)
- Ontario Ministry of Environment (OMOE) Soil Standards for Use Under Part XV 1 of the Environmental Protection Act, Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition, Residential Land Use, soil contact human-health guideline
- Alberta Tier 1 Surface Soil Guidelines for Residential Land Use - Direct soil contact human health guidelines
- There are no applicable guidelines for perylene or phenanthrene, therefore, the most stringent of all non-carcinogenic PAH guidelines (Acenaphthylene) has been selected for comparison purposes.
- CCME Soil Quality Guidelines for the Protection of Environmental and Human Health - Residential land use, non-potable groundwater, direct contact human-health guidelines (note: where no CCME human health guideline exists, AENV, then OMOE, then US EP; have been consulted).
- As per current CCME guidance, all carcinogenic PAHs are assumed to act cumulatively and, therefore, the entire group is carried forward and is assessed based on a Total Potency Equivalents (TPE) basis, relative to B[a]P
- US EPA (Oak Ridge National Laboratory) Regional Screening Levels for Chemical Contaminants at Superfund Sites (December 2009). Residential land use. As per current Health Canada guidance, concentrations have been multiplied by 0.2
- Iron and Aluminum are considered to be elements of low inherent toxicity
- There are no applicable guidelines (i.e., CCME, OMOE, US EPA) for rubidium or bismuth. Both are typically associated with seawater spray and could be expected to be present at the site due to its proximity to the ocean, and not as a result of historical site activities
- prov = provisional human health guideline (CCME)
- ND = not detected above laboratory detection limits
- N/A = no human-health-based guideline available

Table 25.2 Human Health Screening for Chemicals in Soil - Residential Area  
 Human Health and Ecological Risk Assessment  
 Former Military Site, Hopedale, NL  
 Stantec Project No. 121410103

Constituent	Maximum Concentration in Surface Soil (mg/kg) (Sample ID)	Selected Soil Quality Guidelines - Residential/ Parkland (mg/kg)	Max > Guideline (or was a substance with guideline detected)?	Background Soil Concentrations (mg/kg)	MAX > Background?	EPC	Is EPC > Screening Guideline for was a substance with no guideline detected)?	Is element major mineral forming element or nutrient of low inherent toxicity?	Carried forward in HHRA?
<b>BTEX/TPH</b>									
Benzene	nd	390	NO	-	-	-	-	-	-
Toluene	0.39 TP231BS2 (Old Dump Pond)	12000	NO	-	-	-	-	-	-
Ethylbenzene	0.1 MW61SS1 (Subdivision)	7000	NO	-	-	-	-	-	-
Xylenes	0.65 MW40SS1 (Subdivision)	120000	NO	-	-	-	-	-	-
TPH (Fuel Oil)	52,000 BS230 (Wharf Area)	5300	YES	-	-	6279	YES	NO	YES
TPH (Lube Oil)	3,400 MW61SS1 (Old Dump Pond)	8300	NO	-	-	-	-	-	-
<b>PAHs</b>									
<b>Non-Carcinogenic</b>									
1-Methylnaphthalene	nd	1300	NO	-	-	-	-	-	-
2-Methylnaphthalene	nd	5300	NO	-	-	-	-	-	-
Acenaphthene	nd	1000	NO	-	-	-	-	-	-
Acenaphthylene	nd	24000	NO	-	-	-	-	-	-
Anthracene	nd	3500	NO	-	-	-	-	-	-
Fluoranthene	nd	2700	NO	-	-	-	-	-	-
Fluorene	nd	1800	NO	-	-	-	-	-	-
Naphthalene	nd	1000	NO	-	-	-	-	-	-
Perylene	nd	1000	NO	-	-	-	-	-	-
Phenanthrene	nd	1000	NO	-	-	-	-	-	-
Pyrene	nd	2100	NO	-	-	-	-	-	-
<b>Carcinogenic</b>									
Benz[a]anthracene	nd	N/A		-	-	-	-	-	-
Benz[a]pyrene	nd	N/A		-	-	-	-	-	-
Benz[b]fluoranthene	nd	N/A		-	-	-	-	-	-
Benz[k]fluoranthene	nd	N/A		-	-	-	-	-	-
Benz[ghi]perylene	nd	N/A	NO	-	-	-	-	-	-
Chrysene	nd	N/A		-	-	-	-	-	-
Dibenz[a,h]anthracene	nd	N/A		-	-	-	-	-	-
Indeno[1,2,3-cd]pyrene	nd	N/A		-	-	-	-	-	-
Benz[ghi]perylene (TPE)	0.0 Calculated	5.3	YES	-	-	22	NO	NO	YES <sup>9</sup>
<b>Other</b>									
1,2-Dichlorobenzene	0.16 MW61SS1 (Old Dump Pond)	18000	NO	-	-	-	-	-	-
1,2-Dichloroethane	0.044 MW61SS1 (Old Dump Pond)	2800	NO	-	-	-	-	-	-
1,3-Dichlorobenzene	0.065 MW61SS1 (Old Dump Pond)	3000	NO	-	-	-	-	-	-
1,4-Dichlorobenzene	0.27 MW61SS1 (Old Dump Pond)	4200	NO	-	-	-	-	-	-
Trichloroethylene	0.041 MW61SS1 (Old Dump Pond)	35	NO	-	-	-	-	-	-
PCBs	29 MW61SS1 (Old Dump Pond)	22	YES	-	-	22	NO	NO	YES <sup>9</sup>

**Notes:**  
 1. Atlantic PIRI PSSL for residential sites with non-potable groundwater, coarse grained soil and fuel oil or lube oil impacts (Soil Ingestion)  
 2. Ontario Ministry of Environment (OMOE) Soil Standards for Use Under Part XV.1 of the Environmental Protection Act, Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition, Residential Land Use, soil contact human-health guideline  
 3. Alberta Tier 1 Surface Soil Guidelines for Residential Land Use - Direct soil contact human health guidelines  
 4. There are no applicable guidelines for perylene or phenanthrene, therefore, the most stringent of all non-carcinogenic PAH guidelines (Acenaphthylene) has been selected for comparison purposes  
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 7. US EPA (Oak Ridge National Laboratory) Regional Screening Levels for Chemical Contaminants at Superfund Sites (December 2009). Residential land use. As per current Health Canada guidance, concentrations have been multiplied by 0.2.  
 8. The EPC for PCBs was equal to the screening guideline (AENV, 2009) of 22 mg/kg. PCBs were carried forward because the AENV guideline is based on a TRV of 0.001 mg/kg-day (Health Canada, 2004) and not the TRV of 0.00013 mg/kg-day (Health Canada, 2009).  
 9. Iron and Aluminum are considered to be elements of low inherent toxicity.  
 9. There is no applicable guideline (i.e., CCME, OMOE, US EPA) for rubidium. Rubidium is typically associated with seawater spray and could be expected to be present at the site due to its proximity to the ocean, and not as a result of historical site activities  
 ND = not detected above laboratory detection limits  
 N/A = no human-health-based guideline available  
 Note that the petroleum hydrocarbons detected in soil at the Residential Area were a mixture of lube oil and fuel oil. As per Atlantic PIRI guidance, the impacts were assessed for the most restrictive product type (i.e., fuel oil).

Table 26.2 Human Health Screening for Chemicals in Soil - Residential Area  
 Human Health and Ecological Risk Assessment  
 Former Military Site, Hopedale, NL  
 Stantec Project No. 121410103

Inorganics	20,000	MW51SSZ (Subdivision)	15,400	7	YES	1400 - 7300	YES	8552	NO	YES	NO <sup>9</sup>
Aluminum	42	TP233BS2 (Old Dump Pond)	13	2	YES	nd	YES	42	YES	NO	YES
Antimony	6	TP233BS2 (Old Dump Pond)	12	5	NO	nd	-	-	-	-	NO
Arsenic	190	BS230 (Wharf Area)	0.37	2	NO	10 - 67	-	-	-	-	NO
Barium	nd	-	N/A	-	NO	nd	-	-	-	-	NO
Beryllium	nd	-	N/A	-	NO	nd	-	-	-	-	NO
Bismuth	21	TP233BS2 (Old Dump Pond)	3,200	7	NO	6 - 15	-	-	-	-	NO
Boron	11	TP233BS2 (Old Dump Pond)	14	5	NO	0.4 - 0.6	-	-	-	-	NO
Cadmium	110	BS230 (Wharf Area)	220	5	NO	3 - 22	-	-	-	-	NO
Chromium (Total)	13	TP233BS2 (Old Dump Pond)	2,700	2	NO	1 - 3	-	-	-	-	NO
Cobalt	380	TP233BS2 (Old Dump Pond)	1,100	5	NO	6 - 85	-	-	-	-	NO
Copper	77,000	TP233BS2 (Old Dump Pond)	11,000	7	YES	1300 - 1700	YES	28321	YES	YES	NO <sup>9</sup>
Iron	590	TP233BS2 (Old Dump Pond)	140	5	YES	4.4 - 43	YES	156	YES	NO	YES
Lead	19	MW51SSZ (Subdivision)	32	7	NO	4.0	-	-	-	-	NO
Lithium	360	TP233BS2 (Old Dump Pond)	360	7	YES	5 - 79	YES	172	NO	-	NO
Manganese	1.9	TP233BS2 (Old Dump Pond)	6.6	5	NO	0.1 - 0.5	-	-	-	-	NO
Mercury	9	TP233BS2 (Old Dump Pond)	170	2	NO	2 - 4	-	-	-	-	NO
Molybdenum	87	TP233BS2 (Old Dump Pond)	310	2	NO	3 - 28	-	-	-	-	NO
Nickel	22	TP246BS1 (Subdivision)	N/A	-	YES	nd	YES	11	YES	-	NO <sup>10</sup>
Rubidium	nd	-	80	5	NO	nd	-	-	-	-	NO
Selenium	2.9	TP233BS2 (Old Dump Pond)	98	2	NO	nd	-	-	-	-	NO
Silver	53	MW51SSZ (Subdivision)	9,400	7	NO	10 - 35	-	-	-	-	NO
Strontium	TP237BS1, TP245BS1 (Subdivision)	-	-	-	NO	-	-	-	-	-	NO
Thallium	0.2	BS23 (Wharf Area)	1	5 <sup>prov</sup>	NO	nd	-	-	-	-	NO
Tin	320	TP231BS2 (Old Dump Pond)	9,400	7	NO	3	-	-	-	-	NO
Uranium	2.2	TP249BS2 (Subdivision)	23	5	NO	0.5 - 26	-	-	-	-	NO
Vanadium	43	TP233BS2 (Old Dump Pond)	470	2	NO	2 - 12	-	-	-	-	NO
Zinc	2,700	TP233BS2 (Old Dump Pond)	16,000	2	NO	11 - 24	-	-	-	-	NO

Notes:

1. Atlantic PIRI PSSLI for residential sites with non-potable groundwater, coarse grained soil and fuel oil or lube oil impacts (Soil Ingestion)
  2. Ontario Ministry of Environment (OMOE) Soil Standards for Use Under Part XV.1 of the Environmental Protection Act, Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition, Residential Land Use, soil contact human-health guideline
  3. Alberta Tier 1 Surface Soil Guidelines for Residential Land Use - Direct soil contact human health guidelines
  4. There are no applicable guidelines for perylene or phenanthrene, therefore, the most stringent of all non-carcinogenic PAH guidelines (Acenaphthylene) has been selected for comparison purposes.
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  6. As per current CCME guidance, all carcinogenic PAHs are assumed to act cumulatively and therefore, the entire group is carried forward and is assessed based on a Total Potency Equivalents (TPE) basis, relative to B[a]P.
  7. US EPA (Oak Ridge National Laboratory) Regional Screening Levels for Chemical Contaminants at Superfund Sites (December 2009). Residential land use. As per current Health Canada guidance, concentrations have been multiplied by 0.2.
  8. The EPC for PCBs was equal to the screening guideline (AENV, 2009) of 22 mg/kg. PCBs were carried forward because the AENV guideline is based on a TRV of 0.001 mg/kg-day (Health Canada, 2004) and not the TRV of 0.00013 mg/kg-day (Health Canada, 2009).
  9. Iron and Aluminum are considered to be elements of low inherent toxicity
  10. There is no applicable guideline (i.e., CCME, OMOE, US EPA) for rubidium. Rubidium is typically associated with seawater spray and could be expected to be present at the site due to its proximity to the ocean, and not as a result of historical site activities <sup>prov</sup> = provisional human health guideline (CCME)
  - ND = not detected above laboratory detection limits
  - N/A = no human-health-based guideline available
- Note that the petroleum hydrocarbons detected in soil at the Residential Area were a mixture of lube oil and fuel oil. As per Atlantic PIRI guidance, the impacts were assessed for the most restrictive product type (i.e., fuel oil).



## Pro-rating Tables

**Table 26.3 Pro-Rated Soil TPH Fractionation Chemistry for RBCA - Fuel Oil  
Hopedale Radar Site Hopedale, NL - Radar Site  
Stantec Project No. 121410103**

17,211

TPH	EQL (mg/kg)	TP117-BS2	Mass Fraction	EPC
<b>TPH by Fractionation</b>				
<b>Aromatics</b>				
>C7-C8	0.025	-		0.48
>C8-C10	0.1	170	0.0077	145
>C10-C12	4	1500	0.068	1173
>C12-C16	15	2200	0.100	1721
>C16-C21	15	260	0.012	203
>C21-C32	15	130	0.006	102
<b>Aliphatics</b>				
>C6-C8	0.1	45	0.002	35
>C8-C10	0.4	990	0.045	774
>C10-C12	8	5500	0.250	4303
>C12-C16	15	10000	0.455	7823
>C16-C21	15	630	0.029	493
>C21-C32	15	420	0.019	329
<b>Modified TPH</b>		22000	0.993	17102
Toluene	0.025	0.11	-	0.48
Ethylbenzene	0.025	0.4	-	0.08
Xylenes	0.050	12	-	12

Notes:

Aromatics >C7-C8 = toluene

Aromatics >C8-C10 = fraction range + ethylbenzene & xylenes

Benzene, Toluene, Ethylbenzene and Xylene = maximum

**Table 26.4 Pro-Rated Soil TPH Fractionation Chemistry for RBCA - Lube Oil  
Hopedale Radar Site Hopedale, NL  
Stantec Project No. 121410103**

8,787

TPH	EQL (mg/kg)	TP141-BS1	Mass Fraction	EPC
<b>TPH by Fractionation</b>				
<b>Aromatics</b>				
>C7-C8	0.025	-		4.7
>C8-C10	0.1	0.05	0.0000	11
>C10-C12	4	81	0.003	28
>C12-C16	15	550	0.022	193
>C16-C21	15	440	0.018	155
>C21-C32	15	5700	0.228	2003
<b>Aliphatics</b>				
>C6-C8	0.1	120	0.005	42
>C8-C10	0.4	39	0.002	14
>C10-C12	8	410	0.016	144
>C12-C16	15	2400	0.096	844
>C16-C21	15	730	0.029	257
>C21-C32	15	14000	0.560	4921
<b>Modified TPH</b>		25000	0.979	8617
Toluene	0.025	0.11	-	4.7
Ethylbenzene	0.025	0.4	-	0.08
Xylenes	0.050	12	-	11

Notes:

Aromatics >C7-C8 = toluene

Aromatics >C8-C10 = fraction range + ethylbenzene & xylenes

Benzene, Toluene, Ethylbenzene and Xylene = maximum

**Table 26.5 Pro-Rated Soil TPH Fractionation Chemistry for RBCA - Fuel Oil  
Hopedale Radar Site Hopedale, NL - Residential Area  
Stantec Project No. 121410103**

6,279

TPH	EQL (mg/kg)	TP117-BS2	Mass Fraction	EPC
<b>TPH by Fractionation</b>				
<b>Aromatics</b>				
>C7-C8	0.025	-		0.39
>C8-C10	0.1	170	0.0077	49
>C10-C12	4	1500	0.068	428
>C12-C16	15	2200	0.100	628
>C16-C21	15	260	0.012	74
>C21-C32	15	130	0.006	37
<b>Aliphatics</b>				
>C6-C8	0.1	45	0.002	13
>C8-C10	0.4	990	0.045	283
>C10-C12	8	5500	0.250	1570
>C12-C16	15	10000	0.455	2854
>C16-C21	15	630	0.029	180
>C21-C32	15	420	0.019	120
<b>Modified TPH</b>		22000	0.993	6236
Toluene	0.025	0.11	-	0.39
Ethylbenzene	0.025	0.4	-	0.1
Xylenes	0.050	12	-	0.65

Notes:

Aromatics >C7-C8 = toluene

Aromatics >C8-C10 = fraction range + ethylbenzene & xylenes

Benzene = 1/2 RDL

Toluene, Ethylbenzene and Xylene = maximum

**Table 26.6 Pro-Rated Sediment TPH Fractionation Chemistry for RBCA  
Hopedale Radar Site Hopedale, NL - Residential Area  
Stantec Project No. 121410103**

6,484

TPH	EQL (mg/kg)	TP117-BS2	Mass Fraction	EPC
<b>TPH by Fractionation</b>				
<b>Aromatics</b>				
>C7-C8	0.025	-		nd
>C8-C10	0.1	170	0.0077	50
>C10-C12	4	1500	0.068	442
>C12-C16	15	2200	0.100	648
>C16-C21	15	260	0.012	77
>C21-C32	15	130	0.006	38
<b>Aliphatics</b>				
>C6-C8	0.1	45	0.002	13
>C8-C10	0.4	990	0.045	292
>C10-C12	8	5500	0.250	1621
>C12-C16	15	10000	0.455	2947
>C16-C21	15	630	0.029	186
>C21-C32	15	420	0.019	124
<b>Modified TPH</b>		22000	0.993	6438
Toluene	0.025	0.11	-	nd
Ethylbenzene	0.025	0.4	-	nd
Xylenes	0.050	12	-	nd

Notes:

Aromatics >C7-C8 = toluene

Aromatics >C8-C10 = fraction range + ethylbenzene & xylenes

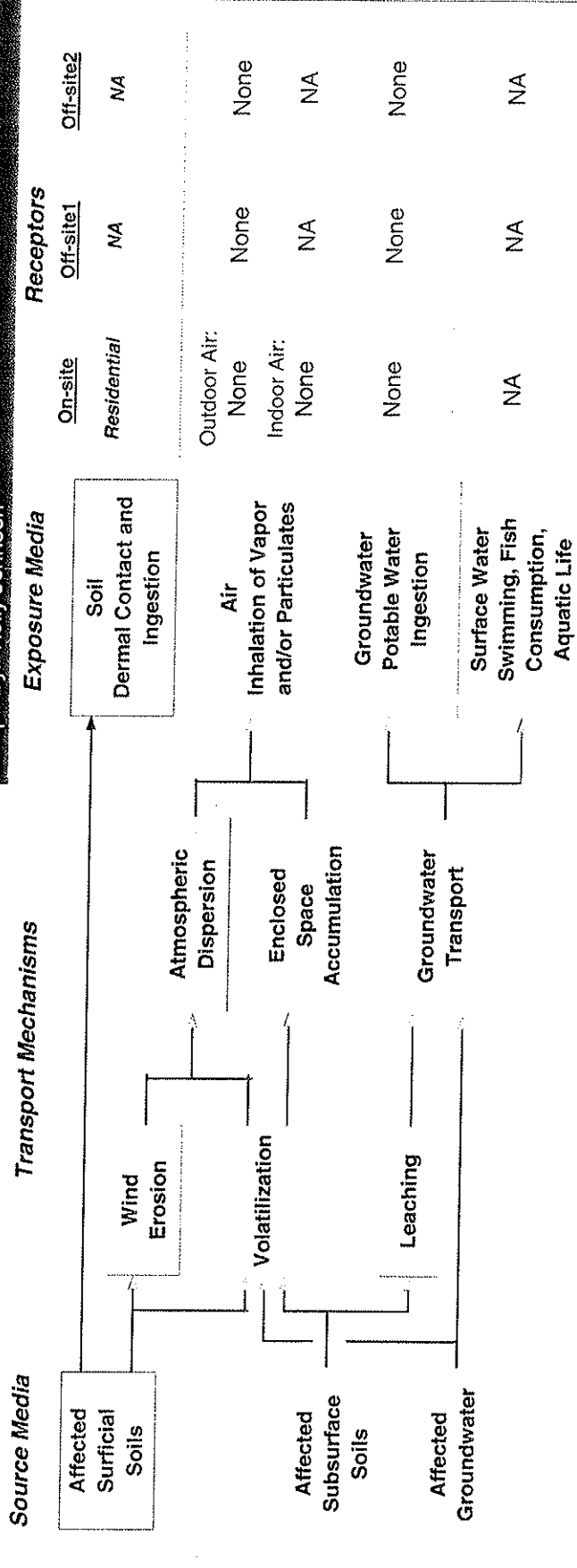
Benzene, Toluene, Ethylbenzene and Xylene = not detected

## Risk Assessment Results

Former Radar Site – Fuel Oil

# Exposure Pathway Flowchart

Site Name: Hopedale Radar Site Job ID: 121410103  
 Location: Hopedale, NL Date: 31-Mar-10  
 Compl. By: Kelly Johnson



**RECEPTOR**

**TRANSPORT**

**SOURCE**

Commands and Options

Main Screen

Print Sheet

Help



# RBGA SITE ASSESSMENT

## Input Parameter Summary

Job ID: 121410103

Completed By: Kelly Johnson  
Date Completed: 31-Mar-10

1 OF 1

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL

Exposure Parameters	Residential		Commercial/Industrial	
	Adult	Age 3-11 yrs.	Adult	Children
AT <sub>c</sub>	78	4	25	1
AT <sub>n</sub>	25	16.5	70.7	
BW	70.7	4	25	
ED	25	7	25	
EF	25	7	25	
EF <sub>h</sub>	78		100	100
EF <sub>s</sub>	78		250	
IR <sub>h</sub>	1.5	0.6	1.5	
IR <sub>s</sub>	20	80	20	100
SA	3400	3000	3400	3400
M	0.1			
ET <sub>swim</sub>	1			
EV <sub>swim</sub>	12	12	12	
IR <sub>swim</sub>	0.05	0.5	0.5	
SA <sub>swim</sub>	20000	4400	8100	
IR <sub>fish</sub>	0.05			
IR <sub>fish</sub>	1			

Complete Exposure Pathways and Receptors	Off-site 1		Off-site 2	
	On-site	Off-site 1	Off-site 2	Off-site 2
<b>Groundwater:</b>				
Groundwater Ingestion	None	None	None	None
Soil Leaching to Groundwater Ingestion	None	None	None	None
<b>Applicable Surface Water Exposure Routes:</b>				
Swimming				
Fish Consumption				
Aquatic Life Protection				
<b>Soil:</b>				
Direct Ingestion and Dermal Contact	Residential			
<b>Outdoor Air:</b>				
Particulates from Surface Soils	None	None	None	None
Volatilization from Soils	None	None	None	None
Volatilization from Groundwater	None	None	None	None
<b>Indoor Air:</b>				
Volatilization from Subsurface Soils	None	None	None	None
Volatilization from Groundwater	None	None	None	None

Receptor Distance from Source Media	Off-site 1		Off-site 2	
	On-site	Off-site 1	Off-site 2	Off-site 2
<b>Groundwater receptor: Distance downgradient</b>				
Lateral distance off centreline	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA
Soil leaching to groundwater receptor: Dist. downgradient	NA	NA	NA	NA
Lateral distance off centreline	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA
Outdoor air inhalation receptor: downwind distance	NA	NA	NA	NA

Target Health Risk Values	Individual	Cumulative
TR <sub>95</sub> Target Risk (class A&B carcinogens)	1.0E-5	1.0E-5
TR <sub>50</sub> Target Risk (class C carcinogens)	1.0E-5	1.0E-5
THO Target Hazard Quotient (non-carcinogenic risk)	1.0E-0	1.0E-0

Modelling Options	Tier 2 or 3
RBGA tier	Individual & Cumulative Risks
Calculation option	NA
Outdoor air volatilization model	NA
Indoor air volatilization model	NA
Soil leaching model	NA
Use soil attenuation model (SAM) for leachate?	NA
Air dilution factor	NA
Groundwater dilution/attenuation factor	NA

NOTE: NA = Not applicable; Data value font indicates value differs from Tier 1 default value.

Surface Parameters	General	Construction	Units
A	NA	NA	(m <sup>2</sup> )
W	NA	NA	(m)
W <sub>pw</sub>	NA	NA	(m)
U <sub>air</sub>	NA	NA	(m/s)
δ <sub>air</sub>	NA	NA	(m)
P <sub>a</sub>	NA	NA	(g/cm <sup>2</sup> /s)
L <sub>sk</sub>	NA	NA	(m)

Surface Soil Column Parameters	Value	Units
Capillary zone thickness	NA	(m)
Vadose zone thickness	NA	(m)
Soil bulk density	NA	(g/cm <sup>3</sup> )
Fraction organic carbon	NA	(-)
Soil total porosity	NA	(-)
Vertical hydraulic conductivity	NA	(cm/s)
Vapour permeability	NA	(m <sup>2</sup> )
Depth to groundwater	NA	(m)
Depth to top of affected soils	NA	(m)
Depth to base of affected soils	NA	(m)
Thickness of affected soils	NA	(m)
Soil/groundwater pH	NA	(-)
Volumetric water content	capillary	(-)
Volumetric air content	vadose	(-)
	NA	(-)
	NA	(-)
	foundation	(-)
	NA	(-)
	NA	(-)

Building Parameters	Residential	Commercial	Units
L <sub>b</sub> Building volume/area ratio	NA	NA	(m <sup>2</sup> )
A <sub>b</sub> Foundation area	NA	NA	(m <sup>2</sup> )
X <sub>ca</sub> Foundation perimeter	NA	NA	(m)
ER Building air exchange rate	NA	NA	(1/s)
L <sub>ca</sub> Foundation thickness	NA	NA	(m)
Z <sub>so</sub> Depth to bottom of foundation slab	NA	NA	(m)
φ Foundation crack fraction	NA	NA	(-)
dP Indoor/outdoor differential pressure	NA	NA	(g/cm <sup>3</sup> /s <sup>2</sup> )
U <sub>i</sub> Convective air flow through slab	NA	NA	(m <sup>3</sup> /s)

Groundwater Parameters	Value	Units
b <sub>pw</sub> Groundwater mixing zone depth	NA	(m)
I <sub>g</sub> Net groundwater infiltration rate	NA	(cm/yr)
U <sub>g</sub> Groundwater Darcy velocity	NA	(cm/s)
V <sub>g</sub> Groundwater seepage velocity	NA	(cm/s)
K <sub>s</sub> Saturated hydraulic conductivity	NA	(cm/s)
i Groundwater gradient	NA	(-)
S <sub>w</sub> Width of groundwater source zone	NA	(m)
S <sub>1</sub> Depth of groundwater source zone	NA	(m)
θ <sub>air</sub> Effective porosity in water-bearing unit	NA	(-)
f <sub>oc,sw</sub> Fraction organic carbon in water-bearing unit	NA	(-)
pH <sub>sw</sub> Groundwater pH	NA	(-)
Biodegradation considered?	NA	(-)

Transport Parameters	Off-site 1	Off-site 2	Off-site 1	Off-site 2	Units
<b>Lateral Groundwater Transport</b>					
α <sub>l</sub> Longitudinal dispersivity	NA	NA	NA	NA	(m)
α <sub>t</sub> Transverse dispersivity	NA	NA	NA	NA	(m)
α <sub>v</sub> Vertical dispersivity	NA	NA	NA	NA	(m)
<b>Lateral Outdoor Air Transport</b>					
α <sub>l</sub> Lateral dispersion coefficient	NA	NA	NA	NA	(m)
α <sub>t</sub> Transverse dispersion coefficient	NA	NA	NA	NA	(m)
ADF Air dispersion factor	NA	NA	NA	NA	(-)

Surface Water Parameters	Off-site 2	Units
Q <sub>sw</sub> Surface water flow rate	NA	(m <sup>3</sup> /s)
W <sub>pw</sub> Width of GW plume at SW discharge	NA	(m)
δ <sub>sw</sub> Thickness of GW plume at SW discharge	NA	(m)
DF <sub>sw</sub> Groundwater-to-surface water dilution factor	NA	(-)

**REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA**

CONSTITUENT	Representative COC Concentration			
	Groundwater		Soils (0 - 3 m)	
	value (mg/L)	note	value (mg/kg)	note
TPH - Aliph >C06-C08			4.2E+1	EPC
TPH - Aliph >C08-C10			1.4E+1	EPC
TPH - Aliph >C10-C12			1.4E+2	EPC
TPH - Aliph >C12-C16			8.4E+2	EPC
TPH - Aliph >C16-C21			2.6E+2	EPC
TPH - Aliph >C21-C34			4.9E+3	EPC
TPH - Arom >C07-C08			4.7E+0	EPC
TPH - Arom >C08-C10			1.1E+1	EPC
TPH - Arom >C10-C12			2.8E+1	EPC
TPH - Arom >C12-C16			1.9E+2	EPC
TPH - Arom >C16-C21			1.6E+2	EPC
TPH - Arom >C21-C35			2.0E+3	EPC

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site      Site Location: Hopedale, NL      Completed By: Kelly Johnson      Date Completed: 31-Mar-10      1 OF 1

**TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION**

**SOIL EXPOSURE PATHWAY**

SURFACE SOILS OR SEDIMENTS:  
ON-SITE INGESTION AND  
DERMAL CONTACT

(CHECKED IF PATHWAY IS ACTIVE)

Constituents of Concern	1) Source/Exposure Medium Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (IR+SA)MxRAF x EF x ED / (BW x AT) (kg/kg/day)		3) Average Daily Intake Rate (mg/kg/day) (1) x (2)	
		Residential	Construction Worker	Residential	Construction Worker
TPH - Aliph >C06-C08	4.2E+1	3.0E-6		1.3E-4	
TPH - Aliph >C08-C10	1.4E+1	3.0E-6		4.2E-5	
TPH - Aliph >C10-C12	1.4E+2	3.0E-6		4.3E-4	
TPH - Aliph >C12-C16	8.4E+2	3.0E-6		2.5E-3	
TPH - Aliph >C16-C21	2.6E+2	3.0E-6		7.7E-4	
TPH - Aliph >C21-C34	4.9E+3	3.0E-6		1.5E-2	
TPH - Arom >C07-C08	4.7E+0	3.0E-6		1.4E-5	
TPH - Arom >C08-C10	1.1E+1	3.0E-6		3.3E-5	
TPH - Arom >C10-C12	2.8E+1	3.0E-6		8.3E-5	
TPH - Arom >C12-C16	1.9E+2	3.0E-6		5.7E-4	
TPH - Arom >C16-C21	1.6E+2	3.0E-6		4.6E-4	
TPH - Arom >C21-C35	2.0E+3	3.0E-6		6.0E-3	

NOTE: RAF = Relative absorption factor (-)  
M = Adherence factor (mg/cm<sup>2</sup>)  
AT = Averaging time (days)  
BW = Body weight (kg)  
ED = Exposure duration (yrs)  
EF = Exposure frequency (days/yr)  
IR = Soil ingestion rate (mg/day)  
SA = Skin exposure area (cm<sup>2</sup>/day)

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL  
Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**CARCINOGENIC RISK**

Constituents of Concern	(1) Total Carcinogenic Intake Rate (mg/kg/day)		(2) Slope Factor (mg/kg/day) <sup>-1</sup>	(3) Individual COC Risk (1a)x(2a) + (1b)x(2b) + (1d)x(2d)
	(a) via Ingestion Residential	(b) via Dermal Contact Residential		
TPH - Aliph >C06-C08				
TPH - Aliph >C08-C10				
TPH - Aliph >C10-C12				
TPH - Aliph >C12-C16				
TPH - Aliph >C16-C21				
TPH - Aliph >C21-C34				
TPH - Arom >C07-C08				
TPH - Arom >C08-C10				
TPH - Arom >C10-C12				
TPH - Arom >C12-C16				
TPH - Arom >C16-C21				
TPH - Arom >C21-C35				

Total Pathway Carcinogenic Risk =

--

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**TOXIC EFFECTS**

Constituents of Concern	(4) Total Toxicant Intake Rate (mg/kg/day)				(5) Oral Reference Dose (mg/kg-day)		(6) Individual COC Hazard Quotient	
	(a) via Ingestion	(b) via Dermal Contact	(c) via Ingestion	(d) via Dermal Contact	(a) Oral	(b) Dermal	Residential	Construction Worker
TPH - Aliph >C06-C08	4.4E-5	8.2E-5			5.0E+0	5.0E+0*	2.5E-5	
TPH - Aliph >C08-C10	1.5E-5	2.7E-5			1.0E-1	1.0E-1*	4.2E-4	
TPH - Aliph >C10-C12	1.5E-4	2.8E-4			1.0E-1	1.0E-1*	4.3E-3	
TPH - Aliph >C12-C16	8.7E-4	1.6E-3			1.0E-1	1.0E-1*	2.5E-2	
TPH - Aliph >C16-C21	2.7E-4	5.0E-4			2.0E+0	2.0E+0*	3.8E-4	
TPH - Aliph >C21-C34	5.1E-3	9.6E-3			2.0E+0	2.0E+0*	7.3E-3	
TPH - Arom >C07-C08	4.9E-6	9.1E-6			2.0E-1	2.0E-1*	7.0E-5	
TPH - Arom >C08-C10	1.1E-5	2.1E-5			4.0E-2	4.0E-2*	8.2E-4	
TPH - Arom >C10-C12	2.9E-5	5.4E-5			4.0E-2	4.0E-2*	2.1E-3	
TPH - Arom >C12-C16	2.0E-4	3.7E-4			4.0E-2	4.0E-2*	1.4E-2	
TPH - Arom >C16-C21	1.6E-4	3.0E-4			3.0E-2	3.0E-2*	1.5E-2	
TPH - Arom >C21-C35	2.1E-3	3.9E-3			3.0E-2	3.0E-2*	2.0E-1	

\* No dermal reference dose available--oral reference dose used.

**Total Pathway Hazard Index =**

**2.7E-1**

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RECA SITE ASSESSMENT**

Job ID: 121410103

Completed By: Kelly Johnson  
Date Completed: 31-Mar-10

**SOIL (0 - 3 m) SSTL VALUES**

Target Risk (Class A & B): 1.0E-5  
Target Risk (Class C): 1.0E-5  
Target Hazard Quotient: 1.0E-0

Source Depletion Option: No  
Time to Future Exposure: 0 years

CAS No.	Name	Representative Concentration (mg/kg)	SSTL Results For Complete Exposure Pathways (X* if Complete)												SSTL Exceeds? "X" if yes	Applicable SSTL (mg/kg)	Required CRF Only if "yes" left			
			Soil Vol. to Indoor Air			Soil Volatilization and Surface Soil Particulates to Outdoor Air			Surface Soil Impaction and Dermal Contact			Soil Leaching to Groundwater						Ingestion / Discharges to Surface Water		
			On-site (0 m)	Off-site 1 (0 m)	Off-site 2 (0 m)	On-site (0 m)	Off-site 1 (0 m)	Off-site 2 (0 m)	On-site (0 m)	Residential	Construction Worker	On-site (0 m)	None	Construction Worker				None	On-site (0 m)	Off-site 1 (0 m)
106-08-0	TPH - Aliph >C06-C08	4.2E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+6	<1	
108-10-0	TPH - Aliph >C08-C10	1.4E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0E+4	<1	
110-12-0	TPH - Aliph >C10-C12	1.4E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0E+4	<1	
112-16-0	TPH - Aliph >C12-C16	8.4E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4E+4	<1	
116-21-0	TPH - Aliph >C16-C21	2.6E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4E+4	<1	
121-34-0	TPH - Aliph >C21-C34	4.9E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.7E+5	<1	
207-08-0	TPH - Arom >C07-C08	4.7E+0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.7E+5	<1	
208-10-0	TPH - Arom >C08-C10	1.1E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.6E+4	<1	
210-12-0	TPH - Arom >C10-C12	2.8E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+4	<1	
212-16-0	TPH - Arom >C12-C16	1.9E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3E+4	<1	
216-21-0	TPH - Arom >C16-C21	1.6E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3E+4	<1	
221-35-0	TPH - Arom >C21-C35	2.0E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+4	<1	

\* Indicates risk-based target concentration greater than constituent residual saturation value. NA = Not applicable. NC = Not calculated.

**RBCA SITE ASSESSMENT**

TPH Criteria SSTL Worksheet

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL

Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10

Job ID: 121410103

Target Hazard Index: 1.0E+0

Source Depletion Option: No  
 Time to Future Exposure: 0 years

**SSTL VALUES FOR TPH**

CONSTITUENTS OF CONCERN CAS No.	Name	Mass Fractions		Representative Concentrations		Calculated Concentration Limits		Applicable SSTL Values	
		Soil ( <sup>-</sup> )	Groundwater ( <sup>-</sup> )	Soil (mg/kg)	Groundwater (mg/L)	Residual Soil Concentration (mg/kg)	Solubility (mg/L)	Soils (0 - 3 m) (mg/kg)	Groundwater (mg/L)
106-08-0	TPH - Aliph >C06-C08	4.9E-3	( <sup>-</sup> )	4.2E+1		1.5E+2		1.0E+6	
108-10-0	TPH - Aliph >C08-C10	1.6E-3		1.4E+1		7.4E+1		3.0E+4	
110-12-0	TPH - Aliph >C10-C12	1.7E-2		1.4E+2		4.3E+1		3.4E+4	
112-16-0	TPH - Aliph >C12-C16	9.8E-2		8.4E+2		1.9E+1		3.4E+4	
116-21-0	TPH - Aliph >C16-C21	3.0E-2		2.6E+2		7.9E+0		6.7E+5	
121-34-0	TPH - Aliph >C21-C34	5.7E-1		4.9E+3		1.3E+5		6.7E+5	
207-08-0	TPH - Arom >C07-C08	5.5E-4		4.7E+0		7.1E+2		6.6E+4	
208-10-0	TPH - Arom >C08-C10	1.3E-3		1.1E+1		5.2E+2		1.0E+4	
210-12-0	TPH - Arom >C10-C12	3.2E-3		2.8E+1		3.2E+2		1.3E+4	
212-16-0	TPH - Arom >C12-C16	2.2E-2		1.9E+2		1.5E+2		1.3E+4	
216-21-0	TPH - Arom >C16-C21	1.8E-2		1.6E+2		5.2E+1		1.0E+4	
221-35-0	TPH - Arom >C21-C35	2.3E-1		2.0E+3		4.2E+0		1.0E+4	
<b>Total</b>		1.0E+0	0.0E+0	8.6E+3	0.0E+0	<b>Total TPH SSTL</b>		3.2E+4	

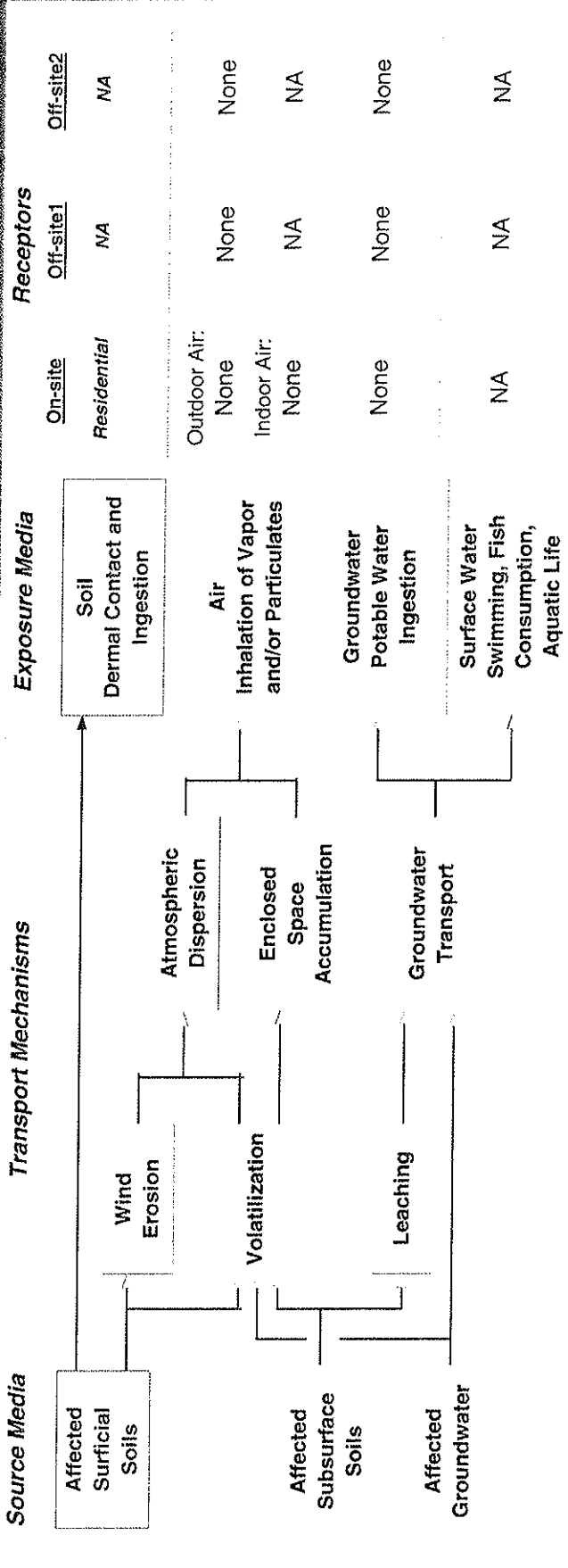
\*s\* indicates risk-based target concentration greater than constituent residual saturation value. NC = Not calculated.

Former Radar Site – Lube Oil



# Exposure Pathway Flowchart

Site Name: Hopedale Radar Site  
 Location: Hopedale, NL  
 Compl. By: Kelly Johnson  
 Job ID: 121410103  
 Date: 31-Mar-10



**SOURCE** → **TRANSPORT** → **RECEPTOR**

**Commands and Options**

# RBCA SITE ASSESSMENT

## Input Parameter Summary

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL

Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10

Job ID: 121410103

1 OF 1

Exposure Parameters	Residential		Commercial/Industrial	
	Area 1-11 VZ <sub>1</sub>	Area 5-11 VZ <sub>2</sub>	Adult	Children
AT <sub>c</sub>	78	7	25	1
AT <sub>n</sub>	25	4	70.7	70.7
BW	70.7	16.5	25	25
ED	25	4	25	25
T	25	7	100	100
EF	78	0.6	1.5	1.5
EF <sub>o</sub>	78	80	20	20
IR <sub>h</sub>	1.5	3000	5000	3400
IR <sub>s</sub>	3400	12	12	12
M	0.1	0.5	0.5	0.5
ET <sub>form</sub>	1	4400	8100	8100
EV <sub>form</sub>	12	0.05	0.05	0.05
IR <sub>swim</sub>	23000	0.05	0.05	0.05
SA <sub>swim</sub>	0.05			
IR <sub>fish</sub>	1			
IR <sub>cont</sub>				

Complete Exposure Pathways and Receptors	Off-site 1		Off-site 2	
	On-site	Off-site 1	Off-site 2	Off-site 2
Groundwater Ingestion	None	None	None	None
Soil Leaching to Groundwater Ingestion	None	None	None	None
Applicable Surface Water Exposure Routes:				
Swimming	Residential	NA	NA	NA
Fish Consumption	Residential	NA	NA	NA
Aquatic Life Protection	Residential	NA	NA	NA
Soil:				
Direct Ingestion and Dermal Contact	None	None	None	None
Outdoor Air:				
Particulates from Surface Soils	None	None	None	None
Volatilization from Soils	None	None	None	None
Volatilization from Groundwater	None	None	None	None
Indoor Air:				
Volatilization from Subsurface Soils	None	None	None	None
Volatilization from Groundwater	None	None	None	None

Receptor Distance from Source Media	Off-site 1		Off-site 2	
	On-site	Off-site 1	Off-site 2	Off-site 2
Groundwater receptor: Distance downgradient	NA	NA	NA	NA
Lateral distance off centreline	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA
Soil leaching to groundwater receptor: Dist. downgradient	NA	NA	NA	NA
Lateral distance off centreline	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA
Outdoor air inhalation receptor: downwind distance	NA	NA	NA	NA

Target Health Risk Values	Individual		Cumulative	
	TR <sub>h</sub>	Target Risk (class A&B carcinogens)	TR <sub>h</sub>	Target Risk (class C carcinogens)
TR <sub>h</sub>	1.0E-5	1.0E-5	1.0E-5	1.0E-5
TR <sub>h</sub>	1.0E-5	1.0E-5	1.0E-5	1.0E-5
TR <sub>h</sub>	1.0E-5	1.0E-5	1.0E-5	1.0E-5

Modelling Options	Tier 2 or 3	
	Individual & Cumulative Risks	Individual & Cumulative Risks
RBCA Inr	NA	NA
Calculation option	NA	NA
Outdoor air volatilization model	NA	NA
Indoor air volatilization model	NA	NA
Soil leaching model	NA	NA
Use soil attenuation model (SAM) for leachate?	NA	NA
Air dilution factor	NA	NA
Groundwater dilution-attenuation factor	NA	NA

NOTE: NA = Not applicable. Bold italic font indicates value differs from 1 or 1 default value.

Surface Parameters	General		Construction	
	Value	Units	Value	Units
A	Soil source zone area	(m <sup>2</sup> )	NA	NA
W	Length of source-zone area parallel to wind	(m)	NA	NA
W <sub>dir</sub>	Length of source-zone area parallel to GW flow	(m)	NA	NA
U <sub>dir</sub>	Ambient air velocity in mixing zone	(m/s)	NA	NA
δ <sub>dir</sub>	Air mixing zone height	(m)	NA	NA
P <sub>a</sub>	Areal particulate emission rate	(g/cm <sup>2</sup> /s)	NA	NA
L <sub>ss</sub>	Thickness of affected surface soils	(m)	NA	NA

Surface Soil Column Parameters	Value		Units	
	Value	Units	Value	Units
h <sub>cap</sub>	Capillary zone thickness	(m)	NA	NA
h <sub>v</sub>	Vadose zone thickness	(m)	NA	NA
ρ <sub>s</sub>	Soil bulk density	(g/cm <sup>3</sup> )	NA	NA
f <sub>oc</sub>	Fraction organic carbon	(-)	NA	NA
θ <sub>r</sub>	Soil total porosity	(-)	NA	NA
K <sub>sc</sub>	Vertical hydraulic conductivity	(m/s)	NA	NA
k <sub>v</sub>	Vapour permeability	(m <sup>2</sup> )	NA	NA
L <sub>g</sub>	Depth to groundwater	(m)	NA	NA
L <sub>t</sub>	Depth to top of affected soils	(m)	NA	NA
L <sub>base</sub>	Depth to base of affected soils	(m)	NA	NA
L <sub>ex</sub>	Thickness of affected soils	(m)	NA	NA
pH	Soil/groundwater pH	(-)	NA	NA
θ <sub>v</sub>	Volumetric water content	(-)	NA	NA
f <sub>v</sub>	Volumetric air content	(-)	NA	NA

Building Parameters	Residential		Commercial	
	Value	Units	Value	Units
L <sub>b</sub>	Building volume/area ratio	(m)	NA	NA
A <sub>b</sub>	Foundation area	(m <sup>2</sup> )	NA	NA
X <sub>oc</sub>	Foundation perimeter	(m)	NA	NA
ER	Building air exchange rate	(1/s)	NA	NA
Z <sub>frk</sub>	Foundation thickness	(m)	NA	NA
Z <sub>rk</sub>	Depth to bottom of foundation slab	(m)	NA	NA
η	Foundation crack fraction	(-)	NA	NA
dp	Indoor/outdoor differential pressure	(Pa)	NA	NA
U <sub>s</sub>	Convective air flow through slab	(m <sup>3</sup> /s)	NA	NA

Groundwater Parameters	Value		Units	
	Value	Units	Value	Units
h <sub>gw</sub>	Groundwater mixing zone depth	(m)	NA	NA
U <sub>gw</sub>	Net groundwater infiltration rate	(cm/yr)	NA	NA
U <sub>gw</sub>	Groundwater Darcy velocity	(cm/s)	NA	NA
v <sub>gw</sub>	Groundwater seepage velocity	(cm/s)	NA	NA
K <sub>s</sub>	Saturated hydraulic conductivity	(cm/s)	NA	NA
i	Groundwater gradient	(-)	NA	NA
S <sub>w</sub>	Width of groundwater source zone	(m)	NA	NA
S <sub>d</sub>	Depth of groundwater source zone	(m)	NA	NA
f <sub>eff</sub>	Effective porosity in water-bearing unit	(-)	NA	NA
f <sub>oc-ss</sub>	Fraction organic carbon in water-bearing unit	(-)	NA	NA
pH <sub>gw</sub>	Groundwater pH	(-)	NA	NA
	Biodegradation considered?	(-)	NA	NA

Transport Parameters	Off-site 1		Off-site 2	
	Groundwater Ingestion	Soil Leaching to GW	Groundwater Ingestion	Soil Leaching to GW
α <sub>l</sub>	Longitudinal dispersivity	NA	NA	NA
α <sub>t</sub>	Transverse dispersivity	NA	NA	NA
α <sub>v</sub>	Vertical dispersivity	NA	NA	NA
α <sub>l</sub>	Lateral Outdoor Air Transport	NA	NA	NA
α <sub>v</sub>	Vertical Outdoor Air Transport	NA	NA	NA
ADF	Air dispersion factor	NA	NA	NA

Surface Water Parameters	Off-site 1		Off-site 2	
	Value	Units	Value	Units
Q <sub>sw</sub>	Surface water flowrate	(m <sup>3</sup> /s)	NA	NA
W <sub>pl</sub>	Width of GW plume at SW discharge	(m)	NA	NA
δ <sub>pl</sub>	Thickness of GW plume at SW discharge	(m)	NA	NA
DF <sub>sw</sub>	Groundwater-to-surface water dilution factor	(-)	NA	NA

**REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA**

CONSTITUENT	Representative COC Concentration			
	Groundwater		Soils (0 - 3 m)	
	value (mg/L)	note	value (mg/kg)	note
TPH - Aliph >C06-C08			3.5E+1	EPC
TPH - Aliph >C08-C10			7.7E+2	EPC
TPH - Aliph >C10-C12			4.3E+3	EPC
TPH - Aliph >C12-C16			7.8E+3	EPC
TPH - Aliph >C16-C21			4.9E+2	EPC
TPH - Aliph >C21-C34			3.3E+2	EPC
TPH - Arom >C07-C08			4.8E-1	EPC
TPH - Arom >C08-C10			1.5E+2	EPC
TPH - Arom >C10-C12			1.2E+3	EPC
TPH - Arom >C12-C16			1.7E+3	EPC
TPH - Arom >C16-C21			2.0E+2	EPC
TPH - Arom >C21-C35			1.0E+2	EPC

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site      Site Location: Hopedale, NL      Completed By: Kelly Johnson      Date Completed: 31-Mar-10      1 OF 1

**TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION**

**SOIL EXPOSURE PATHWAY**

SURFACE SOILS OR SEDIMENTS:  
ON-SITE INGESTION AND  
DERMAL CONTACT

(CHECKED IF PATHWAY IS ACTIVE)

Constituents of Concern	1) Source/Exposure Medium Surface Soil Conc. (mg/kg)		2) Exposure Multiplier (IR+SA)MxRAF)EFxED/(BWxAT) (kg/kg/day)		3) Average Daily Intake Rate (mg/kg/day) (1) x (2)	
	Residential	Construction Worker	Residential	Construction Worker	Residential	Construction Worker
TPH - Aliph >C06-C08	3.5E+1	7.7E+2	3.0E-6	3.0E-6	1.0E-4	1.0E-4
TPH - Aliph >C08-C10	7.7E+2	4.3E+3	3.0E-6	3.0E-6	2.3E-3	2.3E-3
TPH - Aliph >C10-C12	4.3E+3	7.8E+3	3.0E-6	3.0E-6	1.3E-2	1.3E-2
TPH - Aliph >C12-C16	7.8E+3	4.9E+2	3.0E-6	3.0E-6	2.3E-2	2.3E-2
TPH - Aliph >C16-C21	4.9E+2	3.3E+2	3.0E-6	3.0E-6	1.5E-3	1.5E-3
TPH - Aliph >C21-C34	3.3E+2	4.8E-1	3.0E-6	3.0E-6	9.8E-4	9.8E-4
TPH - Arom >C07-C08	4.8E-1	1.5E+2	3.0E-6	3.0E-6	1.4E-6	1.4E-6
TPH - Arom >C08-C10	1.5E+2	1.2E+3	3.0E-6	3.0E-6	4.3E-4	4.3E-4
TPH - Arom >C10-C12	1.2E+3	1.7E+3	3.0E-6	3.0E-6	3.5E-3	3.5E-3
TPH - Arom >C12-C16	1.7E+3	2.0E+2	3.0E-6	3.0E-6	5.1E-3	5.1E-3
TPH - Arom >C16-C21	2.0E+2	1.0E+2	3.0E-6	3.0E-6	6.0E-4	6.0E-4
TPH - Arom >C21-C35	1.0E+2		3.0E-6	3.0E-6	3.0E-4	3.0E-4

NOTE: RAF = Relative absorption factor (-)  
M = Adherence factor (mg/cm<sup>2</sup>)

AT = Averaging time (days)  
BW = Body weight (kg)

ED = Exposure duration (yrs)  
EF = Exposure frequency (days/yr)

IR = Soil ingestion rate (mg/day)  
SA = Skin exposure area (cm<sup>2</sup>/day)

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL  
Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**CARCINOGENIC RISK**

Constituents of Concern	(1) Total Carcinogenic Intake Rate (mg/kg/day)		(2) Slope Factor (mg/kg/day) <sup>-1</sup>		(3) Individual COC Risk (1a)x(2a) + (1b)x(2b) + (1c)x(2c) Residential Construction Worker
	(a) via Ingestion Residential	(b) via Dermal Contact Residential	(c) via Ingestion Construction Worker	(d) via Dermal Contact Construction Worker	
TPH - Aliph >C06-C08					
TPH - Aliph >C08-C10					
TPH - Aliph >C10-C12					
TPH - Aliph >C12-C16					
TPH - Aliph >C16-C21					
TPH - Aliph >C21-C34					
TPH - Arom >C07-C08					
TPH - Arom >C08-C10					
TPH - Arom >C10-C12					
TPH - Arom >C12-C16					
TPH - Arom >C16-C21					
TPH - Arom >C21-C35					

Total Pathway Carcinogenic Risk =

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**TOXIC EFFECTS**

Constituents of Concern	(4) Total Toxicant Intake Rate (mg/kg/day)				(5) Oral Reference Dose (mg/kg-day)		(6) Individual COC Hazard Quotient	
	(a) via Ingestion	(b) via Dermal Contact	(c) via Ingestion	(d) via Dermal Contact	(a) Oral	(b) Dermal	Residential	Construction Worker
	Residential		Construction Worker					
TPH - Aliph >C08-C08	3.6E-5	6.8E-5			5.0E+0	5.0E+0*	2.1E-5	
TPH - Aliph >C08-C10	8.0E-4	1.5E-3			1.0E-1	1.0E-1*	2.3E-2	
TPH - Aliph >C10-C12	4.5E-3	8.4E-3			1.0E-1	1.0E-1*	1.3E-1	
TPH - Aliph >C12-C16	8.1E-3	1.5E-2			1.0E-1	1.0E-1*	2.3E-1	
TPH - Aliph >C16-C21	5.1E-4	9.6E-4			2.0E+0	2.0E+0*	7.3E-4	
TPH - Aliph >C21-C34	3.4E-4	6.4E-4			2.0E+0	2.0E+0*	4.9E-4	
TPH - Arom >C07-C08	5.0E-7	9.3E-7			2.0E-1	2.0E-1*	7.1E-6	
TPH - Arom >C08-C10	1.5E-4	2.8E-4			4.0E-2	4.0E-2*	1.1E-2	
TPH - Arom >C10-C12	1.2E-3	2.3E-3			4.0E-2	4.0E-2*	8.7E-2	
TPH - Arom >C12-C16	1.8E-3	3.3E-3			4.0E-2	4.0E-2*	1.3E-1	
TPH - Arom >C16-C21	2.1E-4	3.9E-4			3.0E-2	3.0E-2*	2.0E-2	
TPH - Arom >C21-C35	1.1E-4	2.0E-4			3.0E-2	3.0E-2*	1.0E-2	

\* No dermal reference dose available--oral reference dose used.

**Total Pathway Hazard Index =**

**6.4E-1**

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

Job ID: 121410103

Completed By: Kelly Johnson

Date Completed: 31-Mar-10

Target Risk (Class A & B): 1.0E-5

Target Risk (Class C): 1.0E-5

Target Hazard Quotient: 1.0E-0

Site Name: Hopedale Radar Site

Site Location: Hopedale, NL

**SOIL (0 - 3 m) SSTL VALUES**

Source Depletion Option: No

Time to Future Exposure: 0 years

CAS No.	Name	Representative Concentration (mg/kg)	Soil Leaching to Groundwater						Soil Volatilization and Surface Soil Particulates to Outdoor Air						X	Applicable SSTL (mg/kg)	SSTL Exceeded? * if yes	Required CRF Only if "yes" left		
			Ingestion / Discharge to Surface Water		Soil Vol. to Indoor Air		Soil Vol. to Outdoor Air		On-site (0 m)		Construction Worker		On-site (0 m)						Residential	Construction Worker
			On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)								
106-08-0	TPH - Aliph >C06-C08	3.5E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+6	<input type="checkbox"/>	<1			
108-10-0	TPH - Aliph >C08-C10	7.7E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0E+4	<input type="checkbox"/>	<1			
110-12-0	TPH - Aliph >C10-C12	4.3E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4E+4	<input type="checkbox"/>	<1			
112-16-0	TPH - Aliph >C12-C16	7.8E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4E+4	<input type="checkbox"/>	<1			
116-21-0	TPH - Aliph >C16-C21	4.9E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.7E+5	<input type="checkbox"/>	<1			
121-34-0	TPH - Aliph >C21-C34	3.3E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.7E+5	<input type="checkbox"/>	<1			
207-08-0	TPH - Arom >C07-C08	4.8E-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.6E+4	<input type="checkbox"/>	<1			
208-10-0	TPH - Arom >C08-C10	1.5E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+4	<input type="checkbox"/>	<1			
210-12-0	TPH - Arom >C10-C12	1.2E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3E+4	<input type="checkbox"/>	<1			
212-16-0	TPH - Arom >C12-C16	1.7E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3E+4	<input type="checkbox"/>	<1			
216-21-0	TPH - Arom >C16-C21	2.0E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+4	<input type="checkbox"/>	<1			
221-35-0	TPH - Arom >C21-C35	1.0E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+4	<input type="checkbox"/>	<1			

\* indicates risk-based target concentration greater than constituent residual saturation value. NA = Not applicable. NC = Not calculated.

**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL

Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10

Job ID: 121410103

Target Hazard Index: 1.0E+0

Source Depletion Option: No  
 Time to Future Exposure: 0 years

**SSTL VALUES FOR TPH**

CONSTITUENTS OF CONCERN CAS No.	Mass Fractions		Representative Concentrations		Calculated Concentration Limits		Applicable SSTL Values	
	Soil (-)	Groundwater (-)	Soil (mg/kg)	Groundwater (mg/L)	Residual Soil Concentration (mg/kg)	Solubility (mg/L)	Soils (0 - 3 m) (mg/kg)	Groundwater (mg/L)
106-08-0 TPH - Aliph >C06-C08	2.0E-3	(-)	3.5E+1		1.5E+2		1.0E+6	
108-10-0 TPH - Aliph >C08-C10	4.5E-2		7.7E+2		7.4E+1		3.0E+4	
110-12-0 TPH - Aliph >C10-C12	2.5E-1		4.3E+3		4.3E+1		3.4E+4	
112-16-0 TPH - Aliph >C12-C16	4.8E-1		7.8E+3		1.9E+1		3.4E+4	
116-21-0 TPH - Aliph >C16-C21	2.9E-2		4.9E+2		7.9E+0		6.7E+5	
121-34-0 TPH - Aliph >C21-C34	1.9E-2		3.9E+2		1.3E+5		6.7E+5	
207-08-0 TPH - Arom >C07-C08	2.8E-5		4.8E-1		7.1E+2		6.6E+4	
208-10-0 TPH - Arom >C08-C10	8.5E-3		1.5E+2		5.2E+2		1.0E+4	
210-12-0 TPH - Arom >C10-C12	6.9E-2		1.2E+3		3.2E+2		1.3E+4	
212-16-0 TPH - Arom >C12-C16	1.0E-1		1.7E+3		1.5E+2		1.3E+4	
216-21-0 TPH - Arom >C16-C21	1.2E-2		2.0E+2		5.2E+1		1.0E+4	
221-35-0 TPH - Arom >C21-C35	6.0E-3		1.0E+2		4.2E+0		1.0E+4	
<b>Total</b>	1.0E+0	0.0E+0	1.7E+4	0.0E+0			<b>Total TPH SSTL</b>	2.6E+4

\*s\* indicates risk-based target concentration greater than constituent residual saturation value. NC = Not calculated.



Former Radar Site – Metals and PCBs

Site Specific Target Levels for Human Health (Non-carcinogenic Substances) - Hopedale Radar Site Toddler  
Hopedale Radar Site - Soil Exposure Pathways

Receptor: Toddler Hopedale Radar Site

$$\text{SSTL Toddler} = (\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}}) + \text{BSC}$$

$$\text{HQ Toddler} = \frac{\text{Cs} \times [(\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}})]}{\text{TDI} \times \text{BW}}$$

Compound	TDI (mg/kg bw-day) (oral)	SAF	BSC	AF <sub>gut</sub>	AF <sub>lung</sub>	AF <sub>skin</sub>	SSTL - Toddler (mg/kg)	EPC (mg/kg)	HQ (unitless)
PCBs	0.00013	0.2	0	1	1	0.14	22	29	0.26
Lead	0.00185	0.2	4.4	0.6	1	0.006	587	372	0.13

Time on site:

Hours per day (inhalation) 6 (ingestion/dermal contact always assumed 24 hours per day)  
Days per Week 3  
Weeks per Year 26

Parameter	Definition (units)	Default Value	Reference
TDI =	reference dose (mg/kg bw-day)		chemical specific Bold - Health Canada (2009), Underline - US EPA IRIS
C <sub>s</sub> =	concentration in soil (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
SAF =	soil allocation factor (unitless)		chemical specific
BW =	body weight (kg)		16.5 Health Canada (2009) - Toddler
BSC =	background soil concentration (mg/kg)		chemical specific Health Canada (2009) - Toddler
AF <sub>gut</sub> =	absorption factor for gut (unitless)		chemical specific Assumed
AF <sub>lung</sub> =	absorption factor for lung (unitless)		chemical specific Assumed
AF <sub>skin</sub> =	absorption factor skin (unitless)		chemical specific Health Canada (2009)
SIR =	soil ingestion rate (kg/day)		0.00008 Health Canada (2009) - Toddler
IR <sub>soil</sub> =	soil inhalation rate (kg/day) = CRP (kg/m <sup>3</sup> ) × IR <sub>air</sub> (m <sup>3</sup> /day)		2.1E-06 calculated
SDR =	soil dermal contact rate (kg/day) = (SA <sub>hands</sub> × M <sub>hands</sub> ) + (SA <sub>body</sub> × M <sub>body</sub> ) × 1E-6 (kg/mg)		0.0000688 calculated
ET <sub>ing</sub> =	exposure term for soil ingestion pathway (unitless)		0.2143 Site Specific [ 24 Hours per Day, 3 Days per Week, 26 Weeks per Year]
ET <sub>inh</sub> =	exposure term for soil inhalation pathway (unitless)		0.0536 Site Specific [ 6 Hours per Day, 3 Days per Week, 26 Weeks per Year]
ET <sub>derm</sub> =	exposure term for soil dermal contact pathway (unitless)		0.2143 Site Specific [ 24 Hours per Day, 3 Days per Week, 26 Weeks per Year]
CRP =	concentration of respirable particles (kg/m <sup>3</sup> )		2.50E-07 Health Canada (2004a) - Unpaved roads with vehicle traffic
IR <sub>air</sub> =	daily inhalation rate (m <sup>3</sup> /day)		8.3 Health Canada (2009) - Toddler
SA <sub>hands</sub> =	skin surface area - hands (cm <sup>2</sup> /day)		430 Health Canada (2009) - Toddler
SA <sub>body</sub> =	skin surface area - rest of body (cm <sup>2</sup> /day)		2560 Health Canada (2009) - Toddler - arms and legs
M <sub>hands</sub> =	soil to skin adherence factor - hands (mg/cm <sup>2</sup> )		0.1 Health Canada (2009) - Toddler
M <sub>body</sub> =	soil to skin adherence factor - rest of body (mg/cm <sup>2</sup> )		0.01 Health Canada (2009) - Toddler

Site-Specific Target Levels for Human Health (Non-Threshold Substances) - Hopedale Radar Site Lifetime  
 Hopedale Radar Site - Soil Exposure Pathways

Receptor: Lifetime Hopedale Radar Site

$$\text{SSTL Lifetime} = \frac{\text{TR} \times \text{LE}}{(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_1) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}} \times \text{SF}_1) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{soil}} \times \text{ET}_{\text{derm}} \times \text{SF}_2)} + \text{BSC}$$

$$\text{ILCR Lifetime} = \frac{C_s \times [(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_1) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}} \times \text{SF}_1) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{soil}} \times \text{ET}_{\text{derm}} \times \text{SF}_2)]}{\text{LE}}$$

Compound	SF <sub>o</sub> (mg/kg-d) <sup>-1</sup>	SF <sub>1</sub> (mg/kg-d) <sup>-1</sup>	BSC (mg/kg)	AF <sub>gut</sub>	AF <sub>lung</sub>	AF <sub>skin</sub>	SSTL - Lifetime (mg/kg)	EPC (mg/kg)	ILCR (unitless)
PCBs	2	2	0	1	1	0.14	27	29	1.1E-05

Time on site:

Hours per day (inhalation)	6
Days per Week	3
Weeks per Year	26
Years Exposed	80
Life Expectancy	80

Parameter Definition (units)

Parameter	Definition (units)	Default Value	Reference
SF <sub>o</sub>	oral slope factor [ 1/(mg/kg-day) ]	chemical specific	Health Canada (2009)
SF <sub>1</sub>	inhalation slope factor [ 1/(mg/kg-day) ]	chemical specific	Health Canada (2009)
C <sub>s</sub>	concentration in soil (mg/kg)	site specific calculated	Exposure Point Concentration (EPC)
TR	target risk	1.00E-05	Health Canada (2009)
BSC	background soil concentration	chemical specific	Assumed
AF <sub>gut</sub>	absorption factor for gut (unitless)	chemical specific	Assumed
AF <sub>lung</sub>	absorption factor for lung (unitless)	chemical specific	Health Canada (2009)
AF <sub>skin</sub>	absorption factor skin (unitless)	chemical specific	Health Canada (2009) - Lifetime
SIR <sub>soil</sub>	soil ingestion rate (kg soil-yr/kg bw-day)	4.69E-05	Health Canada (2009) - Lifetime
IR <sub>soil</sub>	soil inhalation rate (kg soil-yr/kg bw-day) = CRP (kg/m <sup>3</sup> ) x IR <sub>air</sub> (m <sup>3</sup> air-yr/kg bw-day)	5.42E-06	calculated
SDR <sub>soil</sub>	soil dermal contact rate (kg soil-yr/kg bw-day) = (SA <sub>hands</sub> x M <sub>hands</sub> ) + (SA <sub>body</sub> x M <sub>body</sub> ) x 10 <sup>-6</sup> (kg/mg)	1.54E-04	calculated
ET <sub>ing</sub>	exposure term for soil ingestion pathway (unitless)	0.214	Site Specific [ 24 Hours per Day, 3 Days per Week, 26 Weeks per Year]
ET <sub>inh</sub>	exposure term for soil inhalation pathway (unitless)	0.054	Site Specific [ 6 Hours per Day, 3 Days per Week, 26 Weeks per Year]
ET <sub>derm</sub>	exposure term for soil dermal contact pathway (unitless)	0.214	Site Specific [ 24 Hours per Day, 3 Days per Week, 26 Weeks per Year]
CRP	concentration of respirable particles (kg/m <sup>3</sup> )	2.50E-07	Health Canada (2009) - Unpaved roads with vehicle traffic
IR <sub>air</sub>	daily inhalation rate (m <sup>3</sup> air-yr/kg bw-day)	21.7	Health Canada (2009) - Lifetime
SA <sub>hands</sub>	skin surface area - hands (cm <sup>2</sup> -yr/kg bw-day)	1125	Health Canada (2009) - Lifetime
SA <sub>body</sub>	skin surface area - arms (cm <sup>2</sup> -yr/kg bw-day)	4181	Health Canada (2009) - Lifetime
M <sub>hands</sub>	soil to skin adherence factor - hands (mg/cm <sup>2</sup> )	0.1	Health Canada (2009) - Lifetime
M <sub>body</sub>	soil to skin adherence factor - rest of body (mg/cm <sup>2</sup> )	0.01	Health Canada (2009) - Lifetime

Site-Specific Target Levels for Human Health (Non-Threshold Substances) - Hopedale Radar Site Lifetime  
Hopedale Radar Site - Wild Game Ingestion Exposure Pathway

Receptor: Lifetime Hopedale Radar Site

$$\text{SSTL Lifetime} = \frac{\text{TR} \times \text{LE}}{(\text{AF}_{\text{gut}} \times \text{GIR}_{\text{adj}} \times \text{ET}_{\text{ing}} \times \text{SF}_o \times \text{F}_{\text{site}} \times \text{F}_{\text{skn}} \times \text{P}_{\text{smalgame}})} + \text{BCK}$$

$$\text{ILCR Lifetime} = \frac{(\text{C}_g \times \text{AF}_{\text{gut}} \times \text{GIR}_{\text{adj}} \times \text{ET}_{\text{ing}} \times \text{SF}_o \times \text{F}_{\text{site}} \times \text{F}_{\text{skn}} \times \text{P}_{\text{smalgame}})}{\text{LE}}$$

Compound	SF <sub>o</sub> (mg/kg-d) <sup>-1</sup>	AF <sub>gut</sub>	GIR <sub>adj</sub> (kg-yr/kg bw-day)	F <sub>site</sub>	P <sub>smalgame</sub>	BCK (mg/kg)	SSTL - Lifetime (mg/kg)	EPC (mg/kg)	ILCR (unitless)
PCBs	2	1	3.02E-01	0.300	0.080		0.0551	0.16	2.9E-05

Time on site:  
 Hours per day 24 (ingestion/dermal contact always assumed 24 hours per day)  
 Days per Week 7  
 Weeks per Year 52  
 Years Exposed 80 Health Canada (2009)  
 Life Expectancy 80 Health Canada (2009)

**Parameter**

**Definition (units)**

**Default Value**

**Reference**

SF <sub>o</sub> =	oral slope factor [ 1/(mg/kg-day) ]	chemical specific	Health Canada (2009)
C <sub>g</sub> =	concentration in wild game (mg/kg)	site specific	calculated Exposure Point Concentration (EPC)
TR =	target risk	1.00E-05	Health Canada (2009)
AF <sub>gut</sub> =	absorption factor for gut (unitless)	chemical specific	Assumed
GIR <sub>adj</sub> =	wild game ingestion rate (kg-yr/kg bw-day)	3.02E-01	Health Canada (2009) - Lifetime
ET <sub>ing</sub> =	exposure term for game ingestion pathway (unitless)	1.000	Site Specific [ 24 Hours per Day, 7 Days per Week, 52 Weeks per Year]
F <sub>site</sub> =	Fraction from site	0.300	Assumed (ESG, 2009)
P <sub>smalgame</sub> =	Percentage of game harvest	0.080	Usher, 1982
BCK =	Background game concentration	chemical specific	

Site Specific Target Levels for Human Health (Non-carcinogenic Substances) - Hopedale Radar Site Toddler  
Hopedale Radar Site - Wild Game Ingestion Exposure Pathway

Receptor: Toddler Hopedale Radar Site

$$\text{SSTL Toddler} = \frac{\text{TDI} \times \text{THQ} \times \text{BW}}{(\text{AF}_{\text{gut}} \times \text{GIR} \times \text{ET}_{\text{ing}} \times \text{F}_{\text{site}} \times \text{P}_{\text{smallgame}})} + \text{BCK}$$

$$\text{HQ Toddler} = \frac{\text{Cg} \times \text{AF}_{\text{gut}} \times \text{GIR} \times \text{ET}_{\text{ing}} \times \text{F}_{\text{site}} \times \text{P}_{\text{smallgame}}}{\text{TDI} \times \text{BW}}$$

Compound	TDI (oral)	THQ	AF <sub>gut</sub>	GIR (kg/day)	F <sub>site</sub>	P <sub>smallgame</sub>	BCK (mg/kg)	SSTL - Toddler (mg/kg)	EPC (mg/kg)	HQ (unitless)
PCBs	0.00013	0.2	1	0.085	0.3	0.08		0.21	0.157	0.15
Lead	0.00185	0.2	1	0.085	0.3	0.08		3	0.71	0.05

Time on site:

Hours per day 24 (ingestion/dermal contact always assumed 24 hours per day)  
Days per Week 7  
Weeks per Year 52

Parameter	Definition (units)	Default Value	Reference
TDI =	reference dose (mg/kg bw-day)		chemical specific Bold - Health Canada (2009), Underline - US EPA IRIS
C <sub>g</sub> =	concentration in game (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
THQ =	target HQ (unitless)		chemical specific
BW =	body weight (kg)	16.5	Health Canada (2009) - Toddler
AF <sub>gut</sub> =	absorption factor for gut (unitless)		chemical specific Assumed
GIR =	game ingestion rate (kg/day)	0.085	Health Canada (2009) - Toddler
ET <sub>ing</sub> =	exposure term for game ingestion pathway (unitless)	1.0	Site Specific [ 24 Hours per Day, 7 Days per Week, 52 Weeks per Year]
F <sub>site</sub> =	Fraction from Site	0.3	Assumed (ESG, 2009)
P <sub>smallgame</sub> =	Percentage of wild game ingested	0.08	Usher, 1982
BCK =	Background game concentration		chemical specific

Site-Specific Target Levels for Human Health (Non-Threshold Substances) - Former Radar Site Lifetime  
 Former Radar Site, Hopedale, NL - Berry Ingestion Exposure Pathway

Receptor: Former Radar Site

$$\text{SSTL Lifetime} = \frac{\text{TR} \times \text{LE}}{(\text{AF}_{\text{gut}} \times \text{BIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_b)} + \text{BCK}$$

$$\text{ILCR Lifetime} = \frac{C_b \times (\text{AF}_{\text{gut}} \times \text{BIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_b)}{\text{LE}}$$

Compound	SF <sub>b</sub> (mg/kg-d) <sup>-1</sup>	BCK (mg/kg)	AF <sub>gut</sub>	SSTL - Lifetime (mg/kg)	EPC (mg/kg)	ILCR (unitless)
PCBS	2		1	0.0023	0.003	1.3E-05

Time on site:

Hours per day (inhalation)	24
Days per Week	7
Weeks per Year	52
Years Exposed	80
Life Expectancy	80

Health Canada (2009)  
 Health Canada (2009)

Parameter

Definition (units)

Parameter	Definition (units)	Default Value	Reference
SF <sub>b</sub> =	oral slope factor [ 1/(mg/kg-day) ]		chemical specific Health Canada (2009)
SF <sub>i</sub> =	inhalation slope factor [ 1/(mg/kg-day) ]		chemical specific Health Canada (2009)
C <sub>b</sub> =	concentration in berries (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
TR =	target risk	1.00E-05	Health Canada (2009)
BCK =	background berry concentration (mg/kg)		chemical specific
AF <sub>gut</sub> =	absorption factor for gut (unitless)		chemical specific Assumed
BIR <sub>soil</sub> =	berry ingestion rate (kg berry-yr/kg bw-day)	1.76E-01	Health Canada (2009) - Lifetime
ET <sub>ing</sub> =	exposure term for soil ingestion pathway (unitless)	1.000	Site Specific [ 24 Hours per Day, 7 Days per Week, 52 Weeks per Year ]

**Site Specific Target Levels for Human Health (Non-carcinogenic Substances) - Former Radar Site Toddler**  
**Former Radar Site, Hopedale, NL - Berry Ingestion Exposure Pathway**

Receptor: **Toddler**      Former Radar Site

$$\text{SSTL Toddler} = \frac{\text{TDI} \times \text{THQ} \times \text{BW}}{(\text{AF}_{\text{gut}} \times \text{BIR} \times \text{ET}_{\text{ing}})} + \text{BCK}$$

$$\text{HQ Toddler} = \frac{\text{Cb} \times (\text{AF}_{\text{gut}} \times \text{BIR} \times \text{ET}_{\text{ing}})}{\text{TDI} \times \text{BW}}$$

Compound	TDI (oral)	THQ	BCK	AF <sub>gut</sub>	SSTL - Toddler (mg/kg)	EPC (mg/kg)	HQ (unitless)
Lead	0.00185	0.2		0.6	0.2	0.025	0.0329
PCBs	0.00013	0.2		1	0.0064	0.003	0.094

**Time on site:**  
 Hours per day (inhalation)      24      (ingestion/dermal contact always assumed 24 hours per day)  
 Days per Week      7  
 Weeks per Year      52

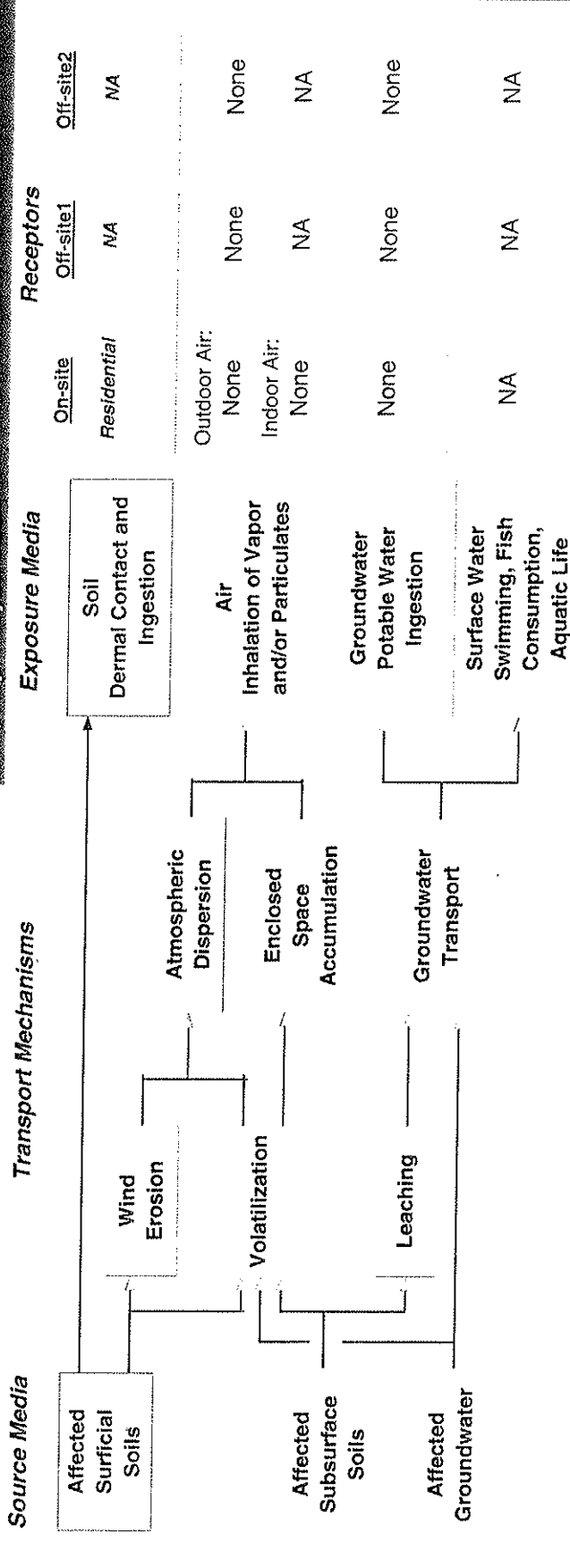
Parameter	Definition (units)	Default Value	Reference
TDI =	reference dose (mg/kg bw-day)		chemical specific Boid - Health Canada (2004b), Underline - US EPA IRIS
C <sub>b</sub> =	concentration in berries (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
THQ =	target hazard quotient (unitless)	0.2 Health Canada (2009)	
BW =	body weight (kg)	16.5 Health Canada (2009) - Toddler	
BCK =	background concentration (mg/kg)	chemical specific	
AF <sub>gut</sub> =	absorption factor for gut (unitless)	chemical specific Assumed	
AF <sub>skin</sub> =	absorption factor skin (unitless)	chemical specific Health Canada (2009)	
BIR =	berry ingestion rate (kg/day)	0.067 Health Canada (2009) - Toddler	
ET <sub>ing</sub> =	exposure term for berry ingestion pathway (unitless)	1.0000 Site Specific [ 24 Hours per Day, 7 Days per Week, 52 Weeks per Year]	

Residential Area – Soil - Fuel Oil



# Exposure Pathway Flowchart

Site Name: Hopedale Radar Site Job ID: 121410103  
 Location: Hopedale, NL Date: 31-Mar-10  
 Compl. By: Kelly Johnson



SOURCE

RECEPTOR

**Commands and Options**

Main Screen

Print Sheet

Help

# RBCA SITE ASSESSMENT

## Input Parameter Summary

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10

Job ID: 121410103  
 1 OF 1

Exposure Parameters	Residential		Commercial/Industrial	
	Avg. 1-4 yrs.	Avg. 5-11 yrs.	Adult	Child
AT <sub>c</sub>	4	7	25	1
AT <sub>n</sub>	16.5	33	70.7	1
BW	4	7	25	1
ED	25	25	25	1
E <sub>f</sub>	182	182	100	100
E <sub>f</sub> <sub>g</sub>	182	182	250	100
IR <sub>w</sub>	0.6	0.9	1.5	1.5
IR <sub>d</sub>	80	20	20	100
SA	3000	5000	3400	3400
M	0.1			
E <sub>f</sub> <sub>swim</sub>	1			
E <sub>f</sub> <sub>swim</sub>	12	12	12	12
IR <sub>swim</sub>	0.05	0.5	0.5	0.5
SA <sub>swim</sub>	23000	4400	8100	8100
IR <sub>fish</sub>	0.05			
IR <sub>fish</sub>	1			

Complete Exposure Pathways and Receptors	On-site		Off-site 1		Off-site 2	
	Groundwater: Groundwater Ingestion Soil Leaching to Groundwater Ingestion	None None	None None	None None	None None	None None
Applicable Surface Water Exposure Routes: Swimming Fish Consumption Aquatic Life Protection						
Soil: Direct Ingestion and Dermal Contact	Residential					
Outdoor Air: Particulates from Surface Soils Volatilization from Soils Volatilization from Groundwater	None None None	None None None	None None None	None None None	None None None	None None None
Indoor Air: Volatilization from Subsurface Soils Volatilization from Groundwater	None None	None None	None None	None None	None None	None None

Receptor Distance from Source Media	On-site		Off-site 1		Off-site 2	
	On-site	Off-site 1	Off-site 1	Off-site 2	Off-site 2	Off-site 2
Groundwater receptor: Distance downgradient	NA	NA	NA	NA	NA	NA
Lateral distance off centreline	NA	NA	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA	NA	NA
Soil leaching to groundwater receptor: Dist. downgradient	NA	NA	NA	NA	NA	NA
Lateral distance off centreline	NA	NA	NA	NA	NA	NA
Vertical distance below top of water-bearing unit	NA	NA	NA	NA	NA	NA
Outdoor air inhalation receptor: downwind distance	NA	NA	NA	NA	NA	NA

Target Health Risk Values	Individual	Cumulative
TR <sub>th</sub>	1.0E-5	1.0E-5
TR <sub>c</sub>	1.0E-5	1.0E-5
TR <sub>Q</sub>	1.0E-0	1.0E-0

Modelling Options	Tier 2 or 3	
	Individual & Cumulative Risks	Individual & Cumulative Risks
RBCA tier	NA	NA
Calculation option	NA	NA
Outdoor air volatilization model	NA	NA
Indoor air volatilization model	NA	NA
Soil leaching model	NA	NA
Use soil attenuation model (SAM) for leachate?	NA	NA
Air dilution factor	NA	NA
Groundwater dilution-attenuation factor	NA	NA

Surface Parameters	General	Construction	(Units)
A	NA	NA	(m <sup>2</sup> )
W	NA	NA	(m)
W <sub>gr</sub>	NA	NA	(m)
U <sub>av</sub>	NA	NA	(m/s)
U <sub>av</sub>	NA	NA	(m)
F <sub>a</sub>	NA	NA	(g/cm <sup>2</sup> /s)
L <sub>oc</sub>	NA	NA	(m)

Surface Soil Column Parameters	Value	(Units)
H <sub>cap</sub>	NA	(m)
H <sub>v</sub>	NA	(m)
ρ <sub>s</sub>	NA	(g/cm <sup>3</sup> )
f <sub>oc</sub>	NA	(-)
θ <sub>r</sub>	NA	(-)
K <sub>ov</sub>	NA	(cm/s)
K <sub>v</sub>	NA	(m <sup>2</sup> )
L <sub>gw</sub>	NA	(m)
L <sub>base</sub>	NA	(m)
L <sub>act</sub>	NA	(m)
pH	NA	(-)
θ <sub>w</sub>	NA	(-)
θ <sub>v</sub>	NA	(-)

Building Parameters	Residential	Commercial	(Units)
L <sub>b</sub>	NA	NA	(m)
A <sub>b</sub>	NA	NA	(m <sup>2</sup> )
X <sub>0.05</sub>	NA	NA	(m)
ER	NA	NA	(1/s)
L <sub>0.05</sub>	NA	NA	(m)
Z <sub>0.05</sub>	NA	NA	(m)
η	NA	NA	(-)
dP	NA	NA	(g/cm <sup>2</sup> )
U <sub>a</sub>	NA	NA	(m <sup>3</sup> /s)

Groundwater Parameters	Value	(Units)
Q <sub>gw</sub>	NA	(m <sup>3</sup> /y)
i	NA	(cm/s)
U <sub>gw</sub>	NA	(cm/s)
V <sub>gw</sub>	NA	(cm/s)
K <sub>s</sub>	NA	(cm/s)
i	NA	(-)
S <sub>w</sub>	NA	(m)
S <sub>n</sub>	NA	(m)
θ <sub>eff</sub>	NA	(-)
f <sub>oc,sw</sub>	NA	(-)
pH <sub>sw</sub>	NA	(-)

Transport Parameters	Off-site 1	Off-site 2	Off-site 1	Off-site 2	(Units)
Lateral Groundwater Transport	NA	NA	NA	NA	(m)
Longitudinal dispersivity	NA	NA	NA	NA	(m)
Transverse dispersivity	NA	NA	NA	NA	(m)
Vertical dispersivity	NA	NA	NA	NA	(m)
Lateral Outdoor Air Transport	NA	NA	NA	NA	(m)
Transverse dispersion coefficient	NA	NA	NA	NA	(m <sup>2</sup> /s)
Vertical dispersion coefficient	NA	NA	NA	NA	(m <sup>2</sup> /s)
ADF	NA	NA	NA	NA	(-)

Surface Water Parameters	Off-site 2	(Units)
Q <sub>sw</sub>	NA	(m <sup>3</sup> /s)
W <sub>sw</sub>	NA	(m)
DF <sub>sw</sub>	NA	(m)
DF <sub>sw</sub>	NA	(-)

NOTE: NA = Not applicable; **bold italic** font indicates values others from Tier 1 default value.

**RBCA SITE ASSESSMENT**

User-Specified COC Data

**REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA**

CONSTITUENT	Groundwater		Soils (0 - 3 m)	
	value (mg/L)	note	value (mg/kg)	note
TPH - Aliph >C06-C08			1.3E+1	EPC
TPH - Aliph >C08-C10			2.8E+2	EPC
TPH - Aliph >C10-C12			1.6E+3	EPC
TPH - Aliph >C12-C16			2.9E+3	EPC
TPH - Aliph >C16-C21			1.8E+2	EPC
TPH - Aliph >C21-C34			1.2E+2	EPC
TPH - Arom >C07-C08			3.9E-1	EPC
TPH - Arom >C08-C10			4.9E+1	EPC
TPH - Arom >C10-C12			4.3E+2	EPC
TPH - Arom >C12-C16			6.3E+2	EPC
TPH - Arom >C16-C21			7.4E+1	EPC
TPH - Arom >C21-C35			3.7E+1	EPC

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site Site Location: Hopedale, NL Completed By: Kelly Johnson Date Completed: 31-Mar-10 1 OF 1

**TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**SURFACE SOILS OR SEDIMENTS:**

**ON-SITE INGESTION AND DERMAL CONTACT**

Constituents of Concern	1) Source/Exposure Medium Surface Soil Conc. (mg/kg)		2) Exposure Multiplier (IR <sub>→</sub> SA <sub>→</sub> M <sub>→</sub> RAF) <sub>→</sub> EF <sub>→</sub> ED/(BW <sub>→</sub> AT) (kg/kg/day)		3) Average Daily Intake Rate (mg/kg/day) (1) x (2)	
	Residential	Construction Worker	Residential	Construction Worker	Residential	Construction Worker
TPH - Aliph >C06-C08	1.3E+1	7.0E-6	7.0E-6	9.0E-5	9.0E-5	9.0E-5
TPH - Aliph >C08-C10	2.8E+2	7.0E-6	7.0E-6	2.0E-3	2.0E-3	2.0E-3
TPH - Aliph >C10-C12	1.6E+3	7.0E-6	7.0E-6	1.1E-2	1.1E-2	1.1E-2
TPH - Aliph >C12-C16	2.9E+3	7.0E-6	7.0E-6	2.0E-2	2.0E-2	2.0E-2
TPH - Aliph >C16-C21	1.8E+2	7.0E-6	7.0E-6	1.3E-3	1.3E-3	1.3E-3
TPH - Aliph >C21-C34	1.2E+2	7.0E-6	7.0E-6	8.3E-4	8.3E-4	8.3E-4
TPH - Arom >C07-C08	3.9E+1	7.0E-6	7.0E-6	2.7E-6	2.7E-6	2.7E-6
TPH - Arom >C08-C10	4.9E+1	7.0E-6	7.0E-6	3.4E-4	3.4E-4	3.4E-4
TPH - Arom >C10-C12	4.3E+2	7.0E-6	7.0E-6	3.0E-3	3.0E-3	3.0E-3
TPH - Arom >C12-C16	6.3E+2	7.0E-6	7.0E-6	4.4E-3	4.4E-3	4.4E-3
TPH - Arom >C16-C21	7.4E+1	7.0E-6	7.0E-6	5.1E-4	5.1E-4	5.1E-4
TPH - Arom >C21-C35	3.7E+1	7.0E-6	7.0E-6	2.6E-4	2.6E-4	2.6E-4

NOTE: RAF = Relative absorption factor (-)  
M = Adherence factor (mg/cm<sup>2</sup>)

AT = Averaging time (days)  
BW = Body weight (kg)

ED = Exposure duration (yrs)  
EF = Exposure frequency (days/yr)

IR = Soil ingestion rate (mg/day)  
SA = Skin exposure area (cm<sup>2</sup>/day)

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL  
Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

SOIL EXPOSURE PATHWAY  (CHECKED IF PATHWAY IS ACTIVE)

**CARCINOGENIC RISK**

Constituents of Concern	(1) Total Carcinogenic Intake Rate (mg/kg/day)		(2) Slope Factor (mg/kg/day) <sup>-1</sup>	(3) Individual COC Risk (1a)x(2a) + (1b)x(2b) Residential Construction Worker
	(a) via Ingestion Residential	(b) via Dermal Contact Residential		
TPH - Aliph >C06-C08				
TPH - Aliph >C08-C10				
TPH - Aliph >C10-C12				
TPH - Aliph >C12-C16				
TPH - Aliph >C16-C21				
TPH - Aliph >C21-C34				
TPH - Arom >C07-C08				
TPH - Arom >C08-C10				
TPH - Arom >C10-C12				
TPH - Arom >C12-C16				
TPH - Arom >C16-C21				
TPH - Arom >C21-C35				

Total Pathway Carcinogenic Risk =

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

SOIL EXPOSURE PATHWAY

(CHECKED IF PATHWAY IS ACTIVE)

TOXIC EFFECTS

Constituents of Concern	(4) Total Toxicant Intake Rate (mg/kg/day)				(5) Oral Reference Dose (mg/kg-day)		(6) Individual COC Hazard Quotient	
	(a) via Ingestion	(b) via Dermal Contact	(c) via Ingestion	(d) via Dermal Contact	(a) Oral	(b) Dermal	Residential	Construction Worker
	Residential	Residential	Construction Worker	Construction Worker				
TPH - Aliph >C06-C08	3.1E-5	5.9E-5			5.0E+0	5.0E+0*	1.8E-5	
TPH - Aliph >C08-C10	6.8E-4	1.3E-3			1.0E-1	1.0E-1*	2.0E-2	
TPH - Aliph >C10-C12	3.8E-3	7.1E-3			1.0E-1	1.0E-1*	1.1E-1	
TPH - Aliph >C12-C16	6.9E-3	1.3E-2			1.0E-1	1.0E-1*	2.0E-1	
TPH - Aliph >C16-C21	4.4E-4	8.2E-4			2.0E+0	2.0E+0*	6.3E-4	
TPH - Aliph >C21-C34	2.9E-4	5.4E-4			2.0E+0	2.0E+0*	4.2E-4	
TPH - Arom >C07-C08	9.4E-7	1.8E-6			2.0E-1	2.0E-1*	1.4E-5	
TPH - Arom >C08-C10	1.2E-4	2.2E-4			4.0E-2	4.0E-2*	8.5E-3	
TPH - Arom >C10-C12	1.0E-3	1.9E-3			4.0E-2	4.0E-2*	7.4E-2	
TPH - Arom >C12-C16	1.5E-3	2.8E-3			4.0E-2	4.0E-2*	1.1E-1	
TPH - Arom >C16-C21	1.8E-4	3.4E-4			3.0E-2	3.0E-2*	1.7E-2	
TPH - Arom >C21-C35	8.9E-5	1.7E-4			3.0E-2	3.0E-2*	8.6E-3	

\* No dermal reference dose available--oral reference dose used.

Total Pathway Hazard Index =

5.5E-1

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RECA SITE ASSESSMENT**

Job ID: 121410103

Completed By: Kelly Johnson  
Date Completed: 31-Mar-10

Target Risk (Class A & B): 1.0E-5  
Target Risk (Class C): 1.0E-5  
Target Hazard Quotient: 1.0E-0

**SOIL (0 - 3 m) SSTL VALUES**

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL

Source Depletion Option: No  
Time to Future Exposure: 0 years

CAS No.	Name	Representative Concentration (mg/kg)	SSTL Results For Complete Exposure Pathways (X* if Complete)										Applicable SSTL (mg/kg)	SSTL Exceeded? * if yes	Required CRF Only if "yes" left		
			Soil Leaching to Groundwater Ingestion / Discharge to Surface Water		Soil Volatilization and Surface Soil Particulates to Outdoor Air		Soil Volatilization and Surface Soil Particulates to Outdoor Air		Surface Soil Ingestion and Dermal Contact		Off-site 2 (0 m)						
			On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)	On-site (0 m)	Off-site 1 (0 m)	Residential	Construction Worker							
106-08-0	TPH - Aliph >C06-C08	1.3E+1	None	None	None	None	None	None	None	None	None	None	None	None	7.2E+5	<input type="checkbox"/>	<1
108-10-0	TPH - Aliph >C08-C10	2.8E+2	None	None	None	None	None	None	None	None	None	None	None	None	1.3E+4	<input type="checkbox"/>	<1
110-12-0	TPH - Aliph >C10-C12	1.6E+3	None	None	None	None	None	None	None	None	None	None	None	None	1.4E+4	<input type="checkbox"/>	<1
112-16-0	TPH - Aliph >C12-C16	2.9E+3	None	None	None	None	None	None	None	None	None	None	None	None	1.4E+4	<input type="checkbox"/>	<1
116-21-0	TPH - Aliph >C16-C21	1.8E+2	None	None	None	None	None	None	None	None	None	None	None	None	2.9E+5	<input type="checkbox"/>	<1
121-34-0	TPH - Aliph >C21-C34	1.2E+2	None	None	None	None	None	None	None	None	None	None	None	None	2.9E+5	<input type="checkbox"/>	<1
207-08-0	TPH - Arom >C07-C08	3.9E-1	None	None	None	None	None	None	None	None	None	None	None	None	2.8E+4	<input type="checkbox"/>	<1
208-10-0	TPH - Arom >C08-C10	4.9E+1	None	None	None	None	None	None	None	None	None	None	None	None	4.4E+3	<input type="checkbox"/>	<1
212-12-0	TPH - Arom >C10-C12	4.3E+2	None	None	None	None	None	None	None	None	None	None	None	None	5.8E+3	<input type="checkbox"/>	<1
212-16-0	TPH - Arom >C12-C16	6.3E+2	None	None	None	None	None	None	None	None	None	None	None	None	5.8E+3	<input type="checkbox"/>	<1
216-21-0	TPH - Arom >C16-C21	7.4E+1	None	None	None	None	None	None	None	None	None	None	None	None	4.3E+3	<input type="checkbox"/>	<1
221-35-0	TPH - Arom >C21-C35	3.7E+1	None	None	None	None	None	None	None	None	None	None	None	None	4.3E+3	<input type="checkbox"/>	<1

\* Indicates risk-based target concentration greater than constituent residual saturation value. NA = Not applicable. NC = Not calculated.

**RBCA SITE ASSESSMENT**

TPH Criteria SSTL Worksheet

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL

Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10  
 Job ID: 121410103

**SSTL VALUES FOR TPH**

Target Hazard Index: 1.0E+0  
 Source Depletion Option: No  
 Time to Future Exposure: 0 years

CONSTITUENTS OF CONCERN CAS No.	Mass Fractions		Representative Concentrations		Calculated Concentration Limits		Applicable SSTL Values	
	Soil (-)	Groundwater (-)	Soil (mg/kg)	Groundwater (mg/L)	Residual Soil Concentration (mg/kg)	Solubility (mg/L)	Soils (0 - 3 m) (mg/kg)	Groundwater (mg/L)
106-08-0 TPH - Aliph >C06-C08	2.1E-3		1.3E+1		1.5E+2		7.2E+5	
108-10-0 TPH - Aliph >C08-C10	4.5E-2		2.8E+2		7.4E+1		1.3E+4	
110-12-0 TPH - Aliph >C10-C12	2.5E-1		1.6E+3		4.3E+1		1.4E+4	
112-16-0 TPH - Aliph >C12-C16	4.6E-1		2.9E+3		1.9E+1		1.4E+4	
116-21-0 TPH - Aliph >C16-C21	2.9E-2		1.8E+2		7.9E+0		2.9E+5	
121-34-0 TPH - Aliph >C21-C34	1.9E-2		1.2E+2		1.3E+5		2.9E+5	
207-08-0 TPH - Arom >C07-C08	6.3E-5		3.9E-1		7.1E+2		2.8E+4	
208-10-0 TPH - Arom >C08-C10	7.9E-3		4.9E+1		5.2E+2		4.4E+3	
210-12-0 TPH - Arom >C10-C12	6.9E-2		4.3E+2		3.2E+2		5.8E+3	
212-16-0 TPH - Arom >C12-C16	1.0E-1		6.3E+2		1.5E+2		5.8E+3	
216-21-0 TPH - Arom >C16-C21	1.2E-2		7.4E+1		5.2E+1		4.3E+3	
221-35-0 TPH - Arom >C21-C35	5.9E-3		3.7E+1		4.2E+0		4.3E+3	
<b>Total</b>	1.0E+0	0.0E+0	6.2E+3	0.0E+0			<b>Total TPH SSTL</b>	1.1E+4

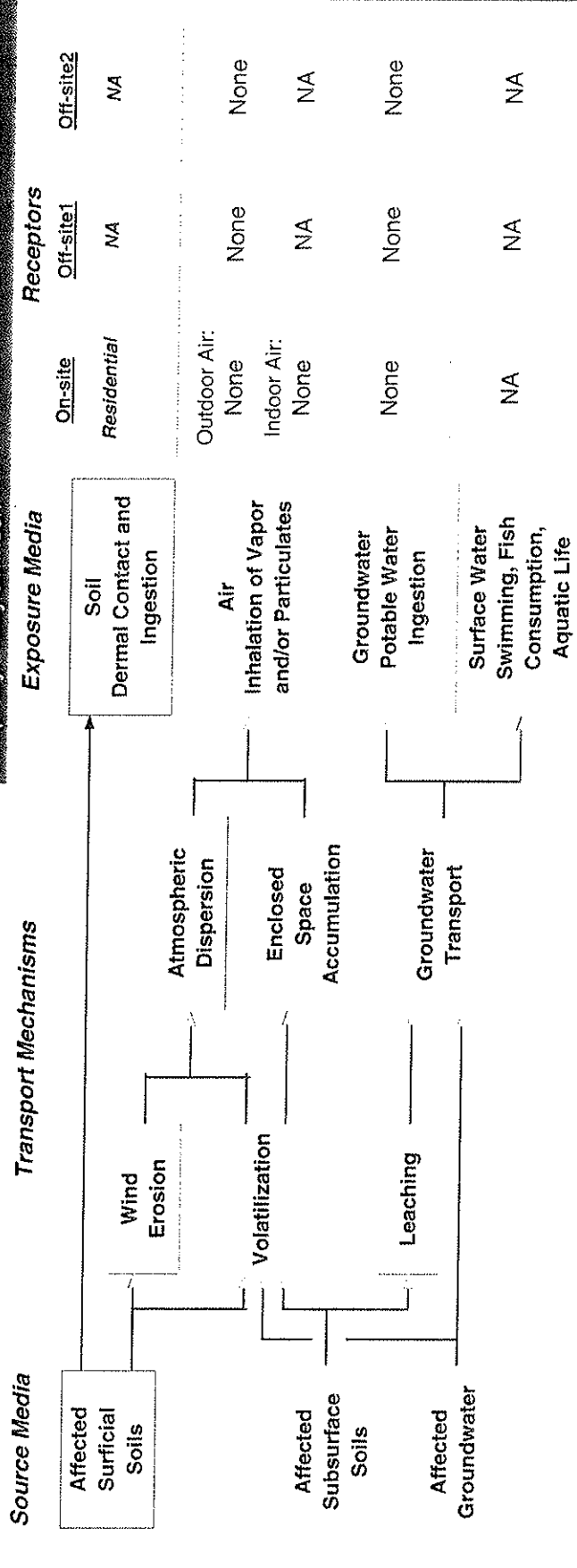
\* > indicates risk-based target concentration greater than constituent residual saturation value. NC = Not calculated.



Residential Area – Sediment – Fuel Oil

# Exposure Pathway Flowchart

Site Name: Hopedale Radar Site Job ID: 121410103  
 Location: Hopedale, NL Date: 31-Mar-10  
 Compl. By: Kelly Johnson



**SOURCE** → **TRANSPORT** → **RECEPTOR**

## Commands and Options

- Main Screen
- Print Sheet
- Help



**REPRESENTATIVE COC CONCENTRATIONS IN SOURCE MEDIA**

CONSTITUENT	Representative COC Concentration		note
	Groundwater	Soils (0 - 3 m)	
	value (mg/L)	value (mg/kg)	note
TPH - Aliph >C06-C08		1.3E+1	EPC
TPH - Aliph >C08-C10		2.8E+2	EPC
TPH - Aliph >C10-C12		1.6E+3	EPC
TPH - Aliph >C12-C16		2.9E+3	EPC
TPH - Aliph >C16-C21		1.8E+2	EPC
TPH - Aliph >C21-C34		1.2E+2	EPC
TPH - Arom >C07-C08		3.9E-1	EPC
TPH - Arom >C08-C10		4.9E+1	EPC
TPH - Arom >C10-C12		4.3E+2	EPC
TPH - Arom >C12-C16		6.3E+2	EPC
TPH - Arom >C16-C21		7.4E+1	EPC
TPH - Arom >C21-C35		3.7E+1	EPC

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site Site Location: Hopedale, NL Completed By: Kelly Johnson Date Completed: 31-Mar-10 1 OF 1

**TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

SURFACE SOILS OR SEDIMENTS:  
ON-SITE INGESTION AND  
DERMAL CONTACT

Constituents of Concern	1) Source/Exposure Medium Surface Soil Conc. (mg/kg)	2) Exposure Multiplier (IR+SAxMxRAF)/EFxED/(BWxAT) (kg/kg/day)		3) Average Daily Intake Rate (mg/kg/day) (1) x (2)	
		Residential	Construction Worker	Residential	Construction Worker
TPH - Aliph >C06-C08	1.3E+1	3.2E-6		4.2E-5	
TPH - Aliph >C08-C10	2.8E+2	3.2E-6		9.1E-4	
TPH - Aliph >C10-C12	1.6E+3	3.2E-6		5.0E-3	
TPH - Aliph >C12-C16	2.9E+3	3.2E-6		9.2E-3	
TPH - Aliph >C16-C21	1.8E+2	3.2E-6		5.8E-4	
TPH - Aliph >C21-C34	1.2E+2	3.2E-6		3.8E-4	
TPH - Arom >C07-C08	3.9E-1	3.2E-6		1.3E-6	
TPH - Arom >C08-C10	4.9E+1	3.2E-6		1.6E-4	
TPH - Arom >C10-C12	4.3E+2	3.2E-6		1.4E-3	
TPH - Arom >C12-C16	6.3E+2	3.2E-6		2.0E-3	
TPH - Arom >C16-C21	7.4E+1	3.2E-6		2.4E-4	
TPH - Arom >C21-C35	3.7E+1	3.2E-6		1.2E-4	

NOTE: RAF = Relative absorption factor (-)  
M = Adherence factor (mg/cm<sup>2</sup>)

AT = Averaging time (days)  
BW = Body weight (kg)

ED = Exposure duration (yrs)  
EF = Exposure frequency (days/yr)

IR = Soil ingestion rate (mg/day)  
SA = Skin exposure area (cm<sup>2</sup>/day)

Site Name: Hopedale Radar Site  
Site Location: Hopedale, NL  
Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

SOIL EXPOSURE PATHWAY

(CHECKED IF PATHWAY IS ACTIVE)

**CARCINOGENIC RISK**

Constituents of Concern	(1) Total Carcinogenic Intake Rate (mg/kg/day)		(2) Slope Factor (mg/kg/day) <sup>-1</sup>	(3) Individual COC Risk (1c)x(2a) + (1b)x(2b) + (1d)x(2b)
	(a) via Ingestion Residential	(b) via Dermal Contact Construction Worker		
TPH - Aliph > C08-C08				
TPH - Aliph > C08-C10				
TPH - Aliph > C10-C12				
TPH - Aliph > C12-C16				
TPH - Aliph > C16-C21				
TPH - Aliph > C21-C34				
TPH - Arom > C07-C08				
TPH - Arom > C08-C10				
TPH - Arom > C10-C12				
TPH - Arom > C12-C16				
TPH - Arom > C16-C21				
TPH - Arom > C21-C35				

Total Pathway Carcinogenic Risk =

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**RBCA SITE ASSESSMENT**

**TIER 2 PATHWAY RISK CALCULATION**

**SOIL EXPOSURE PATHWAY**

(CHECKED IF PATHWAY IS ACTIVE)

**TOXIC EFFECTS**

Constituents of Concern	(4) Total Toxicant Intake Rate (mg/kg/day)		(5) Oral Reference Dose (mg/kg-day)		(6) Individual COC Hazard Quotient (4a)/(5a) + (4b)/(5b) Residential Construction Worker
	(a) via Ingestion	(b) via Dermal Contact	(a) Oral	(b) Dermal	
TPH - Aliph >C06-C08	1.5E-5	2.7E-5	5.0E+0	5.0E+0*	8.3E-6
TPH - Aliph >C08-C10	3.2E-4	5.9E-4	1.0E-1	1.0E-1*	9.1E-3
TPH - Aliph >C10-C12	1.8E-3	3.3E-3	1.0E-1	1.0E-1*	5.0E-2
TPH - Aliph >C12-C16	3.2E-3	6.0E-3	1.0E-1	1.0E-1*	9.2E-2
TPH - Aliph >C16-C21	2.0E-4	3.8E-4	2.0E+0	2.0E+0*	2.9E-4
TPH - Aliph >C21-C34	1.3E-4	2.5E-4	2.0E+0	2.0E+0*	1.9E-4
TPH - Arom >C07-C08	4.4E-7	8.2E-7	2.0E-1	2.0E-1*	6.3E-6
TPH - Arom >C08-C10	5.5E-5	1.0E-4	4.0E-2	4.0E-2*	3.9E-3
TPH - Arom >C10-C12	4.8E-4	9.0E-4	4.0E-2	4.0E-2*	3.4E-2
TPH - Arom >C12-C16	7.0E-4	1.3E-3	4.0E-2	4.0E-2*	5.0E-2
TPH - Arom >C16-C21	8.3E-5	1.5E-4	3.0E-2	3.0E-2*	7.9E-3
TPH - Arom >C21-C35	4.1E-5	7.7E-5	3.0E-2	3.0E-2*	4.0E-3

\* No dermal reference dose available--oral reference dose used.

**Total Pathway Hazard Index =**

**2.5E-1**

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL  
 Completed By: Kelly Johnson

Date Completed: 31-Mar-10  
 Job ID: 121410103

**HECA SITE ASSESSMENT**

Job ID: 121410103

Completed By: Kelly Johnson  
Date Completed: 31-Mar-10

Target Risk (Class A & B): 1.0E-5  
Target Risk (Class C): 1.0E-5  
Target Hazard Quotient: 1.0E+0

**SOIL (0 - 3 m) SSTL VALUES**

Source Depletion Option: No  
Time to Future Exposure: 0 years

CAS No.	Name	Representative Concentration (mg/kg)	Soil Leaching to Groundwater						Soil Volatilization and Surface Soil Particulates to Outdoor Air						X	Applicable SSTL (mg/kg)	SSTL Exceeded? "N" - If Yes	Required CPF Only if "Yes" left		
			Ingestion / Discharge to Surface Water		Off-site 1 (0 m)		Off-site 2 (0 m)		On-site (0 m)		On-site 1 (0 m)		On-site 2 (0 m)						Res/Mental	Construction Worker
			On-site (0 m)	None	On-site (0 m)	None	On-site (0 m)	None	On-site (0 m)	None	On-site (0 m)	None								
106-08-0	TPH - Aliph >C06-C08	1.3E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E+6	<input type="checkbox"/>	<1			
108-10-0	TPH - Aliph >C08-C10	2.8E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8E+4	<input type="checkbox"/>	<1			
110-12-0	TPH - Aliph >C10-C12	1.6E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.1E+4	<input type="checkbox"/>	<1			
112-16-0	TPH - Aliph >C12-C16	2.9E+3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.1E+4	<input type="checkbox"/>	<1			
116-21-0	TPH - Aliph >C16-C21	1.8E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.2E+5	<input type="checkbox"/>	<1			
121-34-0	TPH - Aliph >C21-C34	1.2E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.2E+5	<input type="checkbox"/>	<1			
207-08-0	TPH - Arom >C07-C08	3.9E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.1E+4	<input type="checkbox"/>	<1			
208-10-0	TPH - Arom >C08-C10	4.9E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.5E+3	<input type="checkbox"/>	<1			
210-12-0	TPH - Arom >C10-C12	4.3E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2E+4	<input type="checkbox"/>	<1			
212-16-0	TPH - Arom >C12-C16	6.3E+2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2E+4	<input type="checkbox"/>	<1			
216-21-0	TPH - Arom >C16-C21	7.4E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.4E+3	<input type="checkbox"/>	<1			
221-35-0	TPH - Arom >C21-C35	3.7E+1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.4E+3	<input type="checkbox"/>	<1			

\* indicates risk-based target concentration greater than constituent residual saturation value. NA = Not applicable. NC = Not calculated.



**RBCA SITE ASSESSMENT**

Site Name: Hopedale Radar Site  
 Site Location: Hopedale, NL

Completed By: Kelly Johnson  
 Date Completed: 31-Mar-10

Job ID: 121410103

**SSSL VALUES FOR TPH**

Target Hazard Index: 1.0E+0

Source Depletion Option: No  
 Time to Future Exposure: 0 years

CONSTITUENTS OF CONCERN CAS No.	Mass Fractions		Representative Concentrations		Calculated Concentration Limits		Applicable SSSL Values	
	Soil (-)	Groundwater (-)	Soil (mg/kg)	Groundwater (mg/L)	Residual Soil Concentration (mg/kg)	Solubility (mg/L)	Soils (0 - 3 m) (mg/kg)	Groundwater (mg/L)
106-08-0 TPH - Aliph >C06-C08	2.1E-3	(-)	1.3E+1		1.5E+2		1.0E+6	
108-10-0 TPH - Aliph >C08-C10	4.5E-2		2.8E+2		7.4E+1		2.8E+4	
110-12-0 TPH - Aliph >C10-C12	2.5E-1		1.6E+3		4.3E+1		3.1E+4	
112-16-0 TPH - Aliph >C12-C16	4.6E-1		2.9E+3		1.9E+1		3.1E+4	
116-21-0 TPH - Aliph >C16-C21	2.9E-2		1.8E+2		7.9E+0		6.2E+5	
121-34-0 TPH - Aliph >C21-C34	1.9E-2		1.2E+2		1.3E+5		6.2E+5	
207-08-0 TPH - Arom >C07-C08	6.3E-5		3.9E-1		7.1E+2		6.1E+4	
208-10-0 TPH - Arom >C08-C10	7.9E-3		4.9E+1		5.2E+2		9.5E+3	
210-12-0 TPH - Arom >C10-C12	6.9E-2		4.3E+2		3.2E+2		1.2E+4	
212-16-0 TPH - Arom >C12-C16	1.0E-1		6.3E+2		1.5E+2		1.2E+4	
216-21-0 TPH - Arom >C16-C21	1.2E-2		7.4E+1		5.2E+1		9.4E+3	
221-35-0 TPH - Arom >C21-C35	5.9E-3		3.7E+1		4.2E+0		9.4E+3	
<b>Total</b>	1.0E+0	0.0E+0	6.2E+3	0.0E+0			<b>Total TPH SSSL</b>	2.5E+4

">" indicates risk-based target concentration greater than constituent residual saturation value. NC = Not calculated.

Residential Area – Metals and PCBs

Site-Specific Target Levels for Human Health (Non-Threshold Substances) - Town of Hopedale Lifetime  
 Town of Hopedale - Sediment Exposure Pathways

Receptor: Lifetime Town of Hopedale

$$\text{SSTL Lifetime} = \frac{\text{TR} \times \text{I} \times \text{LE}}{(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{sed}} \times \text{ET}_{\text{ing}} \times \text{SF}_d) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{sed}} \times \text{ET}_{\text{derm}} \times \text{SF}_d)} + \text{BSC}$$

$$\text{ILCR Lifetime} = \frac{\text{C}_s \times [(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{sed}} \times \text{ET}_{\text{ing}} \times \text{SF}_d) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{sed}} \times \text{ET}_{\text{derm}} \times \text{SF}_d)]}{\text{LE}}$$

Compound	SF <sub>d</sub> (mg/kg-d) <sup>-1</sup>	BSC (mg/kg)	AF <sub>gut</sub>	AF <sub>skin</sub>	SSTL - Lifetime (mg/kg)	EPC (mg/kg)	ILCR (unitless)
PCBs	2	0	1	0.14	25	14	5.5E-06

Time on site:

Hours per day (inhalation)	24
Days per Week	7
Weeks per Year	12
Years Exposed	30
Life Expectancy	30

Health Canada (2009)  
Health Canada (2009)

Parameter Definition (units)

SF <sub>d</sub> =	oral slope factor [1/(mg/kg-day)]	chemical specific, USEPA IRIS
C <sub>s</sub> =	concentration in sediment (mg/kg)	site specific, calculated Exposure Point Concentration (EPC)
TR =	target risk	1.00E-05 Health Canada (2009)
BSC =	background sediment concentration	chemical specific
AF <sub>gut</sub> =	absorption factor for gut (unitless)	chemical specific, Assumed
AF <sub>skin</sub> =	absorption factor skin (unitless)	chemical specific, Health Canada (2009)
SIR <sub>sed</sub> =	sediment ingestion rate (kg sediment-yr/kg bw-day)	4.69E-05 Health Canada (2009) - Lifetime
SDR <sub>sed</sub> =	sediment dermal contact rate (kg sediment-yr/kg bw-day) = (SA <sub>hands</sub> × M <sub>hands</sub> ) + (SA <sub>body</sub> × M <sub>body</sub> ) × 10 <sup>-6</sup> (l)	1.54E-04 calculated
ET <sub>ing</sub> =	exposure term for sediment ingestion pathway (unitless)	0.231 Site Specific [24 Hours per Day, 7 Days per Week, 12 Weeks per Year]
ET <sub>derm</sub> =	exposure term for sediment dermal contact pathway (unitless)	0.231 Site Specific [24 Hours per Day, 7 Days per Week, 12 Weeks per Year]
SA <sub>hands-sed</sub> =	skin surface area - hands (cm <sup>2</sup> -yr/kg bw-day)	1125 Health Canada (2009) - Lifetime
SA <sub>body-sed</sub> =	skin surface area - arms (cm <sup>2</sup> -yr/kg bw-day)	4181 Health Canada (2009) - Lifetime
M <sub>hands</sub> =	soil to skin adherence factor - hands (mg/cm <sup>2</sup> )	0.1 Health Canada (2009) - Lifetime
M <sub>body</sub> =	soil to skin adherence factor - rest of body (mg/cm <sup>2</sup> )	0.01 Health Canada (2009) - Lifetime

Site-Specific Target Levels for Human Health (Non-Threshold Substances) - Town of Hopedale  
Hopedale Radar Site - Soil Exposure Pathways

Receptor: Lifetime Town of Hopedale

$$\text{SSTL Lifetime} = \frac{\text{TR} \times \text{LE}}{(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_g) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}} \times \text{SF}_i) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{soil}} \times \text{ET}_{\text{derm}} \times \text{SF}_d)} + \text{BSC}$$

$$\text{ILCR Lifetime} = C_1 \times [(\text{AF}_{\text{gut}} \times \text{SIR}_{\text{soil}} \times \text{ET}_{\text{ing}} \times \text{SF}_g) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}} \times \text{SF}_i) + (\text{AF}_{\text{skin}} \times \text{SDR}_{\text{soil}} \times \text{ET}_{\text{derm}} \times \text{SF}_d)] \times \text{LE}$$

Compound	SF <sub>g</sub> (mg/kg-d) <sup>-1</sup>	SF <sub>i</sub> (mg/kg-d) <sup>-1</sup>	BSC (mg/kg)	AF <sub>gut</sub>	AF <sub>lung</sub>	AF <sub>skin</sub>	SSTL Lifetime (mg/kg)	EPC (mg/kg)	ILCR (unitless)
PCBs	2	2	0	1	1	0.14	11	22	2.05E-09

Time on site:

Hours per day (inhalation)	24
Days per Week	7
Weeks per Year	26
Years Exposed	80
Life Expectancy	80

Health Canada (2009)  
Health Canada (2009)

Parameter Definition (units)

- SF<sub>g</sub> = oral slope factor [ 1/(mg/kg-day) ]
- SF<sub>i</sub> = inhalation slope factor [ 1/(mg/kg-day) ]
- C<sub>1</sub> = concentration in soil (mg/kg)
- TR = target risk
- BSC = background soil concentration
- AF<sub>gut</sub> = absorption factor for gut (unitless)
- AF<sub>lung</sub> = absorption factor for lung (unitless)
- AF<sub>skin</sub> = absorption factor skin (unitless)
- SIR<sub>soil</sub> = soil ingestion rate (kg soil-yr/kg bw-day)
- IR<sub>soil</sub> = soil inhalation rate (kg soil-yr/kg bw-day) = CRP (kg/m<sup>3</sup>) × IR<sub>sk</sub> (m<sup>3</sup> air-yr/kg bw-day)
- SDR<sub>soil</sub> = soil dermal contact rate (kg soil-yr/kg bw-day) = (SA<sub>hand</sub> × M<sub>hand</sub>) + (SA<sub>body</sub> × M<sub>body</sub>) × 10<sup>-6</sup> (kg/mg)
- ET<sub>ing</sub> = exposure term for soil ingestion pathway (unitless)
- ET<sub>inh</sub> = exposure term for soil inhalation pathway (unitless)
- ET<sub>derm</sub> = exposure term for soil dermal contact pathway (unitless)
- CRP = concentration of respirable particles (kg/m<sup>3</sup>)
- IR<sub>sk</sub> = daily inhalation rate (m<sup>3</sup> air-yr/kg bw-day)
- SA<sub>hand</sub> = skin surface area - hands (cm<sup>2</sup>-yr/kg bw-day)
- SA<sub>body</sub> = skin surface area - arms (cm<sup>2</sup>-yr/kg bw-day)
- M<sub>hand</sub> = soil to skin adherence factor - hands (mg/cm<sup>2</sup>)
- M<sub>body</sub> = soil to skin adherence factor - rest of body (mg/cm<sup>2</sup>)

Default Value Reference

- chemical specific Health Canada (2009)
- chemical specific Health Canada (2009)
- site specific calculated Exposure Point Concentration (EPC)
- 1.00E-05 Health Canada (2009)
- chemical specific
- chemical specific Assumed
- chemical specific Assumed
- chemical specific Health Canada (2009)
- 4.69E-05 Health Canada (2009) - Lifetime
- 5.42E-06 calculated
- 1.54E-04 calculated
- 0.500 Site Specific [24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
- 0.500 Site Specific [24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
- 0.500 Site Specific [24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
- 2.50E-07 Health Canada (2009) - Unpaved roads with vehicle traffic.
- 21.7 Health Canada (2009) - Lifetime
- 1125 Health Canada (2009) - Lifetime
- 4181 Health Canada (2009) - Lifetime
- 0.1 Health Canada (2009) - Lifetime
- 0.01 Health Canada (2009) - Lifetime

Site Specific Target Levels for Human Health (Non-carcinogenic Substances) - Town of Hopedale Toddler  
 Town of Hopedale - Sediment Exposure Pathways

Receptor: Toddler Town of Hopedale

$$\text{SSTL Toddler} = \frac{\text{TDI} \times \text{SAF} \times \text{BW}}{(\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}})} + \text{BSC}$$

$$\text{HQ Toddler} = \frac{\text{Cs} \times [(\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}})]}{\text{TDI} \times \text{BW}}$$

Compound	TDI (oral)	SAF	BSC	AF <sub>gut</sub>	AF <sub>skin</sub>	SSTL - Toddler (mg/kg)	EPC (mg/kg)	HQ (unitless)
Antimony	0.0004	0.2	0	1	0.1	56	6	0.018
Lead	0.00185	0.2	9.1	0.6	0.006	556	39.3	0.014
PCBs	0.00013	0.2	0	1	0.14	21	14	0.135

Time on site:

Hours per day (inhalation) 24 (ingestion/dermal contact always assumed 24 hours per day)

Days per Week 7

Weeks per Year 12

Parameter	Definition (units)	Default Value	Reference
TDI =	reference dose (mg/kg bw-day)		chemical specific Bold - OMOE (1994), Underline - Health Canada (2009)
C <sub>s</sub> =	concentration in soil (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
SAF =	soil allocation factor (unitless)		chemical specific
BW =	body weight (kg)		16.5; Health Canada (2009) - Toddler
BSC =	background soil concentration (mg/kg)		chemical specific
AF <sub>gut</sub> =	absorption factor for gut (unitless)		chemical specific Assumed
AF <sub>skin</sub> =	absorption factor skin (unitless)		chemical specific Health Canada (2009)
SIR =	sediment ingestion rate (kg/day)		0.00008; Health Canada (2009) - Toddler
SDR =	soil dermal contact rate (kg/day) = (SA <sub>hands</sub> × M <sub>hands</sub> ) + (SA <sub>body</sub> × M <sub>body</sub> ) × 1E-6 (kg/mg)		0.0000688; calculated
ET <sub>derm</sub> =	exposure term for soil dermal contact pathway (unitless)		0.2308; Site Specific [24 Hours per Day, 7 Days per Week, 12 Weeks per Year]
ET <sub>ing</sub> =	exposure term for soil ingestion pathway (unitless)		0.2308; Site Specific [24 Hours per Day, 7 Days per Week, 12 Weeks per Year]
SA <sub>hands</sub> =	skin surface area - hands (cm <sup>2</sup> /day)		430; Health Canada (2009) - Toddler
SA <sub>body</sub> =	skin surface area - rest of body (cm <sup>2</sup> /day)		2580; Health Canada (2009) - Toddler - arms and legs
M <sub>hands</sub> =	soil to skin adherence factor - hands (mg/cm <sup>2</sup> )		0.1; Health Canada (2009) - Toddler
M <sub>body</sub> =	soil to skin adherence factor - rest of body (mg/cm <sup>2</sup> )		0.01; Health Canada (2009) - Toddler

Site Specific Target Levels for Human Health (Non-carcinogenic Substances) - Town of Hopedale Toddler  
 Town of Hopedale - Soil Exposure Pathways

Receptor: Toddler Town of Hopedale

$$\text{SSTL Toddler} = (\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}}) + \text{BSC}$$

$$\text{HQ Toddler} = \text{Cs} \times [(\text{AF}_{\text{gut}} \times \text{SIR} \times \text{ET}_{\text{ing}}) + (\text{AF}_{\text{lung}} \times \text{IR}_{\text{soil}} \times \text{ET}_{\text{inh}}) + (\text{AF}_{\text{skin}} \times \text{SDR} \times \text{ET}_{\text{derm}})] / \text{TDI} \times \text{BW}$$

Compound	TDI (oral)	SAF	BSC	AF <sub>gut</sub>	AF <sub>lung</sub>	AF <sub>skin</sub>	SSTL - Toddler (mg/kg)	EPC (mg/kg)	HQ (unitless)
Antimony	0.0004	0.2	0	1	1	0.1	30	42	0.283
PCBs	0.00013	0.2	0	1	1	0.14	9	22	0.470
Lead	0.00185	0.2	4.4	0.6	1	0.006	246	156	0.129

Time on site:

Hours per day (inhalation) 24 (ingestion/dermal contact always assumed 24 hours per day)  
 Days per Week 7  
 Weeks per Year 26

Parameter	Definition (units)	Default Value	Reference
TDI	reference dose (mg/kg bw-day)		chemical specific Bold - Health Canada (2009), Underline - US EPA IRIS
C <sub>s</sub>	concentration in soil (mg/kg)		site specific calculated Exposure Point Concentration (EPC)
SAF	soil allocation factor (unitless)		chemical specific
BW	body weight (kg)	16.5	Health Canada (2009) - Toddler
BSC	background soil concentration (mg/kg)		chemical specific
AF <sub>gut</sub>	absorption factor for gut (unitless)		chemical specific Assumed
AF <sub>lung</sub>	absorption factor for lung (unitless)		chemical specific Assumed
AF <sub>skin</sub>	absorption factor skin (unitless)		chemical specific Health Canada (2009)
SIR	soil ingestion rate (kg/day)	0.00008	Health Canada (2009) - Toddler
IR <sub>soil</sub>	soil inhalation rate (kg/day) = CRP (kg/m <sup>3</sup> ) x IR <sub>soil</sub> (m <sup>3</sup> /day)	2.1E-06	calculated
SDR	soil dermal contact rate (kg/day) = (SA <sub>hands</sub> x M <sub>hands</sub> ) + (SA <sub>body</sub> x M <sub>body</sub> ) x 1E-6 (kg/mg)	0.0000688	calculated
ET <sub>ing</sub>	exposure term for soil ingestion pathway (unitless)	0.5000	Site Specific [ 24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
ET <sub>inh</sub>	exposure term for soil inhalation pathway (unitless)	0.5000	Site Specific [ 24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
ET <sub>derm</sub>	exposure term for soil dermal contact pathway (unitless)	0.5000	Site Specific [ 24 Hours per Day, 7 Days per Week, 26 Weeks per Year]
CRP	concentration of respirable particles (kg/m <sup>3</sup> )	2.50E-07	Health Canada (2009) - Unpaved roads with vehicle traffic
IR <sub>air</sub>	daily inhalation rate (m <sup>3</sup> /day)	8.3	Health Canada (2009) - Toddler
SA <sub>hands</sub>	skin surface area - hands (cm <sup>2</sup> /day)	430	Health Canada (2009) - Toddler
SA <sub>body</sub>	skin surface area - rest of body (cm <sup>2</sup> /day)	2560	Health Canada (2009) - Toddler - arms and legs
M <sub>hands</sub>	soil to skin adherence factor - hands (mg/cm <sup>2</sup> )	0.1	Health Canada (2009) - Toddler
M <sub>body</sub>	soil to skin adherence factor - rest of body (mg/cm <sup>2</sup> )	0.01	Health Canada (2009) - Toddler