

4/12/00-00456

**Memorandum**

To: Mr. Tim Reisch

From: Ms. Susan Spielberger

Date: April 12, 2000

Subject: *Proposed Methods for Preparation of the Human Health Risk Assessment for St. Juliens Creek Annex for Landfill B (Site 2), Landfill C (Site 3), Landfill D (Site 4), and the Burning Grounds (Site 5)*

This Technical Approach Memorandum has been submitted for your review and presents the methods for preparation of the Human Health Risk Assessment for Landfill B (Site 2), Landfill C (Site 3), Landfill D (Site 4), and the Burning Grounds (Site 5) at the St. Juliens Creek Annex in Chesapeake, Virginia. Separate risk assessments are being completed for each site and include soil, groundwater, sediment, and surface water (except for Site 3).

If you have any questions regarding this submittal please call myself or Ms. Mary Jo Apakian at (610) 293-0450 or Mr. Dave Schroeder at (703) 968-0900.

Sincerely,



Sor Susan Spielberger  
CDM Federal Programs Corporation

cc: J. Tomik (CH2M HILL) Letter only  
MJ. Apakian (CDM Federal Programs Corp)  
D. Schroeder (CDM Federal Programs Corp)  
L. France (CDM Federal Programs Corp)

## Section 1

# Site Descriptions

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Site 2 (Landfill B) is an inactive unlined landfill (approximately one acre) located at the corner of St. Juliens Drive and Craddock Street in the southwestern section of the facility. Burning and incineration of refuse was conducted at the landfill. Refuse disposed at Site 2 included garbage, acids, waste ordnance, and blast grit from ship repair operations. Presently, the landfill is grass covered with heavy brush in the southwestern part of the site. The eastern part of the site is water covered and drains into St. Juliens Creek to the south. The site is bounded to the north by a drainage ditch and to the east by Building 130 and the building's adjacent area. The drainage ditch appears to empty into the eastern (water covered) area of the landfill.

Site 3 (Landfill C) is adjacent to the northeastern corner of the St. Julien's Creek Annex property boundary and covers approximately 10 acres. The area was originally a mudflat where refuse was dumped and allowed to burn; the ash was then used to fill in the area. Refuse disposed of at Site 3 included solvents, acids, bases, and mixed municipal waste. Two pits reportedly used for disposal of oils and oily sludges as well as for periodic burning, were also located at Site 3. At the present time, the landfill is grass covered with no visible signs of debris or refuse. A communication and/or radar facility is located in the northeastern area of the landfill. The downgradient direction of the site appears to be toward Site 4 and Blow's Creek.

Site 4 (Landfill D) covers an estimated 5 acres approximately 300 feet south of Site 3. While in operation, the site was an unlined trench and fill landfill. Refuse disposed of at Site 4 included drums of unknown wastes and polychlorinated biphenyls (PCBs). The site is characterized by raised surface features and areas which lack vegetation. A brush line borders the northern edge of the landfill with brush also extending beyond the western and southern edges. Metal and concrete debris piles are dispersed throughout the site.

Site 5 (Burning Grounds) is located off of Craddock Street in the northern part of the facility. Wastes disposed at the burning grounds included ordnance materials such as black powder, smokeless powder, explosive D, Composition A-3, tetryl, TNT, and fuses. Non-ordnance materials included carbon tetrachloride, trichloroethylene (TCE), paint sludges, pesticides, and various types of refuse. In 1977, the surface area was burned with straw, diced, and burned again, in an effort to decontaminate the soil.

Dioxin

## Section 2

# Data Collection and Selection

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The nature of the site-related contamination has been evaluated during multiple investigations.

Soil, groundwater, surface water, and sediment samples collected during the Phase I Remedial Investigation (RI) in 1996 and Phase II follow-up sampling conducted in 1999 will be evaluated in the risk assessment. Based on investigation results, both organic and inorganic constituents will be evaluated in the human health risk assessment (HHRA).

Soil, groundwater, sediment, and surface water samples were collected during the Phase I and Phase II investigation. Only validated data will be evaluated in the risk assessment. Data from Phase I and II will be combined for the risk assessment.

## 2.1 Monitoring Well Installation and Sampling

Shallow and deep monitoring wells have been installed at all sites. Shallow monitoring wells were designed to sample the uppermost saturated zone encountered, while the deep monitoring wells were designed to sample groundwater in the Yorktown Aquifer. Where they are installed, deep monitoring wells were paired with shallow wells in order to provide an indication of the vertical profile of groundwater quality and indication of the vertical groundwater flow direction. At each site, one deep and one shallow monitoring well was installed at upgradient locations.

All monitoring wells are constructed of nominal 2-inch diameter PVC well riser and 10-slot, 10-ft long screen. Details of well construction are provided in the RI Work Plan (CDM Federal, 1997).

All monitoring wells were developed by surging with a surge block assembly and pumping the wells with a submersible pump. Wells were developed until water quality parameters (pH, conductivity, temperature, and turbidity) had stabilized.

All wells installed during Phase I of the RI were sampled twice (once in July 1997 and again in November 1997). In addition, all existing monitoring wells from the Phase I field activities and all wells installed during Phase II field activities were sampled in June 1999. The wells were sampled using a decontaminated submersible pump and clean tubing. Generally, samples were analyzed for TCL organic constituents, TAL metals (filtered and unfiltered), and total phosphorous. During Phase I, two samples were selected, using field-screening techniques for TNT, and sent to an offsite laboratory for nitramine analysis. During Phase II, low concentration VOC analysis was conducted on groundwater

Number and locations of wells installed during Phases I and II for each site are provided below.

Site	Phase I	Phase II
Site 2	Three shallow Two deep	Two shallow One deep
Site 3	Four shallow Two deep	Two shallow No deep
Site 4	Four shallow Two deep	No shallow No deep
Site 5	Three shallow Two deep	Two shallow One deep

## 2.2 Surface Soil Sampling

Surface soil samples were collected at all sites using a stainless steel spoon and bowl following protocols described in the RI workplan (CDM Federal, 1997). The objective of the surface soil sampling was to obtain analytical data for use in the risk assessment. Samples were analyzed for TCL organics constituents, TAL metals, and total phosphorous. During Phase I and II, one sample was selected, using field-screening techniques for TNT, and sent to an offsite laboratory for nitramine analysis. During Phase II, surface soils were analyzed for explosives and phosphorous at Sites 2 and 5 since these sites had a history of potential explosive material disposal.

Numbers of samples are provided below:

Site	Phase I	Phase II
Site 2	9	10
Site 3	7	11
Site 4	10	8
Site 5	7	26

## 2.3 Subsurface Soil Sampling

During the Phase I and Phase II RI, direct push technology (DPT) was used to collect subsurface soil samples. This method involves the use of a truck-mounted rig, however, some of the proposed sampling locations for Phase II included areas of heavy brush and areas that were potentially wet, or where near surface soils were saturated. In order to avoid the unnecessary destruction of potential wetlands, or time-consuming brush clearance operations during Phase II, a stainless steel hand auger was used to collect subsurface soils in these areas. The truck mounted DPT rig was used at all other locations. Upgradient locations were selected at each of the sites. In general, samples were analyzed for TCL organics and TAL metals. During Phase II, subsurface soil samples were analyzed for explosives and phosphorous at Sites 2 and 5 since these sites had a history of potential explosive material disposal.

The number of samples by site are provided below:

Site	Phase I	Phase II
Site 2	4	6
Site 3	7	13
Site 4	3	5
Site 5	16	6

## 2.4 Surface Water and Sediment Sampling

During Phase I, sediment samples were collected with stainless steel bowls and spoons. During Phase II, where there was greater than six inches of standing water, samples were collected with a stainless steel petite (mini) ponar dredge or equivalent. Surface water samples were collected directly into the sample jar. In general, samples were analyzed for TCL organics and TAL metals. During Phase II, surface water and sediment samples were analyzed for explosives and phosphorous at Sites 2 and 5 since these sites had a history of potential explosive material disposal.

The number of samples by site are provided below:

Site	Phase I	Phase II
Site 2	3 Sediment 1 Surface water	6 Sediment 7 Surface water
Site 3	4 Sediment 0 Surface water	3 Sediment 0 Surface water
Site 4	4 Sediment 1 Surface water	5 Sediment 7 Surface water
Site 5	3 Sediment 0 Surface water	4 Sediment 7 Surface water

## Data Handling

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Only data which have been fully validated will be used in the risk assessment. Upgradient samples were collected from sediment, surface soil, subsurface soil, shallow groundwater and deep groundwater at each site. As upgradient contaminant levels do not represent site-related conditions, upgradient samples will not be considered in the risk assessment. The following bullets discuss how data that have been qualified will be evaluated, and additional data handling issues.

- Estimated values flagged with a J qualifier will be treated as unqualified detected concentrations.
- Data qualified with an R (rejected) will not be included in the risk assessment.
- Data qualified with a B (blank contamination) will be used in the risk assessment as if it is non-detected and one-half the B-flagged value will be used.
- For duplicate samples, the higher of the two concentrations will be used. The duplicates will be counted as one sample.
- One-half the sample quantitation limit will be used for cases where no detectable contaminant quantities were found in that sample but the contaminant was detected in that medium at the site.

## Selection of Contaminants of Potential Concern

A tiered approach will be used for selection of contaminants of potential concern. The first tier follows the methodology presented in EPA Region III's *Selection of Exposure Routes and Contaminants of Concern by Risk-Based Screening*, January 1993. Maximum detected concentrations of site contaminants are compared to risk-based screening concentrations (RBCs) and are discussed in detail below.

Constituents that are essential human nutrients (magnesium, calcium, potassium, and sodium) will not be considered further in the quantitative risk assessment as they are present at low concentrations and are only toxic at very high doses.

### Groundwater

For Tier I screening, groundwater data will be compared to the current EPA Region III Risk-Based Concentrations (RBCs) for tap water. The tap water RBCs will be used to select the COPCs for all scenarios. RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.

No Tier II screening for groundwater will be conducted. The chemicals which remain after the Tier I screening will then be evaluated in the baseline risk assessment.

### Surface Soil

For Tier I screening, surface soil data will be compared to current EPA Region III RBCs for residential soil. The residential soil RBCs will be used to select the COPCs for all scenarios. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs. The COPCs selected based on the RBC screening will be quantitatively evaluated in the risk assessment for the residential scenario.

A Tier II screening for the trespasser, construction worker, and other worker scenarios will compare maximum detected soil concentrations to current EPA Region III RBCs for industrial soil. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.

RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table.

### Sediment

For Tier I screening, sediment data will be compared to current EPA Region III RBCs for residential soil multiplied by a factor of 10. The rationale is that sediment exposure occurs much less frequently than exposure to soil. The residential soil (multiplied by 10) RBCs will be used to select the COPCs for all scenarios. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs. The COPCs selected based

on the RBC screening will be quantitatively evaluated in the risk assessment for the residential scenario.

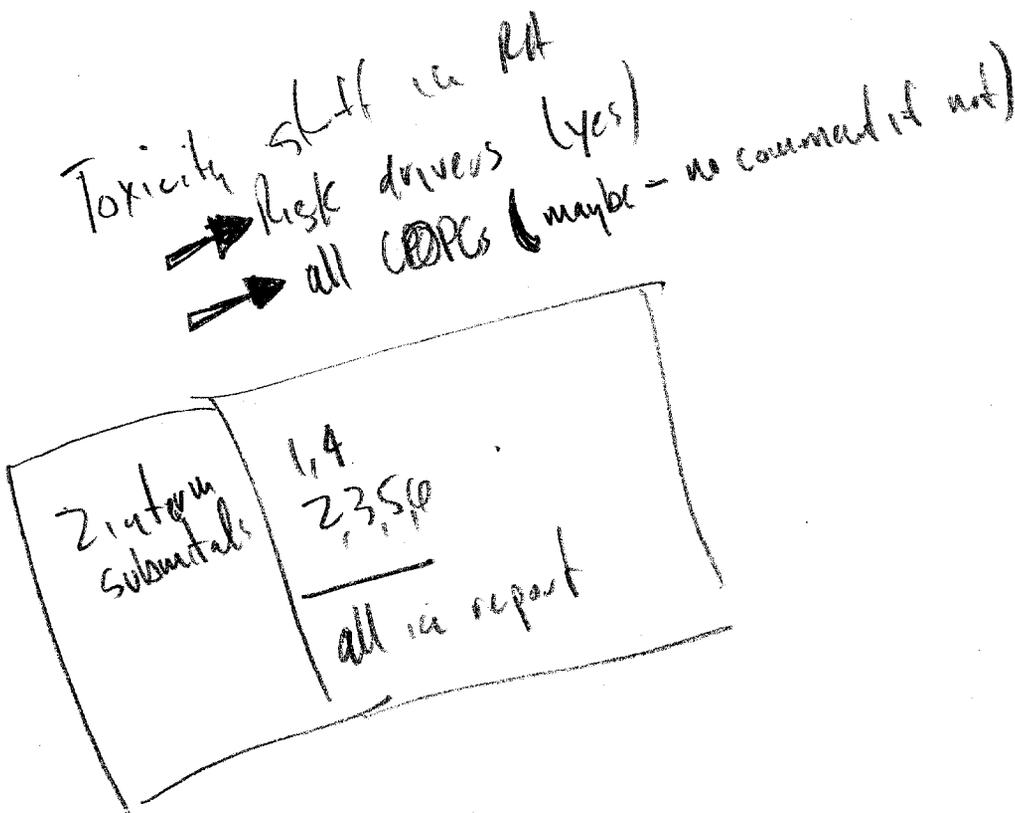
A Tier II screening for sediment for the trespasser scenario will compare maximum detected sediment concentrations to current EPA Region III RBCs for industrial soil multiplied by a factor of 10. The rationale is that sediment exposure occurs much less frequently than exposure to soil. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.

RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table.

### Surface Water

For Tier I screening, surface water will be compared to current EPA Region III RBCs for tap water multiplied by a factor of 10. The rationale is that surface water exposure occurs much less frequently than exposure to tap water. The tap water (multiplied by 10) RBCs will be used to select the COPCs for all scenarios. RBCs that are based on noncarcinogenic effects will be divided by 10 to account for exposure to multiple constituents. RBCs based on carcinogenic effects will be used as presented in the most current RBC table. Constituents whose maximum detected concentration is below the RBC will not be retained as COPCs.

No Tier II screening for surface water will be conducted. The chemicals which remain after the Tier I screening will then be evaluated in the baseline risk assessment.



## Section 5

# Exposure Assessment

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Currently, Sites 2, 3, 4, and 5 are unused areas on the St. Juliens property. The future use of these areas will likely be industrial although a future residential scenario is conservatively proposed in the risk assessment.

Table 1 in Attachment A details the exposure pathways that will be evaluated in the risk assessment for each site. Table 1 is identical for each site with the exception of surface water. There is not a surface water pathway at Site 3; Sites 2, 4, and 5 have a surface water pathway.

For all sites, the deep groundwater will be evaluated under the current/future residential scenario because the local municipality uses the deep aquifer as a source of drinking water and will likely continue to be used in the future. The current/future exposure to deep groundwater will be evaluated for residents (adults and children) through dermal, ingestion and inhalation (adult only). Shallow groundwater at the site is not currently used, however, the shallow groundwater will be evaluated for dermal contact during excavation activities.

For all sites, surface soil is accessible to trespassers (adults and adolescents) under the current/ future scenarios through the ingestion and dermal pathways and through inhalation of airborne vapors and particulates emanating from the surface soil. It is highly unlikely that the site will be used for residential purposes, however, a residential soil scenario will be conservatively included in the risk assessment. The potential future exposure scenario conservatively assumes that the subsurface soil will be excavated and become surface soil. The potential future exposure will be evaluated for the resident (adult and child), construction worker, and other worker for the ingestion and dermal pathways. The construction worker will also be evaluated for inhalation of airborne vapors and particulates emanating from the soil.

Surface water associated with Sites 2, 4, and 5 are not used for swimming due to the depth of water. However, a wading scenario is considered in the risk assessment. Surface water and sediment will be evaluated under the Current/ Future scenario for trespassers, as the sites are potentially accessible to adults and adolescents. This includes access to the ponded area at Site 2, the drainage ditch at Site 4, and access to the tributary to Blows Creek which is adjacent to Site 5. The exposure will be evaluated through the dermal and ingestion pathways. Because there is the potential that the sites will become residential in the future, the surface water and sediment exposure pathway will be evaluated for residents using recreational exposure assumptions (residents are assumed to wade in the surface water).

Tables 4.1 to 4.21 in Attachment A detail the exposure parameters that will be used for quantitative evaluation of each of the exposure pathways listed in Table 1 in Attachment A.

For the exposure point concentration for Reasonable Maximum Exposure (RME), the 95% upper confidence limit of the mean (95UCL) will be calculated for media in which five or

more samples were collected. The W-test will be used to determine if the data fit a lognormal or normal distribution. If the results of the W-test are inconclusive, the larger 95UCL from the lognormal or normal distribution will be selected. The lower of the selected 95UCL or the maximum detected concentration will be used as the exposure point concentration. For data sets with fewer than five samples, the maximum detected concentration will be used as the exposure point concentration.

Tables 4.1 through 4.21 in Attachment A also detail the exposure parameters that will be used for Central Tendency (CT). CT calculations will be performed only for exposure pathways which exceed the acceptable risk range ( $1E-05$  cancer risk or hazard index greater than 1). For CT calculations, CT exposure parameters will be used along with a calculated mean exposure point concentration.

Maximum soil concentrations of lead will be screened against the residential soil screening value of 400 ppm. Maximum water concentrations of lead will be screened against the action level of 15 ug/l. If the maximum concentrations exceed these screening values, then for the residential scenario, the child lead model will be used to predict potential for elevated blood lead levels.

If <sup>max</sup> >1000ppm run adult lead model as well; use <sup>site</sup> avg in RA

Clean-up value (Region III) typically 1,000 ppm

## Section 6

# Toxicity Assessment

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Toxicity values for use in the risk assessment will be obtained from the Integrated Risk Information System (IRIS) and Health Effects Summary Tables (HEAST) databases. If information is not available from these two sources, toxicity values from the EPA Region III Risk Based Concentration Table will be used. If information is not available from the preceding sources, EPA Region III risk assessors will be consulted.

Oral toxicity values will be adjusted from administered to absorbed doses for evaluating dermal exposure. Oral absorption factors obtained from EPA Region III (USEPA Region III, *Oral Absorption Values for Oral-to-Dermal Extrapolation Per RAGS Appendix A*, dated April 8, 1999) will be used to adjust the oral toxicity factors to dermal toxicity factors.

Section 7

## **Risk Assessment Deliverables**

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The risk assessment will be conducted following EPA's *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*, January 1998. Therefore, ten different types of standard tables will be prepared for the risk assessment. Tables 1 and 4 are submitted with this memorandum. If requested, additional interim deliverables will be submitted for review prior to submittal of the RI report.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill B (Site 2)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway			
Current / Future	Surface Soil	Surface Soil	At Site 2	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil			
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil			
		Air		Emissions from Surface Soil at Site 2	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates		
						Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates		
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer			
					Child <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer			
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer		
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Ponded Area	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water			
					Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water			
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Ponded Area	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment			
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment			
	Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 2	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil		
Child <sup>2</sup>						Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil			
Construction Worker						Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil		
Air					Emissions from Soil at Site 2	Construction Worker	Adult	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
							Other Worker	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil
								Construction Worker	Adult	Inhalation	On-Site	Quant
Surface Water <sup>3</sup>		Surface Water <sup>3</sup>	Drainage Features and Ponded Area	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water			
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water			
Sediment <sup>3</sup>		Sediment <sup>3</sup>	Drainage Features and Ponded Area	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment			
					Child <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment			
Groundwater		Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater			

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill C (Site 3)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway	
Current / Future	Surface Soil	Surface Soil	At Site 3	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
		Air		Emissions from Surface Soil at Site 3	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
						Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
					Child <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Sediment at Site 3	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
	Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 3	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil
Child <sup>2</sup>						Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil	
Construction Worker					Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
					Other Worker	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil
Air					Emissions from Soil at Site 3	Construction Worker	Adult	Inhalation	On-Site	Quant
Sediment <sup>3</sup>		Sediment <sup>3</sup>	Sediment at Site 3	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
					Child <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
				Groundwater	Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill D (Site 4)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway	
Current / Future	Surface Soil	Surface Soil	At Site 4	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
		Air		Emissions from Surface Soil at Site 4	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
						Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
					Child <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
					Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
	Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 4	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil
Child <sup>2</sup>						Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil	
Construction Worker						Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil
Other Worker					Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
					Air	Emissions from Soil at Site 4	Construction Worker	Adult	Inhalation	On-Site
Surface Water <sup>3</sup>		Surface Water <sup>3</sup>	Drainage Features	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
Sediment <sup>3</sup>		Sediment <sup>3</sup>	Drainage Features	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
					Child <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
Groundwater		Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Burning Grounds (Site 5)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway	
Current / Future	Surface Soil	Surface Soil	At Site 5	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
		Air		Emissions from Surface Soil at Site 5	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
						Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
					Child <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
					Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
	Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 5	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil
Child <sup>2</sup>						Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil	
Construction Worker						Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
Other Worker					Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil		
					Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
					Construction Worker	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
Surface Water <sup>3</sup>		Surface Water <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
Sediment <sup>3</sup>		Sediment <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
					Child <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
					Construction Worker	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	
Groundwater		Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill B (Site 2)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway	
Current / Future	Surface Soil	Surface Soil	At Site 2	Trespasser	Adult	Dermal Ingestion	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with soil	
					Adolescent	Dermal Ingestion	On-Site	Quant	Trespassers may incidentally ingest soil	
		Air		Emissions from Surface Soil at Site 2	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
					Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates	
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer	
					Child <sup>2</sup>	Dermal Ingestion	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer	
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Poned Area	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
					Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Poned Area	Trespasser	Adult	Dermal Ingestion	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with sediment	
					Adolescent	Dermal Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment	
					Adolescent	Dermal Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment	
Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 2	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil	
					Child <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may incidentally ingest soil	
					Child <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil	
					Child <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may incidentally ingest soil	
				Construction Worker	Adult	Dermal Ingestion	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
					Adult	Dermal Ingestion	On-Site	Quant	Workers may incidentally ingest soil	
				Other Worker	Adult	Dermal Ingestion	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
					Adult	Dermal Ingestion	On-Site	Quant	Workers may incidentally ingest soil	
	Air	Emissions from Soil at Site 2	Construction Worker	Adult	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates		
			Construction Worker	Adult	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates		
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Poned Area	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Poned Area	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may have exposed skin surfaces come into contact with sediment		
				Child <sup>2</sup>	Dermal Ingestion	On-Site	Quant	Residents may incidentally ingest sediment		
Groundwater	Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater		
				Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater		

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill C (Site 3)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current / Future	Surface Soil	Surface Soil	At Site 3	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with soil
					Ingestion	On-Site	Quant	Trespassers may incidentally ingest soil	
		Adolescent		Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with soil		
		Ingestion		On-Site	Quant	Trespassers may incidentally ingest soil			
	Air	Emissions from Surface Soil at Site 3	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates	
				Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates	
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
					Ingestion	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer	
		Child <sup>2</sup>		Dermal	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer		
		Ingestion		Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer			
Air	Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer		
Sediment <sup>3</sup>	Sediment <sup>3</sup>	Sediment at Site 3	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with sediment	
				Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment		
				Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with sediment	
Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment						
Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 3	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil
					Ingestion	On-Site	Quant	Residents may incidentally ingest soil	
				Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Residents may incidentally ingest soil		
			Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Workers may incidentally ingest soil		
			Other Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Workers may incidentally ingest soil		
	Air	Emissions from Soil at Site 3	Construction Worker	Adult	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Sediment at Site 3	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with sediment
Ingestion					On-Site	Quant	Residents may incidentally ingest sediment		
Child <sup>2</sup>				Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with sediment		
Ingestion	On-Site	Quant	Residents may incidentally ingest sediment						
Groundwater	Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Landfill D (Site 4)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway	
Current / Future	Surface Soil	Surface Soil	At Site 4	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with soil Trespassers may incidentally ingest soil	
		Air		Emissions from Surface Soil at Site 4	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
						Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
					Child <sup>2</sup>	Dermal Ingestion	Off-Site Off-Site	Quant Quant	Local municipality currently has some uses for groundwater from deep aquifer Local municipality currently has some uses for groundwater from deep aquifer	
		Air		Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
					Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features	Trespasser	Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
					Adolescent	Dermal Ingestion	On-Site On-Site	Quant Quant	Trespassers may have exposed skin surfaces come into contact with sediment Trespassers may incidentally ingest sediment	
	Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 4	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil
Child <sup>2</sup>						Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with soil Residents may incidentally ingest soil	
Construction Worker						Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
Other Worker					Adult	Dermal Ingestion	On-Site On-Site	Quant Quant	Workers may have exposed skin surfaces come into contact with soil Workers may incidentally ingest soil	
					Construction Worker	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
					Construction Worker	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
Surface Water <sup>3</sup>		Surface Water <sup>3</sup>	Drainage Features	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water	
Sediment <sup>3</sup>		Sediment <sup>3</sup>	Drainage Features	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
					Child <sup>2</sup>	Dermal Ingestion	On-Site On-Site	Quant Quant	Residents may have exposed skin surfaces come into contact with sediment Residents may incidentally ingest sediment	
Groundwater		Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 1  
SELECTION OF EXPOSURE PATHWAYS  
St. Julien's Creek - Burning Grounds (Site 5)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current / Future	Surface Soil	Surface Soil	At Site 5	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with soil
					Ingestion	On-Site	Quant	Trespassers may incidentally ingest soil	
		Adolescent		Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with soil		
		Ingestion		On-Site	Quant	Trespassers may incidentally ingest soil			
	Air	Emissions from Surface Soil at Site 5	Trespasser	Adult	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates	
				Adolescent	Inhalation	On-Site	Quant	Trespassers may inhale volatiles/particulates	
	Groundwater	Deep Groundwater	Tap Water	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer
					Ingestion	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer	
		Child <sup>2</sup>		Dermal	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer		
		Ingestion		Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer			
	Air	Deep Groundwater - Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-Site	Quant	Local municipality currently has some uses for groundwater from deep aquifer	
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water
Adolescent					Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with surface water	
Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Trespasser	Adult	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with sediment	
				Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment		
				Adolescent	Dermal	On-Site	Quant	Trespassers may have exposed skin surfaces come into contact with sediment	
				Ingestion	On-Site	Quant	Trespassers may incidentally ingest sediment		
Future	Soil <sup>1</sup>	Soil <sup>1</sup>	At Site 5	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil
					Ingestion	On-Site	Quant	Residents may incidentally ingest soil	
				Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Residents may incidentally ingest soil		
			Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Workers may incidentally ingest soil		
			Other Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with soil	
				Ingestion	On-Site	Quant	Workers may incidentally ingest soil		
	Air	Emissions from Soil at Site 5	Construction Worker	Adult	Inhalation	On-Site	Quant	Workers may inhale volatiles/particulates	
	Surface Water <sup>3</sup>	Surface Water <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water
					Child <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with surface water
	Sediment <sup>3</sup>	Sediment <sup>3</sup>	Drainage Features and Tributary to Blows Creek	Resident <sup>2</sup>	Adult <sup>2</sup>	Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with sediment
Ingestion					On-Site	Quant	Residents may incidentally ingest sediment		
Child <sup>2</sup>				Dermal	On-Site	Quant	Residents may have exposed skin surfaces come into contact with sediment		
Ingestion				On-Site	Quant	Residents may incidentally ingest sediment			
Groundwater	Shallow Groundwater	Water Table	Construction Worker	Adult	Dermal	On-Site	Quant	Workers may have exposed skin surfaces come into contact with groundwater	

<sup>1</sup> Includes both surface soil and subsurface soil.

<sup>2</sup> Total resident cancer risk is the sum of both the adult and child residential risks; Total cancer risk will be presented in the risk assessment.

<sup>3</sup> Surface water and sediment exposure scenarios are for waders.

TABLE 4.1  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Current/Future  
Medium: Surface Soil  
Exposure Medium: Surface Soil  
Exposure Point: At Site  
Receptor Population: Trespasser  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgment	26 <sup>1</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>1</sup>	Professional judgment	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	10,950	EPA, 1989	5,475	EPA, 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.19	EPA, 1997	0.19	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgment	26 <sup>1</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>1</sup>	Professional judgment	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	10,950	EPA, 1989	5,475	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area is obtained from Table 6-14, central tendency surface area for outdoor soil contact (assumes 25% of total surface area).

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

CT soil ingestion rate found on Table 4-23. Soil to Skin Adherence Factor calculated from Table 6-12 by averaging hand values for gardeners no. 1 and 2. (No trespasser activity on Table 6-12).

TBD = To Be Determined

NA = Not Available

Note:

1. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.2  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Surface Soil  
Exposure Medium: Surface Soil  
Exposure Point: At Site  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgement	26 <sup>1</sup>	Professional judgement	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	56	EPA, 1997	56	EPA, 1997	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	4,000	EPA, 1997	2,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.11	EPA, 1997	0.11	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgement	26 <sup>1</sup>	Professional judgement	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	BW	Body Weight	kg	56	EPA, 1997	56	EPA, 1997	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The skin surface area presented in this table includes hands, forearms, lower legs, and feet (assumes 25% of total surface area)

and is obtained by averaging the 50 percentile total body surface area of male and female children ages 12 through 17 and dividing by 4.

The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 13%) for children ages 12 through 17 found on Table 6-8, then multiplying by total surface body area (16,000 cm<sup>2</sup>).

Mean body weight for adolescent derived by averaging the mean (12 to 17 years) boy and girl values (see Table 7-3).

Soil to Skin Adherence Factor obtained from Table 6-12 for the Soccer No. 1 activity (most conservative) for hands.

TBD = To Be Determined

NA = Not Available

Note:

1. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.3  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Surface Soil  
Exposure Medium: Air  
Exposure Point: Emissions from Soil at Site  
Receptor Population: Trespasser  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CA	Chemical Concentration in Air	mg/m <sup>3</sup>	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day) = CA x IR x ET x EF x ED x 1/BW x 1/AT
	IR	Inhalation Rate	m <sup>3</sup> /hour	1.6	EPA, 1997	1	EPA, 1997	
	ET	Exposure Time	hr/day	1 <sup>1</sup>	Professional judgment	0.5 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgment	26 <sup>1</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>1</sup>	Professional judgment	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	10,950	EPA, 1989	5,475	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

Inhalation rates are based on adult values assuming moderate activity for the RME and light activity for the CT (Table 5-23 of EPA, 1997).

TBD = To Be Determined

Notes:

1. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.4  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Surface Soil  
Exposure Medium: Air  
Exposure Point: Emissions from Soil at Site  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CA	Chemical Concentration in Air	mg/m <sup>3</sup>	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day) = CA x IR x ET x EF x ED x 1/BW x 1/AT
	IR	Inhalation Rate	m <sup>3</sup> /hour	1.4	EPA, 1997	1	EPA, 1997	
	ET	Exposure Time	hr/day	1 <sup>1</sup>	Professional judgment	0.5 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>1</sup>	Professional judgment	26 <sup>1</sup>	Professional judgment	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	BW	Body Weight	kg	56	EPA, 1991	56	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

Inhalation rates are based on averaging the adult and child values assuming moderate activity for the RME and light activity for the CT (Table 5-23 of EPA, 1997).

Mean body weight for adolescent derived by averaging the mean (12 to 17 years) boy and girl values (see Table 7-3).

TBD = To Be Determined

Notes:

1. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.5  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Deep Groundwater  
Exposure Medium: Groundwater  
Exposure Point: Tap Water  
Receptor Population: Resident  
Receptor Age: Adult<sup>2</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x IR-W x EF x ED x 1/BW x 1/AT
	IR-W	Ingestion Rate of Water	l/day	2	EPA, 1991	1.4	EPA, 1989	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1989	
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	20,000	EPA, 1997	17,000	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1989	
	ET	Exposure Time	hours	0.25	EPA, 1997	0.17 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>3</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1989	

Sources:  
EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.  
EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,  
EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B. The CT skin surface area is the lower range value.  
EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.  
EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area is obtained from Table 6-14.  
TBD = To Be Determined

Notes:  
1. CT value assumes showering for 10 minutes.  
2. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.6  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Groundwater  
Exposure Medium: Deep Groundwater  
Exposure Point: Tap Water  
Receptor Population: Resident  
Receptor Age: Child <sup>2</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x IR-W x EF x ED x 1/BW x 1/AT
	IR-W	Ingestion Rate of Water	l/day	1	EPA, 1989b	0.87	EPA, 1997	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1993	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989a	25,550	EPA, 1989a	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989a	2,190	EPA, 1989a	
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	7,200	EPA, 1997	7,200	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1989	
	ET	Exposure Time	hours	0.33	EPA, 1997	0.25 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1991	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>2</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989a	25,550	EPA, 1989a	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989a	2,190	EPA, 1989a	

Sources:

EPA, 1989a: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.  
EPA, 1989b: Exposure Factors Handbook, July 1989, EPA/600/8-89/043.  
EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.  
EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.  
EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposure  
EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. CT ingestion rate value is obtained from Table 3-30 for 3-5 year child mean value. The skin surface area presented in this table was derived by averaging the mean child (2 to 7 years) values from Tables 6-6 and 6-7.  
TBD = To Be Determined

Notes:

1. CT value assumes an exposure time of 15 minutes while bathing.
2. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.7  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Groundwater  
Exposure Medium: Air  
Exposure Point: Deep Groundwater - Water Vapor at Showerhead  
Receptor Population: Resident  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation (1)								

(1) Inhalation exposure to groundwater for adults will be evaluated using the Foster and Chrotowski Shower Model.

TABLE 4.8  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: (See note 1 below)  
Receptor Population: Trespasser  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1992	
	ET	Exposure Time	hours/day	1 <sup>2</sup>	Professional judgment	0.5 <sup>2</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>2</sup>	Professional judgment	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>3</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
AT-N	Averaging Time - Non-Cancer	days	10,950	EPA, 1989	5,475	EPA, 1989		

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,

EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

TBD = To Be Determined

Notes:

1. Exposure Point Site 2 - Drainage Features and Pooled Area

Site 3 - No table necessary since surface water not evaluated in the risk assessment.

Site 4 - Drainage Features

Site 5 - Drainage Features and Tributary to Blows Creek

2. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.9  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: (See note 1 below)  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= $CW \times SA \times PC \times ET \times EF \times ED \times CF \times 1/BW \times 1/AT$
	SA	Skin Surface Area	cm <sup>2</sup>	4,000	EPA, 1997	2,000	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1992	
	ET	Exposure Time	hours/day	1 <sup>2</sup>	Professional judgment	0.5 <sup>2</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>3</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	56	EPA, 1997	56	EPA, 1997	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,

EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The skin surface area presented in this table includes hands, forearms, lower legs, and feet (assumes 25% of total surface area) and is obtained by averaging the 50 percentile total body surface area of male and female children ages 12 through 17 and dividing by 4.

The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 13%) for children ages 12 through 17 found on Table 6-8, then multiplying by total surface body area (16,000 cm<sup>2</sup>).

Mean body weight for adolescent derived by averaging the mean (12 to 17 years) boy and girl values (see Table 7-3).

TBD = To Be Determined

Notes:

1. Exposure Point Site 2 - Drainage Features and Pondered Area

Site 3 - No table necessary since surface water not evaluated in the risk assessment.

Site 4 - Drainage Features

Site 5 - Drainage Features and Tributary to Blows Creek

2. For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.10  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Current/Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: (See note 1 below)  
Receptor Population: Trespasser  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Sediment	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>2</sup>	Professional judgment	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	10,950	EPA, 1989	5,475	EPA, 1989	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.19	EPA, 1997	0.19	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	30	EPA, 1991	15 <sup>2</sup>	Professional judgment	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	10,950	EPA, 1989	5,475	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

CT soil ingestion rate found on Table 4-23. Soil to Skin Adherence Factor calculated from Table 6-12 by averaging hand values for gardeners no. 1 and 2. (No trespasser activity on Table 6-12).

TBD = To Be Determined

NA = Not Available

Note:

- Exposure Point: Site 2 - Drainage Features and Ponded Area  
Site 3 - No table necessary since surface water not evaluated in the risk assessment.  
Site 4 - Drainage Features  
Site 5 - Drainage Features and Tributary to Blows Creek

- For RME values, assumes trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assumes one-half of RME values.

TABLE 4.11  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Current/Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: (See note 1 below)  
Receptor Population: Trespasser  
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CT Value	CT Rationale/Reference	Intake Equation/Model Name
Ingestion	CS	Chemical Concentration In Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Sediment	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgement	26 <sup>2</sup>	Professional judgement	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	56	EPA, 1997	56	EPA, 1997	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	
Dermal	CS	Chemical Concentration In Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	4,000	EPA, 1997	2,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	6.7	EPA, 1997	6.7	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgement	26 <sup>2</sup>	Professional judgement	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	BW	Body Weight	kg	56	EPA, 1997	56	EPA, 1997	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

- EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
- EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.
- EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.
- EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/500/6-91/011B.
- EPA, 1995: Assessing Dermal Exposure from Soil. Technical Guidance manual, Region III. EPA/503-K-95-003.
- EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The skin surface area presented in this table includes hands, forearms, lower legs, and feet (assumes 25% of total surface area) and is obtained by averaging the 50 percentile total body surface area of male and female children ages 12 through 17 and dividing by 4.
- The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 13%) for children ages 12 through 17 found on Table G-8, then multiplying by total surface body area (16,000 cm<sup>2</sup>).
- Mean body weight for adolescent derived by averaging the mean (12 to 17 years) boy and girl values (see Table 7-3).
- Soil to Skin Adherence Factor from Table 6-12 for Kids in Mud No. 2 using feet value which is conservative considering the surface water will wash some of the sediment off.
- TBD = To Be Determined
- NA = Not Available

Notes:

- Exposure Point: Site 2 - Drainage Features and Pooled Area
  - Site 3 - No table necessary since surface water not evaluated in the risk assessment.
  - Site 4 - Drainage Features
  - Site 5 - Drainage Features and Tributary to Blows Creek
- For RME values, assume trespassing one hour per day, one day per week for 52 weeks per year. For CT values, assume one-half of RME values.

TABLE 4.12  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Soil  
Exposure Medium: Soil  
Exposure Point: At Site  
Receptor Population: Resident  
Receptor Age: Adult<sup>1</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.19	EPA, 1997	0.19	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1997	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area is obtained from Table 6-14, central tendency surface area for outdoor soil contact (assumes 25% of total surface area).

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

CT soil ingestion rate found on Table 4-23. Soil to Skin Adherence Factor calculated from Table 6-12 by averaging hand values for gardeners no. 1 and 2.

TBD = To Be Determined

NA = Not Available

Note:

1. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.13  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Soil  
Exposure Medium: Soil  
Exposure Point: At Site  
Receptor Population: Resident  
Receptor Age: Child<sup>1</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	200	EPA, 1991	100	EPA, 1997	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	
Dermal	CS	Chemical Concentration In Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	3,600	EPA, 1997	864	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.11	EPA, 1997	0.11	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	350	EPA, 1991	234	EPA, 1993	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.0-03.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1: EPA/600/P-95/002Fa. The RME skin surface area is for hands, arms, legs, and feet (assumes 50% of total surface area) and is obtained by averaging the 50% values of male and female children from age 2 through 7 years found on Table 6-6 and 6-7 and dividing by 2. The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 12%) for children ages 1 through 7 found on Table 6-8, then multiplying by the total surface body area (7,200 cm<sup>2</sup>).

CT soil ingestion rate found on Table 4-23. Soil to Skin Adherence Factor obtained from Table 6-12 for the Soccer No. 1 activity (most conservative) for hands.

TBD = To Be Determined

NA = Not Available

Note:

1. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.14  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Soil  
Exposure Medium: Soil  
Exposure Point: At Site  
Receptor Population: Construction Worker  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	480	EPA, 1993	240 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	250	EPA, 1991	219	EPA, 1993	
	ED	Exposure Duration	years	0.5	VADEQ, 1997	0.25 <sup>1</sup>	Professional judgment	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	183	EPA, 1989	91	EPA, 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.24	EPA, 1997	0.24	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	250	EPA, 1991	219	EPA, 1993	
	ED	Exposure Duration	years	0.5	VADEQ, 1997	0.25 <sup>1</sup>	Professional judgment	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	183	EPA, 1989	91	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

The RME and CT Soil to Skin Adherence Factor is calculated from Table 6-12 for construction worker's hands.

VADEQ, 1997: Value provided by Pat McMurray, Virginia Department of Environmental Quality, during St. Juliens Creek risk assessment assumptions conference call on November 20, 1997.

TBD = To Be Determined

NA = Not Available

Note:

1. CT value assumes one-half the RME value.

TABLE 4.15  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Soil  
Exposure Medium: Soil  
Exposure Point: At Site  
Receptor Population: Other Worker  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Soil	mg/day	50	VADEQ, 1997	25 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	250	EPA, 1991	219	EPA, 1993	
	ED	Exposure Duration	years	25	EPA, 1991	5	EPA, 1993	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	9,125	EPA, 1989	1,825	EPA, 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.071	EPA, 1997	0.071	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	250	EPA, 1991	219	EPA, 1993	
	ED	Exposure Duration	years	25	EPA, 1991	5	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	9,125	EPA, 1989	1,825	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

The RME and CT Soil to Skin Adherence Factor is calculated from Table 6-12 using the average of the five groundskeepers' values for hands.

VADEQ, 1997: Value provided by Pat McMurray, Virginia Department of Environmental Quality, during St. Juliens Creek risk assessment assumptions conference call on November 20, 1997.

TBD = To Be Determined

NA = Not Available

Note:

1. CT value assumes one-half the RME value.

TABLE 4.16  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Air
Exposure Point: Emissions from Soil at Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CA	Chemical Concentration in Air	mg/m <sup>3</sup>	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day) = CA x IR x ET x EF x ED x 1/BW x 1/AT
	IR	Inhalation Rate	m <sup>3</sup> /hour	2.5	EPA, 1997	1.5	EPA, 1997	
	ET	Exposure Time	hr/day	8 <sup>1</sup>	Professional judgment	4 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	250	EPA, 1991	219	EPA, 1993	
	ED	Exposure Duration	years	0.5	VADEQ, 1997	0.25 <sup>2</sup>	Professional judgment	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time (Non-Cancer)	days	183	EPA, 1989	91	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

Inhalation rates are based on values for the outdoor worker assuming heavy activity for the RME and moderate activity for the CT (Table 5-23 of EPA, 1997).

VADEQ, 1997: Value provided by Pat McMurray, Virginia Department of Environmental Quality, during St. Juliens Creek risk assessment assumptions conference call on November 20, 1997.

TBD = To Be Determined

Notes:

1. Professional Judgement based on activities that would occur 8 hrs per day for the RME and 1/2 of a day for the CT.

2. For CT value, assumes one-half of the RME value.

TABLE 4.17  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: (See note 1 below)  
Receptor Population: Resident  
Receptor Age: Adult<sup>3</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1992	
	ET	Exposure Time	hours/day	2 <sup>2</sup>	Professional judgment	1 <sup>2</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>3</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1993	

Sources:

- EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
- EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.
- EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.
- EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.
- EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.
- The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.
- TBD = To Be Determined

Notes:

- Exposure Point: Site 2 - Drainage Features and Ponded Area  
Site 3 - No table necessary since surface water not evaluated in the risk assessment.  
Site 4 - Drainage Features  
Site 5 - Drainage Features and Tributary to Blows Creek
- For RME value, assumes residents recreate two hours per day, one day per week for 52 weeks per year. For CT value, assumes one-half of RME values.
- Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.18  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Julien's Creek

Scenario Timeframe: Future  
Medium: Surface Water  
Exposure Medium: Surface Water  
Exposure Point: (See note 1 below)  
Receptor Population: Resident  
Receptor Age: Child<sup>3</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	3,600	EPA, 1997	864	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1992	
	ET	Exposure Time	hours/day	2 <sup>2</sup>	Professional judgment	1 <sup>2</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA,	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>3</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA,	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area is for hands, arms, legs, and feet (assumes 50% of total surface area) and is obtained by averaging the 50% values of male and female children from age 2 through 7 years found on Table 6-6 and 6-7 and dividing by 2. The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 12%) for children ages 1 through 7 found on Table 6-8, then multiplying by the total surface body area (7,200 cm<sup>2</sup>).

TBD = To Be Determined

Notes:

1. Exposure Point: Site 2 - Drainage Features and Pondered Area

Site 3 - No table necessary since surface water not evaluated in the risk assessment.

Site 4 - Drainage Features

Site 5 - Drainage Features and Tributary to Blows Creek

2. For RME value, assumes residents recreate two hours per day, one day per week for 52 weeks per year. For CT value, assumes one-half of RME values.

3. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.19  
VALUES USED FOR DAILY INTAKE CALCULATIONS

St. Juliens Creek

Scenario Timeframe: Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: (See note 1 below)  
Receptor Population: Resident  
Receptor Age: Adult<sup>3</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Sediment	mg/day	100	EPA, 1991	50	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1988	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	0.19	EPA, 1997	0.19	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>2</sup>	Professional judgment	26 <sup>2</sup>	Professional judgment	
	ED	Exposure Duration	years	24	EPA, 1991	9	EPA, 1993	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
AT-N	Averaging Time - Non-Cancer	days	8,760	EPA, 1989	3,285	EPA, 1988		

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

CT soil ingestion rate found on Table 4-23. Soil to Skin Adherence Factor calculated from Table 6-12 by averaging hand values for gardeners no.1 and 2.

TBD = To Be Determined

NA = Not Available

Notes:

1. Exposure Point Site 2 - Drainage Features and Ponded Area

Site 3 - No table necessary since surface water not evaluated in the risk assessment.

Site 4 - Drainage Features

Site 5 - Drainage Features and Tributary to Blows Creek

2. For RME value, assumes residents recreate two hours per day, one day per week for 52 weeks per year. For CT value, assumes one-half of RME values.

3. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

TABLE 4.20  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Sediment  
Exposure Medium: Sediment  
Exposure Point: (See note 1 below)  
Receptor Population: Resident  
Receptor Age: Child<sup>2</sup>

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x IR x EF x ED x CF1 x 1/BW x 1/AT
	IR-S	Ingestion Rate of Sediment	mg/day	200	EPA, 1991	100	EPA, 1997	
	EF	Exposure Frequency	days/year	52 <sup>3</sup>	Professional judgment	26 <sup>3</sup>	Professional judgment	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
	CF1	Conversion Factor	kg/mg	1.00E-06	NA	1.00E-06	NA	
	SA	Skin Surface Area Available for Contact	cm <sup>2</sup>	3,600	EPA, 1997	884	EPA, 1997	
	AF	Soil to Skin Adherence Factor	mg/cm <sup>2</sup>	6.7	EPA, 1997	6.7	EPA, 1997	
	AB	Absorption Factor	unitless	chemical-specific	EPA, 1995	chemical-specific	EPA, 1995	
	EF	Exposure Frequency	days/year	52 <sup>3</sup>	Professional judgment	26 <sup>3</sup>	Professional judgment	
	ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
	BW	Body Weight	kg	15	EPA, 1991	15	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	2,190	EPA, 1989	2,190	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1983: Superfund Standard Default Exposure Factors for Central Tendency and Reasonable Maximum Exposures.

EPA, 1995: Assessing Dermal Exposure from Soil, Technical Guidance manual, Region III, EPA/803-K-95-003.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area is for hands, arms, legs, and feet (assumes 50% of total surface area) and is obtained by averaging the 50% values of male and female children from age 2 through 7 years found on Table 6-6 and 6-7 and dividing by 2. The CT skin surface area is for hands and feet and is calculated by averaging the mean percentage of total surface body area for hands and feet (approximately 12%) for children ages 1 through 7 found on Table 6-8, then multiplying by the total surface body area (7,200 cm<sup>2</sup>).

Soil to Skin Adherence Factor from Table 6-12 for Kids in Mud No. 2 using feet value which is conservative considering the surface water will wash some of the sediment off.

CT soil ingestion rate found on Table 4-23.

TBD = To Be Determined

NA = Not Available

Notes:

1. Exposure Point Site 2 - Drainage Features and Ponded Area

Site 3 - No table necessary since surface water not evaluated in the risk assessment.

Site 4 - Drainage Features

Site 5 - Drainage Features and Tributary to Blows Creek

2. Total resident cancer risk is the sum of both the adult and child residential risks. Total cancer risk will be presented in the risk assessment.

3. For RME value, assumes residents recreate two hours per day, one day per week for 52 weeks per year. For CT value, assumes one-half of RME values.

TABLE 4.21  
VALUES USED FOR DAILY INTAKE CALCULATIONS  
St. Juliens Creek

Scenario Timeframe: Future  
Medium: Groundwater  
Exposure Medium: Shallow Groundwater  
Exposure Point: Water Table  
Receptor Population: Construction Worker  
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Water	mg/l	TBD	TBD	TBD	TBD	Chronic Daily Intake (CDI) (mg/kg-day)= CW x SA x PC x ET x EF x ED x CF x 1/BW x 1/AT
	SA	Skin Surface Area	cm <sup>2</sup>	5,000	EPA, 1997	1,000	EPA, 1997	
	PC	Permeability Constant	cm/hr	Chemical Specific	EPA, 1992	Chemical Specific	EPA, 1992	
	ET	Exposure Time	hours/day	2 <sup>1</sup>	Professional judgment	1 <sup>1</sup>	Professional judgment	
	EF	Exposure Frequency	days/year	63 <sup>1</sup>	Professional judgment	31 <sup>1</sup>	Professional judgment	
	ED	Exposure Duration	years	0.5	VADEQ, 1997	0.25 <sup>1</sup>	Professional judgment	
	CF	Volumetric Conversion Factor for Water	l/cm <sup>2</sup>	0.001	EPA, 1989	0.001	EPA, 1989	
	BW	Body Weight	kg	70	EPA, 1991	70	EPA, 1991	
	AT-C	Averaging Time - Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
	AT-N	Averaging Time - Non-Cancer	days	183	EPA, 1989	91	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03,

EPA, 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.

EPA, 1997: Exposure Factors Handbook, Vol. 1. EPA/600/P-95/002Fa. The RME skin surface area assumes 25% of total surface area of 20,000.

The CT surface area assumes exposure to hands and feet and is obtained by averaging both male and female hands and feet mean values found on Table 6-4.

VADEQ, 1997: Value provided by Pat McMurray, Virginia Department of Environmental Quality, during St. Juliens Creek risk assessment assumptions conference call on November 20, 1997.

TBD = To Be Determined

Note:

1. For RME values, assumes workers spend two hours per day exposed to shallow groundwater during excavation and construction activities (i.e. basement or footer construction), one-quarter of the RME exposure frequency (one-fourth of 250 days per year) for one-half year. For CT value, assumes one-half of RME values.