BASELINE HUMAN HEALTH RISK ASSESSMENT FOR THE INTERMOUNTAIN WASTE OIL REFINERY SITE BOUNTIFUL, UTAH

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LIST OF ACRONYMS AND ABBREVIATIONS

AT	Averaging Time
bgs	Below ground surface
BW	Body Weight
C	Concentration of a chemical in an environmental medium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
CTE	Central Tendency Exposure
CDI	Chronic Daily Intake (dose) of a chemical
CDI_L	Chronic Daily Intake (dose) of a chemical, averaged over a lifetime
CRDL	Contract Required Detection Limit
DL	Detection Limit
ED	Exposure Duration
EF	Exposure Frequency
EPC	Exposure Point Concentration
EU	Exposure Unit
GC/MS	Gas Chromatography/Mass Spectrometry
HEAST	Health Effects Assessment Summary Table
HI	Hazard Index
HIF	Human Intake Factor
HQ	Hazard Quotient
IDL	Instrument Detection Limit
IR	Ingestion Rate
IRIS	Integrated Risk Information System
IWOR	Intermountain Waste Oil Refinery
LOAEL	Lowest-Observed-Adverse-Effect-Level
NCEA	National Center for Environmental Assessment
NOAEL	No-Observed-Adverse-Effect-Level
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
RBC	Risk-Based Concentration
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RPF	Relative Potency Factors
SF	Cancer Slope Factor
SVOC	Semi-Volatile Organic Compound
TF	Transfer Factor
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Values
TWA	Time-weighted Average
UCL	Upper Confidence Limit of the Mean
UR	Unit Risk
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WOE	Weight-of-Evidence

EXECUTIVE SUMMARY

INTRODUCTION

This document is a baseline human health risk assessment for the Intermountain Waste Oil Refinery (IWOR) site, located in Bountiful, Utah. The purpose of this document is to assess the potential risks to humans, both now and in the future, from contaminants that are present at the site or which may be released from the site, assuming that no steps are taken to remediate or cleanup the environment or to reduce contact with the contaminated media. The methods used to evaluate human health risks are consistent with current guidelines provided by the United States Environmental Protection Agency (USEPA) for use at Superfund sites.

The primary focus of the assessment is Operable Unit 1, which includes soils and other contamination sources. A preliminary evaluation of risks from groundwater (Operable Unit 2) has been included, but groundwater data are currently quite limited. EPA will evaluate risks from groundwater in greater detail as more data become available.

SITE CHARACTERIZATION

The IWOR site covers approximately five acres of land in a residential/commercial section of Bountiful. The site is largely flat. At present, two building exist on-site, and most of the property is fenced.

Groundwater at the site is about 80-100 feet below ground surface, and flows in a west to northwest direction. The shallow portion of the aquifer is classified as a Class II drinking water source, but is not reportedly used for drinking water at the present time. The shallow aquifer has been used for industrial and agricultural purposes.

There are no permanent bodies of surface water on the site. Overland drainage from the site flows west into a storm drain system that runs along 500 West. This storm drain flows northward approximately 1,500 ft and drains into Mill Creek. Mill Creek runs approximately seven miles to the west and drains into the Farmington Bay Bird Refuge, a wetland area on the southeastern border of the Great Salt Lake.

Early land uses at the site are not well established. Beginning in 1957 and extending for 35 years (to 1993), the site was used for handling and refining of waste oil. Refined oil was sold to area cement facilities for use as fuel for their kilns. Waste sludge was disposed of at the North Davis County Landfill or in the Salt Lake County/City Landfill. Waste water resulting from the treatment process was boiled off at the site.

Under a cooperative agreement with Utah Division of Solid and Hazardous Waste, the owner began to dismantle the refinery in 1993. Solid waste and contaminated soil on site was

consolidated into waste piles in the rear north east section of the site. However, remediation was later stopped and the surface of the site was covered with approximately two inches of gravel/soil backfill.

DATA SUMMARY AND EVALUATION

This risk assessment is based on data collected during three studies of on-site media: UDEQ (1997), URS (1998), and Washington Group Phase I (2001b) and Phase II (2001c, 2001d). These studies detected a wide range of different chemicals in samples of on-site soil and on-site groundwater, including inorganics, pesticides, petroleum hydrocarbon-related chemicals (aliphatics, aromatics, PAHs), PCBs, and a range of other semi-volatile and volatile organics, including a number of chlorinated solvents.

Data from the three studies above were reviewed to determine their suitability for use in the risk assessment. All soil and groundwater data available from Washington Group (2001d) and URS (1998) studies were found to have adequate data quality information and all of the reported data were incorporated into the risk assessment database. Likewise, most of the data from the UDEQ (1997) report were used in the risk assessment, but some data points were excluded because the available data reports did not include laboratory qualifiers for the analytical results.

EXPOSURE ASSESSMENT

Site Conceptual Model

Figure ES-1 is a site conceptual model that summarizes how humans might be exposed to chemical contaminants associated with the site. As seen, the principal populations likely to come into contact with site-related chemicals, and the exposure pathways that are likely to be of greatest potential concern, are as follows:

Exposure Scenarios Evaluated Quantitatively

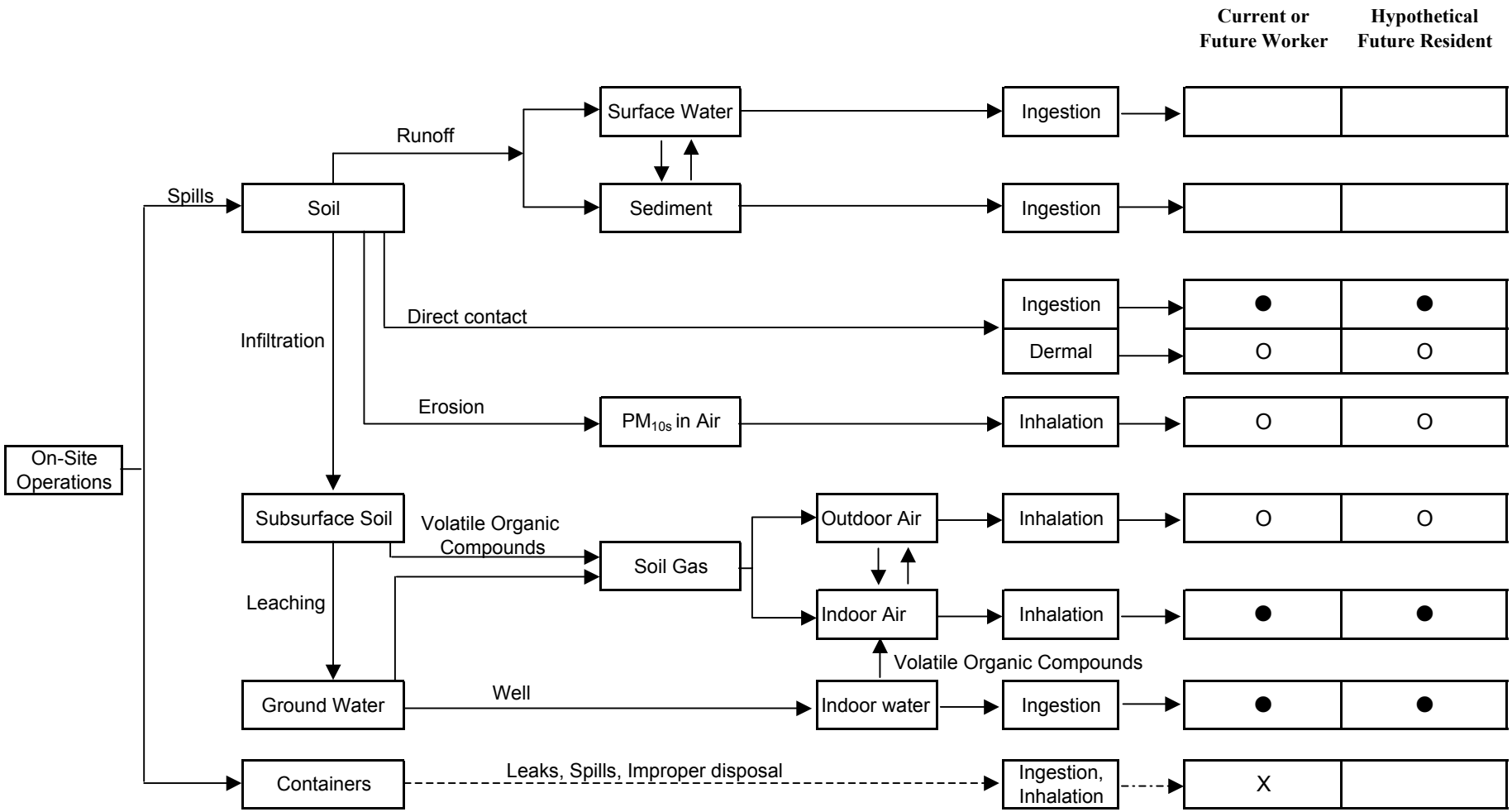
Exposed Population	Contaminated Medium	Exposure Pathways
Current or future on-site workers Hypothetical future on-site residents	Soil	Ingestion
	Indoor air	Inhalation of volatile organic chemicals
	Groundwater	Ingestion

Exposure to hazardous substances potentially released from containers stored on the site could be of concern but cannot be quantified. Other exposure pathways are judged to be sufficiently minor that quantitative evaluation is not warranted.

Chemicals of Potential Concern

Chemicals of potential concern (COPCs) are chemicals which exist in the environment at

Figure ES-1. Conceptual Site Model for Human Exposure



KEY

	Pathway is incomplete; no evaluation needed.
O	Pathway is or might be complete, but exposure is considered to be minor; qualitative evaluation.
●	Pathway is or might be complete and could be significant; quantitative evaluation.
X	Pathway might be complete in the future, but cannot be quantified; qualitative evaluation.

concentrations that might be of potential health concern to exposed humans. COPCs were defined as any chemical that meets the following criteria: a) is not an essential nutrient, b) was detected in 5% or more of on-site samples, c) occurs in site samples at a concentration higher than in background locations, and d) the maximum detected concentration exceeds a conservative risk-based concentration (RBC). Table ES-1 summarizes the chemicals that were identified and retained for quantitative evaluation as COPCs for ingestion of soil or groundwater, or inhalation in indoor air. Note that there were no volatile organic compounds (VOCs) identified as COPCs for intrusion from groundwater into indoor air, so this pathway was not evaluated further.

Exposure Points

For soil, it is considered likely that most current or future workers would be randomly exposed across the entire site. However, it is plausible that some workers might tend to be preferentially exposed at a specific sub-location of the site. Thus, the site was divided into 10 lots, and exposure to soil was evaluated at each of the 10 lots as well as the entire site. These 10 lots were also used to evaluate exposure of hypothetical future residents. This same approach was followed for inhalation exposure to volatile chemical intrusion from soil and groundwater. For groundwater ingestion, exposure was evaluated on a well-by-well basis.

Exposure Point Concentrations (EPCs)

For soil, the exposure point concentration was based on samples from the 0-1 foot depth interval. The exposure point concentration (EPC) was the 95% upper confidence limit (UCL) of the mean or the maximum value (whichever is lower). The 95% UCL was calculated from the data based on the assumption the data were distributed lognormally. For groundwater, because exposure was evaluated on a well-by-well basis, the exposure parameter of interest is the long-term average concentration and/or the 95% UCL in each well. However, at present there are only one or two data points available for each well, so risks were based on the maximum measured value at each well.

For indoor air, concentrations of volatile organic chemicals (VOCs) attributable to release from subsurface soil were estimated by modeling, using the soil gas model developed by Johnson and Ettinger (1991). Two alternative building construction scenarios were evaluated: the slab-on grade scenario and the basement scenario.

Human Exposure Parameters

All human exposure parameters used in this risk assessment to quantify typical (CTE) and upper-bound (RME) exposure of workers and residents were default values recommended by USEPA for use at Superfund sites.

TOXICITY ASSESSMENT

The noncancer effects of a chemical are characterized by identifying a dose (called the Reference Dose, or RfD) or a concentration (the reference concentration or RfC) that does not pose a risk of

Table ES-1 COPC Summary

Media	Ingestion	VOC Intrusion in Indoor Air
Soil	Benzo(a)Anthracene Benzo(a)Pyrene Benzo(b)Fluoranthene Bis(2-Ethylhexyl)Phthalate	1 2 4-Trimethylbenzene 1 2-Dichloroethane 1 3 5-Trimethylbenzene Benzene cis-1 2-Dichloroethylene Ethylbenzene Hexane Isopropylbenzene Methylene Chloride Tetrachloroethylene Toluene Naphthalene Acetone
Groundwater	Manganese Bis(2-Ethylhexyl)Phthalate Acetophenone Trichloroethylene	

adverse noncancer effects in exposed humans. The cancer risks of a chemical are characterized by an oral or inhalation Slope Factor (SF). The chemical- and route-specific toxicity values used in this risk assessment are all based on values that have been developed by USEPA and are available in the Integrated Risk Information System (IRIS), the Health Effects Assessment Summary Tables (HEAST), or are available from USEPA's Superfund Technical Assistance Center operated by the National Center for Environmental Assessment (NCEA). These values are summarized in Section 4 of the main report.

RISK CHARACTERIZATION

Basic Methods for Risk Characterization

The potential for adverse noncancer effects from exposure to a chemical is evaluated by comparing the estimated chronic daily intake (CDI) of the chemical by the RfD for that chemical. This comparison results in a noncancer Hazard Quotient:

$$HQ = CDI / RfD$$

If the HQ for a chemical is equal to or less than one , it is believed that there is no appreciable risk that noncancer health effects will occur. If an HQ exceeds one, there is some possibility that noncancer effects may occur, although an HQ above one does not indicate an effect will definitely occur.

The risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of that exposure by age 70. For each chemical of concern, this value is calculated from the lifetime average chronic daily intake of the chemical from the site and the slope factor (SF) for the chemical, as follows (USEPA 1989):

$$\text{Cancer Risk} = 1 - \exp(-CDI_L \cdot SF)$$

Excess cancer risks are summed across all chemicals of concern and all exposure pathways that contribute to exposure of an individual in a given population.

The level of total cancer risk that is of concern is a matter of personal, community and regulatory judgement. In general, the USEPA considers excess cancer risks that are below about 1 in one million (0.000001) to be so small as to be negligible, and risks above 1 in ten thousand (100 per million, or 0.0001) to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between these two values are generally considered to be acceptable (USEPA 1991b), although this is evaluated on a case by case basis.

Risks from Ingestion of Soil

Table ES-2 summarizes the estimated risks to workers and hypothetical future residents from ingestion exposure to on-site soils. As seen, noncancer risks are below a level of concern in all

Table ES-2 Summary of Risks from Soil Ingestion

Location	Worker				Resident			
	Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)		Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Sitewide	< 0.1	< 0.1	1	10	< 0.1	< 0.1	9	60
Lot 1	< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1	0.4	2
Lot 2	< 0.1	< 0.1	0.1	1	< 0.1	< 0.1	1	6
Lot 3	< 0.1	< 0.1	0.1	1	< 0.1	< 0.1	1	7
Lot 4	< 0.1	< 0.1	0.2	2	< 0.1	< 0.1	2	10
Lot 5	< 0.1	< 0.1	0.3	4	< 0.1	< 0.1	3	20
Lot 6	< 0.1	< 0.1	< 0.1	0.6	< 0.1	< 0.1	0.4	2
Lot 7	< 0.1	< 0.1	0.1	1	< 0.1	< 0.1	1	7
Lot 8	< 0.1	< 0.1	0.2	3	< 0.1	< 0.1	2	10
Lot 9	< 0.1	< 0.1	0.2	2	< 0.1	< 0.1	2	9
Lot 10	< 0.1	< 0.1	0.3	4	< 0.1	< 0.1	3	20
Waste piles	< 0.1	< 0.1	0.3	3	< 0.1	< 0.1	2	10

All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

cases (i.e., HI < one), even if exposure were to occur preferentially at the waste piles of contaminated soil. Likewise, cancer risks are all within or below the EPA risk range (1 per million to 100 per million). These results indicate that direct ingestion of soil is not likely to be of significant concern to either workers or hypothetical future on-site residents.

Risks from Groundwater

Table ES-3 summarizes estimated risks to workers and hypothetical future on-site residents from exposure to groundwater from on-site wells. The upper panel shows the risks from groundwater ingestion, while the lower panel shows the risks associated with inhalation of volatile COPCs released from indoor water uses to indoor air.

As seen, all wells are within or below EPA's risk range for excess cancer risk (1 to 100 per million) for both ingestion (upper panel) and inhalation of VOCs released from indoor water (lower panel). Likewise, noncancer HI values are also below a level of concern (HI $\leq$ 1) at all wells for both ingestion and inhalation exposure. In interpreting these results, it is important to recall that only one or two groundwater samples are presently available for each well, so the long-term average concentration values within a well may be either higher or lower than the current estimates. EPA is currently collecting additional samples of groundwater as part of the Operable Unit 2 investigation, and risk estimates will be updated as new data become available.

Risk calculations shown in Table ES-3 do not include well IW-GW-04 located in Lot 3, since that well is now dry and the values from that well are no longer applicable. However, it should be noted that the concentration of trichloroethylene measured in that well in 1998 would be associated with excess cancer and noncancer risks that are above EPA's risk range for both the worker and the resident for both ingestion and inhalation exposure. A new groundwater monitoring well located near MG-GW-04 has not shown the high levels of contamination observed in IW-GW-04.

Risks from Inhalation of VOCs Intruding into Indoor Air from Soil and Groundwater

As noted above, risks from VOC intrusion from groundwater into indoor air are below a level of concern. Table ES-4 summarizes the estimated risks to workers and hypothetical future residents from inhalation of VOCs intruding from soil into indoor air. The evaluation of this exposure pathway considered two alternative building construction scenarios (slab-on-grade and basement), and for each of these, two alternative building sizes were assessed: a large building that covers most of the lot (evaluated by using the average soil concentration for the lot) and a small building (evaluated by using the maximum concentration for the lot).

As seen, excess cancer risks are within or below EPA's risk range in all lots for all scenarios. Likewise, noncancer risks are mainly below a level of concern (HI $\leq$ 1) except for lots 3, 4, 5, and 8. At these lots, noncancer risks may enter a range of potential concern for both workers and residents, with HI values ranging from 2 to 20. The majority of the risk is due to 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, with smaller contributions from naphthalene, hexane and cis-1,2-dichloroethylene in some locations.

Table ES-3 Summary of Risks from Groundwater

INGESTION

Well ID	Lot Number	N	Worker				Resident			
			Noncancer HQ Hazard Quotient		Excess Cancer Risk (cases per million people)		Noncancer HQ Hazard Quotient		Excess Cancer Risk (cases per million people)	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME
MW-02/PZ-02	1	2	0.3	0.5	0.3	2	0.9	1	2	8
MW-04	2	1	< 0.1	< 0.1	< 0.1	0.5	0.2	0.2	0.4	2
MW-05	6	1	0.1	0.2	0.2	2	0.4	0.5	1	6
MW-01/PZ-01	8	2	< 0.1	< 0.1	< 0.1	0.6	0.2	0.2	0.4	2
MW-03/PZ-03	10	2	0.2	0.3	0.2	2	0.6	0.8	1	6

INHALATION

Well ID	Lot	N	Worker				Resident			
			Noncancer HQ Hazard Quotient		Excess Cancer Risk (cases per million people)		Noncancer HQ Hazard Quotient		Excess Cancer Risk (cases per million people)	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME
MW-02/PZ-02	1	2	< 0.1	0.1	0.2	3	0.1	0.2	0.9	5
MW-04	2	1	< 0.1	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.1	0.6
MW-05	6	1	< 0.1	< 0.1	0.2	2	< 0.1	0.1	0.7	3
MW-01/PZ-01	8	2	< 0.1	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.1	0.7
MW-03/PZ-03	10	2	< 0.1	< 0.1	0.2	2	< 0.1	0.1	0.7	3

All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Table ES-4. Summary of Risks from VOCs Intrusion from Soil

Basement Scenario (Soil Depth>2ft), Worker

Locations	Noncancer Hazard Index				Excess Cancer Risk (cases per million people)			
	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lot 2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4	< 0.1	1
Lot 3	1	3	3	7	0.1	2	0.4	4
Lot 4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4	< 0.1	0.6
Lot 5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Lot 6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.8	< 0.1	0.8
Lot 7 *	--	--	--	--	--	--	--	--
Lot 8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	0.7
Lot 9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4	< 0.1	0.7
Lot 10	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.1

Basement Scenario (Soil Depth>2ft), Residents

Locations	Noncancer Hazard Index				Excess Cancer Risk (cases per million people)			
	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.1
Lot 2	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.6	0.3	2
Lot 3	3	4	7	10	0.5	3	1	7
Lot 4	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.6	0.2	1
Lot 5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	0.4
Lot 6	< 0.1	< 0.1	< 0.1	< 0.1	0.3	1	0.3	1
Lot 7 *	--	--	--	--	--	--	--	--
Lot 8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	0.2	1
Lot 9	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.7	0.2	1
Lot 10	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.2

Slab Scenario (All Soil Depths), Worker

Locations	Noncancer Hazard Index				Excess Cancer Risk (cases per million people)			
	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	< 0.1	0.2	0.4	0.9	< 0.1	0.6	0.2	2
Lot 2	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.5	0.1	1
Lot 3	0.9	2	5	10	< 0.1	1	0.6	6
Lot 4	0.7	2	5	10	0.2	3	2	20
Lot 5	0.6	1	3	6	0.2	2	0.6	7
Lot 6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.7	0.1	1
Lot 7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5	0.1	1
Lot 8	0.8	2	3	6	< 0.1	0.5	0.2	2
Lot 9	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.5	0.2	2
Lot 10	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.7	0.1	1

Slab Scenario (All Soil Depths), Residents

Locations	Noncancer Hazard Index				Excess Cancer Risk (cases per million people)			
	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	0.2	0.3	0.8	1	< 0.1	0.1	< 0.1	0.3
Lot 2	< 0.1	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	0.2
Lot 3	2	3	10	20	< 0.1	0.2	0.2	1
Lot 4	1	2	10	20	< 0.1	0.5	0.7	3
Lot 5	1	2	5	8	< 0.1	0.3	0.2	1
Lot 6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.2
Lot 7	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	0.2
Lot 8	2	3	6	9	< 0.1	< 0.1	< 0.1	0.3
Lot 9	< 0.1	< 0.1	0.2	0.3	< 0.1	< 0.1	< 0.1	0.3
Lot 10	< 0.1	< 0.1	0.1	0.2	< 0.1	0.1	< 0.1	0.2

All values shown to 1 significant figure.
* No data was available for Lot 7 at depths > 2 feet.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
Shaded cells indicate values that exceed EPA's usual risk range.

Combined Risks from All Exposure Pathways

Table ES-5 presents a summary of the range of risks which might occur if the same worker or future resident were exposed by all of the primary exposure pathways at a lot (soil ingestion, groundwater ingestion, inhalation of VOCs released to indoor air from indoor water, inhalation of VOCs intruding into indoor air from soil and groundwater). Because risks from intrusion of VOCs depend on the type of building (slab vs basement) and on the size of the building (large vs small), the total are presented separately for the minimum and the maximum contribution from the soil gas intrusion estimates.

As seen, even when all exposure pathways are combined, excess cancer risks still fall within EPA's risk range (1 to 100 per million) for both residents and workers. For non-cancer risks, screening level HI values exceed a value of 1 in Lots 1, 3, 4, 5, and 8 in several cases. These exceedences are due mainly to risks attributable to VOC intrusion from soil, with only low risk from ingestion of soil or groundwater.

UNCERTAINTIES

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty (lack of precise knowledge) regarding a number of important exposure and toxicity factors. Thus, exposure and risk calculations are usually derived using a number of values that are estimated from the best information that is available. It is important for risk managers and the public to keep these uncertainties in mind when interpreting the results of a risk assessment. The main sources of uncertainty in the exposure and risk calculations performed at this site include the following.

Source of Uncertainty	Comment	Probable Direction of Error	Probable Magnitude of Error
Analytical data	Relative errors may be large near detection limit	Either high or low	Usually small
Exposure point concentrations for soil	Use of 95% UCL or max helps ensure conservatism; many samples were biased	More likely high than low	Often moderate, sometimes large
	VOC levels may be low due to loss before analysis	Underestimation of risk from VOCs	Moderate
Exposure point concentrations for groundwater	Only one or two samples per well; maximum value used	Either high or low	Uncertain; might be large
Exposure point concentrations for VOCs in indoor air	Values are calculated using a mathematical model rather than being measured	Unknown	Possibly large

Source of Uncertainty	Comment	Probable Direction of Error	Probable Magnitude of Error
Toxicity values (RfD, RfC, SF)	Some are interim; all have uncertainty	Usually tend to overestimate risk	Unknown; possibly large
Chemicals not evaluated		Underestimate risks	Unknown; probably small
Exposure pathways not evaluated		Underestimate risks	Unknown; probably small
Effect of chemical interactions		Unknown	Unknown; probably small

Because of the uncertainties summarized above, none of the exposure and risk calculations presented above should be interpreted as precise measures of the true risk. Rather, all values should be interpreted as estimates.

CONCLUSION

At this site, available data indicate that risks to humans are not of concern from ingestion of soil. Risks from groundwater appear to be minimal based on current data, but one well that is now dry had levels of TCE that would be of concern if long term exposure were to occur. Risks could exist from inhalation exposure to VOCs that intrude from soil into indoor air in some locations, but these risks are based on modeled indoor air concentrations and so are not certain.

Table ES-5 Summary of Total Risks

Minimum Contribution for Volatile Organic Compounds

Location	Worker				Resident			
	Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)		Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Lot 1	0.3	0.6	0.6	6	1	1	3	20
Lot 2	<0.1	<0.1	0.3	3	0.2	0.3	2	9
Lot 3	0.9	2	0.2	3	2	3	1	9
Lot 4	<0.1	<0.1	0.2	3	<0.1	<0.1	2	10
Lot 5	<0.1	<0.1	0.4	4	<0.1	<0.1	3	20
Lot 6	0.2	0.3	0.5	5	0.5	1	2	10
Lot 7	<0.1	<0.1	0.2	2	<0.1	<0.1	1	7
Lot 8	<0.1	0.1	0.4	4	0.2	0	3	10
Lot 9	<0.1	<0.1	0.2	3	<0.1	<0.1	2	10
Lot 10	0.2	0.4	0.7	8	0.6	0.9	5	30

Maximum Contribution for Volatile Organic Compounds

Location	Worker				Resident			
	Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)		Non-cancer Hazard Index		Excess Cancer Risk (cases per million people)	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Lot 1	0.7	1	0.7	7	2	3	4	20
Lot 2	0.1	0.2	0.4	4	0.3	0.4	2	10
Lot 3	5	10	0.7	8	10	20	3	20
Lot 4	5	10	2	20	10	20	8	40
Lot 5	3	6	0.9	10	5	8	5	30
Lot 6	0.2	0.3	0.5	6	0.5	0.7	3	10
Lot 7	<0.1	<0.1	0.2	3	<0.1	0.1	1	9
Lot 8	3	6	0.5	5	6	9	3	20
Lot 9	<0.1	0.2	0.3	4	0.2	0.3	2	10
Lot 10	0.3	0.5	0.9	9	0.7	1	5	30

All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

1.0 INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

This document is a baseline human health risk assessment for the Intermountain Waste Oil Refinery (IWOR) Superfund site located in Bountiful, Utah. The purpose of the document is to assess the potential health risks to humans from site-related chemical contaminants, both now and in the future, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media.

The results of this assessment are intended to help inform risk managers and the public about potential human risks attributable to site-related contaminants and to help determine the need for remedial action (USEPA 1989). The overall management goal for human health at the site is to ensure protection of humans from deleterious effects of acute and chronic exposures to site-related chemicals of concern at on-site locations, as well as impacted areas off-site, for both current and future uses.

The methods used to evaluate risks to humans in this assessment are consistent with current guidelines provided by the USEPA for use at Superfund sites (USEPA 1989, 1991a, 1991b, 1991c, 1992a, 1992b, 1993).

An evaluation of potential risks to ecological receptors from site-related contamination is presented in a separate report (SRC 2002).

1.2 ORGANIZATION OF THIS DOCUMENT

In addition to this introduction, this report is organized into the following sections:

Section 2 This section provides a description of the site and a review of data that characterize the nature and extent of environmental contamination at the site.

Section 3 This section identifies human exposure scenarios of potential concern at the site, identifies chemicals of potential concern (COPCs) for each exposure scenario, and derives quantitative estimates of exposure for those pathways that are most likely to be significant.

Section 4 This section summarizes the characteristic cancer and noncancer health effects associated with the COPCs at the site and lists the quantitative toxicity factors used to calculate cancer and noncancer risk levels in exposed humans.

Section 5 This section provides quantitative estimates of cancer and noncancer risk to humans exposed to site-related contaminants by each of the exposure scenarios of primary concern.

Section 6 This section summarizes the likely magnitude and direction of the sources of uncertainty in the risk estimates for human receptors.

Section 7 This section provides full citations for USEPA guidance documents, site-related documents, and scientific publications referenced in the baseline risk assessment.

2.0 SITE CHARACTERIZATION

2.1 SITE DESCRIPTION

Detailed descriptions of the site are provided in *Analytical Results Report: Intermountain Waste Oil Refinery* (UDEQ 1997), *Site Inspection Report for Expanded Site Inspection: Intermountain Waste Oil Refinery* (URS 1998), and *Technical Memorandum I: Intermountain Waste Oil Refinery Bountiful, Utah* (Washington Group 2001a). Information from these reports that is helpful in performing the human health risk assessment at the site is summarized below.

2.1.1 Location

The Intermountain Waste Oil Refinery (IWOR) site is located in Bountiful, Utah in Davis County at 995 South 500 West (Figure 2-1). The geographic coordinates are 40°52.80' North Latitude and 111°53.39' West Longitude (URS 1998). The site is neighbored by the Wasatch Mountains on the east, I-15 to the west, North Salt Lake City to the south, and Centerville to the north (URS 1998).

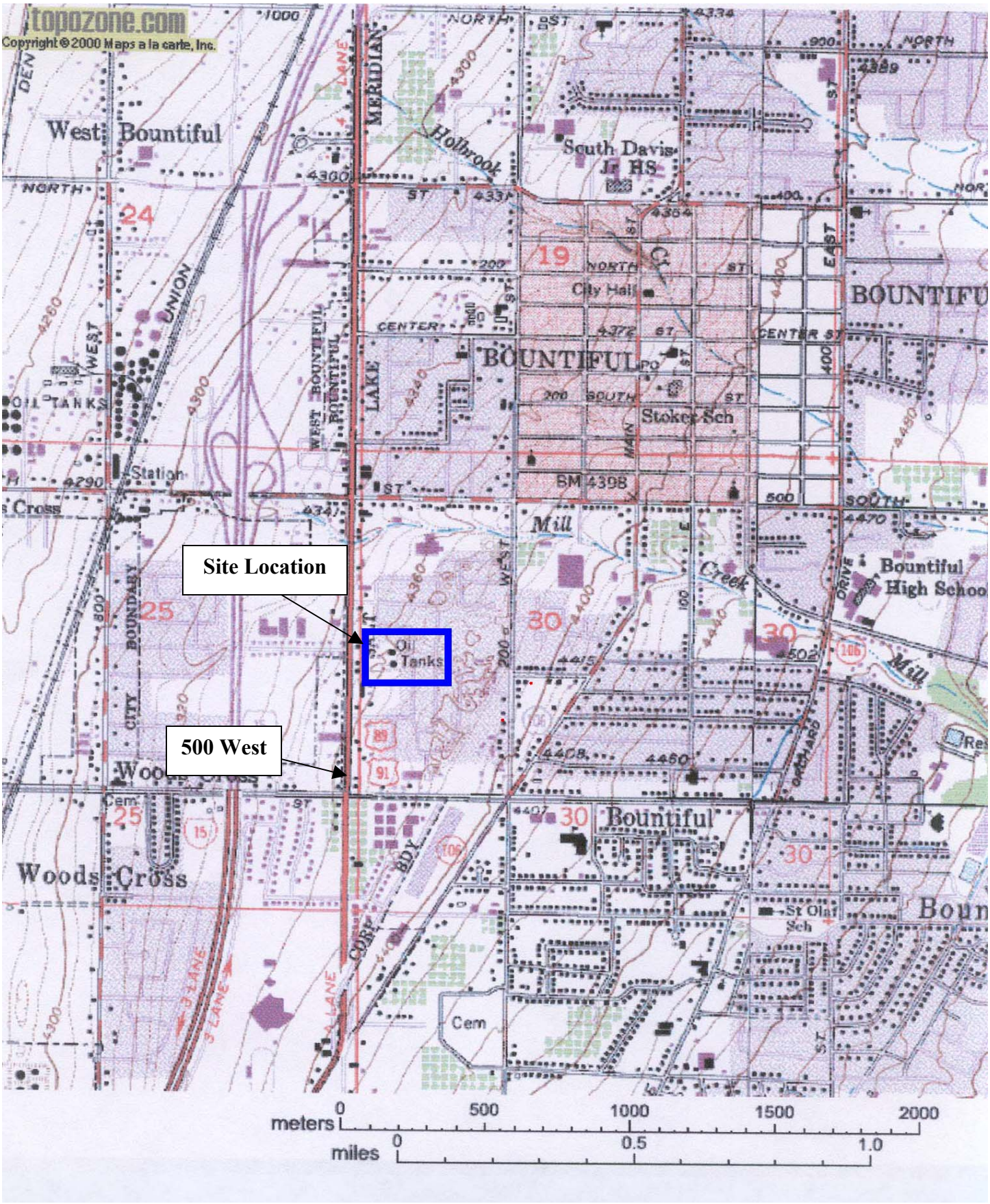
2.1.2 Topography

The site covers approximately five acres of both fenced and unfenced land in a residential/commercial section of Bountiful. The site is largely flat. Elevations at the site and in the immediate area range from 4,280 to 4,450 feet above sea level (URS 1998).

2.1.3 Hydrogeology

Located on the western side of Bountiful, the IWOR site lies over the southern portion of the East Shore Aquifer. This East Shore Aquifer system is defined as consisting of saturated alluvial deposits between the Wasatch Mountain Range and the Great Salt Lake and includes artesian aquifers plus a deep unconfined aquifer along the mountain front (Washington Group 2001a). In the Bountiful area, there are shallow (60 to 250 feet below ground surface (bgs)), intermediate (250 to 500 feet bgs), and deep artesian aquifers (greater that 500 ft bgs). Groundwater flow is generally towards the Great Salt Lake along the Wasatch front. At the IWOR site, groundwater flows in a west to northwest direction. Groundwater depth has been measured at 83 feet bgs in an onsite monitoring well and 101 feet bgs in a monitoring well just offsite. The shallow aquifer is classified by the State of Utah as a Class II drinking water source, but water from the shallow aquifer is currently not used for drinking water. However, it has been used for industrial and agricultural purposes in the past.

Figure 2-1
Site Location Map



Bountiful has a semi-arid climate with an average annual precipitation of 23.24 inches and a mean annual evapotranspiration of 18.54 inches, resulting in a net annual precipitation of 4.7 inches (URS 1998). There are no permanent bodies of surface water on the site. Overland drainage from the site flows west into a storm drain system that runs along 500 West. This storm drain flows northward approximately 1,500 ft and drains into Mill Creek. Mill Creek runs approximately seven miles to the west and drains into the Farmington Bay Bird Refuge, a wetland area on the southeastern border of the Great Salt Lake (Washington Group 2001a).

Data from the installation of wells on and near the site indicate that the near-surface soils include sands, gravels, and silty sands, with lenses of silt and clay. Deeper subsurface soils (20-120 feet below grade) consist of coarser sandy gravels although lenses of silts are also found (Washington Group 2001d).

2.1.4 Site History

Early land uses at the site are not well established. Activities in the 1950s or earlier are reported to have included an asphalt business, manufacture of coal dust suppressant, brick production, and a bulk oil distributing business.

Beginning in 1957 and extending for 35 years (to 1993), the site was used for handling and refining of waste oil. Waste oils from Utah, Nevada, Idaho, and Wyoming were received and treated at the IWOR site. Refined oil was used by area cement facilities as fuel for their kilns. Waste sludge was disposed of at the North Davis County Landfill or in the Salt Lake County/City Landfill. Waste water resulting from the treatment process was boiled off at the site (URS 1998).

A diagram of the site is provided in Figure 2-2. The western third of the site was used for vehicle parking as well as an area where material could be staged for separation of oil and water. The eastern two-thirds of the site is where the majority of the oil refining occurred. A laboratory, a shop, two small surface impoundments (which once contained tanks), and a sump are located in this eastern section of the site.

Under a cooperative agreement with Utah Division of Solid and Hazardous Waste, the owner began to dismantle the refinery in 1993. Contaminated surface soil and other solid waste on site was consolidated into 100 cubic yard waste piles in the rear north east section of the site (Washington Group 2001a). Due to the owner's lack of funds, remediation of the site was stopped and the surface of the site was covered with approximately two inches of gravel/soil backfill (URS 1998).

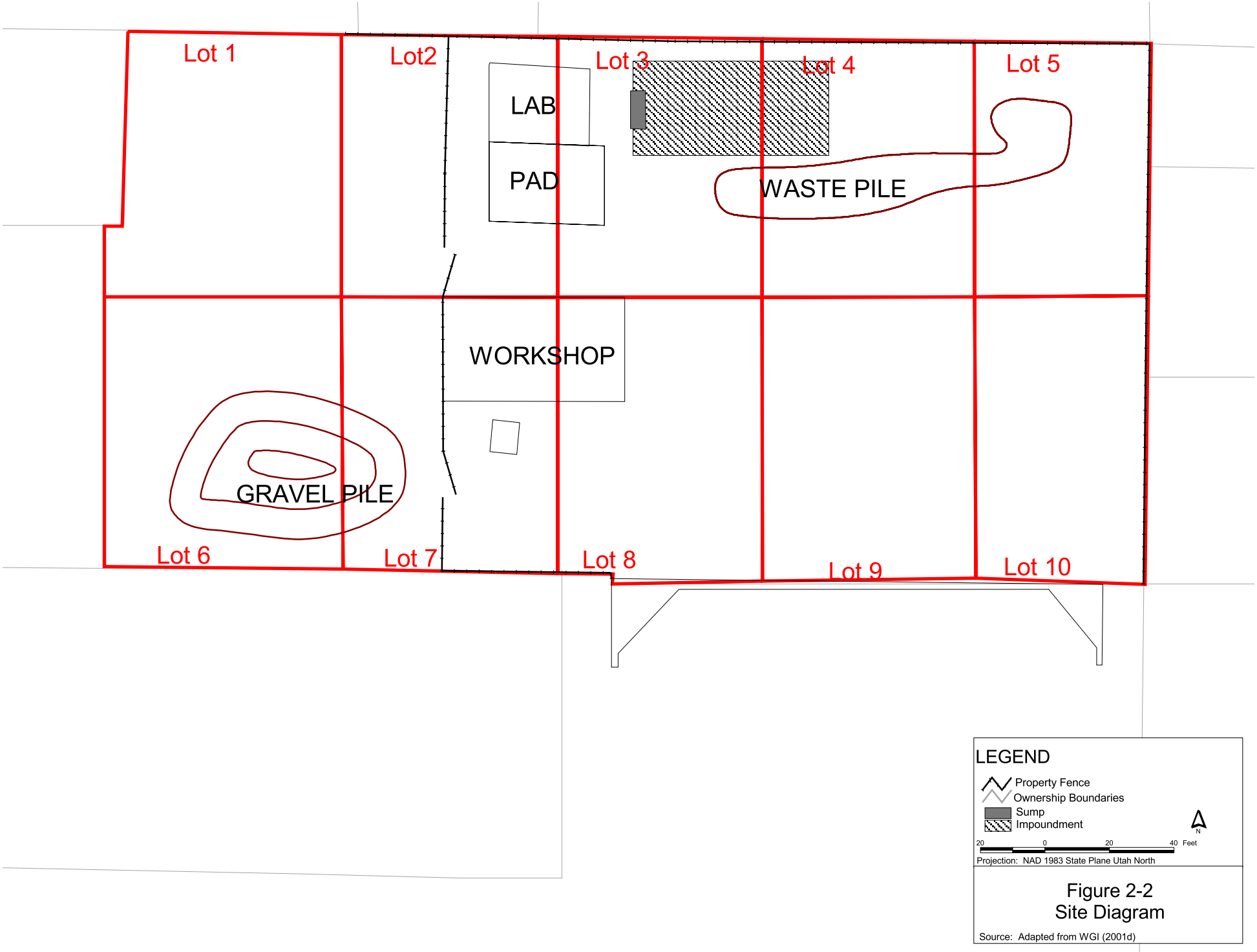


Figure 2-2
Site Diagram

Source: Adapted from WGI (2001d)

2.2 DATA SUMMARY AND EVALUATION

2.2.1 Summary of Existing Studies

This risk assessment is based on data collected during three studies of on-site media: UDEQ (1997), URS (1998), and Washington Group Phase I (2001b) and Phase II (2001c,d). Key aspects of these studies are summarized in Table 2-1.

UDEQ (1997)

The Utah Department of Environmental Quality (UDEQ) performed sampling at and around the site on April 9-10 and May 20, 1996, under the initial Site Inspection to determine the conditions at the site, to assess any public health or environmental threats, and to gather information to support decisions regarding the need for additional CERCLA action. On-site, UDEQ collected three samples from potential sources (the sump and two tanker trucks), four soil samples (primarily from areas with visible oil staining or from the impoundments), and one groundwater sample. UDEQ also collected several samples from off-site locations, including three background soil samples, one off-site groundwater sample, and samples of surface water and sediment from Mill Creek at two stations west (downstream) of the outfall of the storm drain along 500 West. All samples were analyzed for total metals, volatile organics, and semi-volatile organics.

Results showed that the source samples taken from the tankers contained high levels of solvents and that solvents were also present in a number of soil samples. Analysis of groundwater from the onsite monitoring well showed elevated levels of 1,2-dichloroethylene (430 ppb) and trichloroethylene (750 ppb). Onsite soils exhibited high levels of ethylbenzene (1,910 ppm), trimethylbenzene (2,900 ppm), n–butylbenzene (275 ppm), toluene (2,085 ppm), and cis-1,2-dichloroethylene (420 ppm). Offsite soils did not contain significant levels of contamination. This sampling event indicated that onsite groundwater and soil are contaminated with multiple site-related chemicals.

Table 2-1. Summary and Evaluation of Available Studies

Reference	Media	Analytes	Comment	Use Data in Quantitative Risk Assessment?
UDEQ (1997)	4 Onsite Soils (0-6")	VOC, SVOC, Organics, Inorganics	West of lab, east impoundment, west impoundment, center back portion of site.	Yes (except samples without qualifiers)
	3 Background Soils (0-6")	VOC, SVOC, Organics, Inorganics	Background = Off-site (two residences and one school)	Yes (except samples without qualifiers)
	2 Groundwater	VOC, SVOC, Inorganics	One onsite monitoring well and one municipal drinking well	No (qualifiers not provided)
	4 Surface Water	VOC, SVOC, Inorganics	Sump (east of lab), 2 locations along Mill Creek, and 1 sample from the flood retention pond on Mill Creek	Yes (except samples without qualifiers)
	2 Sediment	VOC, SVOC, Inorganics	Co-located with surface water samples	Yes (except samples without qualifiers)
URS (1998)	6 Onsite Soils (0-2')	VOC, SVOC, Organics, Inorganics, PCB, & pesticides	Smaller east waste pile, 2 spots in larger south waste pile, southern surface impoundment	Yes
	1 Background Soil (0-1')	VOC, SVOC, Organics, Inorganics, PCB, & pesticides	Off-site residence	Yes
	3 Groundwater	VOC, SVOC, Organics, Inorganics, PCB, & pesticides	One on-site monitoring well, one upgradient monitoring well, and one well east of site	Yes
	1 Surface Water	VOC, SVOC, Organics, Inorganics, PCB, & pesticides	Sump (east of lab)	Yes
Washington Group Phase I (2001b)	100 Soil Gas Sample Modules	VOC	100 samples were installed onsite and in the neighboring area, 97 were analyzed for soil gas mass	No (Use qualitatively to confirm VOC COPC list)
Washington Group Phase II (2001d)	10 Onsite Surface/Subsurface Soil Locations at 3 depth intervals (30 samples total)	VOC, SVOC, Inorganics, PCB, TOC, TPH	10 lots divided into 5 zones. Grab samples from each zone: 0-2 in, 3-12 in, 12-24 in. Grab samples composited by depth.	Yes
	1 site-wide composite of surface or subsurface soil (3 depth intervals, 3 samples total)	PCB	Three composite samples prepared from subsamples of 10 composite samples from each depth interval	Yes
	3 Background Surface/Subsurface Soil Locations each at 3 depth intervals	VOC, SVOC, Inorganics, PCB, TOC, TPH	Residence, school, and the Water Dept. Same procedure as onsite sampling (0-2", 3-12", 12-24")	Yes
	6 Waste Pile Sample Locations sampled at 3 depth intervals (18 samples total)	VOC, SVOC, Inorganics,TOC, TPH	Sample depths 0-8", 8-24", 24-60"	Yes
	5 Biased Soil Locations at 3 depth intervals (15 samples total)	VOC, SVOC, Inorganics,TOC, TPH	Sample depths 0-2",2-12",12-24"	Yes
	4 Borehole Soil Sample Locations each sampled at 2 depths (8 samples total)	VOC, SVOC, Inorganics,TOC, TPH	Sample depth 7',12',37',43.5'	Yes
	3 Piezometer Installation Soil Locations	VOC, SVOC, Inorganics,TOC, TPH	Sample depth 102',108',109'	Yes
	3 Groundwater	VOC, TDS, TPH	Piezometer	Yes
	5 Monitoring Wells	VOC, SVOC, Inorganics	Onsite monitoring wells	Yes
	1 Surface Water	VOC, SVOC, PCB, Inorganic	Sump (east side of lab)	Yes

URS (1998)

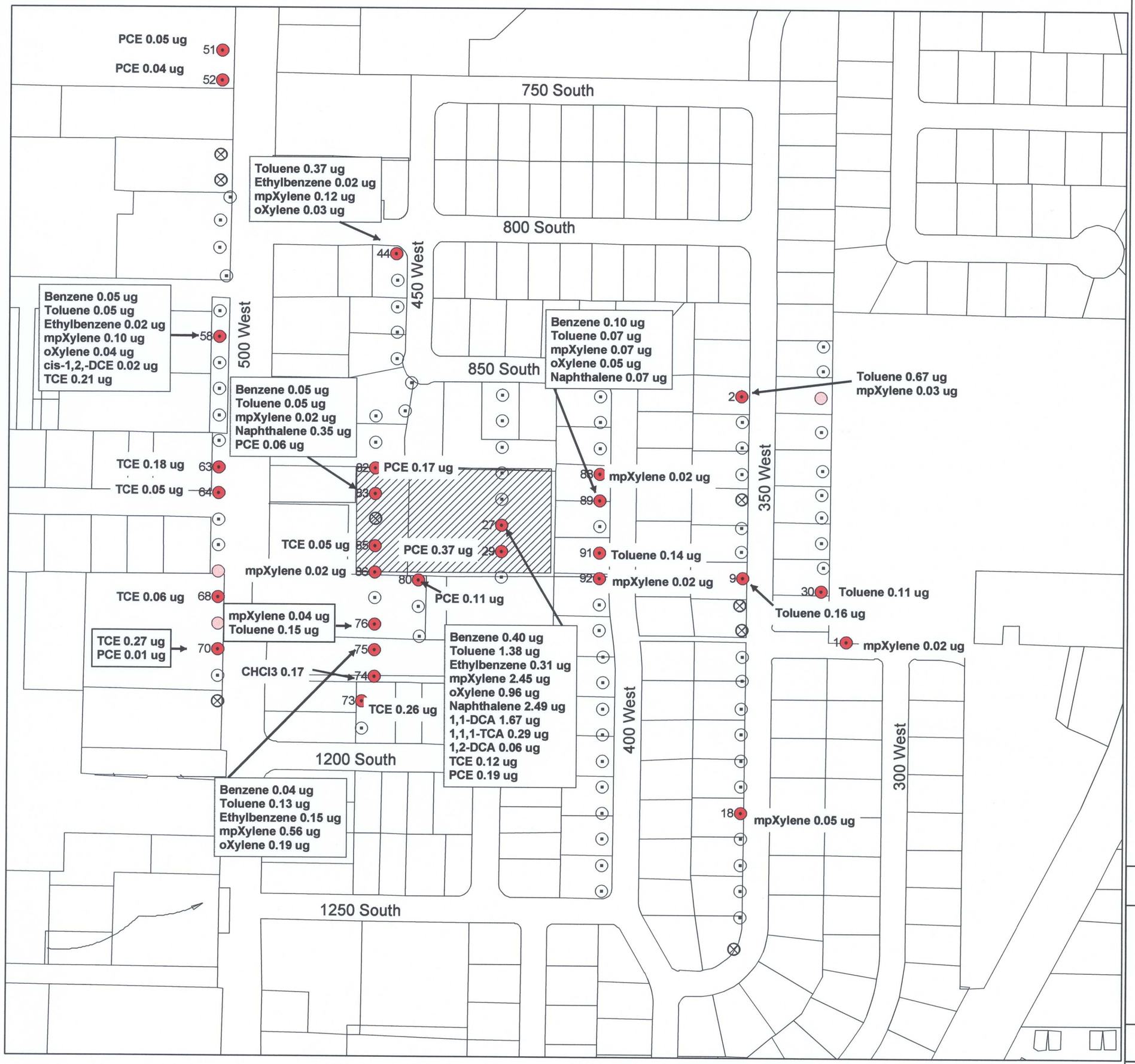
The purpose of this study was to gather information so that the site could be evaluated using EPA's Hazard Ranking System criteria. Specific objectives included collecting soil/source samples to characterize source contaminants and evaluate waste quantity, collect groundwater samples from existing onsite and offsite wells to identify if the study area has been affected by site waste practices, and identify and delineate target populations and environments within the study area.

On-site, URS (1998) collected four samples of surface soil (three from the waste piles and one from the southern impoundment), and one groundwater sample. Off-site, one background soil sample and two background groundwater samples were collected. All samples were analyzed for inorganics, semi-volatile and volatile organic compounds, and pesticides. In on-site soil, cadmium (2.1 ppm), copper (117 ppm), lead (221ppm), mercury (0.29 ppm), bis (2-ethylhexyl)phthalate (3,500 ppb), and 4,4-DDT (180 ppb) were detected. In groundwater, 1,2-dichloroethylene (500 ppb) and trichloroethylene (840 ppb) were detected. Because the site is no longer active and is fenced in, the study concluded that under current site conditions the major pathway of potential concern is groundwater contamination, but that any future changes in the use and layout of the site could result in new threats to residents or workers from soil contamination.

Washington Group (2001b,c,d)

As part of the Phase I sampling event in March, 2001, Washington Group International (Washington Group 2001b) performed a study to identify and characterize spatial patterns of volatile organic chemicals in shallow soils that would indicate approximate locations of soil sources or groundwater contamination. A total of 100 soil vapor adsorbent modules were installed, and 97 of these samples were successfully retrieved and analyzed for benzene, toluene, ethylbenzene, xylenes, naphthalene, chloroform, cis-1,2-dichloroethylene, tetrachloroethylene, trichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, and 1,1,1-trichloroethane. This sampling method provides information on the mass of chemical that becomes adsorbed to the sorbent module, and therefore provides an index of the relative amount of VOC present in soil gas at each sampling location. However, the results do not provide information of the concentration of VOCs in soil gas, and so cannot be used directly for human exposure assessment.

The results are shown in Figure 2-3 and are summarized below:



N

100 50 0 100 200 300 400 Feet

20 10 0 20 40 60 Meters

Legend

Intermountain Waste Oil Refinery Site

Parcels

SYMBOL
(Location Approximate)

Soil Gas Contaminants Detected

Installed Soil Gas Sample Lost in Field

Proposed Soil Gas Sample Not Installed

Non-Detect Sample Results

Figure 2-3

Intermountain Waste Oil Refinery
Bountiful, Utah

Soil Gas Sample Results

Source: Washington Group, 2001b

Number of Different VOCs Detected	Number of Samples
0	69
1	19
2	3
3	0
≥4	6
Total	97

As seen, a majority of the samples (91 out of 97) detected zero to two VOCs, usually at low levels. However, six samples detected four or more VOCs, sometimes at levels higher than most other samples. Two of these samples (locations 27 and 83 in Figure 2-3) were located on-site, while the others were located off-site (e.g., sample 44, 58, 75 and 89). These results suggest that VOCs do occur at elevated levels in some (but not all) on-site soils.

In the subsequent Phase II sampling round in August 2001, Washington Group (Washington Group 2001c,d) sampled soil, groundwater, and miscellaneous waste containers as part of a remedial investigation and remedial action plan. Many of the containers as well as both of the tankers were subsequently removed from the site.

For soil sampling, the site was divided into ten lots (see Figure 2-2), and composite soil samples at three depths (0-2",3-12",13-24") were taken from each lot for analysis. Soil was also collected from waste piles and several investigative boreholes. Three temporary piezometers were installed, sampled, and subsequently converted to monitoring wells.

Results of the sampling are presented in Washington Group (2001d). High concentrations of total petroleum hydrocarbons (TPH) were found in composite soil samples at all three depths in lot 4. Lot 9 surface samples showed high concentrations of PAHs. Surface sample at lots 4, 7, 8, and 9, as well as samples from 3-12 inches at lots 4 and 5 and samples from 13-24 inches at lots 3 and 4 showed high levels of TPH concentrations. Fuel related VOCs and TPH were found in all depths of soil in the two waste piles. Soil from an investigative borehole located east of the laboratory showed high levels of TPH, fuel-related VOCs and PAHs at depths as great as 43.5 ft (the deepest tested).

The first round of groundwater samples from on-site wells showed detectable levels of acetone and isopropyl alcohol, but not any chlorinated solvents. Subsequent sampling (as part of the quarterly sampling plan) showed detectable levels of inorganics as well as trichloroethylene, cis-1,2-dichloroethylene, acetophenone, and bis (2-ethylhexyl)phthalate.

2.2.2 Data Quality Review

Table 2-2 summarizes the types of data qualifiers that were assigned to the data, and the approach used for incorporating qualified data into this risk assessment. Data from the three studies above were reviewed to determine their suitability for use in the risk assessment, as follows:

- All data from URS (1998) were found to have adequate data quality information, and all of the reported data were incorporated into the risk assessment database. However, data from groundwater well IW-GW-04 were excluded from subsequent use in the risk assessment because the well is now dry and the values from this well are not considered to be applicable to current site conditions.

- All data available from Washington Group (2001d) were found to have adequate data quality information and all of the reported data were incorporated into the risk assessment database.

- Most of the data from the UDEQ (1997) report were used in the risk assessment, but some data points were excluded because the available data reports did not include laboratory qualifiers for the analytical results. This included results for inorganic analysis of three source samples, five soil samples, one surface water sample, and two sediment samples. All groundwater results were excluded due to the lack of qualifiers. There were also some discrepancies between the data sets presented in UDEQ (1997) Appendix F and Appendix H. Because Appendix H was a summary of the results found in Appendix F, results found in Appendix F were assumed to be the most reliable and results from Appendix H were disregarded.

2.2.3 Summary Statistics

Detailed summary statistics of all of the analytical data used in the risk assessment are presented in Appendix A (organized by medium). Table 2-3 provides an overview of the types of chemicals that were detected at the site. As seen, a wide range of chemical types are observed in one or more samples, including metals, pesticides, volatile organics and semivolatile organics. It is important

Table 2-2. Data Qualifiers and Data Usability

Data Qualifier (see below)		Rule for Data Use (USEPA 1989)
Laboratory	**Validation**	
Missing	Missing	Do not use
None	None	Use
None	J, U, or UJ	Use
B	None, E, J or N	Use
D or E	None	Use
J or JB	None or J	Use
J	U or UJ	Use
NJ or NJD	None	Use
P or PJ	None	Use
U or UJ or BU	None or J	Use ½ reported detection limit
U	R	Do not use

Meaning of Laboratory Qualifiers for Inorganic Data

B = Reported value is <Contract Required Detection Limit, but > Instrument Detection Limit
U = Compound was analyzed for, but not detected
E = Value is estimated due to matrix interferences
J = Estimated value
N = Spiked sample recovery not within control limits

Meaning of Laboratory Qualifiers for Organic Data

B = Analyte found in associated blank as well as in sample
U = Compound was analyzed for, but not detected
D = Compound identified in an analysis at a secondary dilution factor
E = Concentration exceeds calibration range of GC/MS instrument
J = Estimated value
N = Spiked sample recovery not within control limits
P = Pesticide/Aroclor sample with greater than 25% difference between two GC columns: lower of two values reported. USEPA (1998)

Meaning of Validation Qualifier (Inorganic and Organic Data)

J = Estimated value
U = Material was analyzed for, bot not detected
E = Concentration exceeds calibration range of GC/MS instrument
N = Presumptive evidence of presence of material (Tentatively Identified Compounds)
R = Quality Control indicates that data are unusable

Source: USEPA (1989), unless otherwise noted

Table 2-3 Summary of Analytes Detected

Group	Chemical	Soil	Water
Inorganic	Aluminum	X	X
	Antimony	X	
	Arsenic	X	
	Barium	X	X
	Beryllium	X	
	Cadmium	X	
	Calcium	X	X
	Chromium	X	
	Cobalt	X	
	Copper	X	X
	Iron	X	X
	Lead	X	
	Magnesium	X	X
	Manganese	X	X
	Mercury	X	
	Nickel	X	X
	Potassium	X	X
	Selenium	X	X
	Silver	X	
	Sodium	X	X
	Thallium	X	
	Vanadium	X	
	Zinc	X	X
PAH	2-Methylnaphthalene	X	
	Acenaphthene	X	
	Acenaphthylene		
	Aniline		
	Anthracene	X	
	Benzo(a)Anthracene	X	
	Benzo(a)Pyrene	X	
	Benzo(b)Fluoranthene	X	
	Benzo(g,h,i)Perylene	X	
	Benzo(k)Fluoranthene	X	
	Chrysene	X	
	Fluoranthene	X	
	Fluorene	X	
	Naphthalene	X	
	Phenanthrene	X	
	Pyrene	X	
PCB	Aroclor 1016		
	Aroclor 1221		
	Aroclor 1232		
	Aroclor 1242		
	Aroclor 1248		
	Aroclor 1254		
	Aroclor 1260	X	
	Aroclor 1262		
	Aroclor 1268		
Pesticide	Atrazine		
	Caprolactam		X
	Endrin Aldehyde	X	
	Endrin Ketone	X	
	Methoxychlor	X	
	4,4-DDT	X	
	Gamma-Chlordane	X	

Group	Chemical	Soil	Water
Petroleum Hydrocarbon	Petroleum Hydrocarbons (>C12 TO C28)	X	
	Petroleum Hydrocarbons (>C28 TO C35)	X	
	Petroleum Hydrocarbons (C6 TO C12)	X	
	TPH (C6 To C35)	X	
SVOC	1 1 -Biphenyl		
	1 2 4-Trichlorobenzene		
	1 2-Dichlorobenzene	X	
	1 3-Dichlorobenzene		
	1 4-Dichlorobenzene		
	1-Chlorohexane		
	2 4 5-Trichlorophenol		
	2 4 6-Trichlorophenol		
	2 4-Dichlorophenol		
	2 4-Dimethylphenol		
	2 4-Dinitrophenol		
	2 4-Dinitrotoluene		
	2 6-Dinitrotoluene		
	2-Chloronaphthalene		
	2-Chlorophenol		
	2-Ethyl-1-Hexanol		X
	2-Methylphenol		
	2-Nitroaniline		
	2-Nitrophenol		
	2-Nitropropane		
	3 & 4 Methylphenol (m&p Cresol)		
	3 3-Dichlorobenzidine		
	4 6-Dinitro-2-Methylphenol		
	4-Bromophenyl Phenyl Ether		
	4-Chloro-3-Methylphenol		
	4-Chloroaniline	X	
	4-Chlorophenyl Phenyl Ether		
	4-Methylphenol		
	4-Nitroaniline		
	4-Nitrophenol		
	Acetophenone		X
	Benzaldehyde		
	Benzyl Alcohol		
	Benzyl Chloride		
	Bis(2-Chloroethoxy)Methane		
	Bis(2-Chloroethyl)Ether		
	Bis(2-Chloroisopropyl)Ether		
	Bis(2-Ethylhexyl)Phthalate	X	X
	Butyl Benzyl Phthalate		X
	Carbazole	X	
	cis-1 4-Dichloro-2-Butene		
	Decachlorobiphenyl		
	Dibenzo(a,h)Anthracene	X	
	Dibenzofuran	X	
	Diethyl Phthalate		
	Dimethyl Phthalate		X
	Di-N-Butyl Phthalate		X
	Di-N-Octyl Phthalate		
	Hexachlorobenzene		
	Hexachlorobutadiene		
	Hexachlorocyclopentadiene		
	Hexachloroethane		
	Indeno(1 2 3-c,d)Pyrene	X	

Group	Chemical	Soil	Water
SVOC	Isophorone		
	M-Nitroaniline		
	Nitrobenzene		
	N-Nitrosodi-N-Propylamine		
	N-Nitrosodiphenylamine		
	Pentachlorophenol		
	Phenol	X	X
	Pyridine		
VOC	1 1 1 2-Tetrachloroethane		
	1 1 1-Trichloroethane		X
	1 1 2 2-Tetrachloroethane		
	1 1 2-Trichloro-1 2 2-Trifluoroethane		
	1 1 2-Trichloroethane		
	1 1-Dichloroethane		
	1 1-Dichloroethylene		
	1 1-Dichloropropene		
	1 2 3-Trichlorobenzene		
	1 2 3-Trichloropropane		
	1 2 4-Trimethylbenzene	X	
	1 2-Dibromo-3-Chloropropane		
	1 2-Dibromoethane		
	1 2-Dichloroethane	X	
	1 2-Dichloropropane		
	1 3 5-Trimethylbenzene	X	
	1 3-Butadiene		
	1 3-Dichloropropane		
	1 4-Dioxane	X	
	2 2-Dichloropropane		
	2-Butanone	X	X
	2-Chloro-1 3-Butadiene		
	2-Chloroethylvinyl Ether		
	2-Chlorotoluene	X	
	2-Hexanone		
	4-Chlorotoluene		
	4-Methyl-2-Pentanone	X	X
	Acetone	X	X
	Acetonitrile		
	Acrolein		
	Acrylonitrile		
	Allyl Chloride (3-Chloro-1-Propene)		
	Benzene	X	
	Bromobenzene		
	Bromochloromethane		
	Bromodichloromethane		
	Bromoform		
	Bromomethane		
	Carbon Disulfide		
	Carbon Tetrachloride		
	Chlorobenzene		
	Chloroethane		
	Chloroform	X	
	Chloromethane		
	cis-1 2-Dichloroethylene	X	X
	cis-1 3-Dichloropropene	X	
	Cyclohexane	X	
	Cyclohexanone		
	Dibromochloromethane		

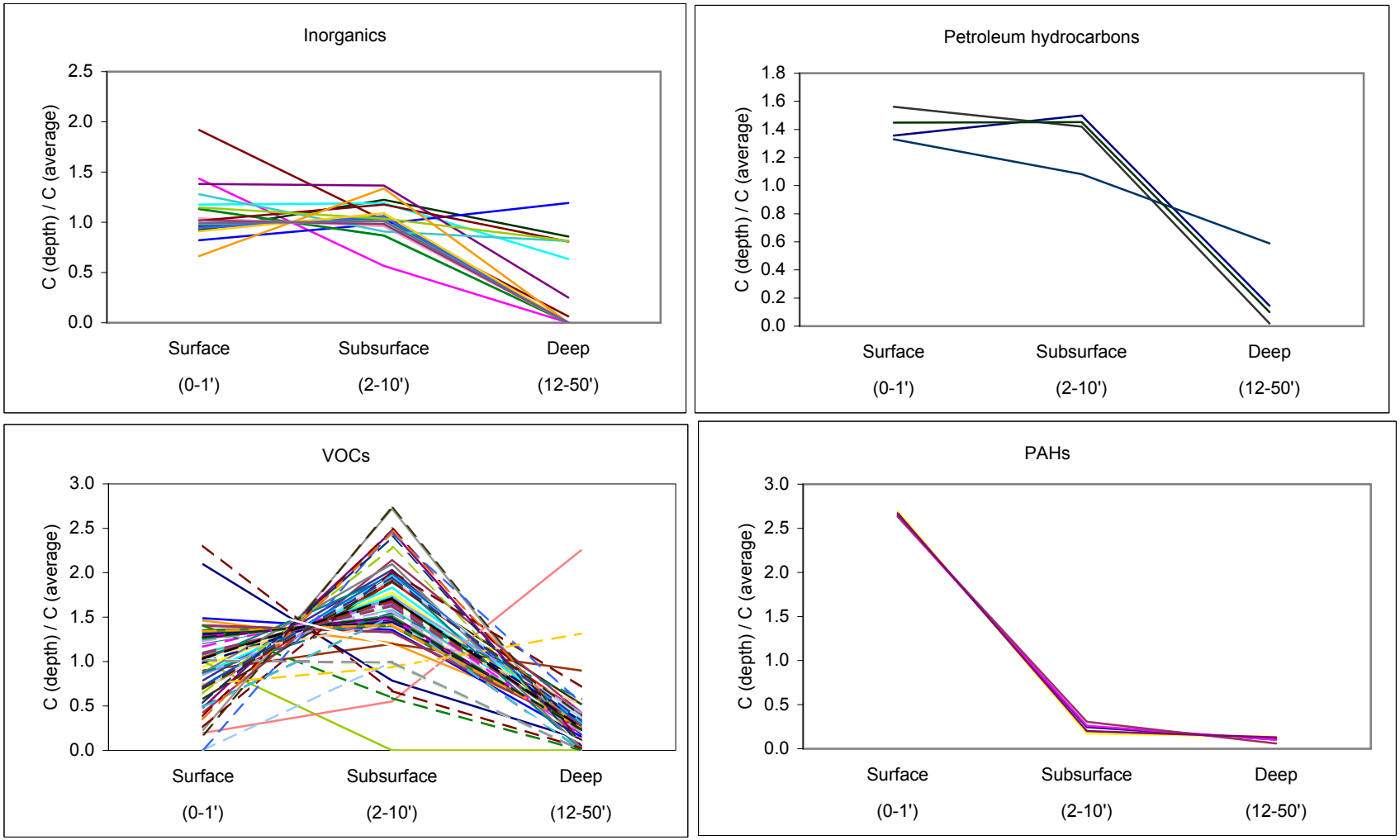
Group	Chemical	Soil	Water
	Dibromofluoromethane	X	
	Dibromomethane		
	Dichlorodifluoromethane		
	Ethyl Acetate	X	
	Ethyl Ether (Diethyl Ether)		
	Ethyl Methacrylate		
	Ethylbenzene	X	
	Hexane	X	
	Iodomethane		
	Isobutyl Alcohol	X	
	Isopropyl Alcohol (2-Propanol)	X	X
	Isopropylbenzene	X	
	m&p-Xylenes	X	
	Methyl Acetate		
	Methyl Methacrylate		
	Methylacrylonitrile		
	Methylcyclohexane	X	
	Methylene Chloride	X	
	n-Butyl Alcohol (1-Butanol)		
VOC	n-Butylbenzene	X	
	n-Propylbenzene	X	
	o-Xylene	X	
	p-Isopropyltoluene	X	
	Propionitrile (Ethyl Cyanide)		
	sec-Butylbenzene	X	
	Styrene	X	
	tert-Butyl Methyl Ether (MTBE)		
	tert-Butylbenzene	X	
	Tetrachloroethylene	X	
	Tetrachloro-m-Xylene		
	Toluene	X	X
	Trans-1 2-Dichloroethylene		
	Trans-1 3-Dichloropropene		
	Trans-1 4-Dichloro-2-Butene		
	Trichloroethylene	X	X
	Trichlorofluoromethane		
	Vinyl Acetate		
	Vinyl Chloride		
	Xylenes (Total)	X	

to note that some of these chemicals (primarily the inorganics as well as some of the organics) occur widely in soil, and their detection at this site does not necessarily imply there has been a site-specific release.

Figure 2-4 shows the average depth profiles for several broad classes of chemicals in soil. These profiles were generated by calculating the site-wide average concentration of each chemical at each of three depth intervals (0-1 foot, 2-10 feet, and 12-50 feet), and dividing each depth-specific value by the overall average. Thus, profiles that trend downward indicate chemicals that are more concentrated at the surface than in the subsurface, while profiles that trend upward indicate chemicals that are more concentrated in the subsurface than the surface.

As seen, at this site, most inorganic chemicals and petroleum hyrocarbons tend to be relatively evenly distributed over the surface and shallow subsurface interval (i.e., from zero to 10 feet). However, PAHs tend to be more concentrated in surface soils (this is expected because PAHs tend to bind to soils and have low tendency to migrate). Conversely, most VOCs tend to be more concentrated in subsurface soil than in surface soil (this is expected because VOCs tend to escape from shallow soil by volatilization into outdoor air).

Figure 2-4 Depth Profiles of Chemical Classes



3.0 EXPOSURE ASSESSMENT

3.1 OVERVIEW

Exposure is the process by which humans come into contact with chemicals in the environment. In general, humans can be exposed to chemicals in a variety of environmental media (e.g., soil, water, air, food), and these exposures can occur through several routes (e.g., ingestion, dermal contact, inhalation). Section 3.2 provides an evaluation of exposure pathways that could lead to human contact with site-related contaminants at this site. Section 3.3 identifies chemicals of potential concern in each medium, and Section 3.4 describes the methods used to quantify exposure from each pathway that is considered to be of possible significance.

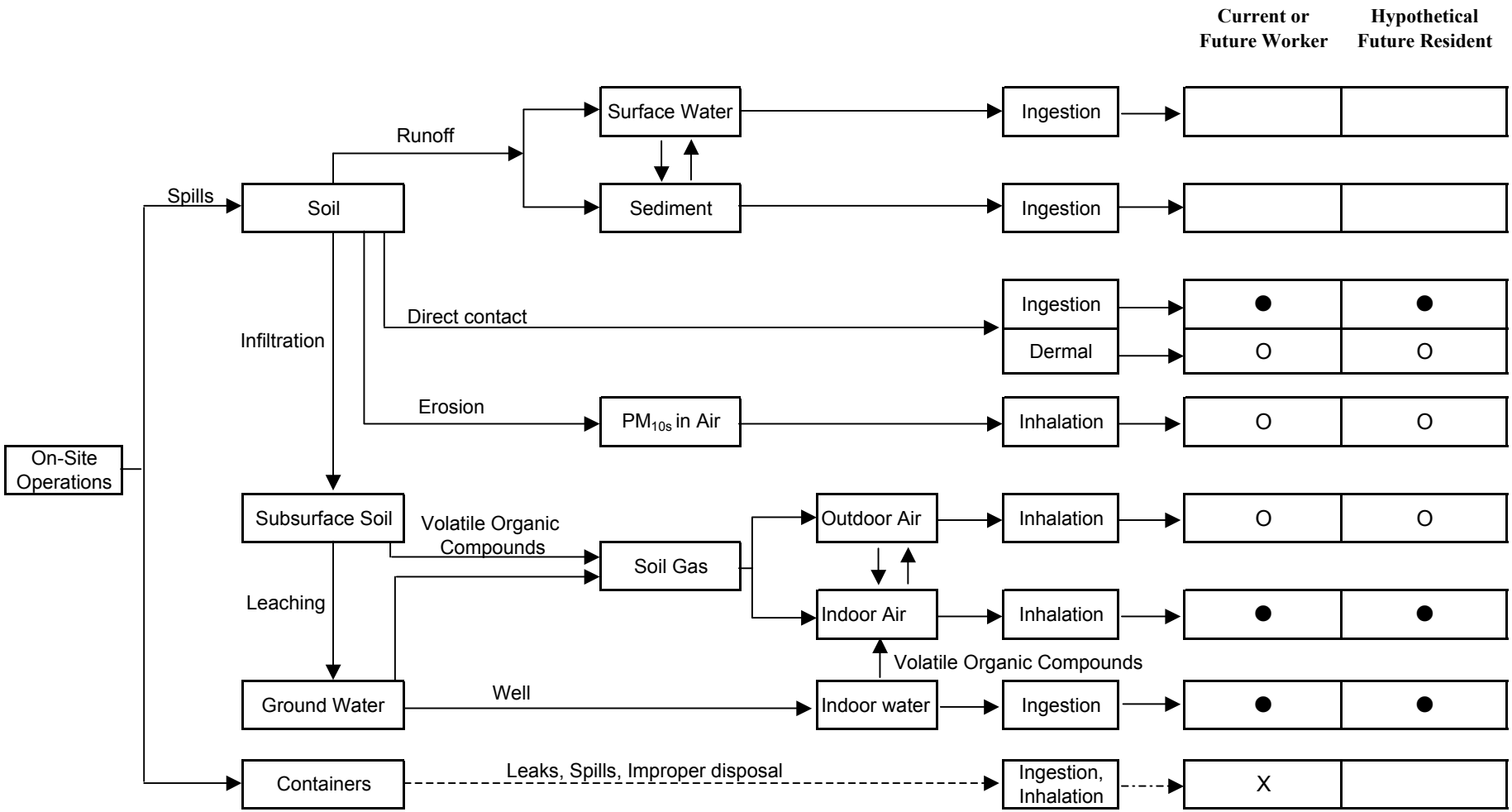
3.2 SITE CONCEPTUAL MODEL

Figure 3-1 presents a site conceptual model showing the exposure pathways by which chemicals that are originally released to the environment at on-site locations may migrate or be transported from one location or medium into another, and the scenarios by which humans might reasonably be exposed to site-related contaminants in the environment. However, not all of these potential exposure routes are likely to be of equal concern. Exposure scenarios that are considered most likely to be of concern, either now or in the future, are shown in Figure 3-1 by boxes containing a solid circle. Greatest attention is focused on quantification of exposure from these pathways in order to determine if the pathway contributes significant risk. Pathways that are judged to be potentially complete but which are considered to contribute only occasional or minor exposures are shown by boxes with an open circle. Incomplete pathways (i.e., those which are not thought to occur) are shown by open boxes. Pathways that might be complete in the future but which cannot be evaluated quantitatively are shown by an X. The following sections present a more detailed description of site-related contamination, migration pathways, and exposure scenarios at the site.

3.2.1 Exposed Populations

At present, the site is not in operation. Hence, aside from occasional exposures of site caretakers or trespassers at the site, there are no human populations known to be regularly exposed at the site itself. In the future, it is expected that the site may again be utilized for light commercial or industrial operations, and so future on-site workers are the population of primary concern at the site. Although current zoning at the site is commercial/industrial, it is considered plausible that future zoning might be changed and the land could be developed for residential use. Therefore, hypothetical future on-site residents are also a population of potential concern.

Figure 3-1. Conceptual Site Model for Human Exposure



KEY

	Pathway is incomplete; no evaluation needed
O	Pathway is or might be complete, but exposure is considered to be minor; qualitative evaluation
●	Pathway is or might be complete and could be significant; quantitative evaluation
X	Pathway might be complete in the future, but cannot be quantified; qualitative evaluation

3.2.2 Exposure Pathways

Incidental Ingestion of Soil and Dust

Even though few people intentionally ingest soil, workers or residents who have direct contact with soil at a site might ingest small amounts that adhere to their hands during outdoor activities. In addition, soil can enter buildings (workplaces, homes) leading to contamination of indoor dust, which may also be ingested by hand to mouth activities. Incidental ingestion of outdoor soil and/or contaminated indoor dust is often one of the most important routes of human exposure at a site; therefore, ingestion of surface soil is considered a potentially complete and significant pathway for both workers and hypothetical future residents.

Dermal Contact with Soil

Humans who are in direct contact with soil may get soil on their skin during outdoor activities. Even though information is limited on the rate and extent of dermal absorption of chemicals in soil across the skin, screening level calculations presented in Appendix B indicate that dermal exposure to most chemicals is likely to result in a dose that is only a few percent of the absorption due to soil ingestion. Based on these considerations, along with a lack of data to allow reliable estimation of dermal uptake of most chemicals, USEPA Region 8 generally recommends that dermal exposure to chemicals in soil not be evaluated quantitatively (USEPA 1995). Therefore, dermal contact with soil is evaluated qualitatively in the risk assessment.

Inhalation of Airborne Soil Particulates

Particles of contaminated surface soil may become resuspended in air, leading to potential inhalation exposure. However, screening level calculations presented in Appendix B indicate that exposure by the inhalation route is likely to be substantially smaller (less than 0.02%) than by the soil ingestion route. Therefore, this pathway is evaluated qualitatively rather than quantitatively.

Indoor Use of Groundwater

At present, there are no on-site wells in the shallow aquifer that are used as a source of indoor water, so exposure to groundwater is not currently of concern. If groundwater were ever used for indoor water at a building, there are two alternative exposure pathways of potential concern: 1) direct ingestion of the water, and 2) release of volatile organic chemicals (VOCs) from the water into indoor air. Because the water is classified by the State of Utah as a Class II drinking water source, the hypothetical future risks from both these pathways are evaluated in order to provide information on the level of risk that would be expected if the shallow aquifer beneath the site ever were used for drinking.

Inhalation of VOCs Emanating from Soil Gas

Subsurface soil and/or groundwater contaminated with VOCs may release those VOCs into soil gas, and the VOCs may diffuse upward through pores in the soil and be released at the surface. If the surface is not covered by a building, the VOCs enter outdoor air where they are diluted and dispersed by wind. Hence, inhalation of VOCs in outdoor air is not considered to be an important exposure route. However, if the VOCs approach the surface at a location near a building, the soil gas may be drawn into the building and the concentration in the building may tend to build up. Inhalation of VOCs in indoor air volatilized from soil gas emanating from groundwater and/or subsurface soil is considered a complete and potentially significant pathway for indoor worker and hypothetical future residents, and this pathway is evaluated quantitatively.

Exposure to Surface Water and Sediment

Because there are no permanent surface water bodies on the site, exposure to surface water and sediments was not evaluated.

Exposure to Contaminants in Containers

There are a number of containers (drums, cans, barrels, etc.) present at the site that contain a variety of potentially toxic substances (see Table 3-1). If these containers remain at the site and the contents remain properly contained, there will be no complete exposure pathway and hence no risk to humans. However, if these containers remain at the site, there is a potential that future workers might be exposed to chemicals if any of the containers developed leaks, or if any of the materials in the containers were released during handling or disposal. The risks from such hypothetical exposures can not be quantified, and so are addressed qualitatively.

3.2.3 Summary of Pathways of Principal Potential Concern

Based on the evaluations above, the following pathways are judged to be of sufficient potential concern to current or hypothetical future human receptors to warrant quantitative risk evaluation:

Exposure Scenarios Evaluated Quantitatively

Exposed Population	Contaminated Medium	Exposure Pathways
Current or future on-site workers Hypothetical future on-site residents	Soil	Ingestion
	Indoor air	Inhalation
	Groundwater	Ingestion

Table 3-1. List of Chemicals Detected in On-Site Containers

Group	Analytes	Maximum Concentration (ppm)				
		5-15 gal. Containers	Above Ground Tanks	Paint Cans	55-gal. Drums	Underground storage tank
Inorganic	Aluminum				440	
	Antimony				8.3	
	Arsenic	2.2	31		11	
	Barium	843	420		190	
	Cadmium	11.4	7.8		4.7	
	Calcium				8500	
	Chromium	136	50		28	
	Cobalt				1.8	
	Copper				150	
	Iron				4700	
	Lead	65	3100		1900	
	Magnesium				1300	
	Manganese				52	
	Mercury	3	0.76			
	Nickel				12	
	Potassium				27000	
	Selenium	0.99	0.5			
	Silver	0.25				
	Sodium				2700	
	Vanadium				3.1	
	Zinc				2700	
Pesticide	Alpha-BHC			4.6		
	Beta-BHC			0.16		
	Gamma-BHC			1.3		
Petroleum Hydrocarbon	Pet. Hydro. (>C12 To C28)		69000			
	TPH (C6 To C35)		69000			
SVOC	1 2-Dichlorobenzene		4.6			
	2 4 5 6-Tetrachloro-m-Xylene			0.403		
	2 4 6-Tribromophenol	46	105		438	
	2 4-Dimethylphenol		0.12			
	2-Fluorobiphenyl	28	383		414	
	2-Fluorophenol	41	481		496	
	2-Methylnaphthalene	27000	330		950	
	2-Methylphenol		0.16			
	3 & 4 Methylphenol (m&p Cresol)		0.25			
	4-Bromofluorobenzene	30	0.097		0.058	
	Acenaphthene	160			50	
	Anthracene				35	
	Bis(2-Chloroethyl)Ether		0.033			
	Bis(2-Ethylhexyl)Phthalate	60	61		120	
	Butyl Benzyl Phthalate		41		27	
	Chrysene	50				
	Decachlorobiphenyl			0.655		
	Fluorene	110	35		110	
	Hexachlorobutadiene				51	
	Naphthalene	13000	83		7300	
	Pentachlorophenol	35				
	Phenanthrene	67	120		370	
	Phenol	3.2			382	0.15
	Pyrene		36		44	
VOC	1 1 1-Trichloroethane	150	1			
	1 1-Dichloroethane		0.001			
	1 1-Dichloroethylene	88	0.002			
	1 2 3-Trichlorobenzene				50	
	1 2 4-Trimethylbenzene	11000	120		2200	
	1 2-Dichloroethane	14				0.09816
	1 3 5-Trimethylbenzene	3400	40		330	

Group	Analytes	Maximum Concentration (ppm)				
		5-15 gal. Containers	Above Ground Tanks	Paint Cans	55-gal. Drums	Underground storage tank
VOC	2-Butanone	2.2	5			
	4-Methyl-2-Pentanone	1800	0.35			
	Acetone	1.2	0.26			
	Benzene		2.2		11	
	Bromochloromethane		0.48			
	Chloroform		0.08			
	Cis-1 2-Dichloroethylene					0.001
	Dibromofluoromethane	50	0.10214		0.050	
	Ethyl Ether (Diethyl Ether)		0.013			
	Ethylbenzene	24000	13		160	
	Iodomethane	0.12				
	Isobutyl Alcohol	9300				
	Isopropyl Alcohol (2-Propanol)		0.78			
	Isopropylbenzene	710	3.5		48	
	m,p-Xylenes	110000	74		450	
	Methylene Chloride	500	5		68	
	N-Butylbenzene	1000	10		960	
	N-Propylbenzene	2200	13		130	
	o-Xylene	21000	30		190	
	p-Isopropyltoluene	240	4.8		120	
	sec-Butylbenzene	580	4.7		140	
	Styrene				120	
	Tert-Butylbenzene	140	1.4		13	
	Tetrachloroethylene		12		17	
	Toluene	16000	34		290	0.095
	Trichloroethylene		0.013			

Exposure to hazardous substances potentially released from containers stored on the site could be of concern but cannot be quantified. Other exposure pathways are judged to be sufficiently minor that quantitative evaluation is not warranted.

3.3 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of Potential Concern (COPCs) are chemicals which exist in the environment at concentration levels that might pose risks of adverse health effects in exposed humans, and which are or might be derived, at least in part, from site-related sources.

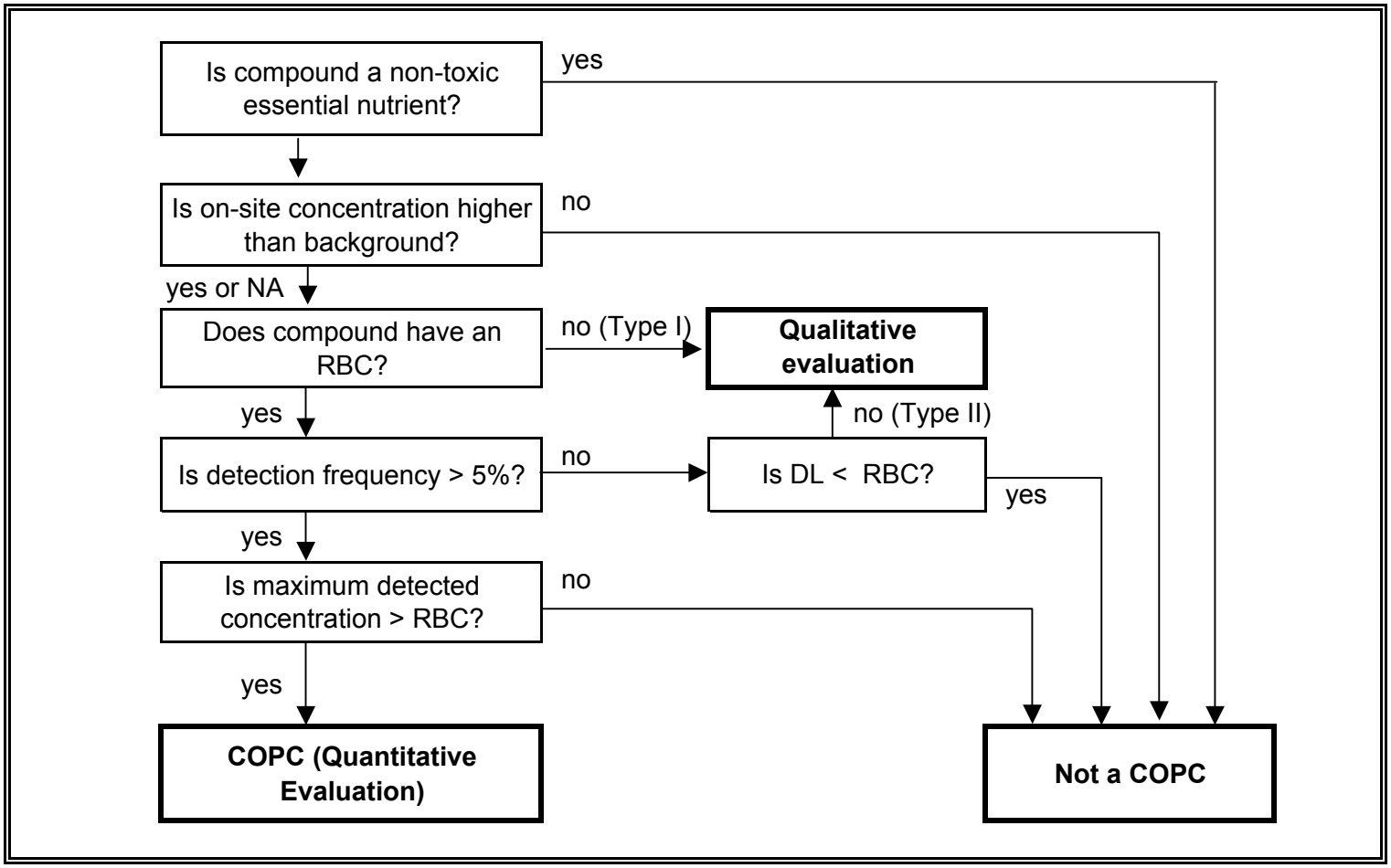
Procedure for Identifying COPCs for Ingestion of Soil or Groundwater

The procedure used to identify COPCs for ingestion of soil and groundwater at this site is shown in Figure 3-2. As seen, chemicals that are not likely to contribute significant risk of adverse health effects to humans are eliminated, while chemicals that might be of potential health concern are assigned to one of two groups: those that lack the data needed to perform a quantitative evaluation (these are addressed qualitatively), and those that have sufficient data to allow quantitative evaluation. It is important to note that this COPC selection procedure is intended to be conservative; that is, it is expected that some chemicals will be identified as COPCs that are actually of little or no health concern, but that no chemicals of authentic health concern will be overlooked.

Step 1: Eliminate Essential Nutrients

When a sample of soil or water is analyzed for inorganic chemicals, data are reported not only for analytes that might pose a risk of adverse health effects, but also for a number of chemicals that are normal constituents of the human body and that are required for good health. Many of these beneficial nutrients occur widely in food, water, and soil, and exposure to these chemicals is not considered to be of concern. These chemicals include calcium, potassium, sodium, magnesium, and iron. Accordingly, these chemicals are not considered to be of potential health concern and are not considered further.

Figure 3-2. COPC Selection Procedure for Ingestion of Soil and Groundwater



Notes:
RBC = Region 3 risk-based concentrations (HI = 0.1, Cancer risk = 1E-06)
NA = not available
COPC = chemical of potential concern
DL = detection limit

Step 2: Eliminate Chemicals that Are Not Higher in On-site Media than in Background

A number of chemicals occur widely in soil and water, and detection in a site sample is not necessarily evidence of a site release. One way to identify chemicals that are not site-related is to perform a statistical comparison of site samples with background samples. If the available data establish that the levels of a chemical in site samples is not higher than in background samples, it may be concluded that the presence of the chemical is not due to a site release, but is due either to natural occurrence, wide spread anthropogenic release, or to laboratory contamination. If the data indicate that levels of a chemical are higher on-site than in background, or if the data are inadequate to perform a reliable comparison, then that chemical is not excluded on the basis of the background comparison.

Appendix C presents the details for how this background comparison was performed. In brief, a t-test was used to compare the log-transformed data from the site and from the background locations. A chemical was judged to be higher than background if the p value for the t-statistic was less than 0.10 (i.e., there is a 90% probability the site mean is higher than background). Cases where the p value was larger than 0.10 but the statistical power of the test did not achieve 70% (i.e., there was less than an 70% chance of detecting a difference of one standard deviation at the 10% confidence limit) were not excluded. This procedure was applied to site soils, but the approach was not used for groundwater since there are too few data for either on-site or background water samples to support a meaningful comparison.

Step 3: Assign chemicals without toxicity values to qualitative COPC list

Risks from chemicals for which EPA has not established toxicity values (see Section 4) cannot be evaluated quantitatively, and so these chemicals are assigned to the qualitative COPC category.

Step 4: Eliminate chemicals never detected or infrequently detected

In accord with USEPA (1989), a chemical may be eliminated from the quantitative risk assessment if it is detected only infrequently (< 5%) in site media. If the analytical detection limit for a chemical in a medium was sufficiently high that the chemical would not have been detected even if it were present at a level of potential health concern, that chemical was assigned to the qualitative COPC category.

Step 5: Eliminate chemicals detected, but whose maximum value is below a level of concern

If a chemical is detected at a rate of 5% or greater, but the maximum detected concentration is well below a level of human health concern, that chemical may be eliminated from further consideration (USEPA 1989). This screening step was performed using Risk-Based Concentration (RBC) values developed by USEPA Region 3 (USEPA 2002). The RBC values reported by Region 3 are based on a cancer risk level of 1E-06 and a non-cancer hazard quotient (HQ) of 1.0. In order to be conservative in the COPC selection procedure, all Region 3 RBC values based on an HQ of 1.0 were divided by a factor of 10 to yield a value equivalent to an HQ of 0.1. This approach was used to help ensure that potential additive non-cancer risks of different chemicals could be properly addressed. Note that for volatile chemicals in water, the Region 3 RBC includes inhalation exposure due to chemical released from water to indoor air.

Results of COPC Screen for Ingestion of Soil and Groundwater

Appendix D-1 presents detailed results of the COPC selection process for ingestion of soil and Appendix D-2 presents the results for groundwater. The outcomes for each medium are summarized below:

Results of COPC Screen for Soil and Groundwater

Metric	**Soil**	**Groundwater**
Total number of samples	87	8
Total analytes evaluated	208	143
Essential nutrient	5	5
Not higher than background	21	--
No RBC or toxicity factors	46	20
Detection frequency 0% to5%	99	95
Maximum detect < RBC	33	19
Retained as quantitative COPC	**4**	**4**

Table 3-2 lists the COPCs identified for quantitative evaluation, while Table 3-3 lists chemicals that are identified for qualitative evaluation. "Type 1" COPCs are those for which no toxicity values (and hence no risk-based concentrations) exist. "Type 2" COPCs are those that were detected at a frequency less than 5%, but the analytical detection limit was too high to expect a high detection frequency if the chemical were present at a level of potential concern.

Procedure for Identifying VOCs of Potential Inhalation Concern in Soil and Groundwater

The procedure for selecting volatile organic chemicals (VOCs) in soil and groundwater that are COPCs for inhalation exposure in indoor air is shown in Figure 3-3. The screening procedure begins with all VOCs that have been detected in either soil or groundwater (excluding well IW-GW-04). As a check, this list of all VOCs detected in soil or groundwater was compared to the list of VOCs that were detected in a semi-quantitative soil gas study performed at the site (Washington Group 2001b). All chemicals detected in the soil gas study were also detected in soil and/or groundwater, except for 1,1-dichloroethane. This chemical was detected in one soil gas sample from the site but was not detected in either soil or groundwater.

First, chemicals that are not higher in on-site samples than in background samples are excluded (see Step 2, above). For water, there are insufficient data to perform a background comparison, so this step was not used to screen VOCs in water.

Next, the maximum detected value of each VOC in each medium is used to calculate the maximum expected concentration in indoor air resulting from the medium, using the Johnson and Ettinger model as described below in Section 3.4.3. In order to be maximally conservative and ensure that any VOC of plausible concern would be retained, the COPC selection procedure assumed that all soils were sand, since diffusion of VOCs through sand is more extensive than through other soil types[1]. Then, if an inhalation RfD or an inhalation slope factor exist for the chemical, the cancer and noncancer risks to an RME residential receptor are calculated as described in Section 5. If the maximum RME cancer risk does not exceed 1E-06 and the maximum RME HQ value does not exceed 1E-01, it is concluded that the chemical will contribute no significant health risk to residents or workers and may be excluded. All other VOCs (those that contribute risk > 1E-06 or have an HQ > 1E-01) are retained as COPCs.

[1] Note that site data suggest the soil is best characterized as sandy loam, and this site-specific soil type is used in Section 5.3 in the estimation of actual exposure and risk.

Table 3-2. List of Quantitative COPCs for Ingestion of Soil and Water

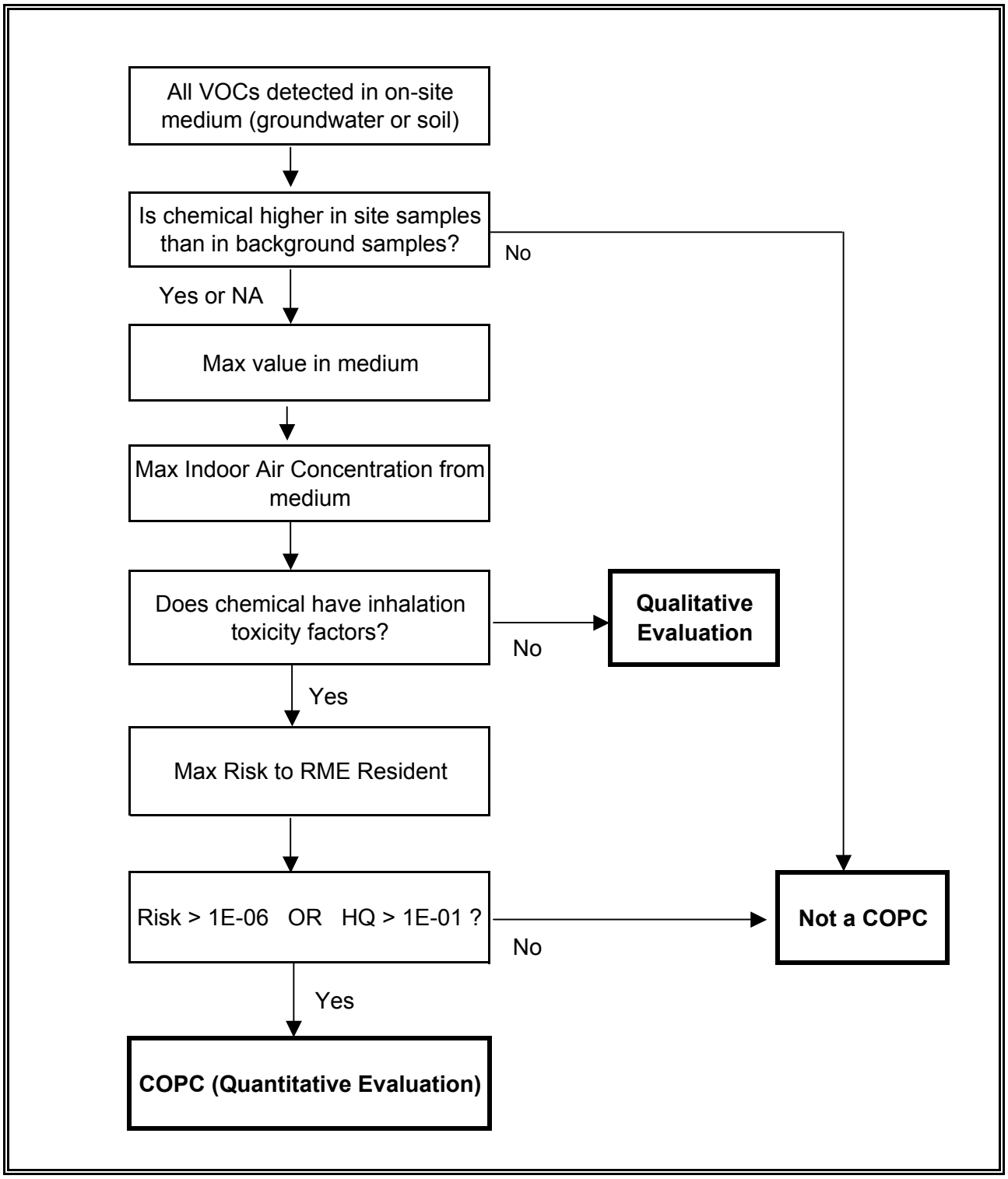
Group	Soil	Groundwater
Inorganic		Manganese
PAH	Benzo(a)Anthracene Benzo(a)Pyrene Benzo(b)Fluoranthene	
SVOC	Bis(2-Ethylhexyl)Phthalate	Bis(2-Ethylhexyl)Phthalate
VOC		Acetophenone Trichloroethylene

Table 3-3. Chemicals in Soil or Groundwater Identified for Qualitative Evaluation

Group	Analyte	Soil		Groundwater	
		Type 1	Type 2	Type 1	Type 2
Inorganic	Arsenic				X
	Thallium				X
PAH	Benzo(a)Anthracene				X
	Benzo(a)Pyrene				X
	Benzo(b)Fluoranthene				X
	Benzo(g,h,i)Perylene	X		X	
	Benzo(k)Fluoranthene				X
	Chrysene				X
	Naphthalene				X
Pesticide	Atrazine		X		X
	Endrin Aldehyde	X			
	Endrin Ketone	X			
	Gamma-Chlordane	X			
Petroleum Hydrocarbon	Petroleum Hydrocarbons (>C12 TO C28)	X		X	
	Petroleum Hydrocarbons (>C28 TO C35)	X		X	
	Petroleum Hydrocarbons (C6 TO C12)	X		X	
	TPH (C6 To C35)	X		X	
SVOC	1 3-Butadiene	X			
	1 4-Dichlorobenzene				X
	1-Chlorohexane	X			
	2 4 5 6-Tetrachloro-M-Xylene	X			
	2 4 6-Trichlorophenol				X
	2-Ethyl-1-Hexanol			X	
	2-Nitroaniline	X		X	
	2-Nitrophenol	X		X	
	2-Nitropropane	X			
	3 & 4 Methylphenol (M&P Cresol)	X			
	3 3-Dichlorobenzidine		X		X
	4 6-Dinitro-2-Methylphenol		X		
	4-Bromophenyl Phenyl Ether	X		X	
	4-Chloro-3-Methylphenol	X		X	
	4-Chlorophenyl Phenyl Ether	X		X	
	4-Nitroaniline	X		X	
	Acenaphthylene	X		X	
	Bis(2-Chloroethoxy)Methane	X		X	
	Bis(2-Chloroethyl)Ether		X		X
	Bis(2-Chloroisopropyl)Ether				X
	Carbazole				X
	Cis-1 4-Dichloro-2-Butene	X			
	Decachlorobiphenyl	X			
	Dibenzo(a,h)Anthracene		X		X
	Hexachlorobenzene		X		X
	Hexachlorobutadiene				X
	Hexachloroethane				X
	Indeno(1 2 3-Cd)Pyrene		X		X
	M-Nitroaniline	X		X	
	Nitrobenzene		X		X
	N-Nitrosodi-N-Propylamine		X		X
	Pentachlorophenol		X		X
	Phenanthrene	X		X	
VOC	1 1 2 2-Tetrachloroethane				X
	1 1 2-Trichloroethane				X
	1 1-Dichloroethylene				X
	1 1-Dichloropropene	X			
	1 2 3-Trichlorobenzene	X			
	1 2-Dibromo-3-Chloropropane				X
	1 2-Dibromoethane				X
	1 2-Dichloroethane				X
	1 2-Dichloropropane				X
	1 3-Dichloropropane	X			
	2 2-Dichloropropane	X			
	2-Chloroethylvinyl Ether	X			
	4-Chlorotoluene	X			
	Acetonitrile	X			
	Allyl Chloride (3-Chloro-1-Propene)	X			
	Benzene				X
	Bromobenzene	X			
	Bromochloromethane	X			
	Bromodichloromethane				X
	Bromoform				X
	Bromomethane				X
	Carbon Tetrachloride				X
	Chloroethane				X
	Chloroform				X
	Chloromethane				X
	Cis-1 3-Dichloropropene	X		X	
	Cyclohexane	X		X	
	Dibromochloromethane				X
	Iodomethane	X			
	Isopropyl Alcohol (2-Propanol)	X		X	
	M&P Xylenes				
	Methyl Tertiary Butyl Ether	X			
	Methylcyclohexane	X			
	Methylene Chloride				X
	P-Isopropyltoluene	X			
	Propionitrile (Ethyl Cyanide)	X			
	Tetrachloroethylene				X
	Trans-1 3-Dichloropropene	X		X	
	Trans-1 4-Dichloro-2-Butene	X			
	Vinyl Chloride				X
	Xylenes-m&p	X			

Type 1 = No RBC
Type 2 = Low detection frequecny, detection limit > risk-based concentrations

Figure 3-3. COPC Selection Procedure for VOCs in Soil and Groundwater



Results of VOC COPC Screening

Appendix D-3 presents detailed results of the COPC selection process for VOCs in indoor air, and the outcomes are summarized below:

Results of COPC Screen for VOC Intrusion from Soil and Groundwater

Metric	Soil	Groundwater
Total VOCs detected	35	8
Not higher in source than background	3	--
No inhalation toxicity factors	15	1
Maximum risk < 1E-06, HQ < 0.1	5	7
Retained as quantitative COPC	**12**	**0**

Table 3-4 lists the COPCs retained for quantitative evaluation. Note that none of the VOCs in groundwater were identified as COPCs for intrusion into indoor air, so this pathway was not evaluated further.

3.4 QUANTIFICATION OF EXPOSURE

3.4.1 Basic Equations

The average amount of a chemical which is ingested, inhaled, or taken up across the skin is referred to as "intake" or "dose", and is usually calculated using an equation of the following general form:

$$CDI = C \cdot (IR / BW) \cdot (EF \cdot ED / AT)$$

where:

CDI = Chronic Daily Intake of chemical (mg of chemical per kg of body weight per day)

C = Concentration of the chemical in the contaminated environmental medium (soil, dust, water, etc.) to which the person is exposed, averaged over the location (exposure point) where contact occurs. The units are mg of chemical per unit of environmental medium (e.g., mg/L for water, mg/kg for soil, mg/m^3 for air).

Table 3-4 COPCs for Indoor Air

COPC Type	Soil	Groundwater
Quantitative	1 2 4-Trimethylbenzene 1 2-Dichloroethane 1 3 5-Trimethylbenzene Benzene cis-1 2-Dichloroethylene Ethylbenzene Hexane Isopropylbenzene Methylene Chloride Tetrachloroethylene Toluene Naphthalene Acetone	None
Qualitative (No Inhalation Tox Factors)	1 4-Dioxane 1,2-Dichloroethylene 2-Chlorotoluene cis-1 3-Dichloropropene Cyclohexane Ethyl Acetate Isobutyl Alcohol Isopropyl Alcohol (2-Propanol) m&p Xylenes n-Butylbenzene n-Propylbenzene p-Isopropyltoluene sec-Butylbenzene tert-Butylbenzene Xylenes (Total)	Isopropyl Alcohol (2-Propanol)
Excluded (max risks < 1E-6 or HI < 0.1)	2-Butanone 4-Methyl-2-Pentanone Methylcyclohexane o-Xylene	1 1 1-Trichloroethane 2-Butanone 4-Methyl-2-Pentanone Toluene Acetone cis-1 2-Dichloroethylene Trichloroethylene
Excluded (Sitewide Concentration < Background Concentration)	Chloroform Styrene Trichloroethylene	None

IR = Intake rate of the contaminated environmental medium. The units are usually kg/day for soil, L/day for water, and m^3/day for air.

BW = Body weight of the exposed person (kg)

EF = Exposure frequency (days/year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED = Exposure duration (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = Averaging time (days). This term specifies the length of time over which the CDI is calculated. Usually, two different averaging times are considered:

AT = 9 to 30 years. This exposure duration is used when assessing the non-cancer risks from chemicals of concern.

AT = 70 years. This exposure interval is selected when evaluating cancer risks.

Note that the last three factors (EF, ED, AT) combine to yield a factor between zero and one. Values near 1.0 indicate that exposure is nearly continuous over the specified averaging period, while values near zero indicate that exposure occurs only rarely.

For mathematical convenience, the general equation for calculating dose is often written as:

$$CDI = C \cdot HIF$$

where:

HIF = Human Intake Factor. This term describes the average amount of an environmental medium contacted by the exposed person each day. The value of HIF is typically given by:

$$HIF = (IR / BW) \cdot (EF \cdot ED / AT)$$

The units of HIF depend on the medium being evaluated (kg/kg-day for solid media such as soil, L/kg-day for water, and m^3/kg-day for air).

3.4.2 Selection of Exposure Points

An exposure point (also referred to as an exposure unit) is an area where a receptor (a worker or resident) may be exposed to one or more environmental media. Selection of the bounds of an exposure point is based mainly on a consideration of the likely activity patterns of the exposed receptors; that is, an exposure point is an area within which a receptor is likely to spend most of their time and to move about more or less at random.

Exposure Points for Soil

For current or future workers, it is considered likely that most workers would be randomly exposed across the entire site. Thus, the entire site is identified as the most relevant exposure point. However, it is plausible that some workers might tend to be preferentially exposed at a specific sub-location of the site. In order to address this possibility, the 10 "lots" established by the Washington Group in the Phase 2 sampling program (Washington Group 2001c) were also evaluated as potential exposure points for on-site workers. In addition, it is possible that some workers might be preferentially exposed at the "waste piles" of contaminated soil that exist on site, and these were also evaluated as a potential exposure point.

For hypothetical future residents, the exposure points would be equal to the future residential properties. In the absence of a plan for residential site development, it is assumed that each of the 10 lots established by the Washington Group (Washington Group 2001c) might be a potential future residence (each is about 0.5 acres in size), and so these are evaluated as the exposure points for residences.

Exposure Points for Groundwater

Because the pattern of groundwater contamination appears to be variable as a function of location, exposure and risk from groundwater ingestion and inhalation of VOCs released from groundwater to indoor air will vary depending on the precise location where a hypothetical future drinking water well might be installed. Therefore, risks from groundwater were evaluated on a well-by-well basis. As noted above, data from well IW-GW-04 were not included in this evaluation, since the data were collected several years ago (1998), and the well is now dry. Thus, this well is not considered to provide relevant data on current groundwater conditions.

Exposure Points for Soil Gas

As discussed above, risks from VOCs in soil gas are due to intrusion of the soil gas into a building. Thus, the risks depend on the location of the building and the concentration of VOCs in subsurface soil and/or groundwater beneath the building. At present, there are two buildings on site: the laboratory (located mainly on Lot 2) and the garage (located mainly on Lot 7). In the future, it is assumed a building could be constructed anywhere on the site, especially if the land is developed for future residential use. Based on this, the exposure points for exposure to soil gas were based on the 10 lots identified as potential future residential construction sites.

If a hypothetical future building constructed on-site is relatively large compared to the size of the lot (i.e., the building footprint covers most of the lot), then the most appropriate exposure point concentration would be the lot-wide average concentration, since VOCs from the entire lot would impact the building. If the hypothetical future building is significantly smaller than a lot, then the level of VOCs in indoor air would depend on precisely where in the lot the building was constructed. Therefore, in order to generate bounding estimates that span these two extremes, risks were evaluated both for the lot-wide average and the lot-specific maximum concentration of each VOC of potential concern.

3.4.3 Exposure Point Concentrations (EPCs)

Approach for Soil

The exposure medium of chief concern for direct contact with soil is soil which is present at the surface. Therefore, all EPCs were based on soil samples that are from 0-1 foot in depth. If future excavations were ever to bring subsurface soil to the surface, it is expected that exposures to PAHs (the COPCs of concern) would decrease because subsurface soils are less contaminated than (see Figure 2-4).

Because of the assumption of random exposure over the exposure point, risk from a chemical is related to the arithmetic mean concentration of that chemical averaged over the entire exposure point. Since the true arithmetic mean concentration cannot be calculated with certainty from a limited number or measurements, the USEPA recommends using the upper 95th percentile confidence interval (UCL) of the arithmetic mean at each exposure point when calculating exposure and risk at that location (USEPA 1992a). If the 95% UCL exceeds the highest detected concentration, the highest detected value is used instead (USEPA 1989).

The equation used to compute the 95% UCL of a data set depends on the distribution (normal, lognormal) of the values (USEPA 1992a). Most environmental data sets are found to be right skewed and are usually well approximated by a lognormal distribution, so the UCL equation for lognormal data is used as the default approach. However, in special cases, the formula for calculating the 95% UCL of the mean for a lognormal distribution may return a value lower than the sample mean. In this case, the 95% UCL based on an assumed normal distribution is used.

When calculating an EPC, samples with concentrations below the detection limit are evaluated by assuming a concentration value equal to one-half of the detection limit (USEPA 1989). Rejected (R-qualified) data are not used when calculating an EPC.

Approach for Groundwater

As noted above, because risk from groundwater is evaluated on a well-by-well basis, the exposure parameter of interest is the long-term average concentration and/or the 95% UCL in each well. However, at present there are only one or two data points available for each well, so it is not possible to calculate a meaningful UCL. Therefore, risks were based on the maximum measured value at each well (non-detects were evaluated at ½ the detection limit). EPA is continuing to investigate and characterize groundwater contamination at the site (as Operable Unit 2), and data from this on-going investigation will be used to refine and update risk estimates related to groundwater contamination.

For release of VOCs from indoor water to indoor air, the EPC in air was estimated using the transfer factor approach recommended by USEPA (1991c):

$$C(air) = C(water) \cdot TF$$

where:

C(air)	=	Concentration of VOC in indoor air that arises from release from indoor uses of groundwater (mg/m^3)
C(water)	=	Concentration of VOC in groundwater (mg/L)
TF	=	Transfer factor (mg/m^3 in air per mg/L in water)

Most measured transfer factors for VOCs generally range from about 0.05 to 0.1 mg/m^3 per mg/L, so a conservative value of 0.5 mg/m^3 per mg/L is used in these calculations (USEPA 1991c).

Approach for VOC Intrusion from Soil

Concentrations of VOCs in indoor air attributable to intrusion from subsurface soil were estimated by modeling using the soil gas model developed by Johnson and Ettinger (1991). These calculations were performed using the computer spreadsheets developed by USEPA (2000) that are available online at http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm.

Table 3-5 lists the model inputs selected for use in the exposure calculations. The soil type (sandy loam) was based on a comparison of data from the well logs, characteristics of soil samples analyzed in the laboratory from piezometer 1, and the soil input descriptions provided in the model. Although the well logs and laboratory samples indicate that the shallower soils (12 feet and less) contain more fines, these appear to be in lenses which do not run consistently throughout the site. Therefore, sandy loam was judged to be the most representative value for the site as a whole, and the same soil type was used for both the slab and basement scenarios [2].

For soil gas intrusion from soil, two alternative building construction scenarios were evaluated: the slab-on-grade scenario and the basement scenario. In both cases, the depth to contaminated soil was assumed to be equal to the depth to the bottom of the building (i.e., the building is assumed to be built directly on the contaminated soil). For the slab-on-grade scenario, soil samples from all depths were used in calculation of average and maximum values. For the basement scenario (depth to floor = 8 feet), only samples deeper than two feet were used.

Results

Appendix E presents detailed tables with calculated exposure point concentrations for COPCs in soil, groundwater and indoor air, stratified by exposure point.

3.4.4 Human Exposure Parameters

For every exposure pathway of potential concern, it is expected that there will be differences between different individuals in the level of exposure at a specific location due to differences in intake rates, body weights, exposure frequencies and exposure durations. Thus, there is normally a

[2] Note that a soil type of sand was used in COPC selection in order to be maximally conservative. However, this is not judged to be realistic or appropriate for use in exposure and risk calculation, so the soil type used in risk calculations is based on site-specific data.

Table 3-5 Inputs Used in Modeling Indoor Air Concentrations for VOCs Released from Soil

Parameter	Value	Basis
Concentration in source (soil, water)	Chemical and location specific	Site data
Depth below grade to bottom of enclosed space floor	15 cm 200 cm	Model default for slab-on-grade building Model default for structure with basement
Depth below grade to top of soil contamination	15 cm 200 cm	Slab on grade scenario Basement scenario
Average soil temperature	10°C	Model default
Vadose zone SCS soil type	Sandy loam	Site specific data (Washington Group 2001d)
Vadose zone soil dry bulk density	1.5 g/cm^3	Assumed value for sandy loam
Vadose zone soil total porosity	0.43	Assumed value for sandy loam
Vadose zone soil water-filled porosity	0.10 cm^3/cm^3	Conservative estimate
Vadose zone soil organic carbon fraction	0.002	Mean of site-specific data for depths greater than 5 feet (Washington Group 2001d)

Johnson and Ettinger (1991) model calculations implemented using spreadsheet developed by USEPA (2000).

wide range of average daily intakes between different members of an exposed population. Because of this, all daily intake calculations must specify what part of the range of doses is being estimated. Typically, attention is focused on intakes that are "average" or are otherwise near the central portion of the range, and on intakes that are near the upper end of the range (e.g., the 95th percentile). These two exposure estimates are referred to as Central Tendency Exposure (CTE) and Reasonable Maximum Exposure (RME), respectively.

This variability in exposure between different members of the population should not be confused with the difficulties that are often encountered in attempting to estimate either CTE or RME daily chemical intake levels. These difficulties arise because there are usually insufficient data to accurately define the true distribution of key variables and to accurately identify key exposure parameters such as typical and upper bound intake rates, exposure frequencies and exposure durations. Thus, intake calculations should always be viewed as estimates that have an associated degree of uncertainty, both for CTE and RME values. This uncertainty is discussed in Section 6.

The USEPA has collected a wide variety of data and has performed a number of studies to help establish default or interim values for most residential and worker exposure parameters. The chief sources of these values are the following documents:

1. Risk Assessment Guidance for Superfund (RAGS). Volume I. Human Health Evaluation Manual (Part A). USEPA 1989.

2. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". USEPA 1991a.

3. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Draft. USEPA 1993.

Table 3-6 lists the default exposure parameters recommended by EPA for evaluation of worker and residential exposure by inhalation, ingestion of groundwater, and incidental ingestion of soil or dust, along with the resulting HIF terms for CTE and RME exposure.

Table 3-6. Exposure Parameters

Scenario	Variable	Units	On-Site Worker				Future Resident			
			CTE	Source	RME	Source	CTE	Source	RME	Source
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[3]	1.0	[1]	1.4	[2]	2	[2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	L/kg-d	6.00E-03	[4]	9.78E-03	[4]	1.92E-02	[4]	2.74E-02	[4]
	HIF(cancer)	L/kg-d	4.29E-04	[4]	3.49E-03	[4]	2.47E-03	[4]	1.17E-02	[4]
Inhalation of Indoor Air	Inhalation rate (indoors)	m^3/day	10	[5]	20	[1,2]	13	[5]	20	[1,2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	m3/kg-d	8.57E-02	[4]	1.96E-01	[4]	1.78E-01	[4]	2.74E-01	[4]
	HIF(cancer)	m3/kg-d	6.12E-03	[4]	6.99E-02	[4]	2.29E-02	[4]	1.17E-01	[4]
Ingestion of Soil	Ingestion rate as child	mg/day	--		--		100	[1,2]	200	[1,2]
	Body weight as child	kg	--		--		15	[1,2]	15	[1,2]
	Exposure frequency as child	days/yr	--		--		350	[2]	350	[1,2]
	Exposure duration as child	yrs	--		--		2	[2]	6	[1,2]
	Ingestion rate as adult	mg/day	50	[2]	100	[2]	50	[2]	100	[2]
	Body weight as adult	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency as adult	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration as adult	yrs	5	[2]	25	[1,2]	7	[2]	24	[1]
	Exposure duration (total)	yrs	5	[4]	25	[4]	9	[4]	30	[4]
	HIF(noncancer)	kg/kg-d	4.29E-07	[4]	9.78E-07	[4]	1.95E-06	[4]	3.65E-06	[4]
	HIF(cancer)	kg/kg-d	3.06E-08	[4]	3.49E-07	[4]	2.51E-07	[4]	1.57E-06	[4]

In accordance with USEPA guidelines, averaging time for cancer = 25,550 days (365 days * 70 yrs). For noncancer, averaging time = exposure duration (yrs) * 365 days.
Soil ingestion HIFs are time weighted fro children and adults.

Sources:

[1] U.S. Environmental Protection Agency. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[3] Professional judgement; Intake by worker assumed to be 1/2 that of resident.

[4] Calculated value.

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

4.0 TOXICITY ASSESSMENT

4.1 OVERVIEW

The basic objective of a toxicity assessment is to identify what adverse health effects a chemical causes, and how the appearance of these adverse effects depends on dose. In addition, the toxic effects of a chemical frequently depend on the route of exposure (oral, inhalation) and the duration of exposure (subchronic, chronic or lifetime). Thus, a full description of the toxic effects of a chemical includes a listing of what adverse health effects the chemical may cause, and how the occurrence of these effects depends upon dose, route, and duration of exposure.

The toxicity assessment process is usually divided into two parts: the first characterizes and quantifies the non-cancer effects of the chemical, while the second addresses the cancer effects of the chemical. This two-part approach is employed because there are typically major differences in the time-course of action and the shape of the dose-response curve for cancer and non-cancer effects.

Non-Cancer Effects

Essentially all chemicals can cause adverse health effects if given at a high enough dose. However, when the dose is sufficiently low, typically no adverse effect is observed. Thus, in characterizing the non-cancer risks of a chemical, the key parameter is the threshold dose at which an adverse effect first becomes evident. Doses below the threshold are considered to be safe, while doses above the threshold are likely to cause an effect.

The threshold dose is typically estimated from toxicological data (derived from studies of humans and/or animals) by finding the highest dose that does not produce an observable adverse effect, and the lowest dose which does produce an effect. These are referred to as the "No-observed-adverse-effect-level" (NOAEL) and the "Lowest-observed-adverse-effect-level" (LOAEL), respectively. The threshold is presumed to lie in the interval between the NOAEL and the LOAEL. However, in order to be conservative (protective), non-cancer risk evaluations are not based directly on the threshold exposure level, but on a value referred to as the Reference Dose (RfD). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

The RfD is derived from the NOAEL (or the LOAEL if a reliable NOAEL is not available) by dividing by an "uncertainty factor". If the data are from studies in humans, and if the observations are considered to be very reliable, the uncertainty factor may be as small as 1.0. However, the uncertainty factor is normally at least 10, and can be much higher if the data are limited. The effect of dividing the NOAEL or the LOAEL by an uncertainty factor is to ensure that the RfD is not higher than the threshold level for adverse effects. Thus, there is always a "margin of safety" built into an RfD, and doses equal to or less than the RfD are nearly certain to be without any risk of adverse effect. Doses higher than the RfD may carry some risk, but because of the margin of safety, a dose above the RfD does not mean that an effect will necessarily occur.

Cancer Effects

For cancer effects, the toxicity assessment process has two components. The first is a qualitative evaluation of the weight of evidence (WOE) that the chemical does or does not cause cancer in humans. Typically, this evaluation is performed by the USEPA, using the system summarized in the table below:

WOE Group	Meaning	Description
A	Known human carcinogen	Sufficient evidence of cancer in humans.
B1	Probable human carcinogen	Suggestive evidence of cancer incidence in humans.
B2	Probable human carcinogen	Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.
C	Possible human carcinogen	Suggestive evidence of carcinogenicity in animals.
D	Cannot be evaluated	No evidence or inadequate evidence of cancer in animals or humans.

For chemicals which are classified in Group A, B1, B2, or C, the second part of the toxicity assessment is to describe the carcinogenic potency of the chemical. This is done by quantifying how the number of cancers observed in exposed animals or humans increases as the dose increases. Typically, it is assumed that the dose response curve for cancer has no threshold, arising from the origin and increasing linearly until high doses are reached. Thus, the most convenient descriptor of cancer potency is the slope of the dose-response curve at low dose (where the slope is still linear). This is referred to as the Slope Factor (SF), which has dimensions of risk of cancer per unit dose.

Estimating the cancer Slope Factor is often complicated by the fact that observable increases in cancer incidence usually occur only at relatively high doses, frequently in the part of the dose-response curve that is no longer linear. Thus, it is necessary to use mathematical models to extrapolate from the observed high dose data to the desired (but unmeasurable) slope at low dose. In order to account for the uncertainty in this extrapolation process, USEPA typically chooses to employ the upper 95th confidence limit of the slope as the Slope Factor. That is, there is a 95 percent probability that the true cancer potency is lower than the value chosen for the Slope Factor. This approach ensures that there is a margin of safety in cancer as well as noncancer risk estimates.

4.2 TOXICITY VALUES

Toxicity values (RfD and SF values) that have been established by USEPA are listed in a database referred to as "IRIS" (Integrated Risk Information System) (IRIS 2002). Other toxicity values are listed in the Health Effects Assessment Summary Tables (HEAST)(USEPA 1997), or are available as interim recommendations from USEPA's Superfund Technical Assistance Center operated by the National Center for Environmental Assessment (NCEA). Most of these values are also compiled in the Risk-Based Concentration tables developed and maintained by EPA Region 3 (USEPA 2002).

4.2.1 Noncancer Effects from Oral Exposure

Table 4-1 summarizes the characteristic noncancer health effects of the chemicals of concern at this site, and lists available inhalation and oral RfD values. Points to note regarding the data in this table are listed below:

- The RfD for manganese is based on the oral RfD of 1.4E-01 in the diet, divided by a Modifying Factor of 3 for exposure to manganese in non-food materials (soil, water).

- EPA has not established oral RfD values for benzo(a)anthracene, benzo(a)pyrene, or benzo(b)fluoranthene. The RfD values for these chemicals listed in Table 4-1 are all assumed values, based on the oral RfD value for naphthalene. This value for naphthalene is employed because it is the lowest oral RfD for a PAH-class compound.

Table 4-1 Non-Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	Characteristic Non-cancer effects	oRfD (mg/kg-day)	Source
Inorganics	Manganese	Central nervous system effects	4.7E-02	a,b
PAHs	Benzo(a)Anthracene	Decreased body weight gain	2E-02	a,c
	Benzo(a)Pyrene	Decreased body weight gain	2E-02	a,c
	Benzo(b)Fluoranthene	Decreased body weight gain	2E-02	a,c
SVOCs	Bis(2-Ethylhexyl)Phthalate	Increased relative liver weight	2E-02	a
VOCs	Acetophenone	General toxicity	1E-01	a
	Trichloroethylene	Renal toxicity	3E-04	d

(a) IRIS
(b) RfD for food (1.4E-01 mg/kg-day) divided by Modifying Factor of 3 as recommended by IRIS.
(c) RfD values are not established for the PAHs shown; the value employed is the RfD for naphthalene.
(d) USEPA (2001)

- The oral RfD for trichloroethylene (TCE) is a provisional value developed by EPA, and hence has more uncertainty associated with it than verified RfD values.

4.2.2 Cancer Effects from Oral Exposure

Table 4-2 summarizes available information on the cancer potential of each of the chemicals of concern at this site. Points to note regarding the data in this table are listed below:

- The toxicity values for benzo(a)anthracene and benzo(b)fluoranthene are extrapolated from the oral slope factor for benzo(a)pyrene, using relative potency factors (RPF) recommended by USEPA (1994). That is:

  $$oSF_x = oSF_{BaP} \cdot RPF_x$$

  The RPF for both benzo(a)anthracene and benzo(b)fluoranthene are both 0.1 (USEPA 1994), so the oral SF for each is 7.3E-01 $(mg/kg\text{-}d)^{-1}$.

- For TCE, EPA has not identified a consensus oral slope factor value, but rather a range of alternative estimates, most of which are between 2E-02 and 4E-01 $(mg/kg\text{-}day)^{-1}$ (USEPA 2001). The value used in this assessment is the geometric mean between these two values.

4.2.3 Cancer and Non-Cancer Effects from Inhalation Exposure

Table 4-3 summarizes available toxicity information on the inhalation toxicity of VOCs identified as COPCs in indoor air. Points to note regarding the data in this table are listed below:

- Inhalation toxicity values in IRIS are generally reported as inhalation reference concentrations (iRfC) and inhalation unit risks (iUR) rather than inhalation reference dose or inhalation slope factor. The equations used to convert RfC and iUR values to RfD and SF values are as follows:

  $$iRfD\ (mg/kg\text{-}d) = iRfC\ (mg/m^3) * (20\ m^3/day\ /\ 70\ kg)$$
  $$iSF\ (mg/kg\text{-}d)\text{-}1 = iUR\ (ug/m^3)\ /\ (1E\text{-}03\ mg/m^3 * 20\ m^3/day\ /\ 70\ kg)$$

- The inhalation RfD for cis-1,2-DCE is a provisional value established by EPA, and hence there is more uncertainty associated with this value than with other verified values. This

Table 4-2 Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	WOE	Characteristic Cancer Effects	oSF $(mg/kg\text{-}day)^{-1}$	Source
Inorganics	Manganese	D	--	--	
PAHs	Benzo(a)Anthracene	B2	Stomach tumors	7.3E-01	a,b
	Benzo(a)Pyrene	B2	Stomach tumors	7.3E+00	a
	Benzo(b)Fluoranthene	B2	Stomach tumors	7.3E-01	a,b
SVOCs	Bis(2-Ethylhexyl)Phthalate	B2	Hepatocellular carcinoma and adenoma	1.4E-02	a
VOCs	Acetophenone	D	--	--	
	Trichloroethylene	--	Pulmonary and liver tumors	9.0E-02	c

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans
D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans
– = No data

Data Source:
(a) IRIS
(b) oSF values are based on benzo(a)pyrene and relative potency factors recommended by EPA (1994).
(c) USEPA (2001)

Table 4-3 Inhalation Toxicity Factors

Parameter	Inhalation Toxicity Factors				
	Non-Cancer		Cancer		
	iRfD (mg/kg-d)	Source	WOE	iSF (mg/kg-d)-1	Source
1 2 4-Trimethylbenzene	1.7E-03	b	--	--	
1 2-Dichloroethane	1.4E-03	b	B2	9.1E-02	a
1 3 5-Trimethylbenzene	1.7E-03	b	--	--	
Benzene	1.7E-03	b	A	2.7E-02	a
cis-1 2-Dichloroethylene	1.0E-02	c	D	--	
Ethylbenzene	2.9E-01	a	D	--	
Hexane	5.7E-02	a	--	--	
Isopropylbenzene	1.1E-01	a	D	--	
Methylene Chloride	8.6E-01	b	B2	1.6E-03	a
Tetrachloroethylene	1.4E-01	b	--	2.0E-03	c
Toluene	1.1E-01	a	D	--	
Naphthalene	8.6E-04	a	C	--	
Acetone	1.0E-01	c	D	--	
Trichloroethylene	1.1E-02	d	--	6.0E-03	b
Acetphenone	--	--	--	--	

-- = No data

A = Known human carcinogen: Sufficient evidence of cancer in humans.

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.

C = Possible human carcinogen: Suggestive evidence of carcinogenicity in animals.

D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans.

(a) Values from IRIS
(b) Values from Region 3 Table (USEPA 2002)
(c) Values from USEPA 2000
(d) Values from USEPA 2001

value was also used to evaluate risk from total 1,2-DCE (mixed isomers), since available data suggest that the cis-isomer is more toxic than the trans-isomer.

- The inhalation slope factor for tetrachloroethylene is also a provisional value established by EPA, and hence there is more uncertainty associated with this value than with other verified slope factors.

5.0 RISK CHARACTERIZATION

5.1 BASIC METHODS

Noncancer Risk

The potential for noncancer effects from exposure to a chemical is evaluated by comparing the estimated chronic daily intake of the chemical over a specific time period with the RfD for that chemical derived for a similar exposed period. This comparison results in a noncancer Hazard Quotient, as follows (USEPA 1989):

$$HQ = CDI / RfD$$

where:

HQ	=	Hazard Quotient
CDI	=	Chronic Daily Intake (mg/kg-day) for non-cancer effects
RfD	=	Reference Dose (mg/kg-day)

If the HQ for a chemical is equal to or less than one (1E+00), it is believed that there is no appreciable risk that noncancer health effects will occur. If an HQ exceeds 1E+00, there is some possibility that noncancer effects may occur, although an HQ above 1E+00 does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all RfD values. However, the larger the HQ value, the more likely it is that an adverse effect may occur.

If more than one chemical affects the same target tissue or organ system (e.g., the liver), then the total risk of adverse effects in that tissue is referred to as the Hazard Index (HI), and is estimated by summing the HQ values for all chemicals that act on that tissue.

Cancer Risk

The risk of cancer from exposure to a chemical at a site is described in terms of the probability that an exposed individual will develop cancer because of that exposure by age 70. For each chemical of concern, this value is calculated from the lifetime average chronic daily intake of the chemical from the site, averaged over a lifetime (CDI_L), and the slope factor (SF) for the chemical, as follows (USEPA 1989):

$$\text{Cancer Risk} = 1 - \exp(-CDI_L \cdot SF)$$

In most cases (except when the product of $CDI_L \cdot SF$ is larger than about 0.01), this equation may be accurately approximated by the following:

$$\text{Cancer Risk} \approx CDI_L \cdot SF$$

Excess cancer risks are summed across all chemicals of concern and all exposure pathways that contribute to exposure of an individual in a given population.

The level of total excess cancer risk that is of concern is a matter of personal, community and regulatory judgement. In general, the USEPA considers excess cancer risks that are below about 1E-06 to be so small as to be negligible, and excess risks above 1E-04 to be sufficiently large that some sort of intervention or remediation is desirable. Excess cancer risks that range between 1E-04 and 1E-06 are generally not considered large enough to warrant action under Superfund (USEPA 1991b), although this is evaluated on a case by case basis.

5.2 RESULTS

The detailed calculations of cancer and noncancer risks are presented in Appendix F. Results are summarized below. In accord with USEPA guidance, all risk values are expressed to one significant figure.

5.2.1 Risks from Ingestion of Soil

Detailed calculations of risk from ingestion of soil are presented in Appendix F-1 and are summarized in Table 5-1. As seen, noncancer risks are below a level of concern in all cases (i.e., HI < 1E+00), even if exposure were to occur preferentially at the waste piles of contaminated soil. Likewise, excess cancer risks are all within or below the EPA risk range (1E-04 to 1E-06). These results indicate that direct ingestion of soil is not likely to be of significant concern to either workers or hypothetical future on-site residents.

5.2.2 Risks from Groundwater

Detailed risk calculations for hypothetical future exposure to groundwater are presented in Appendix F-2 and F-3, and the results are summarized in Table 5-2. The upper panel shows the

Table 5-1 Summary of Risks from Soil Ingestion

Location	Worker				Resident			
	Non-cancer HI		Excess Cancer Risk		Non-cancer HI		Excess Cancer Risk	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Sitewide	7E-04	2E-03	1E-06	1E-05	3E-03	6E-03	9E-06	6E-05
Lot 1	2E-05	4E-05	5E-08	5E-07	8E-05	1E-04	4E-07	2E-06
Lot 2	3E-05	8E-05	1E-07	1E-06	2E-04	3E-04	1E-06	6E-06
Lot 3	5E-05	1E-04	1E-07	1E-06	2E-04	4E-04	1E-06	7E-06
Lot 4	7E-05	2E-04	2E-07	2E-06	3E-04	6E-04	2E-06	1E-05
Lot 5	8E-05	2E-04	3E-07	4E-06	4E-04	7E-04	3E-06	2E-05
Lot 6	2E-05	3E-05	5E-08	6E-07	7E-05	1E-04	4E-07	2E-06
Lot 7	4E-05	8E-05	1E-07	1E-06	2E-04	3E-04	1E-06	7E-06
Lot 8	7E-05	2E-04	2E-07	3E-06	3E-04	6E-04	2E-06	1E-05
Lot 9	7E-05	2E-04	2E-07	2E-06	3E-04	6E-04	2E-06	9E-06
Lot 10	9E-05	2E-04	3E-07	4E-06	4E-04	8E-04	3E-06	2E-05
Waste piles	2E-03	4E-03	3E-07	3E-06	7E-03	1E-02	2E-06	1E-05

All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
HI = Hazard Index

Table 5-2 Summary of Risks from Groundwater

INGESTION

Well ID	Lot	N	Worker				Resident			
			Non-cancer HI		Excess Cancer Risk		Non-cancer HI		Excess Cancer Risk	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME
MW-02/PZ-02	1	2	3E-01	5E-01	3E-07	2E-06	9E-01	1E+00	2E-06	8E-06
MW-04	2	1	5E-02	5E-02	6E-08	5E-07	2E-01	2E-01	4E-07	2E-06
MW-05	6	1	1E-01	2E-01	2E-07	2E-06	4E-01	5E-01	1E-06	6E-06
MW-01/PZ-01	8	2	5E-02	8E-02	7E-08	6E-07	2E-01	2E-01	4E-07	2E-06
MW-03/PZ-03	10	2	2E-01	3E-01	2E-07	2E-06	6E-01	8E-01	1E-06	6E-06

INHALATION

Well ID	Lot	N	Worker				Resident			
			Noncancer HQ		Excess Cancer Risk		Noncancer HQ		Excess Cancer Risk	
			CTE	RME	CTE	RME	CTE	RME	CTE	RME
MW-02/PZ-02	1	2	5E-02	1E-01	2E-07	3E-06	1E-01	2E-01	9E-07	5E-06
MW-04	2	1	6E-03	1E-02	3E-08	4E-07	1E-02	2E-02	1E-07	6E-07
MW-05	6	1	4E-02	8E-02	2E-07	2E-06	7E-02	1E-01	7E-07	3E-06
MW-01/PZ-01	8	2	7E-03	2E-02	3E-08	4E-07	1E-02	2E-02	1E-07	7E-07
MW-03/PZ-03	10	2	4E-02	8E-02	2E-07	2E-06	7E-02	1E-01	7E-07	3E-06

All values shown to 1 significant figure
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
HI = Hazard Index
HQ = Hazard Quotient

risks from groundwater ingestion, while the lower panel shows the risks associated with inhalation of volatile COPCs released from indoor water uses to indoor air.

As seen, all wells are within or below EPA's risk range for excess cancer risk for both ingestion (upper panel) and inhalation of VOCs released from indoor water (lower panel). Likewise, noncancer HI values are also below a level of concern (HI ≤ 1E+00) at all wells for both ingestion and inhalation exposure.

In interpreting these results, it is important to recall that only one or two groundwater samples are presently available for each well, so the long-term average concentration values within a well may be either higher or lower than the current estimates.

As noted earlier, risk calculations shown in Table 5-2 did not include well IW-GW-04 located in Lot 3, since that well is now dry and the values from that well are no longer applicable. However, it should be noted that the concentration of organic solvents (TCE and DCE) measured in that well in 1998 would be associated with excess cancer and/or noncancer risks that are above EPA's risk range for both the worker and the resident for both ingestion and inhalation exposure.

5.2.3 Risks from Inhalation of VOCs Intruding from Soil

Appendix F-4 presents the detailed calculations of risk from potential inhalation exposure to VOCs intruding into indoor air from soil into indoor air. Inhalation exposures due to VOCs emanating from groundwater are not included because screening calculations indicate that groundwater is not a significant source of VOC intrusion at this site (see Section 3.3).

The results are summarized in Table 5-3. As described earlier, the evaluation of this exposure pathway considered two alternative building construction scenarios (slab-on-grade and basement), and for each of these, two alternative building sizes were assessed: a large building that covers most of the lot (evaluated by using the average soil concentration for the lot) and a small building (evaluated by using the maximum concentration for the lot).

As seen, excess cancer risks are within or below EPA's risk range in all lots for all scenarios. Likewise, noncancer risks are mainly below a level of concern (HI ≤ 1E+00) except for lots 3, 4, 5, and 8. At these lots, noncancer risks may enter a range of potential concern for both workers and residents, with HI values ranging from 2E+00 to 2E+01. The majority of the risk is due to 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, with smaller contributions from naphthalene, hexane and cis-1,2-dichloroethylene in some locations.

Table 5-3. Summary of Risks from VOCs Intrusion from Soil

Basement Scenario (Soil Depth>2ft), Worker

	Noncancer HI				Excess Cancer Risk			
Locations	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	2E-03	3E-03	2E-03	3E-03	6E-09	7E-08	6E-09	7E-08
Lot 2	7E-03	2E-02	2E-02	5E-02	3E-08	4E-07	9E-08	1E-06
Lot 3	1E+00	3E+00	3E+00	7E+00	1E-07	2E-06	4E-07	4E-06
Lot 4	7E-03	2E-02	1E-02	3E-02	3E-08	4E-07	5E-08	6E-07
Lot 5	2E-03	5E-03	4E-03	9E-03	2E-08	2E-07	2E-08	2E-08
Lot 6	2E-02	4E-02	2E-02	4E-02	7E-08	8E-07	7E-08	8E-07
Lot 7*	--	--	--	--	--	--	--	--
Lot 8	6E-03	1E-02	2E-02	4E-02	3E-08	3E-07	6E-08	7E-07
Lot 9	2E-02	4E-02	3E-02	7E-02	4E-08	4E-07	6E-08	7E-07
Lot 10	2E-03	3E-03	2E-03	3E-03	1E-08	1E-07	1E-08	1E-07

Basement Scenario (Soil Depth>2ft), Residents

	Noncancer HI				Excess Cancer Risk			
Locations	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	3E-03	5E-03	3E-03	5E-03	2E-08	1E-07	2E-08	1E-07
Lot 2	2E-02	2E-02	4E-02	6E-02	1E-07	6E-07	3E-07	2E-06
Lot 3	3E+00	4E+00	7E+00	1E+01	5E-07	3E-06	1E-06	7E-06
Lot 4	1E-02	2E-02	2E-02	4E-02	1E-07	6E-07	2E-07	1E-06
Lot 5	5E-03	7E-03	8E-03	1E-02	6E-08	3E-07	9E-08	4E-07
Lot 6	4E-02	6E-02	4E-02	6E-02	3E-07	1E-06	3E-07	1E-06
Lot 7*	--	--	--	--	--	--	--	--
Lot 8	1E-02	2E-02	3E-02	5E-02	1E-07	5E-07	2E-07	1E-06
Lot 9	3E-02	5E-02	6E-02	1E-01	1E-07	7E-07	2E-07	1E-06
Lot 10	3E-03	5E-03	3E-03	5E-03	4E-08	2E-07	4E-08	2E-07

Slab Scenario (All Soil Depths), Worker

	Noncancer HI				Excess Cancer Risk			
Locations	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	9E-02	2E-01	4E-01	9E-01	6E-08	6E-07	2E-07	2E-06
Lot 2	1E-02	3E-02	5E-02	1E-01	4E-08	5E-07	1E-07	1E-06
Lot 3	9E-01	2E+00	5E+00	1E+01	1E-07	1E-06	6E-07	6E-06
Lot 4	7E-01	2E+00	5E+00	1E+01	2E-07	3E-06	2E-06	2E-05
Lot 5	6E-01	1E+00	3E+00	6E+00	2E-07	2E-06	6E-07	7E-06
Lot 6	2E-02	4E-02	3E-02	7E-02	6E-08	7E-07	1E-07	1E-06
Lot 7	1E-02	3E-02	4E-02	9E-02	4E-08	5E-07	1E-07	1E-06
Lot 8	8E-01	2E+00	3E+00	6E+00	4E-08	5E-07	2E-07	2E-06
Lot 9	2E-02	5E-02	8E-02	2E-01	4E-08	5E-07	2E-07	2E-06
Lot 10	2E-02	5E-02	5E-02	1E-01	6E-08	7E-07	1E-07	1E-06

Slab Scenario (All Soil Depths), Residents

	Noncancer HI				Excess Cancer Risk			
Locations	Avg CTE	Avg RME	Max CTE	Max RME	Avg CTE	Avg RME	Max CTE	Max RME
Lot 1	2E-01	3E-01	8E-01	1E+00	2E-07	1E-06	6E-07	3E-06
Lot 2	3E-02	5E-02	1E-01	2E-01	2E-07	9E-07	5E-07	2E-06
Lot 3	2E+00	3E+00	1E+01	2E+01	4E-07	2E-06	2E-06	1E-05
Lot 4	1E+00	2E+00	1E+01	2E+01	9E-07	5E-06	7E-06	3E-05
Lot 5	1E+00	2E+00	5E+00	8E+00	6E-07	3E-06	2E-06	1E-05
Lot 6	3E-02	5E-02	6E-02	1E-01	2E-07	1E-06	5E-07	2E-06
Lot 7	3E-02	5E-02	8E-02	1E-01	2E-07	9E-07	4E-07	2E-06
Lot 8	2E+00	3E+00	6E+00	9E+00	1E-07	8E-07	6E-07	3E-06
Lot 9	5E-02	7E-02	2E-01	3E-01	2E-07	8E-07	6E-07	3E-06
Lot 10	5E-02	7E-02	1E-01	2E-01	2E-07	1E-06	5E-07	2E-06

*No soil samples were collected in Lot 7 at a depth >2 feet.
All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
HI = Hazard Index

5.2.4 Combined Risks from All Exposure Pathways

Table 5-4 presents a summary of the range of risks which might occur if the same worker or future resident were exposed by all of the primary exposure pathways at a lot (soil ingestion, groundwater ingestion, inhalation of VOCs released to indoor air from indoor water, inhalation of VOCs intruding into indoor air from soil). Because risks from intrusion of VOCs depend on the type of building (slab *vs* basement) and on the size of the building (large *vs* small), the total are presented separately for the minimum and the maximum contribution from the soil gas intrusion estimates.

As seen, even when all exposure pathways are combined, excess cancer risks still fall within or below EPA's risk range (1E-04 to 1E-06) for both residents and workers. For non-cancer risks, screening level HI values exceed a value of 1E+00 in Lots 1, 3, 4, 5, and 8 in several cases. These exceedences are due mainly to risks attributable to VOC intrusion from soil, with only low risk from ingestion of soil or groundwater.

Table 5-4 Summary of Total Risks

Minimum Contribution for Volatile Organic Compounds

Location	Worker				Resident			
	Non-cancer HI		Excess Cancer Risk		Non-cancer HI		Excess Cancer Risk	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Lot 1	3E-01	6E-01	6E-07	6E-06	1E+00	1E+00	3E-06	2E-05
Lot 2	6E-02	8E-02	3E-07	3E-06	2E-01	3E-01	2E-06	9E-06
Lot 3	9E-01	2E+00	2E-07	3E-06	2E+00	3E+00	1E-06	9E-06
Lot 4	7E-03	2E-02	2E-07	3E-06	1E-02	2E-02	2E-06	1E-05
Lot 5	2E-03	5E-03	4E-07	4E-06	5E-03	8E-03	3E-06	2E-05
Lot 6	2E-01	3E-01	5E-07	5E-06	5E-01	7E-01	2E-06	1E-05
Lot 7	1E-02	3E-02	2E-07	2E-06	3E-02	5E-02	1E-06	7E-06
Lot 8	6E-02	1E-01	4E-07	4E-06	2E-01	3E-01	3E-06	1E-05
Lot 9	2E-02	4E-02	2E-07	3E-06	3E-02	5E-02	2E-06	1E-05
Lot 10	2E-01	4E-01	7E-07	8E-06	6E-01	9E-01	5E-06	3E-05

Maximum Contribution for Volatile Organic Compounds

Location	Worker				Resident			
	Non-cancer HI		Excess Cancer Risk		Non-cancer HI		Excess Cancer Risk	
	CTE	RME	CTE	RME	CTE	RME	CTE	RME
Lot 1	7E-01	1E+00	7E-07	7E-06	2E+00	3E+00	4E-06	2E-05
Lot 2	1E-01	2E-01	4E-07	4E-06	3E-01	4E-01	2E-06	1E-05
Lot 3	5E+00	1E+01	7E-07	8E-06	1E+01	2E+01	3E-06	2E-05
Lot 4	5E+00	1E+01	2E-06	2E-05	1E+01	2E+01	8E-06	4E-05
Lot 5	3E+00	6E+00	9E-07	1E-05	5E+00	8E+00	5E-06	3E-05
Lot 6	2E-01	3E-01	5E-07	6E-06	5E-01	7E-01	3E-06	1E-05
Lot 7	4E-02	9E-02	2E-07	3E-06	8E-02	1E-01	1E-06	9E-06
Lot 8	3E+00	6E+00	5E-07	5E-06	6E+00	9E+00	3E-06	2E-05
Lot 9	8E-02	2E-01	3E-07	4E-06	2E-01	3E-01	2E-06	1E-05
Lot 10	3E-01	5E-01	9E-07	9E-06	7E-01	1E+00	5E-06	3E-05

All values shown to 1 significant figure.
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure
HI = Hazard Index

6.0 UNCERTAINTIES

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty (lack of precise knowledge) regarding a number of important exposure and toxicity factors. Thus, exposure and risk calculations are usually derived using a number of estimated values. In general, when data are limited or absent, the exposure and risk parameters selected are chosen in a way that is intentionally conservative. That is, the values selected are more likely to overestimate than underestimate actual risk. However, some assumptions and approaches used in risk assessment may tend to underestimate risks. It is important for risk managers and the public to keep these uncertainties in mind when interpreting the results of a risk assessment. The following sections review the main sources of uncertainty in the exposure and risk calculations performed at this site.

Uncertainties in Analytical Data

The starting point for all quantitative risk assessments is a set of measured concentration values of chemicals in on-site and off-site media. However, measurement of chemical concentrations in site media is not always easy, and some measured values may be uncertain. This is especially true for values near the detection limit of the analytical method. It is because of this uncertainty in measured analytical values that both the laboratory and the data validator assign qualifier codes to each data point. These qualifiers indicate the reason(s) that a particular value may not be highly accurate. In accord with EPA guidance (USEPA 1989, 1992b), most of these data can be used in the risk assessment, so long as the primary uncertainty is the quantitative estimate of concentration rather than the identity of the chemical. This approach is justified because sampling variability (i.e., differences in concentration values as a function of where and when a samples is collected) is generally much larger than the total error in analytical variability (USEPA 1992b). Thus, while analytical uncertainty is a source of uncertainty in quantitative risk estimates, it is generally only a small contributor to the overall uncertainty.

Uncertainties in Exposure Point Concentrations

For exposure to soil, uncertainty in the exposure point concentration arises because the true mean concentration at an exposure point cannot be calculated precisely from a limited set of samples, especially when some of the analytical results are below the limit of detection. The procedure used to deal with non-detects (assuming ½ the detection limit) is likely to result in a relatively small error when most of the samples are above the detection limit, but will usually result in an overestimation of concentration in cases where most of the values are below the detection limit.

Calculating the 95% UCL of the mean based on the assumption of lognormality is likely to be conservative in most cases, since real data sets are only approximately lognormal, and often are somewhat less skewed in the upper tail than a true lognormal distribution. Using the 95% UCL of the mean rather than the best estimate of the mean in the calculation of exposure is always conservative, since there is a 95% probability that the true mean is lower than the 95%. The magnitude of the conservatism (i.e., the ratio between the 95% UCL and the true mean) introduced by use of this approach depends on the number of samples and the degree of inter-sample variability. When sample numbers are small and variability is large, the margin between the 95% UCL and the true mean may be very high (resulting in a substantial overestimate of exposure) in some cases. Using the maximum value in place of the 95% UCL is usually conservative, but the maximum may occasionally be lower than the true mean, especially when there are only a few samples and there is wide inter-sample variability.

For exposure to groundwater, current data include only one or two samples from each well, which may not be sufficient to derive a reliable estimate of the long-term average concentration. Exposure estimates to groundwater were based on the maximum value detected in each well, but actual exposures may be either higher or lower, and repeat sampling from the wells would be needed to improve the reliability of the exposure estimates.

For inhalation exposure to VOCs in indoor air, all EPC values were derived by mathematical modeling rather than by direct measurement. The resulting concentration values are uncertain for two main reasons. First, the starting point for the calculations is the concentration of VOC in source material (subsurface soil, groundwater). However, measurement of VOCs in field samples of soil or water is difficult because of the tendency for VOCs to escape during sample collection and preparation. To the extent that loss of VOCs in the source material did occur prior to analysis, this would result in an underestimation of exposure. However, the extent of any such loss is not known. Second, mathematical fate and transport models can only approximate the very complex processes that control the final concentration in indoor air, and the predicted results may not be highly accurate, especially if non-site specific default parameters are employed for key model variables. To help account for this uncertainty, many of the model defaults are intentionally conservative and hence will tend to overestimate exposures. For example, assuming that the organic carbon content is only 0.2% is likely to be conservative, especially if the soil is contaminated with oil.

Uncertainties in Human Intake Factors for Environmental Media

Quantification of human exposure to contaminated environmental media requires accurate information on the distribution of a number of variable parameters, including intake rates, exposure frequencies, exposure durations, and body weights. For some variables (e.g., water intake, breathing rate, body weight, and exposure frequency of residents and workers), reliable data are available from large national studies, so the uncertainty in these terms is relatively low. However, for some exposure parameters (especially soil intake rates by children and adults), data are much more limited and the default values recommended by EPA are only rough estimates. Thus, estimates of exposure and risk from the soil ingestion pathway should be viewed as substantially more uncertain than estimates for other exposure pathways.

Uncertainties in Toxicity Data

As discussed in Section 4, there is often substantial uncertainty in the toxicity factors (RfD, RfC, slope factor) used to quantify risk from exposure to a chemical. This uncertainty arises both from limitations in the experimental dose-response data (too few doses and/or too few animals to define the dose-response curve, especially at low dose), and in uncertainties regarding if and how to extrapolate toxicity observations from animals to humans. In general, EPA derives toxicity factors through a consensus process that culminates in the listing of "validated" toxicity values in EPA's online IRIS database. However, a number of COPCs at this site do not have toxicity values that have proceeded to this stage, but rather are older un-verified values, or else are provisional values established by NCEA.

For example, the toxicity of TCE remains a difficult and controversial topic, and the current effort to characterize the cancer risk from ingestion of TCE has not resulted in consensus, but rather a range of alternative slope factors that span more than an order of magnitude (USEPA 2001). The risk estimates in this risk assessment for TCE are based on a central estimate (the geometric mean) of cancer potency, but actual risks could be up to 5-times lower or 5-times higher. It is important to realize the uncertainty associated with these un-validated toxicity factors may be high, and that the values might change (either higher or lower) as a final toxicity review occurs.

However, even after a validated toxicity value has been established, significant uncertainty may still remain. This uncertainty usually stems from inherent limitations in the available toxicity data, as well as uncertainty with regard to how data should be extrapolated across species and from high dose to low dose. To account for these data limitations, EPA generally derives toxicity factors in a way that is intentionally conservative. For example, the NOAEL from a study in animals is

divided by a factor of 10 to extrapolate from animals to humans, even though there is usually no evidence that humans are more sensitive, and the value is divided by another factor of 10 to account for potentially susceptible human subpopulations, even though there is rarely any evidence that one type of human is actually more sensitive than another. Likewise, most cancer slope factors are derived by assuming there is no threshold dose (even though there may be a threshold in some cases), and the upper 95% confidence limit on the slope (rather than the best estimate) is used to quantify cancer risk. These conservative tactics in the derivation of toxicity factors are a large source of uncertainty in the risk calculations, and it is considered likely that most calculated risks are larger (sometimes substantially larger) than actual risks.

Uncertainties Due to Chemicals Not Quantified

As discussed in Section 3.2, although many different chemicals were detected in site samples of soil or water, only a few of these were evaluated quantitatively as COPCs. The chemicals which were not quantified may be divided into two basic types:

Type 1. These are chemicals which were excluded because EPA has not developed quantitative toxicity values, and hence it is not possible to calculate quantitative estimates of risk. At this site, there were 51 such chemicals. Omission of these chemicals is a source of uncertainty, and it is considered possible that at least some of these chemicals could contribute risk that is not included in the results presented in Section 5. However, the development of toxicity values by EPA is not a random process, and priority is given to chemicals that are believed to be of greatest health concern. That is, in many cases, absence of an EPA-derived toxicity factor suggests (but does not prove) that the toxicity of the chemical is relatively low, and hence omission of these chemicals from quantitative evaluation probably does not result in a substantial underestimate of total risk.

Type 2. These are chemicals which were excluded from quantitative risk evaluation because they were not detected or were detected only infrequently, but the detection limit was higher than would have been needed to determine if a significant risk actually existed. At this site, there were 10 chemicals with detection limits that were too high to detect cancer risk at the 1E-06 level or noncancer risk (HQ) at the 0.1 level (see Table 3-3). However, none of these chemicals had detection limits that were too high to allow quantification of cancer risks at the 1E-04 level or of noncancer risks at the HQ = 1E+00 level. Thus, while omission of these chemicals is expected to result in an underestimate of total risk, the magnitude of this error is expected to be low.
A case study that may be used to test the general hypothesis that omitted chemicals are not likely to be of substantial concern is the class of chemicals referred to as total petroleum hydrocarbons (TPH). As noted in Section 2, contamination of soil with TPH is one of the main concerns at this

site, and human exposure to TPH is quite likely. The risks from the most hazardous of the individual chemicals present in TPH (benzene, toluene, ethyl benzene, xylene, and the PAHs) are all evaluated individually, and this likely accounts for most of the hazard associated with TPH. However, these specific chemicals constitute only a small fraction of the TPH group. The remainder of the group is composed mainly of aliphatics (straight chain, branched and cyclic alkanes and alkenes). EPA has not derived any toxicity factors for the aliphatic fractions of TPH, but proposed values are available from the State of Utah (UDEQ 1999). These values are summarized below:

Oral Toxicity Values for TPH Fractions

Aliphatic Fraction	Oral RfD (mg/kg-day)
C5-C6	6E-02
C7-C8	6E-02
C9-C10	1E-01
C11-C12	1E-01
C13-C16	1E-01
C17-C21	2E+00
C22-C35	2E+00

Data on TPH levels at the site are available for three size fractions (C6-C12, C12-C28, and C28-C35). Because these fractions do not correspond to any of the size fractions established by the State of Utah, and because the relative contribution of each of the Utah fractions to the measured fractions is not known, only screening level calculations are possible, as shown in Table 6-1.

As seen, even when the maximum detected concentrations of TPH in site soils are used, estimated noncancer risks from the aliphatic fractions of TPH do not reach a level of concern to either workers or hypothetical future residents. This suggests that TPH (and probably most other chemicals that lack EPA-derived toxicity factors) are not likely to contribute substantial risk.

Uncertainties Due to Pathways Not Quantified

As discussed in Section 3, humans may be exposed to environmental contaminants by a wide variety of pathways, but not all of these are likely to be equally important. For example, exposures through inhalation of dust in air and dermal contact with soil were not evaluated quantitatively in this assessment. Omission of these pathways will tend to underestimate total exposure and risk, but it is believed that the magnitude of the exposure through these pathways (and hence the

Table 6-1. Screening Level Evaluation of Non-Cancer Risks from Total Petroleum Hydrocarbon Fractions

Average

Population	Fraction	Conc ppm	RfD mg/kg-d		HIF CTE	HIF RME	HQ (avg) CTE	HQ (avg) RME
Worker	C6-C12	110	8E-02	(a)	4.29E-07	9.78E-07	5.9E-04	1.3E-03
	C12-C28	2662	1E+00	(b)	4.29E-07	9.78E-07	1.1E-03	2.5E-03
	C28-C35	2050	2E+00	(c)	4.29E-07	9.78E-07	4.4E-04	1.0E-03
	C6-C35	4700	6E-01	(d)	4.29E-07	9.78E-07	3.2E-03	7.3E-03
Resident	C6-C12	110	8E-02	(a)	1.95E-06	3.65E-06	2.7E-03	5.0E-03
	C12-C28	2662	1E+00	(b)	1.95E-06	3.65E-06	5.0E-03	9.3E-03
	C28-C35	2050	2E+00	(c)	1.95E-06	3.65E-06	2.0E-03	3.7E-03
	C6-C35	4700	6E-01	(d)	1.95E-06	3.65E-06	1.5E-02	2.7E-02

Maximum

Population	Fraction	Conc ppm	RfD mg/kg-d		HIF CTE	HIF RME	HQ (max) CTE	HQ (max) RME
Worker	C6-C12	850	8E-02	(a)	4.29E-07	9.78E-07	4.6E-03	1.0E-02
	C12-C28	13000	1E+00	(b)	4.29E-07	9.78E-07	5.3E-03	1.2E-02
	C28-C35	7800	2E+00	(c)	4.29E-07	9.78E-07	1.7E-03	3.8E-03
	C6-C35	20000	6E-01	(d)	4.29E-07	9.78E-07	1.4E-02	3.1E-02
Resident	C6-C12	850	8E-02	(a)	1.95E-06	3.65E-06	2.1E-02	3.9E-02
	C12-C28	13000	1E+00	(b)	1.95E-06	3.65E-06	2.4E-02	4.5E-02
	C28-C35	7800	2E+00	(c)	1.95E-06	3.65E-06	7.6E-03	1.4E-02
	C6-C35	20000	6E-01	(d)	1.95E-06	3.65E-06	6.2E-02	1.2E-01

(a) Average of RfDs for C5 to C12
(b) Average of RfDs for C12 to C21
(c) RfD for C22 to C35
(d) Average of RfDs for C5 to C35

All RfD values are based on UDEQ (1999)

RfD = Reference Dose
HIF = Human Intake Factor
HQ = Hazard Quotient
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

magnitude of the risk) is small compared to the exposure and risk due to the pathways that were evaluated (e.g., ingestion of soil, ingestion of groundwater, inhalation of VOCs in indoor air).

Uncertainty Due to Potential Chemical Interactions

All of the toxicity data in Section 4 and all of the risk calculations in Section 5 are based on information about the toxicity of a chemical when given alone. However, at this site, exposure is likely to occur to more than one chemical at a time. In general, information about how the presence of one chemical affects the toxicity of a second chemical is quite limited. Some examples are known of synergism (the effect of the two together is larger than the sum of each alone), as are cases of antagonism (the effects of two chemicals together is less than would be expected from the sum of each alone). In accord with EPA guidance, this risk assessment evaluated the effects of simultaneous exposure to multiple chemicals by assuming additivity of risks. This approach (an assumption of additivity) is a source of uncertainty for several reasons. First, if any interactions do occur, the direction and magnitude are not known. Second, with regard to noncancer risks, not all chemicals that cause noncancer effects act on the same target tissue or act by the same mechanism of action. Thus, summing their risks by calculating a Hazard Index may tend to overestimate actual risk. With respect to cancer risks, summation of risks without regard to cancer weight of evidence or the level of confidence in the cancer slope factor tends to treat all cancer estimates as if they were equally credible, even though it is generally true that some estimates are much more uncertain than others.

Uncertainty Due to Combination of Conservative Assumptions and Estimates

A second consequence of adding risk estimates across chemicals and across pathways is that any conservatism that is contained in individual estimates tends to be compounded, and the final risk estimate may be especially conservative. For example, risk from each chemical in each medium is based on a conservative estimate of the concentration, and a conservative estimate of the toxicity. Thus, each individual estimate itself tends to be doubly conservative. When risks are summed across all chemicals, this conservatism is compounded, resulting in an estimate of the total risk that is very conservative. Likewise, when RME risks are summed across multiple exposure pathways, this is equivalent to assuming that the same individual is simultaneously exposed at the high end of the exposure distribution for each pathway (this is also unlikely). Thus, risk estimates based on the combination of risks across chemicals and pathways are more uncertain, and are likely more conservative, than risk estimates for individual chemicals and pathways.

Summary of Uncertainties

Because of the uncertainties summarized above, none of the exposure and risk calculations presented above should be interpreted as accurate measures of the true risk. Rather, all values should be interpreted as uncertain estimates. Because many (but not all) of the approaches for dealing with uncertainty are intended to be conservative (i.e., are more likely to overestimate than underestimate), the risk values above should generally be thought of as high-end estimates of the true risk, and actual risks are probably somewhat lower than the calculated values.

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APPENDICES

APPENDIX A

DATA SUMMARY

Data Summary for Soils Samples

Group	Parameter	Onsite Soils					Off-Site Soils (Background)				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
Inorganic	Aluminum	29	29	5.8E+03	2.6E+03	1.5E+04	3	3	1.4E+04	1.3E+04	1.5E+04
	Antimony	15	25	4.1E-01	1.6E-01	7.9E-01		2	4.3E+00	3.9E+00	4.7E+00
	Arsenic	78	82	5.3E+00	1.0E-01	3.0E+01	12	12	7.9E+00	3.5E+00	1.3E+01
	Barium	82	82	8.6E+01	1.4E+01	4.1E+02	12	12	1.5E+02	7.0E+01	2.5E+02
	Beryllium	29	29	3.6E-01	1.3E-01	9.4E-01	3	3	8.4E-01	7.1E-01	9.9E-01
	Cadmium	38	82	2.0E-01	1.0E-02	2.1E+00	3	12	1.6E-01	1.0E-02	8.0E-01
	Calcium	29	29	4.1E+04	1.9E+04	8.0E+04	3	3	2.0E+04	1.3E+04	2.7E+04
	Chromium	82	82	1.7E+01	5.5E+00	3.5E+01	12	12	2.5E+01	1.7E+01	3.7E+01
	Cobalt	28	29	4.6E+00	3.9E-01	8.5E+00	3	3	1.1E+01	8.1E+00	1.6E+01
	Copper	29	29	2.8E+01	6.6E+00	1.2E+02	3	3	4.2E+01	3.8E+01	4.8E+01
	Iron	29	29	1.1E+04	5.7E+03	2.5E+04	3	3	2.1E+04	1.8E+04	2.4E+04
	Lead	82	82	8.4E+01	3.3E+00	6.7E+02	12	12	3.8E+01	2.0E+01	6.2E+01
	Magnesium	29	29	7.1E+03	2.4E+03	1.8E+04	3	3	7.2E+03	6.9E+03	7.6E+03
	Manganese	29	29	2.2E+02	1.2E+02	4.7E+02	3	3	8.5E+02	4.5E+02	1.6E+03
	Mercury	35	82	9.6E-02	2.0E-02	1.6E+00	5	12	2.1E-01	2.5E-02	1.7E+00
	Nickel	29	29	1.2E+01	5.6E+00	3.2E+01	3	3	2.2E+01	1.7E+01	2.8E+01
	Potassium	29	29	1.7E+03	3.9E+02	5.3E+03	3	3	4.4E+03	3.5E+03	5.4E+03
	Selenium	7	78	2.5E-01	1.9E-01	7.9E-01	2	11	4.0E-01	1.9E-01	1.8E+00
	Silver	14	78	5.1E-02	3.0E-02	2.0E-01	4	11	1.8E+00	3.0E-02	1.2E+01
	Sodium	25	25	3.6E+02	2.7E+02	6.8E+02	2	2	2.0E+02	1.5E+02	2.5E+02
	Thallium	1	29	4.7E-01	3.8E-01	1.6E+00	2	3	1.1E+00	5.0E-01	1.4E+00
	Vanadium	29	29	1.5E+01	6.3E+00	3.1E+01	3	3	2.9E+01	2.6E+01	3.2E+01
	Zinc	29	29	1.6E+02	1.9E+01	6.4E+02	3	3	3.3E+02	1.5E+02	6.4E+02
PAH	2-Methylnaphthalene	13	83	2.8E+00	2.3E-02	4.6E+01		13	7.7E-02	2.3E-02	2.1E-01
	Acenaphthene	3	79	2.1E+00	2.3E-02	4.6E+01		12	6.6E-02	2.3E-02	2.0E-01
	Anthracene	8	83	2.1E+00	1.7E-02	4.6E+01		13	7.2E-02	1.7E-02	2.1E-01
	Benzo(a)Anthracene	8	83	1.9E+00	1.7E-02	4.6E+01	2	13	6.2E-02	1.7E-02	2.1E-01
	Benzo(a)Pyrene	9	83	1.9E+00	1.7E-02	4.6E+01	1	13	6.0E-02	1.7E-02	2.1E-01
	Benzo(b)Fluoranthene	6	79	2.1E+00	1.7E-02	4.6E+01	2	12	5.0E-02	1.7E-02	2.0E-01
	Benzo(k)Fluoranthene	5	79	2.0E+00	2.2E-02	4.6E+01	1	12	5.3E-02	2.0E-02	2.0E-01
	Chrysene	19	83	2.1E+00	1.7E-02	4.6E+01	2	13	6.3E-02	1.7E-02	2.1E-01
	Fluoranthene	8	83	2.0E+00	1.7E-02	4.6E+01	2	13	6.5E-02	1.7E-02	2.1E-01
	Fluorene	5	79	2.1E+00	2.2E-02	4.6E+01		12	6.5E-02	2.2E-02	2.0E-01
	Naphthalene	18	79	2.2E+00	4.5E-04	4.6E+01		13	6.0E-02	4.5E-04	2.1E-01
	Pyrene	18	83	2.1E+00	1.7E-02	4.6E+01	3	13	6.5E-02	1.7E-02	2.1E-01
PCB	Aroclor 1016		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1221		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1232		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1242		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1248		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1254		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1260	2	3	1.0E-01	5.0E-02	1.5E-01					
	Aroclor 1262		3	5.0E-02	5.0E-02	5.0E-02					
	Aroclor 1268		3	5.0E-02	5.0E-02	5.0E-02					

Group	Parameter	Onsite Soils					Off-Site Soils (Background)				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
Pesticide	4,4-DDT	4	4	1.4E-01	1.0E-01	1.8E-01		1	2.1E-02	2.1E-02	2.1E-02
	Atrazine		25	5.7E+00	1.8E-01	4.6E+01					
	Endrin Aldehyde	4	4	2.6E-02	1.8E-02	4.3E-02	1	1	5.0E-03	5.0E-03	5.0E-03
	Endrin Ketone	3	4	5.9E-02	1.9E-02	1.2E-01	1	1	8.8E-02	8.8E-02	8.8E-02
	Gamma-Chlordane	4	4	8.8E-03	5.8E-03	1.4E-02	1	1	1.1E-01	1.1E-01	1.1E-01
	Methoxychlor	2	4	9.5E-02	8.5E-02	1.1E-01		1	1.1E-01	1.1E-01	1.1E-01
Petroleum Hydrocarbon	Petroleum Hydrocarbons (>C12 To C28)	64	77	2.7E+03	5.0E+00	1.3E+04		9	8.5E+00	8.5E+00	8.5E+00
	Petroleum Hydrocarbons (>C28 To C35)	62	77	2.0E+03	5.0E+00	7.8E+03		9	8.5E+00	8.5E+00	8.5E+00
	Petroleum Hydrocarbons (C6 To C12)	6	77	1.1E+02	5.0E+00	8.5E+02		9	8.5E+00	8.5E+00	8.5E+00
	TPH (C6 To C35)	63	77	4.7E+03	5.0E+00	2.0E+04		9	8.5E+00	8.5E+00	8.5E+00
SVOC	1 1 -Biphenyl		25	5.7E+00	1.8E-01	4.6E+01					
	1 2 4-Trichlorobenzene		69	3.0E-02	4.0E-04	1.8E+00		12	4.7E-02	4.0E-04	2.0E-01
	1 2-Dichlorobenzene	3	69	3.0E-02	1.5E-04	1.8E+00		12	4.7E-02	1.5E-04	2.0E-01
	1 3-Butadiene		48	2.8E-03	3.0E-04	2.9E-02		9	3.0E-04	3.0E-04	3.0E-04
	1 3-Dichlorobenzene		69	2.9E-02	2.5E-04	1.8E+00		12	4.7E-02	2.5E-04	2.0E-01
	1 4-Dichlorobenzene		69	2.8E-02	1.5E-04	1.8E+00		12	4.7E-02	1.5E-04	2.0E-01
	1-Chlorohexane		48	2.0E-03	2.0E-04	2.2E-02		9	2.0E-04	2.0E-04	2.0E-04
	2 4 5 6-Tetrachloro-M-Xylene		3	5.2E+01	5.1E+01	5.3E+01					
	2 4 5-Trichlorophenol		79	4.8E+00	2.5E-02	1.2E+02		12	1.4E-01	2.5E-02	5.0E-01
	2 4 6-Trichlorophenol		79	2.0E+00	2.3E-02	4.6E+01		12	6.6E-02	2.3E-02	2.0E-01
	2 4-Dichlorophenol		79	2.1E+00	2.7E-02	4.6E+01		12	7.0E-02	2.7E-02	2.0E-01
	2 4-Dimethylphenol		79	2.1E+00	3.0E-02	4.6E+01		12	7.2E-02	3.0E-02	2.0E-01
	2 4-Dinitrophenol		79	4.9E+00	3.9E-02	1.2E+02		12	1.5E-01	3.9E-02	5.0E-01
	2 4-Dinitrotoluene		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	2 6-Dinitrotoluene		79	2.1E+00	2.6E-02	4.6E+01		12	6.9E-02	2.6E-02	2.0E-01
	2-Chloronaphthalene		79	2.0E+00	2.1E-02	4.6E+01		12	6.4E-02	2.1E-02	2.0E-01
	2-Chlorophenol		79	2.1E+00	2.7E-02	4.6E+01		12	6.9E-02	2.7E-02	2.0E-01
	2-Methylphenol		79	2.1E+00	2.6E-02	4.6E+01		12	6.9E-02	2.6E-02	2.0E-01
	2-Nitroaniline		79	4.7E+00	1.7E-02	1.2E+02		12	1.3E-01	1.7E-02	5.0E-01
	2-Nitrophenol		79	2.0E+00	2.4E-02	4.6E+01		12	6.7E-02	2.4E-02	2.0E-01
	2-Nitropropane		48	4.7E-03	5.0E-04	6.5E-02		9	5.0E-04	5.0E-04	5.0E-04
	3 & 4 Methylphenol (M&P Cresol)		53	7.9E-01	5.5E-02	1.2E+01		9	6.2E-02	5.5E-02	1.2E-01
	3 3-Dichlorobenzidine		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	4 6-Dinitro-2-Methylphenol		79	5.0E+00	4.6E-02	1.2E+02		12	1.6E-01	4.6E-02	5.0E-01
	4-Bromophenyl Phenyl Ether		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	4-Chloro-3-Methylphenol		79	2.0E+00	1.9E-02	4.6E+01		12	6.3E-02	1.9E-02	2.0E-01
	4-Chloroaniline	1	79	2.1E+00	2.7E-02	4.6E+01	2	12	9.0E-02	2.7E-02	2.6E-01
	4-Chlorophenyl Phenyl Ether		79	2.0E+00	2.0E-02	4.6E+01		12	6.3E-02	2.0E-02	2.0E-01
	4-Methylphenol		3	7.1E-01	1.8E-01	1.8E+00		3	1.9E-01	1.8E-01	2.0E-01
	4-Nitroaniline		79	4.8E+00	2.5E-02	1.2E+02		12	1.4E-01	2.5E-02	5.0E-01
	4-Nitrophenol		79	5.1E+00	6.0E-02	1.2E+02		12	1.7E-01	6.0E-02	5.0E-01
	Acenaphthylene		79	2.1E+00	2.4E-02	4.6E+01		12	6.7E-02	2.4E-02	2.0E-01
	Aniline		53	4.2E-01	3.0E-02	6.0E+00		9	3.3E-02	3.0E-02	6.0E-02
	Benzaldehyde		25	5.7E+00	1.8E-01	4.6E+01					
	Benzo(g,h,i)Perylene	20	83	2.0E+00	1.7E-02	4.6E+01	3	13	5.4E-02	1.7E-02	2.1E-01
	Benzyl Alcohol		53	4.2E-01	3.0E-02	6.0E+00		9	3.3E-02	3.0E-02	6.0E-02
	Benzyl Chloride		47	5.7E-03	5.0E-04	6.0E-02		9	5.0E-04	5.0E-04	5.0E-04
	Bis(2-Chloroethoxy)Methane		79	2.1E+00	3.2E-02	4.6E+01		12	7.4E-02	3.2E-02	2.0E-01
	Bis(2-Chloroethyl)Ether		79	2.0E+00	2.2E-02	4.6E+01		12	6.5E-02	2.2E-02	2.0E-01
	Bis(2-Chloroisopropyl)Ether		56	3.6E-01	2.5E-02	4.9E+00		12	6.7E-02	2.5E-02	2.0E-01

Group	Parameter	Onsite Soils					Off-Site Soils (Background)				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
SVOC	Bis(2-Ethylhexyl)Phthalate	30	83	3.0E+00	1.7E-02	9.0E+01	11	13	2.7E-01	1.7E-02	1.2E+00
	Butyl Benzyl Phthalate		79	2.1E+00	3.0E-02	4.6E+01	2	12	4.6E-02	2.1E-02	2.0E-01
	Caprolactam		25	5.7E+00	1.8E-01	4.6E+01					
	Carbazole	1	30	4.9E+00	6.7E-02	4.6E+01		4	1.9E-01	1.8E-01	2.1E-01
	Cis-1 4-Dichloro-2-Butene		48	2.0E-03	2.0E-04	2.2E-02		9	2.0E-04	2.0E-04	2.0E-04
	Decachlorobiphenyl		3	4.5E+01	4.2E+01	5.1E+01					
	Dibenzo(a,h)Anthracene	2	79	2.0E+00	1.9E-02	4.6E+01		12	6.2E-02	1.9E-02	2.0E-01
	Dibenzofuran	4	79	2.0E+00	1.9E-02	4.6E+01		12	6.3E-02	1.9E-02	2.0E-01
	Diethyl Phthalate		79	2.2E+00	3.7E-02	4.6E+01		12	7.8E-02	3.7E-02	2.0E-01
	Dimethyl Phthalate		79	2.0E+00	2.1E-02	4.6E+01		12	6.5E-02	2.1E-02	2.0E-01
	Di-N-Butyl Phthalate		79	2.2E+00	3.6E-02	4.6E+01	2	12	5.3E-02	3.4E-02	1.8E-01
	Di-N-Octyl Phthalate		79	2.0E+00	1.8E-02	4.6E+01	1	12	4.9E-02	1.8E-02	2.0E-01
	Hexachlorobenzene		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	Hexachlorobutadiene		75	1.9E+00	3.5E-04	4.6E+01		12	4.7E-02	3.5E-04	2.0E-01
	Hexachlorocyclopentadiene		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	Hexachloroethane		79	2.0E+00	1.7E-02	4.6E+01		12	6.1E-02	1.7E-02	2.0E-01
	Indeno(1 2 3-Cd)Pyrene	3	79	2.0E+00	1.8E-02	4.6E+01		12	6.2E-02	1.8E-02	2.0E-01
	Isophorone		79	2.1E+00	2.8E-02	4.6E+01		12	7.0E-02	2.8E-02	2.0E-01
	M-Nitroaniline		79	4.8E+00	2.2E-02	1.2E+02		12	1.4E-01	2.2E-02	5.0E-01
	Nitrobenzene		79	2.0E+00	2.3E-02	4.6E+01		12	6.6E-02	2.3E-02	2.0E-01
	N-Nitrosodi-N-Propylamine		79	2.1E+00	2.8E-02	4.6E+01		12	7.0E-02	2.8E-02	2.0E-01
	N-Nitrosodiphenylamine		79	2.0E+00	2.0E-02	4.6E+01		12	6.4E-02	2.0E-02	2.0E-01
	Pentachlorophenol		79	4.8E+00	2.8E-02	1.2E+02		12	1.4E-01	2.8E-02	5.0E-01
	Phenanthrene	20	83	2.3E+00	1.7E-02	4.6E+01	2	13	6.3E-02	1.7E-02	2.1E-01
	Phenol	8	87	2.1E+00	2.2E-02	4.6E+01		12	6.5E-02	2.2E-02	2.0E-01
	Pyridine		53	5.6E-01	4.0E-02	8.0E+00		9	4.4E-02	4.0E-02	8.0E-02
VOC	1 1 1 2-Tetrachloroethane		48	1.6E-03	1.5E-04	1.7E-02		9	1.5E-04	1.5E-04	1.5E-04
	1 1 1-Trichloroethane		69	2.8E-03	2.0E-04	1.9E-02		12	1.7E-03	2.0E-04	6.5E-03
	1 1 2 2-Tetrachloroethane		69	4.3E-03	4.0E-04	4.1E-02		12	1.8E-03	4.0E-04	6.5E-03
	1 1 2-Trichloro-1 2 2-Trifluoroethane		68	3.8E-03	3.5E-05	3.5E-02		9	3.5E-04	3.5E-04	3.5E-04
	1 1 2-Trichloroethane		69	2.7E-03	2.0E-04	1.8E-02		12	1.7E-03	2.0E-04	6.5E-03
	1 1-Dichloroethane		69	2.8E-03	2.0E-04	2.0E-02		12	1.7E-03	2.0E-04	6.5E-03
	1 1-Dichloroethene		69	3.1E-03	2.5E-04	2.4E-02		12	1.7E-03	2.5E-04	6.5E-03
	1 1-Dichloropropene		49	1.6E-03	1.5E-04	1.7E-02		9	1.5E-04	1.5E-04	1.5E-04
	1 2 3-Trichlorobenzene		49	4.1E-03	4.5E-04	4.3E-02		9	4.5E-04	4.5E-04	4.5E-04
	1 2 3-Trichloropropane		49	6.4E-03	5.0E-04	7.0E-02		9	5.0E-04	5.0E-04	5.0E-04
	1 2 4-Trimethylbenzene	33	54	7.3E-01	3.0E-04	8.8E+00		9	3.0E-04	3.0E-04	3.0E-04
	1 2-Dibromo-3-Chloropropane		67	3.7E-03	3.0E-04	3.3E-02		9	3.0E-04	3.0E-04	3.0E-04
	1 2-Dichloroethane	61	127	2.5E-01	3.0E-04	5.9E+00	11	23	2.1E-02	3.0E-04	4.8E-02
	1 2-Dichloropropane		69	2.6E-03	1.5E-04	1.6E-02		12	1.6E-03	1.5E-04	6.5E-03
	1 3 5-Trimethylbenzene	25	55	3.2E-01	2.5E-04	4.4E+00		9	2.5E-04	2.5E-04	2.5E-04
	1 3-Dichloropropane		49	1.8E-03	2.0E-04	1.9E-02		9	2.0E-04	2.0E-04	2.0E-04
	1 4-Dioxane	1	3	3.2E-02	1.0E-02	5.0E-02					
	1,2-Dibromoethane		68	2.7E-03	2.0E-04	1.8E-02		9	2.0E-04	2.0E-04	2.0E-04
	1,2-Dichloroethene		2	2.1E-01	5.0E-03	4.2E-01		3	6.0E-03	5.5E-03	6.5E-03
	2 2-Dichloropropane		49	4.6E-03	5.0E-04	4.9E-02		9	5.0E-04	5.0E-04	5.0E-04
	2-Butanone	2	29	4.6E-03	1.0E-03	1.1E-02		3	6.0E-03	5.5E-03	6.5E-03
	2-Chloro-1 3-Butadiene (Chloroprene)		48	4.8E-03	5.0E-04	5.0E-02		9	5.0E-04	5.0E-04	5.0E-04
	2-Chloroethylvinyl Ether		49	3.2E-03	3.5E-04	3.4E-02		9	3.5E-04	3.5E-04	3.5E-04
	2-Chlorotoluene	2	48	2.8E-02	3.5E-04	1.1E+00		9	3.5E-04	3.5E-04	3.5E-04

Group	Parameter	Onsite Soils					Off-Site Soils (Background)				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
VOC	2-Hexanone		69	2.8E-03	2.0E-04	2.0E-02		12	1.7E-03	2.0E-04	6.5E-03
	4-Chlorotoluene		48	2.5E-03	2.5E-04	2.6E-02		9	2.5E-04	2.5E-04	2.5E-04
	4-Methyl-2-Pentanone	9	69	4.1E-03	3.5E-04	3.5E-02		12	1.8E-03	3.5E-04	6.5E-03
	Acetone	45	69	1.8E-01	2.0E-03	5.0E+00	5	12	5.3E-03	1.5E-03	1.6E-02
	Acetonitrile		20	1.2E-03	1.0E-03	4.0E-03		1	1.0E-03	1.0E-03	1.0E-03
	Acetophenone		2	1.8E-01	1.8E-01	1.9E-01					
	Acrolein		3	1.1E-02	4.5E-03	2.3E-02		2	4.5E-03	4.5E-03	4.5E-03
	Acrylonitrile		31	2.9E-02	2.0E-03	2.1E-01		6	2.0E-03	2.0E-03	2.0E-03
	Allyl Chloride (3-Chloro-1-Propene)		48	2.2E-03	2.5E-04	2.3E-02		9	2.5E-04	2.5E-04	2.5E-04
	Benzene	2	69	3.0E-03	2.0E-04	2.0E-02		12	1.7E-03	2.0E-04	6.5E-03
	Bromobenzene		48	1.5E-03	1.5E-04	1.6E-02		9	1.5E-04	1.5E-04	1.5E-04
	Bromochloromethane		48	2.0E-03	2.0E-04	2.1E-02		9	2.0E-04	2.0E-04	2.0E-04
	Bromodichloromethane		69	2.5E-03	1.5E-04	1.5E-02		12	1.6E-03	1.5E-04	6.5E-03
	Bromoform		69	2.7E-03	2.0E-04	1.8E-02		12	1.7E-03	2.0E-04	6.5E-03
	Bromomethane		69	2.9E-03	2.0E-04	2.0E-02		12	1.7E-03	2.0E-04	6.5E-03
	Carbon Disulfide		69	4.9E-03	5.0E-04	5.0E-02		12	1.9E-03	5.0E-04	6.5E-03
	Carbon Tetrachloride		69	2.5E-03	1.5E-04	1.5E-02		12	1.6E-03	1.5E-04	6.5E-03
	Chlorobenzene		69	2.7E-03	1.5E-04	1.7E-02		12	1.6E-03	1.5E-04	6.5E-03
	Chloroethane		69	2.8E-03	2.0E-04	1.9E-02		12	1.7E-03	2.0E-04	6.5E-03
	Chloroform	20	69	3.4E-03	2.0E-04	2.0E-02	4	12	2.6E-03	2.0E-04	6.5E-03
	Chloromethane		69	5.9E-03	1.5E-04	2.5E-01		12	1.6E-03	1.5E-04	6.5E-03
	Cis-1 2-Dichloroethene	3	68	4.2E-02	2.0E-04	1.4E+00		9	2.0E-04	2.0E-04	2.0E-04
	Cis-1 3-Dichloropropene	1	70	9.6E-03	3.0E-04	4.2E-01		12	1.7E-03	3.0E-04	6.5E-03
	Cyclohexane	7	67	3.0E-01	3.5E-04	1.1E+01		9	3.5E-04	3.5E-04	3.5E-04
	Cyclohexanone		47	9.0E-03	1.0E-03	1.2E-01		9	1.0E-03	1.0E-03	1.0E-03
	Dibromochloromethane		69	2.5E-03	1.5E-04	1.5E-02		12	1.6E-03	1.5E-04	6.5E-03
	Dibromofluoromethane	48	48	4.8E-01	3.1E-02	5.8E+00	9	9	4.3E-02	2.9E-02	4.8E-02
	Dibromomethane		49	2.6E-03	3.0E-04	2.8E-02		9	3.0E-04	3.0E-04	3.0E-04
	Dichlorodifluoromethane		68	2.9E-03	2.0E-04	2.1E-02		9	2.0E-04	2.0E-04	2.0E-04
	Ethyl Acetate	1	49	2.3E-03	1.0E-04	5.5E-02		9	1.0E-04	1.0E-04	1.0E-04
	Ethyl Ether (Diethyl Ether)		49	2.1E-03	2.0E-04	2.3E-02		9	2.0E-04	2.0E-04	2.0E-04
	Ethyl Methacrylate		49	1.5E-03	1.5E-04	1.6E-02		9	1.5E-04	1.5E-04	1.5E-04
	Ethylbenzene	36	73	9.7E-02	1.0E-04	1.3E+00		12	1.6E-03	1.0E-04	6.5E-03
	Hexane	38	48	5.4E-02	3.0E-04	1.3E+00	4	9	1.1E-03	3.0E-04	2.0E-03
	Iodomethane		49	6.3E-03	1.5E-04	2.5E-01		9	1.5E-04	1.5E-04	1.5E-04
	Isobutyl Alcohol	1	2	3.4E-02	2.0E-02	4.8E-02					
	Isopropyl Alcohol (2-Propanol)	1	3	4.3E-01	5.5E-02	1.1E+00					
	Isopropylbenzene	6	67	2.6E-02	2.0E-04	5.5E-01		9	2.0E-04	2.0E-04	2.0E-04
	M&P Xylenes	41	51	3.1E-01	3.0E-04	4.1E+00	2	9	5.7E-04	3.0E-04	2.0E-03
	Methyl Acetate		19	5.3E-03	5.0E-03	6.5E-03					
	Methyl Methacrylate		49	2.9E-03	3.0E-04	3.1E-02		9	3.0E-04	3.0E-04	3.0E-04
	Methyl Tertiary Butyl Ether		68	2.6E-03	1.5E-04	1.7E-02		9	1.5E-04	1.5E-04	1.5E-04
	Methylacrylonitrile		48	1.1E-02	1.0E-03	1.2E-01		9	1.0E-03	1.0E-03	1.0E-03
	Methylcyclohexane	1	19	5.3E-03	5.0E-03	6.5E-03					
	Methylene Chloride	49	69	5.8E-02	5.5E-03	2.5E+00	9	12	1.9E-02	5.0E-03	5.8E-02
	N-Butyl Alcohol (1-Butanol)		1	3.0E-01	3.0E-01	3.0E-01					
	N-Butylbenzene	10	54	3.2E-01	2.0E-04	4.6E+00		9	2.0E-04	2.0E-04	2.0E-04
	N-Propylbenzene	14	50	3.5E-01	3.0E-04	7.4E+00		9	3.0E-04	3.0E-04	3.0E-04
	O-Xylene	38	51	1.2E-01	1.0E-04	1.7E+00	1	9	2.0E-04	1.0E-04	1.0E-03

Group	Parameter	Onsite Soils					Off-Site Soils (Background)				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
VOC	P-Isopropyltoluene	9	48	1.1E-01	2.5E-04	2.3E+00		9	2.5E-04	2.5E-04	2.5E-04
	Propionitrile (Ethyl Cyanide)		6	3.4E-03	2.0E-03	1.1E-02		1	2.0E-03	2.0E-03	2.0E-03
	Sec-Butylbenzene	6	48	2.7E-02	1.5E-04	5.5E-01		9	1.5E-04	1.5E-04	1.5E-04
	Styrene	1	69	3.5E-03	2.0E-04	3.3E-02		12	1.7E-03	2.0E-04	6.5E-03
	Tert-Butylbenzene	1	48	3.7E-03	2.0E-04	1.1E-01		9	2.0E-04	2.0E-04	2.0E-04
	Tetrachloroethene	4	71	1.1E-02	1.0E-03	1.5E-01		12	2.3E-03	1.0E-03	6.5E-03
	Toluene	59	85	2.7E-01	1.5E-04	5.5E+00	6	14	7.8E-02	1.5E-04	9.8E-01
	Trans-1 2-Dichloroethene		68	2.9E-03	2.0E-04	2.1E-02		9	2.0E-04	2.0E-04	2.0E-04
	Trans-1 3-Dichloropropene		69	2.9E-03	2.0E-04	2.1E-02		12	1.7E-03	2.0E-04	6.5E-03
	Trans-1 4-Dichloro-2-Butene		48	2.5E-03	2.5E-04	2.6E-02		9	2.5E-04	2.5E-04	2.5E-04
	Trichloroethylene	2	69	3.4E-03	3.0E-04	2.8E-02	1	12	1.3E-03	3.0E-04	6.0E-03
	Trichlorofluoromethane		68	3.4E-03	3.0E-04	2.8E-02		9	3.0E-04	3.0E-04	3.0E-04
	Vinyl Acetate		49	3.6E-03	4.0E-04	3.8E-02		9	4.0E-04	4.0E-04	4.0E-04
	Vinyl Chloride		69	3.8E-03	3.5E-04	3.4E-02		12	1.8E-03	3.5E-04	6.5E-03
	Xylenes (Total)	4	21	6.7E-03	4.0E-04	2.7E-02		3	6.0E-03	5.5E-03	6.5E-03

Data Summary for Groundwater Samples

Group	Parameter	Onsite Groundwater					Off-Site Groundwater				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
Inorganic	Aluminum	2	6	2.3E-01	1.6E-02	1.2E+00		1	1.8E-02	1.8E-02	1.8E-02
	Antimony		5	1.3E-03	1.3E-03	1.3E-03					
	Arsenic		6	1.2E-03	9.0E-04	2.4E-03		1	2.0E-03	2.0E-03	2.0E-03
	Barium	6	6	2.1E-01	7.0E-02	3.1E-01	1	1	6.9E-02	6.9E-02	6.9E-02
	Beryllium		5	1.5E-04	1.5E-04	1.5E-04					
	Cadmium		5	2.0E-04	2.0E-04	2.0E-04					
	Calcium	6	6	1.4E+02	1.3E+02	1.9E+02	1	1	9.1E+01	9.1E+01	9.1E+01
	Chromium	1	6	8.9E-04	2.5E-04	4.1E-03	1	1	1.6E-03	1.6E-03	1.6E-03
	Cobalt		5	5.0E-04	5.0E-04	5.0E-04					
	Copper	2	6	1.2E-03	7.5E-04	2.3E-03	1	1	4.4E-02	4.4E-02	4.4E-02
	Iron	6	6	6.2E-01	6.1E-02	2.3E+00	1	1	2.1E-01	2.1E-01	2.1E-01
	Lead		6	9.5E-04	9.5E-04	9.5E-04	1	1	9.9E-03	9.9E-03	9.9E-03
	Magnesium	6	6	5.3E+01	4.7E+01	6.2E+01	1	1	2.8E+01	2.8E+01	2.8E+01
	Manganese	6	6	4.2E-01	9.0E-02	1.2E+00	1	1	1.4E-03	1.4E-03	1.4E-03
	Mercury		5	5.0E-05	5.0E-05	5.0E-05					
	Nickel	6	6	5.1E-03	3.0E-03	6.6E-03		1	1.6E-03	1.6E-03	1.6E-03
	Potassium	6	6	4.8E+00	3.2E+00	5.9E+00	1	1	1.9E+00	1.9E+00	1.9E+00
	Selenium	3	5	2.0E-03	1.1E-03	2.8E-03					
	Silver		6	5.7E-04	4.5E-04	1.2E-03	1	1	2.7E-03	2.7E-03	2.7E-03
	Sodium	6	6	1.0E+02	8.8E+01	1.4E+02	1	1	4.3E+01	4.3E+01	4.3E+01
	Thallium		5	1.8E-03	1.8E-03	1.8E-03					
	Vanadium		5	5.5E-04	5.5E-04	5.5E-04					
	Zinc	4	6	2.3E-02	4.3E-03	5.5E-02	1	1	2.9E-01	2.9E-01	2.9E-01
OC-Pest	Atrazine		5	5.0E-03	5.0E-03	5.0E-03					
	Beta-BHC	1	1	1.0E-04	1.0E-04	1.0E-04		1	2.5E-05	2.5E-05	2.5E-05
	Endosulfan I	1	1	4.6E-05	4.6E-05	4.6E-05		1	2.5E-05	2.5E-05	2.5E-05
	Gamma-BHC	1	1	3.3E-04	3.3E-04	3.3E-04		1	2.5E-05	2.5E-05	2.5E-05
	Heptachlor	1	1	1.6E-04	1.6E-04	1.6E-04		1	2.5E-05	2.5E-05	2.5E-05

Group	Parameter	Onsite Groundwater					Off-Site Groundwater				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
PAH	2-Chloronaphthalene		5	5.0E-03	5.0E-03	5.0E-03					
	2-Methylnaphthalene		5	5.0E-03	5.0E-03	5.0E-03					
	Acenaphthene		5	5.0E-03	5.0E-03	5.0E-03					
	Acenaphthylene		5	5.0E-03	5.0E-03	5.0E-03					
	Anthracene		5	5.0E-03	5.0E-03	5.0E-03					
	Benzo(a)Anthracene		5	5.0E-03	5.0E-03	5.0E-03					
	Benzo(a)Pyrene		5	5.0E-03	5.0E-03	5.0E-03					
	Benzo(b)Fluoranthene		5	5.0E-03	5.0E-03	5.0E-03					
	Benzo(g,h,i)Perylene		5	5.0E-03	5.0E-03	5.0E-03					
	Benzo(k)Fluoranthene		5	5.0E-03	5.0E-03	5.0E-03					
	Chrysene		5	5.0E-03	5.0E-03	5.0E-03					
	Dibenzo(a,h)Anthracene		5	5.0E-03	5.0E-03	5.0E-03					
	Dibenzofuran		5	5.0E-03	5.0E-03	5.0E-03					
	Fluoranthene		5	5.0E-03	5.0E-03	5.0E-03					
	Fluorene		5	5.0E-03	5.0E-03	5.0E-03					
	Indeno(1 2 3-Cd)Pyrene		5	5.0E-03	5.0E-03	5.0E-03					
	Naphthalene		5	5.0E-03	5.0E-03	5.0E-03					
	Phenanthrene		5	5.0E-03	5.0E-03	5.0E-03					
	Pyrene		5	5.0E-03	5.0E-03	5.0E-03					
Petroleum Hydrocarbon	Petroleum Hydrocarbons (>C12 To C28)		8	9.6E-01	5.5E-01	1.7E+00					
	Petroleum Hydrocarbons (>C28 To C35)		8	9.6E-01	5.5E-01	1.7E+00					
	Petroleum Hydrocarbons (C6 To C12)		8	9.6E-01	5.5E-01	1.7E+00					
	TPH (C6 To C35)		8	9.6E-01	5.5E-01	1.7E+00					
SVOC	1 1 -Biphenyl		5	5.0E-03	5.0E-03	5.0E-03					
	1 2 4-Trichlorobenzene		8	5.0E-03	5.0E-03	5.0E-03					
	1 2-Dichlorobenzene		8	5.0E-03	5.0E-03	5.0E-03					
	1 3-Dichlorobenzene		8	5.0E-03	5.0E-03	5.0E-03					
	1 4-Dichlorobenzene		8	5.0E-03	5.0E-03	5.0E-03					
	2 4 5-Trichlorophenol		5	1.3E-02	1.3E-02	1.3E-02					
	2 4 6-Trichlorophenol		5	5.0E-03	5.0E-03	5.0E-03					
	2 4-Dichlorophenol		5	5.0E-03	5.0E-03	5.0E-03					
	2 4-Dimethylphenol		5	5.0E-03	5.0E-03	5.0E-03					

Group	Parameter	Onsite Groundwater					Off-Site Groundwater				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
SVOC	2 4-Dinitrophenol		5	1.3E-02	1.3E-02	1.3E-02					
	2 4-Dinitrotoluene		5	5.0E-03	5.0E-03	5.0E-03					
	2 6-Dinitrotoluene		5	5.0E-03	5.0E-03	5.0E-03					
	2-Chlorophenol		5	5.0E-03	5.0E-03	5.0E-03					
	2-Ethyl-1-Hexanol	1	1	7.0E-03	7.0E-03	7.0E-03					
	2-Methylphenol		5	5.0E-03	5.0E-03	5.0E-03					
	2-Nitroaniline		5	1.3E-02	1.3E-02	1.3E-02					
	2-Nitrophenol		5	5.0E-03	5.0E-03	5.0E-03					
	3 3-Dichlorobenzidine		5	5.0E-03	5.0E-03	5.0E-03					
	4 6-Dinitro-2-Methylphenol		5	1.3E-02	1.3E-02	1.3E-02					
	4-Bromophenyl Phenyl Ether		5	5.0E-03	5.0E-03	5.0E-03					
	4-Chloro-3-Methylphenol		5	5.0E-03	5.0E-03	5.0E-03					
	4-Chloroaniline		5	5.0E-03	5.0E-03	5.0E-03					
	4-Chlorophenyl Phenyl Ether		5	5.0E-03	5.0E-03	5.0E-03					
	4-Methylphenol		5	5.0E-03	5.0E-03	5.0E-03					
	4-Nitroaniline		5	1.3E-02	1.3E-02	1.3E-02					
	4-Nitrophenol		5	1.3E-02	1.3E-02	1.3E-02					
	Benzaldehyde		5	5.0E-03	5.0E-03	5.0E-03					
	Bis(2-Chloroethoxy)Methane		5	5.0E-03	5.0E-03	5.0E-03					
	Bis(2-Chloroethyl)Ether		5	5.0E-03	5.0E-03	5.0E-03					
	Bis(2-Chloroisopropyl)Ether		5	5.0E-03	5.0E-03	5.0E-03					
	Bis(2-Ethylhexyl)Phthalate	5	6	3.8E-03	1.0E-03	6.0E-03	1	1	1.0E-03	1.0E-03	1.0E-03
	Butyl Benzyl Phthalate	5	5	4.4E-02	2.6E-02	6.4E-02					
	Caprolactam	1	5	4.1E-03	7.0E-04	5.0E-03					
	Carbazole		5	5.0E-03	5.0E-03	5.0E-03					
	Diethyl Phthalate		5	5.0E-03	5.0E-03	5.0E-03					
	Dimethyl Phthalate	3	5	3.0E-03	1.0E-03	5.0E-03					
	Di-N-Butyl Phthalate	1	5	4.2E-03	8.0E-04	5.0E-03					
	Di-N-Octyl Phthalate		5	5.0E-03	5.0E-03	5.0E-03					
	Hexachlorobenzene		5	5.0E-03	5.0E-03	5.0E-03					
	Hexachlorobutadiene		5	5.0E-03	5.0E-03	5.0E-03					
	Hexachlorocyclopentadiene		5	5.0E-03	5.0E-03	5.0E-03					

Group	Parameter	Onsite Groundwater					Off-Site Groundwater				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
SVOC	Hexachloroethane		5	5.0E-03	5.0E-03	5.0E-03					
	Isophorone		5	5.0E-03	5.0E-03	5.0E-03					
	M-Nitroaniline		5	1.3E-02	1.3E-02	1.3E-02					
	Nitrobenzene		5	5.0E-03	5.0E-03	5.0E-03					
	N-Nitrosodi-N-Propylamine		5	5.0E-03	5.0E-03	5.0E-03					
	N-Nitrosodiphenylamine		5	5.0E-03	5.0E-03	5.0E-03					
	Pentachlorophenol		5	1.3E-02	1.3E-02	1.3E-02					
	Phenol	1	5	4.4E-03	2.0E-03	5.0E-03					
VOC	1 1 1-Trichloroethane	1	8	4.5E-03	8.0E-04	5.0E-03					
	1 1 2 2-Tetrachloroethane		8	5.0E-03	5.0E-03	5.0E-03					
	1 1 2-Trichloro-1 2 2-Trifluoroethane		8	5.0E-03	5.0E-03	5.0E-03					
	1 1 2-Trichloroethane		8	5.0E-03	5.0E-03	5.0E-03					
	1 1-Dichloroethane		8	5.0E-03	5.0E-03	5.0E-03					
	1 1-Dichloroethene		8	5.0E-03	5.0E-03	5.0E-03					
	1 2-Dibromo-3-Chloropropane		8	5.0E-03	5.0E-03	5.0E-03					
	1 2-Dichloroethane		8	5.0E-03	5.0E-03	5.0E-03					
	1 2-Dichloropropane		8	5.0E-03	5.0E-03	5.0E-03					
	1,2-Dibromoethane		8	5.0E-03	5.0E-03	5.0E-03					
	1,2-Dichloroethene	1	1	5.0E-01	5.0E-01	5.0E-01		2	3.8E-03	2.5E-03	5.0E-03
	2-Butanone	1	8	5.4E-03	5.0E-03	8.0E-03					
	2-Hexanone		8	5.0E-03	5.0E-03	5.0E-03					
	4-Methyl-2-Pentanone	1	8	4.6E-03	2.0E-03	5.0E-03					
	Acetone	2	9	1.3E-01	5.0E-03	9.2E-01	1	2	6.4E-03	5.0E-03	7.8E-03
	Acetophenone	4	5	1.3E-03	2.0E-04	5.0E-03					
	Benzene		8	5.0E-03	5.0E-03	5.0E-03					
	Bromodichloromethane		8	5.0E-03	5.0E-03	5.0E-03					
	Bromoform		8	5.0E-03	5.0E-03	5.0E-03					
	Bromomethane		8	5.0E-03	5.0E-03	5.0E-03					
	Carbon Disulfide		8	5.0E-03	5.0E-03	5.0E-03					
	Carbon Tetrachloride		8	5.0E-03	5.0E-03	5.0E-03					
	Chlorobenzene		8	5.0E-03	5.0E-03	5.0E-03					
	Chloroethane		8	5.0E-03	5.0E-03	5.0E-03					

Group	Parameter	Onsite Groundwater					Off-Site Groundwater				
		Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)	Detects	Total	Mean (ppm)	Min (ppm)	Max (ppm)
VOC	Chloroform		8	5.0E-03	5.0E-03	5.0E-03					
	Chloromethane		8	5.0E-03	5.0E-03	5.0E-03					
	Cis-1 2-Dichloroethene	2	8	4.1E-03	6.0E-04	5.0E-03					
	Cis-1 3-Dichloropropene		8	5.0E-03	5.0E-03	5.0E-03					
	Cyclohexane		8	5.0E-03	5.0E-03	5.0E-03					
	Dibromochloromethane		8	5.0E-03	5.0E-03	5.0E-03					
	Dichlorodifluoromethane		8	5.0E-03	5.0E-03	5.0E-03					
	Ethylbenzene		8	5.0E-03	5.0E-03	5.0E-03					
	Isopropyl Alcohol (2-Propanol)	1	1	4.5E-01	4.5E-01	4.5E-01					
	Isopropylbenzene		8	5.0E-03	5.0E-03	5.0E-03					
	Methyl Acetate		8	5.0E-03	5.0E-03	5.0E-03					
	Methyl Tertiary Butyl Ether		8	5.0E-03	5.0E-03	5.0E-03					
	Methylcyclohexane		8	5.0E-03	5.0E-03	5.0E-03					
	Methylene Chloride		8	5.0E-03	5.0E-03	5.0E-03					
	Styrene		8	5.0E-03	5.0E-03	5.0E-03					
	Tetrachloroethene		8	5.0E-03	5.0E-03	5.0E-03					
	Toluene	1	8	4.5E-03	1.0E-03	5.0E-03					
	Trans-1 2-Dichloroethene		8	5.0E-03	5.0E-03	5.0E-03					
	Trans-1 3-Dichloropropene		8	5.0E-03	5.0E-03	5.0E-03					
	Trichloroethylene	5	9	1.0E-01	8.0E-04	8.7E-01	1	2	2.3E-03	2.0E-03	2.5E-03
	Trichlorofluoromethane		8	5.0E-03	5.0E-03	5.0E-03					
	Vinyl Chloride		8	5.0E-03	5.0E-03	5.0E-03					
	Xylenes (Total)		8	5.0E-03	5.0E-03	5.0E-03					

APPENDIX B

SCREENING EVALUATION OF RELATIVE EXPOSURE FROM INHALATION OR DERMAL CONTACT WITH SOIL COMPARED TO SOIL INGESTION

APPENDIX B

SCREENING EVALUATION OF RELATIVE EXPOSURE FROM INHALATION OR DERMAL CONTACT WITH SOIL COMPARED TO SOIL INGESTION

1.0 INHALATION OF PARTICULATES IN AIR

The basic equations recommended by USEPA (1989, 1996) for evaluation of exposure from inhalation exposure of soil particles in air and for incidental ingestion of soil are as follows:

<u>Inhalation Exposure</u>

$$DI_{air} = C_{air} \cdot BR_a \cdot EF \cdot ED/(BW \cdot AT)$$
$$C_{air} = C_{soil} \cdot PEF$$

<u>Ingestion Exposure</u>

$$DI_{soil} = C_{soil} \cdot IR_{soil} \cdot EF \cdot ED/(BW \cdot AT)$$

where:

C	=	Concentration of contaminant in air (C_{air}, mg/m^3) or soil (C_{soil}, mg/kg)
BR	=	Breathing rate (m^3/day)
IR_{soil}	=	Ingestion rate for soil (kg/day)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)
PEF	=	Particulate (PM10) emission factor (mg/m^3 in air per mg/kg in soil)

Assuming that the values of BW, EF, ED, and AT are all the same for inhalation and oral exposure, the ratio of the risk from inhalation of particulates in air to that from ingestion of soil is then:

$$\text{Relative exposure (inhalation/oral)} = PEF \cdot BR / IR$$

Screening level defaults inputs for this equation are as follows:

- PEF = 7.61E-10 kg/m^3 (0.76 ug/m^3) (USEPA 1996)
- BR = 20 m3/day (USEPA 1989)
- IR = 1E-04 kg/day (USEPA 1989)

Based on these values, the ratio of the exposure from inhalation exposure to airborne soil particles compared to that from ingestion exposure is:

Relative exposure = (7.6E-10)(20)/(1E-04) = 0.00015 (0.015%)

As seen, the dose from inhaled particulate matter in air is expected to be very small (< 0.02%) compared to that from ingested soil, so this pathway is considered to be sufficiently minor that quantitative evaluation is not required at this site.

2.0 DERMAL EXPOSURE VIA SOIL

The basic equations recommended for estimation of absorbed dosefrom dermal contact with soil and ingestion of soil are as follows (USEPA 1989, 1992):

<u>Dermal Exposure</u>

$$\text{Absorbed Dose}_{dermal} = C_s \cdot SA \cdot AF \cdot ABS \cdot EF \cdot ED/(BW \cdot AT)$$

<u>Oral Exposure</u>

$$\text{Absorbed Dose}_{soil} = C_s \cdot IR_{soil} \cdot EF \cdot ED/(BW \cdot AT) \cdot AFo$$

where:

C_s	=	concentration of chemical in soil (mg/kg)
SA	=	surface area in contact with soil (cm^2)
AF	=	soil adherence factor (kg/cm^2)
ABS	=	dermal absorption fraction (unitless)
AFo	=	oral absorption fraction
IR_{soil}	=	ingestion rate for soil (kg/day)
BW	=	body weight (kg)
EF	=	exposure frequency (days/yr)
ED	=	exposure duration (years)
AT	=	averaging time (days)

Thus, assuming the values of BW, ED, and AT are the same for dermal and oral exposure, the ratio of the absorbed dose for dermal contact compared to that for soil ingestion is given by:

$$\text{Relative risk (dermal/oral)} = (SA \cdot AF \cdot EF_{dermal} \cdot ABS)/(IR \cdot EF_{oral} \cdot AFo)$$

Screening level inputs for this equation are as follows:

- SA = 10% of whole body = 2,000 cm^2 (USEPA 1991b).
- AF = 1E-06 kg/cm^2 (USEPA 1992)
- EF_{dermal} = 50 days/yr (assumed)
- ABS is chemical specific; values larger than 0.01 are uncommon (USEPA 1992)

- IR = 1E-04 kg/day (USEPA 1989, 1991b)
- EF_{oral} = 350 days/yr (USEPA 1989, 1991b)
- AFo = chemical specific; values near 1.0 are common for most organics

Based on these inputs, the estimated ratio of dermal risk to ingestion risk for arsenic in soil is:

$$\text{Relative Exposure} = (2E+03 \cdot 1E-06 \cdot 50 \cdot 0.01)/(1E-04 \cdot 350 \cdot 1.0) = 0.029 \ (2.9\%)$$

Thus, the relative dose from dermal contact with a chemical in soil compared to ingestion of soil is likely to be no more than about 3%, and could be less if the frequency or extent of dermal contact is lower than assumed, or if the dermal absorption fraction is lower than 0.01. On this basis, it is concluded that dermal absorption is a minor contributor of risk compared to oral exposure, and that this pathway may be excluded from quantitative evaluation.

3.0 REFERENCES

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APPENDIX C

STATISTICAL COMPARISON OF SITE DATA WITH BACKGROUND DATA

APPENDIX C
STATISTICAL COMPARISON OF SITE DATA WITH BACKGROUND

1.0 INTRODUCTION

Many chemicals occur naturally in soil and water, and detection of a chemical in an on-site sample is not necessarily evidence of a site-specific release. This appendix describes a statistical approach for comparing the data collected on-site with analogous data collected at off-site background locations in order to determine if on-site concentrations are or might be greater than in the background samples.

2.0 T-TEST

The basic test employed is the t-test. Because nearly all environmental concentration data sets tend to be right skewed and may usually be approximated as lognormal distributions, the t-test is applied to the log-transformed data rather than the raw data. The t- statistic is calculated from the site data and the background data as follows:

$$t = \frac{m_1 - m_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where:

m_1 = mean of log-transformed data from the site
m_2 = mean of log-transformed data from background locations
s_p = pooled standard deviation of log-transformed data
n_1 = number of measurements in the on-site data set
n_2 = number of measurements in the background data set

The value of s_p is calculated as:

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

where:

s_1 = standard deviation of log-transformed data from on-site locations
s_2 = standard deviation of log-transformed data from background locations

Assuming the distributions of the log-transformed data sets are approximately normal, the value of t will be distributed as a Student t-distribution. Thus, the probability that the null hypothesis (the site mean is not higher than the background mean) is true is given by:

$$p(\text{site} \leq \text{bkg}) = \text{TDIST}(t,df) \quad (t > 0)$$
$$= 1 - \text{TDIST}(-t,df) \quad (t < 0)$$

where:

TDIST = One-tailed student's t-distribution
df = Degrees of freedom ($n_1 + n_2 - 2$)

The most common criterion for rejecting the null hypothesis (i.e., accepting the alternative hypothesis that the site mean is greater than the background mean) is $p < 0.05$ (i.e., 95% confidence is required to declare that the site is higher than background). However, in this case, a p value of 0.10 was used to reject the null hypothesis. That is, the site is declared to be higher than background when confidence reaches the 90% rather than the 95% confidence level. This approach will tend to increase the number of false positives (i.e., the site is declared to be higher than background where it really is not), but will tend to decrease the number of false negatives (the chemical is declared to be not higher than background when it really is).

3.0 POWER CALCULATION

The ability of the t-test to identify a statistically significant difference between two data sets (the power of the test) is a function of several variables, including 1) the number of samples in each data set, 2) the degree of inter-sample variability in the data, 3) the magnitude of the difference between the two sets that is considered to be important, and 4) the degree of certainty (confidence) that is required in the decision. The power of a t-test is given by the following:

$$\text{Power} = \text{TDIST}(Z_\beta,df)$$

where:

Z_β	=	Δ / [s_p*sqrt (1/n_1 + 1/n_2)] - $Z_{1-\alpha}$
$Z_{1-\alpha}$	=	Standard normal deviate for a confidence level of α
Δ	=	magnitude of the difference between m_1 and m_2 that must be detected at a confidence limit of α

There is no standard value for the value of Δ. In this case, a value of one standard deviation (based on the pooled variance) is taken to be a useful criterion. That is, the power test yields the probability that the t-test will detect a significant difference if the true difference between the mean of the site samples and the background samples is one standard deviation or larger. Likewise, there is no standard value for the power of a test that must be achieved to consider the test reliable , but power values of 70%-80% (i.e., β = 0.7-0.8) are often considered acceptable.

4.0 DECISION RULE

For the purposes of the COPC selection procedure at this site, a chemical is treated as being potentially greater than background if:

$p <= 0.10$
OR
Power < 70% ($\Delta = s_p$)

This approach (combining the standard t-test with a power test) ensures that chemicals that are not statistically higher than background only as a result of low power will not be excluded from the COPC list.

5.0 RESULTS

At this site, sufficient data were available to support a comparison of on-site soil samples with off-site (background) soil samples. The results of this comparison are shown in Table C-1. Insufficient data were available to support a meaningful comparison of on-site and off-site groundwater samples.

Table C-1. Comparison of On-Site and Background Soils

Analyte	Site				Bkg				P	Power	Site > Bkg ?
	N	Mean	ln(Mean)	ln(Stdev)	N	Mean	ln(Mean)	ln(Stdev)			
Aluminum	29	5.8E+03	8.56	0.44	3	1.4E+04	9.56	0.06	1.000	76%	No
Arsenic	82	5.3E+00	1.34	0.98	12	7.9E+00	1.97	0.47	0.984	100%	No
Barium	82	8.6E+01	4.32	0.55	12	1.5E+02	4.92	0.37	1.000	96%	No
Beryllium	29	3.6E-01	-1.12	0.44	3	8.4E-01	-0.18	0.17	0.999	76%	No
Cadmium	82	2.0E-01	-2.97	1.73	12	1.6E-01	-3.41	1.84	0.205	100%	No
Calcium	29	4.1E+04	10.57	0.34	3	2.0E+04	9.86	0.35	0.001	71%	Yes
Chromium	82	1.7E+01	2.80	0.35	12	2.5E+01	3.21	0.23	1.000	86%	No
Cobalt	29	4.6E+00	1.41	0.57	3	1.1E+01	2.40	0.36	0.997	82%	No
Copper	29	2.8E+01	3.19	0.49	3	4.2E+01	3.74	0.12	0.967	79%	No
Iron	29	1.1E+04	9.21	0.36	3	2.1E+04	9.93	0.15	0.999	72%	No
Lead	82	8.4E+01	3.92	1.07	12	3.8E+01	3.58	0.38	0.143	100%	No
Magnesium	29	7.1E+03	8.75	0.48	3	7.2E+03	8.88	0.05	0.682	78%	No
Manganese	29	2.2E+02	5.34	0.32	3	8.5E+02	6.55	0.73	1.000	72%	No
Mercury	82	9.6E-02	-3.04	0.93	12	2.1E-01	-2.70	1.33	0.866	100%	No
Nickel	29	1.2E+01	2.44	0.40	3	2.2E+01	3.09	0.25	0.995	74%	No
Potassium	29	1.7E+03	7.25	0.59	3	4.4E+03	8.38	0.21	0.999	83%	No
Selenium	78	2.5E-01	-1.49	0.37	11	4.0E-01	-1.30	0.76	0.906	91%	No
Silver	78	5.1E-02	-3.13	0.50	11	1.8E+00	-1.52	2.29	1.000	100%	No
Sodium	25	3.6E+02	5.84	0.24	2	2.0E+02	5.26	0.36	0.002	63%	Yes
Thallium	29	4.7E-01	-0.81	0.30	3	1.1E+00	-0.03	0.57	1.000	70%	No
Vanadium	29	1.5E+01	2.63	0.38	3	2.9E+01	3.35	0.10	0.998	73%	No
Zinc	29	1.6E+02	4.82	0.75	3	3.3E+02	5.62	0.75	0.954	89%	No
Benzo(a)anthracene	83	1.9E+00	-1.33	1.96	13	6.2E-02	-3.38	1.05	0.000	100%	Yes
Benzo(a)pyrene	83	1.9E+00	-1.30	1.95	13	6.0E-02	-3.45	1.06	0.000	100%	Yes
Benzo(b)fluoranthene	79	2.1E+00	-1.36	2.01	12	5.0E-02	-3.53	0.93	0.000	100%	Yes
Benzo(g,h,i)perylene	83	2.0E+00	-1.16	1.92	13	5.4E-02	-3.45	0.97	0.000	100%	Yes
Benzo(k)fluoranthene	79	2.0E+00	-1.24	1.90	12	5.3E-02	-3.40	0.85	0.000	100%	Yes
Chrysene	83	2.1E+00	-1.16	1.97	13	6.3E-02	-3.35	1.04	0.000	100%	Yes
Fluoranthene	83	2.0E+00	-1.35	1.98	13	6.5E-02	-3.30	1.06	0.000	100%	Yes
Phenanthrene	83	2.3E+00	-1.18	2.05	13	6.3E-02	-3.37	1.07	0.000	100%	Yes
Pyrene	83	2.1E+00	-1.16	1.97	13	6.5E-02	-3.28	1.02	0.000	100%	Yes
Endrin aldehyde	4	2.6E-02	-3.70	0.39	1	5.0E-03	-5.30	#DIV/0!	#DIV/0!	#DIV/0!	NA
Gamma-Chlordane	4	8.8E-03	-4.81	0.42	1	1.1E-01	-2.21	#DIV/0!	#DIV/0!	#DIV/0!	NA
2 4 6-Tribromophenol	52	5.4E+00	1.39	0.57	9	3.8E+00	1.31	0.24	0.328	93%	No
2-Fluorobiphenyl	52	3.3E+00	0.86	0.60	9	1.8E+00	0.54	0.24	0.063	94%	Yes
2-Fluorophenol	52	3.9E+00	1.04	0.60	9	2.1E+00	0.70	0.28	0.056	94%	Yes
4-Bromofluorobenzene	48	4.8E-01	-2.84	1.50	9	2.8E-02	-3.62	0.35	0.065	100%	Yes
4-Chloroaniline	79	2.1E+00	-1.18	1.88	12	9.0E-02	-2.87	0.99	0.002	100%	Yes
Bis(2-ethylhexyl)phthalate	83	3.0E+00	-1.19	1.94	13	2.7E-01	-1.97	1.31	0.083	100%	Yes
Acetone	69	1.8E-01	-3.25	1.58	12	5.3E-03	-5.58	0.87	0.000	100%	Yes
Chloroform	69	3.4E-03	-6.54	1.48	12	2.6E-03	-6.81	1.58	0.284	100%	No
Dibromofluoromethane	48	4.8E-01	-2.62	1.39	9	4.3E-02	-3.16	0.15	0.123	100%	No
Hexane	48	5.4E-02	-5.54	1.65	9	1.1E-03	-7.27	1.00	0.002	100%	Yes
Methylene Chloride	69	5.8E-02	-3.97	0.90	12	1.9E-02	-4.37	0.92	0.077	100%	Yes
Styrene	69	3.5E-03	-7.15	1.75	12	1.7E-03	-7.67	1.54	0.171	100%	No
Toluene	85	2.7E-01	-5.12	2.71	14	7.8E-02	-6.38	2.93	0.057	100%	Yes
Trichloroethene	69	3.4E-03	-6.93	1.54	12	1.3E-03	-7.52	1.15	0.103	100%	No
Xylene-o	51	1.2E-01	-5.46	2.81	9	2.0E-04	-8.95	0.77	0.000	100%	Yes
Xylenes-m&p	51	3.1E-01	-4.49	2.59	9	5.7E-04	-7.77	0.71	0.000	100%	Yes

APPENDIX D

COPC SELECTION RESULTS

Appendix D1 COPC Selection for Soil

Appendix D2 COPC Selection for Groundwater

Appendix D3 COPC Screening for Inhalation Exposure to VOCs in Soil and Groundwater

Appendix D1. COPC Selection for Soil

Appendix D1

COPC Selection for Soil

		Data							COPC SELECTION STEPS							
Group	Analyte	CAS #	Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/kg)	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Is cmpd an essential nutrient?	Is Site conc > Bkg?	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
Inorganic	Aluminum	7429905	29	29	100%	NA	1.5E+04	7.8E+03	No	No	Yes	Yes	No	Yes		
	Antimony	7440360	15	25	60%	3.8E-01	7.9E-01	3.1E+00	No	NA	Yes	Yes	Yes	No		
	Arsenic	7440382	78	82	95%	5.5E-01	3.0E+01	4.3E-01	No	No	Yes	Yes	No	Yes		
	Barium	7440393	82	82	100%	NA	4.1E+02	5.5E+02	No	No	Yes	Yes	No	No		
	Beryllium	7440417	29	29	100%	NA	9.4E-01	1.6E+01	No	No	Yes	Yes	No	No		
	Cadmium	7440439	38	82	46%	3.4E-02	2.1E+00	7.8E+00	No	No	Yes	Yes	Yes	No		
	Calcium	7440702	29	29	100%	NA	8.0E+04	na	Yes	Yes	No	Yes	na	No		
	Chromium	18540299	82	82	100%	NA	3.5E+01	2.3E+01	No	No	Yes	Yes	No	Yes		
	Cobalt	7440484	28	29	97%	7.8E-01	8.5E+00	1.6E+02	No	No	Yes	Yes	Yes	No		
	Copper	7440508	29	29	100%	NA	1.2E+02	3.1E+02	No	No	Yes	Yes	No	No		
	Iron	7439896	29	29	100%	NA	2.5E+04	4.7E+03	Yes	No	Yes	Yes	No	Yes		
	Lead	7439921	82	82	100%	NA	6.7E+02	4.0E+02	No	No	Yes	Yes	No	Yes		
	Magnesium	7439954	29	29	100%	NA	1.8E+04	na	Yes	No	No	Yes	na	No		
	Manganese	7439965	29	29	100%	NA	4.7E+02	1.1E+03	No	No	Yes	Yes	No	No		
	Mercury	7487947	35	82	43%	5.9E-02	1.6E+00	2.3E+00	No	No	Yes	Yes	Yes	No		
	Nickel	7440020	29	29	100%	NA	3.2E+01	1.6E+02	No	No	Yes	Yes	No	No		
	Potassium	7440097	29	29	100%	NA	5.3E+03	na	Yes	No	No	Yes	na	No		
	Selenium	7782492	7	78	9%	4.1E-01	7.9E-01	3.9E+01	No	No	Yes	Yes	Yes	No		
	Silver	7440224	14	78	18%	7.6E-02	2.0E-01	3.9E+01	No	No	Yes	Yes	Yes	No		
	Sodium	7440235	25	25	100%	NA	6.8E+02	na	Yes	Yes	No	Yes	na	No		
	Thallium	7440280	1	29	3%	8.7E-01	1.6E+00	5.5E-01	No	No	Yes	No	No	Yes		
	Vanadium	7440622	29	29	100%	NA	3.1E+01	5.5E+01	No	No	Yes	Yes	No	No		
	Zinc	7440666	29	29	100%	NA	6.4E+02	2.3E+03	No	No	Yes	Yes	No	No		
PAH	Benzo(a)Anthracene	56553	8	83	10%	4.1E+00	4.2E+00	8.7E-01	No	Yes	Yes	Yes	No	Yes	YES	
	Benzo(a)Pyrene	50328	9	83	11%	4.1E+00	3.7E+00	8.7E-02	No	Yes	Yes	Yes	No	Yes	YES	
	Benzo(b)Fluoranthene	205992	6	79	8%	4.1E+00	7.6E+00	8.7E-01	No	Yes	Yes	Yes	No	Yes	YES	
	Benzo(g,h,i)Perylene	191242	20	83	24%	5.0E+00	1.7E+00	na	No	Yes	No	Yes	na	No		YES
	Benzo(k)Fluoranthene	207089	5	79	6%	4.2E+00	2.5E+00	8.7E+00	No	Yes	Yes	Yes	Yes	No		
PCB	Aroclor 1016	12674112	0	3	0%	1.0E-01	NA	5.5E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1221	11104282	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1232	11141165	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1242	53469219	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1248	12672296	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1254	11097691	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1260	11096825	2	3	67%	1.0E-01	1.5E-01	3.2E-01	No	NA	Yes	Yes	Yes	No		
	Aroclor 1262	37324235	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	Aroclor 1268	11100144	0	3	0%	1.0E-01	NA	3.2E-01	No	NA	Yes	No	Yes	No		
Pesticide	4,4-DDT	50293	4	4	100%	NA	1.8E-01	1.9E+00	No	NA	Yes	Yes	No	No		
	Atrazine	1912249	0	25	0%	1.1E+01	NA	2.9E+00	No	NA	Yes	No	No	No		YES
	Endrin Aldehyde	7421934	4	4	100%	NA	4.3E-02	na	No	NA	No	Yes	na	No		YES
	Endrin Ketone	53494705	3	4	75%	3.7E-02	1.2E-01	na	No	NA	No	Yes	na	No		YES
	Gamma-Chlordane	12789036	4	4	100%	NA	1.4E-02	na	No	NA	No	Yes	na	No		YES
	Methoxychlor	72435	2	4	50%	1.8E-01	1.1E-01	3.9E+01	No	NA	Yes	Yes	Yes	No		
Petroleum Hydrocarbon	Petroleum Hydrocarbons (>C12 TO C28)	12	64	77	83%	1.5E+01	1.3E+04	na	No	NA	No	Yes	na	No		YES
	Petroleum Hydrocarbons (>C28 TO C35)	28	62	77	81%	3.0E+01	7.8E+03	na	No	NA	No	Yes	na	No		YES
	Petroleum Hydrocarbons (C6 TO C12)	6	6	77	8%	2.1E+02	4.2E+02	na	No	NA	No	Yes	na	No		YES
	TPH (C6 To C35)	35	63	77	82%	1.6E+01	2.0E+04	na	No	NA	No	Yes	na	No		YES
SVOC	1 1 -Biphenyl	92524	0	25	0%	1.1E+01	NA	3.9E+02	No	NA	Yes	No	Yes	No		
	1 2 4-Trichlorobenzene	120821	0	69	0%	6.0E-02	NA	7.8E+01	No	NA	Yes	No	Yes	No		
	1 2-Dichlorobenzene	95501	3	69	4%	5.8E-02	1.1E-01	7.0E+02	No	NA	Yes	No	Yes	No		
	1 3-Butadiene	106990	0	48	0%	5.6E-03	NA	na	No	NA	No	No	na	No		YES
	1 3-Dichlorobenzene	541731	0	69	0%	5.8E-02	NA	2.3E+02	No	NA	Yes	No	Yes	No		
	1 4-Dichlorobenzene	106467	0	69	0%	5.6E-02	NA	2.7E+01	No	NA	Yes	No	Yes	No		

Appendix D1

COPC Selection for Soil

Group	Analyte	Data							COPC SELECTION STEPS							
		CAS #	Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/kg)	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Is cmpd an essential nutrient?	Is Site conc > Bkg?	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
	1-Chlorohexane	544105	0	48	0%	4.1E-03	NA	na	No	NA	No	No	na	No		YES
	2 4 5 6-Tetrachloro-M-Xylene	877098	0	3	0%	1.0E+02	NA	na	No	NA	No	No	na	No		YES
	2 4 5-Trichlorophenol	95954	0	79	0%	9.6E+00	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	2 4 6-Trichlorophenol	88062	0	79	0%	4.1E+00	NA	5.8E+01	No	NA	Yes	No	Yes	No		
	2 4-Dichlorophenol	120832	0	79	0%	4.2E+00	NA	2.3E+01	No	NA	Yes	No	Yes	No		
	2 4-Dimethylphenol	105679	0	79	0%	4.2E+00	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	2 4-Dinitrophenol	51285	0	79	0%	9.9E+00	NA	1.6E+01	No	NA	Yes	No	Yes	No		
	2 4-Dinitrotoluene	121142	0	79	0%	4.0E+00	NA	1.6E+01	No	NA	Yes	No	Yes	No		
	2 6-Dinitrotoluene	606202	0	79	0%	4.1E+00	NA	7.8E+00	No	NA	Yes	No	Yes	No		
	2-Chloronaphthalene	91587	0	79	0%	4.0E+00	NA	6.3E+02	No	NA	Yes	No	Yes	No		
	2-Chlorophenol	95578	0	79	0%	4.2E+00	NA	3.9E+01	No	NA	Yes	No	Yes	No		
	2-Methylnaphthalene	91576	13	83	16%	4.4E+00	1.4E+01	1.6E+02	No	NA	Yes	Yes	Yes	No		
	2-Methylphenol	95487	0	79	0%	4.1E+00	NA	3.9E+02	No	NA	Yes	No	Yes	No		
	2-Nitroaniline	88744	0	79	0%	9.4E+00	NA	na	No	NA	No	No	na	No		YES
	2-Nitrophenol	88755	0	79	0%	4.1E+00	NA	na	No	NA	No	No	na	No		YES
	2-Nitropropane	79469	0	48	0%	9.5E-03	NA	na	No	NA	No	No	na	No		YES
	3 & 4 Methylphenol (M&P Cresol)	1319773	0	53	0%	1.6E+00	NA	na	No	NA	No	No	na	No		YES
	3 3-Dichlorobenzidine	91941	0	79	0%	4.0E+00	NA	1.4E+00	No	NA	Yes	No	No	No		YES
	4 6-Dinitro-2-Methylphenol	534521	0	79	0%	1.0E+01	NA	7.8E+00	No	NA	Yes	No	No	No		YES
	4-Bromophenyl Phenyl Ether	101553	0	79	0%	4.0E+00	NA	na	No	NA	No	No	na	No		YES
	4-Chloro-3-Methylphenol	59507	0	79	0%	4.0E+00	NA	na	No	NA	No	No	na	No		YES
	4-Chloroaniline	106478	1	79	1%	4.2E+00	8.5E-02	3.1E+01	No	Yes	Yes	No	Yes	No		
	4-Chlorophenyl Phenyl Ether	7005723	0	79	0%	4.0E+00	NA	na	No	NA	No	No	na	No		YES
	4-Methylphenol	106445	0	3	0%	1.4E+00	NA	3.9E+01	No	NA	Yes	No	Yes	No		
	4-Nitroaniline	100016	0	79	0%	9.6E+00	NA	na	No	NA	No	No	na	No		YES
	4-Nitrophenol	100027	0	79	0%	1.0E+01	NA	6.3E+01	No	NA	Yes	No	Yes	No		
	Acenaphthene	83329	3	79	4%	4.2E+00	9.4E-01	4.7E+02	No	NA	Yes	No	Yes	No		
SVOC	Acenaphthylene	208968	0	79	0%	4.1E+00	NA	na	No	NA	No	No	na	No		YES
	Aniline	62533	0	53	0%	8.4E-01	NA	1.1E+02	No	NA	Yes	No	Yes	No		
	Anthracene	120127	8	83	10%	4.2E+00	1.4E+01	2.3E+03	No	NA	Yes	Yes	Yes	No		
	Benzaldehyde	100527	0	25	0%	1.1E+01	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	Benzyl Alcohol	100516	0	53	0%	8.4E-01	NA	2.3E+03	No	NA	Yes	No	Yes	No		
	Benzyl Chloride	100447	0	47	0%	1.1E-02	NA	3.8E+00	No	NA	Yes	No	Yes	No		
	Bis(2-Chloroethoxy)Methane	111911	0	79	0%	4.3E+00	NA	na	No	NA	No	No	na	No		YES
	Bis(2-Chloroethyl)Ether	111444	0	79	0%	4.1E+00	NA	5.8E-01	No	NA	Yes	No	No	No		YES
	Bis(2-Chloroisopropyl)Ether	108601	0	56	0%	7.3E-01	NA	9.1E+00	No	NA	Yes	No	Yes	No		
	Bis(2-Ethylhexyl)Phthalate	117817	30	83	36%	5.3E+00	9.0E+01	4.6E+01	No	Yes	Yes	Yes	Yes	Yes	YES	
	Butyl Benzyl Phthalate	85687	0	79	0%	4.2E+00	NA	1.6E+03	No	NA	Yes	No	Yes	No		
	Caprolactam	105602	0	25	0%	1.1E+01	NA	3.9E+03	No	NA	Yes	No	Yes	No		
	Carbazole	86748	1	30	3%	1.0E+01	6.7E-02	3.2E+01	No	NA	Yes	No	Yes	No		
	Chrysene	218019	19	83	23%	4.7E+00	4.6E+00	8.7E+01	No	Yes	Yes	Yes	Yes	No		
	Cis-1 4-Dichloro-2-Butene	1476115	0	48	0%	4.1E-03	NA	na	No	NA	No	No	na	No		YES
	Decachlorobiphenyl	2051243	0	3	0%	9.0E+01	NA	na	No	NA	No	No	na	No		YES
	Dibenzo(a,h)Anthracene	53703	2	79	3%	4.1E+00	1.9E-01	8.7E-02	No	NA	Yes	No	No	Yes		YES
	Dibenzofuran	132649	4	79	5%	4.2E+00	1.0E+00	3.1E+01	No	NA	Yes	Yes	Yes	No		
	Diethyl Phthalate	84662	0	79	0%	4.4E+00	NA	6.3E+03	No	NA	Yes	No	Yes	No		
	Dimethyl Phthalate	131113	0	79	0%	4.0E+00	NA	7.8E+04	No	NA	Yes	No	Yes	No		
	Di-N-Butyl Phthalate	84742	0	79	0%	4.3E+00	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	Di-N-Octyl Phthalate	117840	0	79	0%	4.0E+00	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	Fluoranthene	206440	8	83	10%	4.1E+00	6.3E+00	3.1E+02	No	Yes	Yes	Yes	Yes	No		
	Fluorene	86737	5	79	6%	4.3E+00	2.6E+00	3.1E+02	No	NA	Yes	Yes	Yes	No		
	Hexachlorobenzene	118741	0	79	0%	4.0E+00	NA	4.0E-01	No	NA	Yes	No	No	No		YES
	Hexachlorobutadiene	87683	0	75	0%	3.8E+00	NA	8.2E+00	No	NA	Yes	No	Yes	No		
	Hexachlorocyclopentadiene	77474	0	79	0%	4.0E+00	NA	4.7E+01	No	NA	Yes	No	Yes	No		
	Hexachloroethane	67721	0	79	0%	4.0E+00	NA	4.6E+01	No	NA	Yes	No	Yes	No		

Appendix D1

COPC Selection for Soil

		Data							COPC SELECTION STEPS							
Group	Analyte	CAS #	Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/kg)	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Is cmpd an essential nutrient?	Is Site conc > Bkg?	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
SVOC	Indeno(1 2 3-Cd)Pyrene	193395	3	79	4%	4.0E+00	1.5E+00	8.7E-01	No	NA	Yes	No	No	Yes		YES
	Isophorone	78591	0	79	0%	4.2E+00	NA	6.7E+02	No	NA	Yes	No	Yes	No		
	M-Nitroaniline	99092	0	79	0%	9.5E+00	NA	na	No	NA	No	No	na	No		YES
	Naphthalene	91203	18	79	23%	4.8E+00	1.3E+01	1.6E+02	No	NA	Yes	Yes	Yes	No		
	Nitrobenzene	98953	0	79	0%	4.1E+00	NA	3.9E+00	No	NA	Yes	No	No	No		YES
	N-Nitrosodi-N-Propylamine	621647	0	79	0%	4.2E+00	NA	9.1E-02	No	NA	Yes	No	No	No		YES
	N-Nitrosodiphenylamine	86306	0	79	0%	4.0E+00	NA	1.3E+02	No	NA	Yes	No	Yes	No		
	Pentachlorophenol	87865	0	79	0%	9.6E+00	NA	5.3E+00	No	NA	Yes	No	No	No		YES
	Phenanthrene	85018	20	83	24%	4.6E+00	7.1E+00	na	No	Yes	No	Yes	na	No		YES
	Phenol	108952	8	87	9%	4.1E+00	3.4E+00	4.7E+03	No	NA	Yes	Yes	Yes	No		
	Pyrene	129000	18	83	22%	4.6E+00	6.5E+00	2.3E+02	No	Yes	Yes	Yes	Yes	No		
	Pyridine	110861	0	53	0%	1.1E+00	NA	7.8E+00	No	NA	Yes	No	Yes	No		
VOC	1 1 1 2-Tetrachloroethane	630206	0	48	0%	3.2E-03	NA	2.5E+01	No	NA	Yes	No	Yes	No		
	1 1 1-Trichloroethane	71556	0	69	0%	5.5E-03	NA	2.2E+03	No	NA	Yes	No	Yes	No		
	1 1 2 2-Tetrachloroethane	79345	0	69	0%	8.5E-03	NA	3.2E+00	No	NA	Yes	No	Yes	No		
	1 1 2-Trichloro-1 2 2-Trifluoroethane	76131	0	68	0%	7.6E-03	NA	2.3E+05	No	NA	Yes	No	Yes	No		
	1 1 2-Trichloroethane	79005	0	69	0%	5.5E-03	NA	1.1E+01	No	NA	Yes	No	Yes	No		
	1 1-Dichloroethane	75343	0	69	0%	5.7E-03	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	1 1-Dichloroethene	75354	0	69	0%	6.2E-03	NA	1.1E+00	No	NA	Yes	No	Yes	No		
	1 1-Dichloropropene	563586	0	49	0%	3.1E-03	NA	na	No	NA	No	No	na	No		YES
	1 2 3-Trichlorobenzene	87616	0	49	0%	8.1E-03	NA	na	No	NA	No	No	na	No		YES
	1 2 3-Trichloropropane	96184	0	49	0%	1.3E-02	NA	3.2E-01	No	NA	Yes	No	Yes	No		
	1 2 4-Trimethylbenzene	95636	33	54	61%	6.0E-04	8.8E+00	3.9E+02	No	NA	Yes	Yes	Yes	No		
	1 2-Dibromo-3-Chloropropane	96128	0	67	0%	7.4E-03	NA	4.6E-01	No	NA	Yes	No	Yes	No		
	1 2-Dichloroethane	107062	3	69	4%	7.6E-03	5.0E-03	7.0E+00	No	NA	Yes	No	Yes	No		
	1 2-Dichloropropane	78875	0	69	0%	5.1E-03	NA	9.4E+00	No	NA	Yes	No	Yes	No		
	1 3 5-Trimethylbenzene	108678	25	55	45%	5.0E-04	4.4E+00	3.9E+02	No	NA	Yes	Yes	Yes	No		
	1 3-Dichloropropane	142289	0	49	0%	3.5E-03	NA	na	No	NA	No	No	na	No		YES
	1 4-Dioxane	123911	1	3	33%	6.0E-02	3.5E-02	5.8E+01	No	NA	Yes	Yes	Yes	No		
	1,2-Dibromoethane	106934	0	68	0%	5.4E-03	NA	7.5E-03	No	NA	Yes	No	Yes	No		
	1,2-Dichloroethene	540590	1	2	50%	1.0E-02	4.2E-01	7.0E+01	No	NA	Yes	Yes	Yes	No		
	2 2-Dichloropropane	954207	0	49	0%	9.2E-03	NA	na	No	NA	No	No	na	No		YES
	2-Butanone	78933	2	29	7%	8.6E-03	1.1E-02	4.7E+03	No	NA	Yes	Yes	Yes	No		
	2-Chloro-1 3-Butadiene (Chloroprene)	126998	0	48	0%	9.6E-03	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	2-Chloroethylvinyl Ether	110758	0	49	0%	6.3E-03	NA	na	No	NA	No	No	na	No		YES
	2-Chlorotoluene	95498	2	48	4%	7.2E-03	1.1E+00	1.6E+02	No	NA	Yes	No	Yes	No		
	2-Hexanone	591786	0	69	0%	5.7E-03	NA	3.1E+02	No	NA	Yes	No	Yes	No		
	4-Chlorotoluene	106434	0	48	0%	4.9E-03	NA	na	No	NA	No	No	na	No		YES
	4-Methyl-2-Pentanone	108101	9	69	13%	8.2E-03	1.2E-02	6.3E+02	No	NA	Yes	Yes	Yes	No		
	Acetone	67641	45	69	65%	5.0E-01	2.0E+00	7.8E+02	No	Yes	Yes	Yes	Yes	No		
	Acetonitrile	75058	0	20	0%	2.3E-03	NA	na	No	NA	No	No	na	No		YES
	Acetophenone	98862	0	2	0%	3.7E-01	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	Acrolein	107028	0	3	0%	2.1E-02	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	Acrylonitrile	107131	0	31	0%	5.9E-02	NA	1.2E+00	No	NA	Yes	No	Yes	No		
	Allyl Chloride (3-Chloro-1-Propene)	107051	0	48	0%	4.4E-03	NA	na	No	NA	No	No	na	No		YES
	Benzene	71432	2	69	3%	5.9E-03	8.0E-03	1.2E+01	No	NA	Yes	No	Yes	No		
	Bromobenzene	108861	0	48	0%	3.1E-03	NA	na	No	NA	No	No	na	No		YES
	Bromochloromethane	74975	0	48	0%	3.9E-03	NA	na	No	NA	No	No	na	No		YES
	Bromodichloromethane	75274	0	69	0%	5.0E-03	NA	1.0E+01	No	NA	Yes	No	Yes	No		
	Bromoform	75252	0	69	0%	5.5E-03	NA	8.1E+01	No	NA	Yes	No	Yes	No		
	Bromomethane	74839	0	69	0%	5.7E-03	NA	1.1E+01	No	NA	Yes	No	Yes	No		
	Carbon Disulfide	75150	0	69	0%	9.7E-03	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	Carbon Tetrachloride	56235	0	69	0%	5.1E-03	NA	4.9E+00	No	NA	Yes	No	Yes	No		

Appendix D1

COPC Selection for Soil

		Data							COPC SELECTION STEPS							
Group	Analyte	CAS #	Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/kg)	Maximum Detected Conc (mg/kg)	Residential Soil RBC (mg/kg)	Is cmpd an essential nutrient?	Is Site conc > Bkg?	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
VOC	Chlorobenzene	108907	0	69	0%	5.3E-03	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	Chloroethane	75003	0	69	0%	5.5E-03	NA	2.2E+02	No	NA	Yes	No	Yes	No		
	Chloroform	67663	20	69	29%	7.8E-03	5.0E-03	1.0E+02	No	No	Yes	Yes	Yes	No		
	Chloromethane	74873	0	69	0%	1.2E-02	NA	4.9E+01	No	NA	Yes	No	Yes	No		
	Cis-1 2-Dichloroethene	156592	3	68	4%	4.8E-03	1.4E+00	7.8E+01	No	NA	Yes	No	Yes	No		
	Cis-1 3-Dichloropropene	10061015	1	70	1%	7.2E-03	4.2E-01	na	No	NA	No	No	na	No		YES
	Cyclohexane	110827	7	67	10%	4.5E-03	1.1E+01	na	No	NA	No	Yes	na	No		YES
	Cyclohexanone	108941	0	47	0%	1.8E-02	NA	3.9E+04	No	NA	Yes	No	Yes	No		
	Dibromochloromethane	124481	0	69	0%	5.1E-03	NA	7.6E+00	No	NA	Yes	No	Yes	No		
	Dibromofluoromethane	1868537	48	48	100%	NA	5.8E+00	na	No	No	No	Yes	na	No		
	Dibromomethane	74953	0	49	0%	5.2E-03	NA	7.8E+01	No	NA	Yes	No	Yes	No		
	Dichlorodifluoromethane	75718	0	68	0%	5.7E-03	NA	1.6E+03	No	NA	Yes	No	Yes	No		
	Ethyl Acetate	141786	1	49	2%	2.3E-03	5.5E-02	7.0E+03	No	NA	Yes	No	Yes	No		
	Ethyl Ether (Diethyl Ether)	60297	0	49	0%	4.2E-03	NA	1.6E+03	No	NA	Yes	No	Yes	No		
	Ethyl Methacrylate	97632	0	49	0%	3.0E-03	NA	7.0E+02	No	NA	Yes	No	Yes	No		
	Ethylbenzene	100414	36	73	49%	5.3E-03	1.3E+00	7.8E+02	No	NA	Yes	Yes	Yes	No		
	Hexane	110543	38	48	79%	1.1E-02	1.3E+00	4.7E+02	No	Yes	Yes	Yes	Yes	No		
	Iodomethane	74884	0	49	0%	1.3E-02	NA	na	No	NA	No	No	na	No		YES
	Isobutyl Alcohol	78831	1	2	50%	4.0E-02	4.8E-02	2.3E+03	No	NA	Yes	Yes	Yes	No		
	Isopropyl Alcohol (2-Propanol)	67630	1	3	33%	1.1E+00	1.8E-01	na	No	NA	No	Yes	na	No		YES
	Isopropylbenzene	98828	6	67	9%	3.6E-03	5.5E-01	7.8E+02	No	NA	Yes	Yes	Yes	No		
	Methyl Acetate	79209	0	19	0%	1.1E-02	NA	7.8E+03	No	NA	Yes	No	Yes	No		
	Methyl Methacrylate	80626	0	49	0%	5.7E-03	NA	1.1E+04	No	NA	Yes	No	Yes	No		
	Methyl Tertiary Butyl Ether	1634044	0	68	0%	5.2E-03	NA	na	No	NA	No	No	na	No		YES
	Methylacrylonitrile	126987	0	48	0%	2.2E-02	NA	7.8E-01	No	NA	Yes	No	Yes	No		
	Methylcyclohexane	108872	1	19	5%	1.1E-02	6.0E-03	na	No	NA	No	Yes	na	No		YES
	Methylene Chloride	75092	49	69	71%	3.1E-01	1.3E-01	8.5E+01	No	Yes	Yes	Yes	Yes	No		
	N-Butyl Alcohol (1-Butanol)	71363	0	1	0%	5.9E-01	NA	7.8E+02	No	NA	Yes	No	Yes	No		
	N-Butylbenzene	104518	10	54	19%	2.2E-03	4.6E+00	3.1E+02	No	NA	Yes	Yes	Yes	No		
	N-Propylbenzene	103651	14	50	28%	7.3E-04	7.4E+00	3.1E+02	No	NA	Yes	Yes	Yes	No		
	P-Isopropyltoluene	99876	9	48	19%	1.8E-03	2.3E+00	na	No	NA	No	Yes	na	No		YES
	Propionitrile (Ethyl Cyanide)	107120	0	6	0%	6.8E-03	NA	na	No	NA	No	No	na	No		YES
	Sec-Butylbenzene	135988	6	48	13%	1.2E-03	5.5E-01	3.1E+02	No	NA	Yes	Yes	Yes	No		
	Styrene	100425	1	69	1%	6.1E-03	3.3E-02	1.6E+03	No	No	Yes	No	Yes	No		
	Tert-Butylbenzene	98066	1	48	2%	2.8E-03	1.1E-01	3.1E+02	No	NA	Yes	No	Yes	No		
	Tetrachloroethene	127184	4	71	6%	1.4E-02	1.5E-01	1.2E+01	No	NA	Yes	Yes	Yes	No		
	Toluene	108883	59	85	69%	3.8E-03	5.5E+00	1.6E+03	No	Yes	Yes	Yes	Yes	No		
	Trans-1 2-Dichloroethene	156605	0	68	0%	5.8E-03	NA	1.6E+02	No	NA	Yes	No	Yes	No		
	Trans-1 3-Dichloropropene	10061026	0	69	0%	5.8E-03	NA	na	No	NA	No	No	na	No		YES
	Trans-1 4-Dichloro-2-Butene	110576	0	48	0%	5.0E-03	NA	na	No	NA	No	No	na	No		YES
	Trichloroethylene	79016	2	69	3%	6.8E-03	8.0E-03	5.8E+01	No	No	Yes	No	Yes	No		
	Trichlorofluoromethane	75694	0	68	0%	6.8E-03	NA	2.3E+03	No	NA	Yes	No	Yes	No		
	Vinyl Acetate	108054	0	49	0%	7.1E-03	NA	7.8E+03	No	NA	Yes	No	Yes	No		
	Vinyl Chloride	75014	0	69	0%	7.6E-03	NA	9.0E-02	No	NA	Yes	No	Yes	No		
	Xylenes-m&p	179601231	41	51	80%	2.0E-03	4.1E+00	na	No	Yes	No	Yes	na	No		YES
	Xylene-o	95476	38	51	75%	6.3E-04	1.7E+00	1.6E+04	No	Yes	Yes	Yes	Yes	No		
	Xylenes (Total)	1330207	4	21	19%	1.0E-02	2.7E-02	1.6E+04	No	NA	Yes	Yes	Yes	No		

Appendix D2. COPC Selection for Groundwater

Appendix D2
COPC Selection for Groundwater

Group	Analyte	Data						COPC SELECTION STEPS						
		Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/L)	Maximum Detected Conc (mg/L)	Residential Groundwater RBC (mg/L)	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is cmpd an essential nutrient?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
Inorganic	ALUMINUM	1	5	20%	3.2E-02	5.7E-02	3.7E+01	Yes	Yes	Yes	No	No		
	ANTIMONY	0	5	0%	2.5E-03	NA	1.5E-02	Yes	No	Yes	No	No		
	ARSENIC	0	5	0%	1.8E-03	NA	4.5E-05	Yes	No	No	No	No		YES
	BARIUM	4	5	80%	NA	3.1E-01	2.6E+00	Yes	Yes	No	No	No		
	BERYLLIUM	0	5	0%	3.0E-04	NA	7.3E-02	Yes	No	Yes	No	No		
	CADMIUM	0	5	0%	4.0E-04	NA	1.8E-02	Yes	No	Yes	No	No		
	CALCIUM	5	5	100%	NA	1.4E+02	na	No	Yes	na	Yes	No		
	CHROMIUM	0	5	0%	5.0E-04	NA	1.1E-01	Yes	No	Yes	No	No		
	COBALT	0	5	0%	1.0E-03	NA	7.3E-01	Yes	No	Yes	No	No		
	COPPER	2	5	40%	1.5E-03	2.3E-03	1.5E+00	Yes	Yes	Yes	No	No		
	IRON	3	5	60%	NA	4.8E-01	2.2E+01	Yes	Yes	No	Yes	No		
	LEAD	0	5	0%	1.9E-03	NA	1.5E-02	Yes	No	Yes	No	No		
	MAGNESIUM	5	5	100%	NA	5.4E+01	na	No	Yes	na	Yes	No		
	MANGANESE	5	5	100%	NA	1.2E+00	7.3E-01	Yes	Yes	No	No	Yes	YES	
	MERCURY	0	5	0%	1.0E-04	NA	1.1E-02	Yes	No	Yes	No	No		
	NICKEL	5	5	100%	NA	6.6E-03	7.3E-01	Yes	Yes	No	No	No		
	POTASSIUM	2	5	40%	NA	5.9E+00	na	No	Yes	na	Yes	No		
	SELENIUM	3	5	60%	2.2E-03	2.8E-03	1.8E-01	Yes	Yes	Yes	No	No		
	SILVER	0	5	0%	9.0E-04	NA	1.8E-01	Yes	No	Yes	No	No		
	SODIUM	5	5	100%	NA	1.1E+02	na	No	Yes	na	Yes	No		
	THALLIUM	0	5	0%	3.5E-03	NA	2.6E-03	Yes	No	No	No	No		YES
	VANADIUM	0	5	0%	1.1E-03	NA	2.6E-01	Yes	No	Yes	No	No		
	ZINC	3	5	60%	8.5E-03	5.5E-02	1.1E+01	Yes	Yes	Yes	No	No		
PAH	2-METHYLNAPHTHALENE	0	5	0%	1.0E-02	NA	1.2E-01	Yes	No	Yes	No	No		
	ACENAPHTHENE	0	5	0%	1.0E-02	NA	3.7E-01	Yes	No	Yes	No	No		
	ANTHRACENE	0	5	0%	1.0E-02	NA	1.8E+00	Yes	No	Yes	No	No		
	BENZO(A)ANTHRACENE	0	5	0%	1.0E-02	NA	9.2E-05	Yes	No	No	No	No		YES
	BENZO(A)PYRENE	0	5	0%	1.0E-02	NA	9.2E-06	Yes	No	No	No	No		YES
	BENZO(B)FLUORANTHENE	0	5	0%	1.0E-02	NA	9.2E-05	Yes	No	No	No	No		YES
	Benzo(g,h,i)Perylene	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	BENZO(K)FLUORANTHENE	0	5	0%	1.0E-02	NA	9.2E-04	Yes	No	No	No	No		YES
	CHRYSENE	0	5	0%	1.0E-02	NA	9.2E-03	Yes	No	No	No	No		YES
	FLUORANTHENE	0	5	0%	1.0E-02	NA	1.5E+00	Yes	No	Yes	No	No		
	FLUORENE	0	5	0%	1.0E-02	NA	2.4E-01	Yes	No	Yes	No	No		
	NAPHTHALENE	0	5	0%	1.0E-02	NA	6.5E-03	Yes	No	No	No	No		YES
	PYRENE	0	5	0%	1.0E-02	NA	1.8E-01	Yes	No	Yes	No	No		
Pesticide	ATRAZINE	0	5	0%	1.0E-02	NA	3.0E-04	Yes	No	No	No	No		YES
Petroleum Hydrocarbons	PETROLEUM HYDROCARBONS (>C12 TO C28)	0	8	0%	1.9E+00	NA	na	No	No	na	No	No		YES
	PETROLEUM HYDROCARBONS (>C28 TO C35)	0	8	0%	1.9E+00	NA	na	No	No	na	No	No		YES
	PETROLEUM HYDROCARBONS (C6 TO C12)	0	8	0%	1.9E+00	NA	na	No	No	na	No	No		YES
	TPH (C6 TO C35)	0	8	0%	1.9E+00	NA	na	No	No	na	No	No		YES

Appendix D2
COPC Selection for Groundwater

Group	Analyte	Data						COPC SELECTION STEPS						
		Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/L)	Maximum Detected Conc (mg/L)	Residential Groundwater RBC (mg/L)	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is cmpd an essential nutrient?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
SVOC	1 1 -BIPHENYL	0	5	0%	1.0E-02	NA	3.0E-01	Yes	No	Yes	No	No		
	1 2 4-TRICHLOROBENZENE	0	8	0%	1.0E-02	NA	1.9E-01	Yes	No	Yes	No	No		
	1 2-DICHLOROBENZENE	0	8	0%	1.0E-02	NA	2.7E-01	Yes	No	Yes	No	No		
	1 3-DICHLOROBENZENE	0	8	0%	1.0E-02	NA	1.8E-01	Yes	No	Yes	No	No		
	1 4-DICHLOROBENZENE	0	8	0%	1.0E-02	NA	4.7E-04	Yes	No	No	No	No		YES
	2 4 5-TRICHLOROPHENOL	0	5	0%	2.5E-02	NA	3.7E+00	Yes	No	Yes	No	No		
	2 4 6-TRICHLOROPHENOL	0	5	0%	1.0E-02	NA	6.1E-03	Yes	No	No	No	No		YES
	2 4-DICHLOROPHENOL	0	5	0%	1.0E-02	NA	1.1E-01	Yes	No	Yes	No	No		
	2 4-DIMETHYLPHENOL	0	5	0%	1.0E-02	NA	7.3E-01	Yes	No	Yes	No	No		
	2 4-DINITROPHENOL	0	5	0%	2.5E-02	NA	7.3E-02	Yes	No	Yes	No	No		
	2 4-DINITROTOLUENE	0	5	0%	1.0E-02	NA	7.3E-02	Yes	No	Yes	No	No		
	2 6-DINITROTOLUENE	0	5	0%	1.0E-02	NA	3.7E-02	Yes	No	Yes	No	No		
	2-CHLORONAPHTHALENE	0	5	0%	1.0E-02	NA	4.9E-01	Yes	No	Yes	No	No		
	2-CHLOROPHENOL	0	5	0%	1.0E-02	NA	3.0E-02	Yes	No	Yes	No	No		
	2-ETHYL-1-HEXANOL	1	1	100%	NA	7.0E-03	na	No	Yes	na	No	No		YES
	2-METHYLPHENOL	0	5	0%	1.0E-02	NA	1.8E+00	Yes	No	Yes	No	No		
	2-NITROANILINE	0	5	0%	2.5E-02	NA	na	No	No	na	No	No		YES
	2-NITROPHENOL	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	3 3-DICHLOROBENZIDINE	0	5	0%	1.0E-02	NA	1.5E-04	Yes	No	No	No	No		YES
	4 6-DINITRO-2-METHYLPHENOL	0	5	0%	2.5E-02	NA	3.7E-02	Yes	No	Yes	No	No		
	4-BROMOPHENYL PHENYL ETHER	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	4-CHLORO-3-METHYLPHENOL	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	4-Chloroaniline	0	5	0%	1.0E-02	NA	1.5E-01	Yes	No	Yes	No	No		
	4-CHLOROPHENYL PHENYL ETHER	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	4-Methylphenol	0	5	0%	1.0E-02	NA	1.8E-01	Yes	No	Yes	No	No		
	4-NITROANILINE	0	5	0%	2.5E-02	NA	na	No	No	na	No	No		YES
	4-NITROPHENOL	0	5	0%	2.5E-02	NA	2.9E-01	Yes	No	Yes	No	No		
	ACENAPHTHYLENE	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	BENZALDEHYDE	0	5	0%	1.0E-02	NA	3.7E+00	Yes	No	Yes	No	No		
	BIS(2-CHLOROETHOXY)METHANE	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	BIS(2-CHLOROETHYL)ETHER	0	5	0%	1.0E-02	NA	9.6E-06	Yes	No	No	No	No		YES
	Bis(2-Chloroisopropyl)Ether	0	5	0%	1.0E-02	NA	2.6E-04	Yes	No	No	No	No		YES
	BIS(2-ETHYLHEXYL)PHTHALATE	4	5	80%	1.0E-02	6.0E-03	4.8E-03	Yes	Yes	No	No	Yes	YES	
	BUTYL BENZYL PHTHALATE	5	5	100%	NA	6.4E-02	7.3E+00	Yes	Yes	No	No	No		
	CAPROLACTAM	1	5	20%	1.0E-02	7.0E-04	1.8E+01	Yes	Yes	Yes	No	No		
	CARBAZOLE	0	5	0%	1.0E-02	NA	3.3E-03	Yes	No	No	No	No		YES
	Dibenzo(a,h)Anthracene	0	5	0%	1.0E-02	NA	9.2E-06	Yes	No	No	No	No		YES
	DIBENZOFURAN	0	5	0%	1.0E-02	NA	2.4E-02	Yes	No	Yes	No	No		
	DIETHYL PHTHALATE	0	5	0%	1.0E-02	NA	2.9E+01	Yes	No	Yes	No	No		
	DIMETHYL PHTHALATE	3	5	60%	1.0E-02	2.0E-03	3.7E+02	Yes	Yes	Yes	No	No		
	DI-N-BUTYL PHTHALATE	1	5	20%	1.0E-02	8.0E-04	3.7E+00	Yes	Yes	Yes	No	No		
	DI-N-OCTYL PHTHALATE	0	5	0%	1.0E-02	NA	7.3E-01	Yes	No	Yes	No	No		
	HEXACHLOROBENZENE	0	5	0%	1.0E-02	NA	4.2E-05	Yes	No	No	No	No		YES
	HEXACHLOROBUTADIENE	0	5	0%	1.0E-02	NA	8.6E-04	Yes	No	No	No	No		YES
	HEXACHLOROCYCLOPENTADIENE	0	5	0%	1.0E-02	NA	2.2E-01	Yes	No	Yes	No	No		

Appendix D2
COPC Selection for Groundwater

Group	Analyte	Data						COPC SELECTION STEPS						
		Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/L)	Maximum Detected Conc (mg/L)	Residential Groundwater RBC (mg/L)	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is cmpd an essential nutrient?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
SVOC	HEXACHLOROETHANE	0	5	0%	1.0E-02	NA	4.8E-03	Yes	No	No	No	No		YES
	INDENO(1 2 3-CD)PYRENE	0	5	0%	1.0E-02	NA	9.2E-05	Yes	No	No	No	No		YES
	ISOPHORONE	0	5	0%	1.0E-02	NA	7.0E-02	Yes	No	Yes	No	No		
	M-NITROANILINE	0	5	0%	2.5E-02	NA	na	No	No	na	No	No		YES
	NITROBENZENE	0	5	0%	1.0E-02	NA	3.5E-03	Yes	No	No	No	No		YES
	N-NITROSODI-N-PROPYLAMINE	0	5	0%	1.0E-02	NA	9.6E-06	Yes	No	No	No	No		YES
	N-NITROSODIPHENYLAMINE	0	5	0%	1.0E-02	NA	1.4E-02	Yes	No	Yes	No	No		
	PENTACHLOROPHENOL	0	5	0%	2.5E-02	NA	5.6E-04	Yes	No	No	No	No		YES
	PHENANTHRENE	0	5	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	PHENOL	1	5	20%	1.0E-02	2.0E-03	2.2E+01	Yes	Yes	Yes	No	No		
VOC	1 1 1-TRICHLOROETHANE	1	8	13%	1.0E-02	8.0E-04	3.2E+00	Yes	Yes	Yes	No	No		
	1 1 2 2-TETRACHLOROETHANE	0	8	0%	1.0E-02	NA	5.3E-05	Yes	No	No	No	No		YES
	1 1 2-TRICHLORO-1 2 2-TRIFLUOROETHANE	0	8	0%	1.0E-02	NA	5.9E+01	Yes	No	Yes	No	No		
	1 1 2-TRICHLOROETHANE	0	8	0%	1.0E-02	NA	1.9E-04	Yes	No	No	No	No		YES
	1 1-DICHLOROETHANE	0	8	0%	1.0E-02	NA	8.0E-01	Yes	No	Yes	No	No		
	1 1-DICHLOROETHENE	0	8	0%	1.0E-02	NA	4.4E-05	Yes	No	No	No	No		YES
	1 2-DIBROMO-3-CHLOROPROPANE	0	8	0%	1.0E-02	NA	4.7E-05	Yes	No	No	No	No		YES
	1 2-Dibromoethane	0	8	0%	1.0E-02	NA	7.5E-07	Yes	No	No	No	No		YES
	1 2-DICHLOROETHANE	0	8	0%	1.0E-02	NA	1.2E-04	Yes	No	No	No	No		YES
	1 2-DICHLOROPROPANE	0	8	0%	1.0E-02	NA	1.6E-04	Yes	No	No	No	No		YES
	2-BUTANONE	1	8	13%	1.0E-02	8.0E-03	1.9E+00	Yes	Yes	Yes	No	No		
	2-HEXANONE	0	8	0%	1.0E-02	NA	1.5E+00	Yes	No	Yes	No	No		
	4-METHYL-2-PENTANONE	1	8	13%	1.0E-02	2.0E-03	1.4E-01	Yes	Yes	Yes	No	No		
	ACETONE	1	8	13%	1.0E-02	1.8E-01	6.1E-01	Yes	Yes	Yes	No	No		
	ACETOPHENONE	4	5	80%	1.0E-02	4.0E-04	4.2E-05	Yes	Yes	No	No	Yes	YES	
	BENZENE	0	8	0%	1.0E-02	NA	3.2E-04	Yes	No	No	No	No		YES
	BROMODICHLOROMETHANE	0	8	0%	1.0E-02	NA	1.7E-04	Yes	No	No	No	No		YES
	BROMOFORM	0	8	0%	1.0E-02	NA	8.5E-03	Yes	No	No	No	No		YES
	BROMOMETHANE	0	8	0%	1.0E-02	NA	8.5E-03	Yes	No	No	No	No		YES
	CARBON DISULFIDE	0	8	0%	1.0E-02	NA	1.0E+00	Yes	No	Yes	No	No		
	CARBON TETRACHLORIDE	0	8	0%	1.0E-02	NA	1.6E-04	Yes	No	No	No	No		YES
	CHLOROBENZENE	0	8	0%	1.0E-02	NA	1.1E-01	Yes	No	Yes	No	No		
	CHLOROETHANE	0	8	0%	1.0E-02	NA	3.6E-03	Yes	No	No	No	No		YES
	CHLOROFORM	0	8	0%	1.0E-02	NA	1.5E-04	Yes	No	No	No	No		YES
	CHLOROMETHANE	0	8	0%	1.0E-02	NA	2.1E-03	Yes	No	No	No	No		YES
	CIS-1 2-DICHLOROETHENE	2	8	25%	1.0E-02	2.0E-03	6.1E-02	Yes	Yes	Yes	No	No		
	CIS-1 3-DICHLOROPROPENE	0	8	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	CYCLOHEXANE	0	8	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	DIBROMOCHLOROMETHANE	0	8	0%	1.0E-02	NA	1.3E-04	Yes	No	No	No	No		YES
	DICHLORODIFLUOROMETHANE	0	8	0%	1.0E-02	NA	3.5E-01	Yes	No	Yes	No	No		
	ETHYLBENZENE	0	8	0%	1.0E-02	NA	1.3E+00	Yes	No	Yes	No	No		
	ISOPROPYL ALCOHOL (2-PROPANOL)	1	1	100%	NA	4.5E-01	na	No	Yes	na	No	No		YES
	ISOPROPYLBENZENE	0	8	0%	1.0E-02	NA	6.6E-01	Yes	No	Yes	No	No		
	METHYL ACETATE	0	8	0%	1.0E-02	NA	6.1E+00	Yes	No	Yes	No	No		

Appendix D2
COPC Selection for Groundwater

Group	Analyte	Data						COPC SELECTION STEPS						
		Number of Detections	Number of Samples	Detection Frequency (DF)	Mean Non-Detected Conc (mg/L)	Maximum Detected Conc (mg/L)	Residential Groundwater RBC (mg/L)	Does cmpd have an RBC?	Is DF > 5%?	Is DL < RBC?	Is cmpd an essential nutrient?	Is Max Detect > RBC?	QUANT COPC	QUAL COPC
VOC	METHYLCYCLOHEXANE	0	8	0%	1.0E-02	NA	6.3E+00	Yes	No	Yes	No	No		
	METHYLENE CHLORIDE	0	8	0%	1.0E-02	NA	4.1E-03	Yes	No	No	No	No		YES
	STYRENE	0	8	0%	1.0E-02	NA	1.6E+00	Yes	No	Yes	No	No		
	TERT-BUTYL METHYL ETHER (MTBE)	0	8	0%	1.0E-02	NA	6.3E+00	Yes	No	Yes	No	No		
	TETRACHLOROETHENE	0	8	0%	1.0E-02	NA	1.1E-03	Yes	No	No	No	No		YES
	TOLUENE	1	8	13%	1.0E-02	1.0E-03	7.5E-01	Yes	Yes	Yes	No	No		
	TRANS-1 2-DICHLOROETHENE	0	8	0%	1.0E-02	NA	1.2E-01	Yes	No	Yes	No	No		
	TRANS-1 3-DICHLOROPROPENE	0	8	0%	1.0E-02	NA	na	No	No	na	No	No		YES
	TRICHLOROETHYLENE	4	8	50%	1.0E-02	7.0E-03	1.6E-03	Yes	Yes	No	No	Yes	YES	
	TRICHLOROFLUOROMETHANE	0	8	0%	1.0E-02	NA	1.3E+00	Yes	No	Yes	No	No		
	VINYL CHLORIDE	0	8	0%	1.0E-02	NA	1.5E-05	Yes	No	No	No	No		YES
	XYLENES (TOTAL)	0	8	0%	1.0E-02	NA	1.2E+01	Yes	No	Yes	No	No		

Appendix D3

COPC Screening for Inhalation Exposure to VOCs in Soil and Groundwater

Appendix D-3

COPC Screen
Inputs Used in Modeling Indoor Air Concentrations for VOCs Released from Soil or Groundwater

Parameter	Value	Basis
Concentration in source (soil, water)	Chemical and location specific	Site data
Depth below grade to bottom of enclosed space floor	15 cm 200 cm	Model default for slab-on-grade building Model default for structure with basement
Depth below grade to top of soil contamination	15 cm 200 cm	Slab-on-grade scenario Basement scenario
Depth to groundwater	80 ft	Site-specific data (Washington Group 2001a)
Average soil temperature	10°C	Model default
Vadose zone SCS soil type	Sand	Site specific data (Washington Group 2001d)
Vadose zone soil dry bulk density	1.86 g/cm^3	Assumed Value for Sand
Vadose zone soil total porosity	0.3	Assumed Value for Sand
Vadose zone soil water-filled porosity	0.053 cm^3/cm^3	Conservative estimate
Vadose zone soil organic carbon fraction	0.002	Mean of site-specific data for depths greater than 5 feet (Washington Group 2001d)

Johnson and Ettinger (1991) model calculations implemented using spreadsheet developed by USEPA (2000).

VOCs from Soil: COPC Selection

VOC	VOCs in Onsite Soils					Detected On-Site Conc. > Bkg Conc?	Max Indoor Conc. (ug/m3) (*)	Tox factors			i HIF (Non-Cancer)			i HIF (Cancer)		RME Risk to Resident		COPC for Indoor Air ?
	Detects	Total	DF (%)	Mean (ppm)	Max Detect (ppm)			iRfD (mg/kg-day)	Source	iSF (mg/kg-day)-1	Source	CTE (m3/kg-day)	RME (m3/kg-day)	CTE (m3/kg-day)	RME (m3/kg-day)	HI	Risk	
1 2 4-Trimethylbenzene	33	54	61%	7.3E-01	8.8E+00		6.5E+02	1.7E-03	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E+02	--	Yes
1 2-Dichloroethane	3	69	4%	3.8E-03	5.0E-03		1.7E+00	1.4E-03	b	9.1E-02	a	1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E-01	2E-05	Yes
1 3 5-Trimethylbenzene	25	55	45%	3.2E-01	4.4E+00		5.1E+02	1.7E-03	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	8E+01	--	Yes
1 4-Dioxane	1	3	33%	3.2E-02	3.5E-02							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
2-Butanone	2	29	7%	4.6E-03	1.1E-02		1.7E-01	2.9E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	2E-04	--	
2-Chlorotoluene	2	48	4%	2.8E-02	1.1E+00							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
4-Methyl-2-Pentanone	9	69	13%	4.1E-03	1.2E-02		1.2E-01	2.0E-02	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	2E-03	--	
Acetone	45	69	65%	1.8E-01	2.0E+00		6.7E+01	1.0E-01	c			1.78E-01	2.74E-01	2.29E-02	1.17E-01	2E-01	--	Yes
Benzene	2	69	3%	3.0E-03	8.0E-03		6.7E+00	1.7E-03	b	2.7E-02	a	1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E+00	2E-05	Yes
Chloroform	20	69	29%	3.4E-03	5.0E-03	No	3.9E+00	8.6E-05	b	8.1E-02	a	1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E+01	4E-05	
cis-1 2-Dichloroethylene	3	68	4%	4.2E-02	1.4E+00		1.3E+03	1.0E-02	c			1.78E-01	2.74E-01	2.29E-02	1.17E-01	4E+01	--	Yes
cis-1 3-Dichloropropene	1	70	1%	9.6E-03	4.2E-01							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Cyclohexane	7	67	10%	3.0E-01	1.1E+01							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Ethyl Acetate	1	49	2%	2.3E-03	5.5E-02							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Ethylbenzene	36	73	49%	9.7E-02	1.3E+00		2.7E+02	2.9E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E-01	--	Yes
Hexane	38	48	79%	5.4E-02	1.3E+00		6.4E+03	5.7E-02	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E+01	--	Yes
Isobutyl Alcohol	1	2	50%	3.4E-02	4.8E-02							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Isopropyl Alcohol (2-Propanol)	1	3	33%	4.3E-01	1.8E-01		3.6E-01					1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Isopropylbenzene	6	67	9%	2.6E-02	5.5E-01		9.3E+01	1.1E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	2E-01	--	Yes
m&p Xylenes	41	51	80%	3.1E-01	4.1E+00							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Methylcyclohexane	1	19	5%	5.3E-03	6.0E-03		4.0E+01	8.6E-01	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-02	--	
Methylene Chloride	49	69	71%	5.8E-02	1.3E-01		1.3E+02	8.6E-01	b	1.6E-03	a	1.78E-01	2.74E-01	2.29E-02	1.17E-01	4E-02	3E-05	Yes
n-Butylbenzene	10	54	19%	3.2E-01	4.6E+00							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
n-Propylbenzene	14	50	28%	3.5E-01	7.4E+00							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
o-Xylene	38	51	75%	1.2E-01	1.7E+00		2.3E+02	2.0E+00	c			1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E-02	--	
p-Isopropyltoluene	9	48	19%	1.1E-01	2.3E+00							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
sec-Butylbenzene	6	48	13%	2.7E-02	5.5E-01							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Styrene	1	69	1%	3.5E-03	3.3E-02	No	1.1E+00	2.9E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-03	--	
tert-Butylbenzene	1	48	2%	3.7E-03	1.1E-01							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Tetrachloroethene	4	71	6%	1.1E-02	1.5E-01		1.5E+02	1.4E-01	b	2.0E-03	c	1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E-01	4E-05	Yes
Toluene	59	85	69%	2.7E-01	5.5E+00		2.0E+03	1.1E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	5E+00	--	Yes
Trichloroethene	2	69	3%	3.4E-03	8.0E-03	No	5.0E+00	1.1E-02	d	6.0E-03	c	1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-01	3E-06	
Xylenes (Total)	4	21	19%	6.7E-03	2.7E-02							1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Naphthalene	18	79	23%	2.2E+00	1.3E+01		2.5E+01	9.0E-04	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	7E+00	--	Yes

(*) Concentrations were calculated using the Johnson and Ettinger Model (1991). Model parameters are listed on page D3-1. Concentrations of chemicals without full physico-chemical parameters required by the J&E model have been left blank.
See Table 3-6 for calculation of HIFs.

(a) Values from IRIS
(b) Values from Region 3 Table (USEPA 2002)
(c) Values from USEPA 2000
(d) Values from USEPA 2001

VOCs from Groundwater: COPC Selection

VOC	VOCs in Onsite Groundwater					Max Indoor Conc (ug/m3) (*)	Tox factors				i HIF (Non-Cancer)		i HIF (Cancer)		RME Risk to Resident		COPC for Indoor Air ?
	Detects	Total	DF (%)	Mean (ppm)	Max Detect (ppm)		iRfD (mg/kg-day)	Source	iSF (mg/kg-day)-1	Source	CTE (m3/kg-day)	RME (m3/kg-day)	CTE (m3/kg-day)	RME (m3/kg-day)	HI	Risk	
1 1 1-Trichloroethane	1	8	13%	4.5E-03	8.0E-04	1.1E-02	6.3E-01	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	5E-06	--	
2-Butanone	1	8	13%	5.4E-03	8.0E-03	4.2E-04	2.9E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	4E-07	--	
4-Methyl-2-Pentanone	1	8	13%	4.6E-03	2.0E-03	1.9E-04	2.0E-02	b			1.78E-01	2.74E-01	2.29E-02	1.17E-01	3E-06	--	
Isopropyl Alcohol (2-Propanol)	1	1	100%	4.5E-01	4.5E-01	2.8E-03					1.78E-01	2.74E-01	2.29E-02	1.17E-01	--	--	
Toluene	1	8	13%	4.5E-03	1.0E-03	5.1E-03	1.1E-01	a			1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-05	--	
Acetone	2	8	25%	1.4E-01	9.2E-01	3.8E-02	1.0E-01	c			1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-04	--	
cis-1 2-Dichloroethylene	2	8	25%	4.1E-03	2.0E-03	6.7E-03	1.0E-02	c			1.78E-01	2.74E-01	2.29E-02	1.17E-01	2E-04	--	
Trichloroethylene	4	8	50%	3.7E-03	7.0E-03	5.7E-02	1.1E-02	d	6.0E-03	c	1.78E-01	2.74E-01	2.29E-02	1.17E-01	1E-03	4E-08	

(*) Concentrations were calculated using the Johnson and Ettinger Model (1991). Model parameters are listed on page D3-1.
See Table 3-6 for calculation of HIFs.

(a) Values from IRIS
(b) Values from Region 3 Table (USEPA 2002)
(c) Values from USEPA 2000
(d) Values from USEPA 2001

APPENDIX E

EXPOSURE POINT CONCENTRATIONS

Appendix E1 **Soil Ingestion**

Appendix E2 **Groundwater**

Appendix E3 **VOC Inhalation**

Appendix E1. Soil Ingestion

Exposure Point Concentrations for Soil Ingestion

Soil COPC	Site wide	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10	Waste Piles
Benzo(a)Anthracene	4.2E+00	1.7E-01	4.7E-01	4.8E-01	7.7E-01	1.3E+00	1.8E-01	4.8E-01	8.4E-01	6.8E-01	1.3E+00	8.3E-01
Benzo(a)Pyrene	3.7E+00	1.7E-01	4.7E-01	4.8E-01	7.7E-01	1.3E+00	1.8E-01	4.8E-01	8.4E-01	6.3E-01	1.3E+00	8.6E-01
Benzo(b)Fluoranthene	7.6E+00	1.7E-01	4.7E-01	4.8E-01	7.7E-01	1.3E+00	1.8E-01	4.8E-01	8.4E-01	1.3E+00	1.3E+00	6.3E-01
Bis(2-Ethylhexyl)Phthalate	1.9E+01	2.5E-01	1.9E-01	9.4E-01	7.7E-01	1.3E-01	1.6E-01	2.3E-01	8.4E-01	8.4E-01	4.4E-01	7.2E+01

All concentration values are in units of mg/kg (ppm).
Samples used to compute EPCs for site wide and individual lots are from 0-1 foot in depth.

Appendix E2. Groundwater

Appendix E-2

Concentration Values for Groundwater

Groundwater COPC	Wells				
	MW-01/PZ-01	**MW-02/PZ-02**	**MW-03/PZ-03**	**MW-04**	**MW-05**
	Lot 8	**Lot 1**	**Lot 10**	**Lot 2**	**Lot 6**
	Washington Group (2001d)	Washington Group (2001d)	Washington Group (2001d)	Washington Group (2001d)	Washington Group (2001d)
Acetophenone	4.0E-04	3.0E-04	4.0E-04	5.0E-03	2.0E-04
Bis(2-Ethylhexyl)Phthalate	6.0E-03	5.0E-03	4.0E-03	5.0E-03	2.0E-03
Manganese	2.3E-01	1.2E+00	5.5E-01	2.4E-01	9.0E-02
Trichloroethylene	1.0E-03	7.0E-03	5.0E-03	9.0E-04	5.0E-03

All concentration values are in units of mg/L.

Appendix E3. VOC Inhalation

Predicted Concentration of VOCs in Indoor Air (ug/m3)
Basement Scenario

Lot 1

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.0E-04	3.0E-04	1.2E-03	1.2E-03	1.2E-03	1.2E-03
1 2-Dichloroethane	Soil	3.0E-04	3.0E-04	3.6E-03	3.6E-03	3.6E-03	3.6E-03
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	1.5E-03	1.5E-03	1.5E-03	1.5E-03
Benzene	Soil	2.0E-04	2.0E-04	7.1E-03	7.1E-03	7.1E-03	7.1E-03
Cis-1 2-Dichloroethene	Soil	2.0E-04	2.0E-04	7.2E-03	7.2E-03	7.2E-03	7.2E-03
Ethylbenzene	Soil	1.0E-04	1.0E-04	1.1E-03	1.1E-03	1.1E-03	1.1E-03
Hexane	Soil	2.0E-03	2.0E-03	3.9E-01	3.9E-01	3.9E-01	3.9E-01
Isopropylbenzene	Soil	2.0E-04	2.0E-04	1.8E-03	1.8E-03	1.8E-03	1.8E-03
Methylene Chloride	Soil	8.0E-03	8.0E-03	2.5E-01	2.5E-01	2.5E-01	2.5E-01
Tetrachloroethene	Soil	1.0E-03	1.0E-03	4.8E-02	4.8E-02	4.8E-02	4.8E-02
Toluene	Soil	1.5E-04	1.5E-04	2.6E-03	2.6E-03	2.6E-03	2.6E-03
Naphthalene	Soil	4.5E-04	4.5E-04	4.6E-05	4.6E-05	4.6E-05	4.6E-05
Acetone	Soil	1.5E-01	1.5E-01	1.2E-01	1.2E-01	1.2E-01	1.2E-01

Lot 2

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.2E-03	2.0E-03	4.5E-03	7.9E-03	4.5E-03	7.9E-03
1 2-Dichloroethane	Soil	2.2E-03	6.0E-03	2.6E-02	7.1E-02	2.6E-02	7.1E-02
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	1.5E-03	1.5E-03	1.5E-03	1.5E-03
Benzene	Soil	2.1E-03	6.0E-03	7.5E-02	2.1E-01	7.5E-02	2.1E-01
Cis-1 2-Dichloroethene	Soil	2.1E-03	6.0E-03	7.6E-02	2.1E-01	7.6E-02	2.1E-01
Ethylbenzene	Soil	2.1E-03	6.0E-03	2.2E-02	6.4E-02	2.2E-02	6.4E-02
Hexane	Soil	3.0E-04	3.0E-04	5.9E-02	5.9E-02	5.9E-02	5.9E-02
Isopropylbenzene	Soil	3.1E-03	6.0E-03	2.8E-02	5.4E-02	2.8E-02	5.4E-02
Methylene Chloride	Soil	1.5E-02	2.4E-02	4.7E-01	7.6E-01	4.7E-01	7.6E-01
Tetrachloroethene	Soil	2.7E-03	6.0E-03	1.3E-01	2.9E-01	1.3E-01	2.9E-01
Toluene	Soil	2.1E-03	6.0E-03	3.7E-02	1.1E-01	3.7E-02	1.1E-01
Naphthalene	Soil	7.5E-02	1.9E-01	7.7E-03	2.0E-02	7.7E-03	2.0E-02
Acetone	Soil	6.5E-02	1.3E-01	5.2E-02	1.0E-01	5.2E-02	1.0E-01

Lot 3

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.4E+00	8.6E+00	1.3E+01	3.4E+01	1.3E+01	3.4E+01
1 2-Dichloroethane	Soil	1.1E-02	3.3E-02	1.4E-01	3.9E-01	1.4E-01	3.9E-01
1 3 5-Trimethylbenzene	Soil	1.7E+00	4.4E+00	1.1E+01	2.7E+01	1.1E+01	2.7E+01
Benzene	Soil	7.1E-03	2.0E-02	2.5E-01	7.1E-01	2.5E-01	7.1E-01
Cis-1 2-Dichloroethene	Soil	7.9E-03	2.3E-02	2.8E-01	8.1E-01	2.8E-01	8.1E-01
Ethylbenzene	Soil	3.1E-01	8.0E-01	3.3E+00	8.5E+00	3.3E+00	8.5E+00
Hexane	Soil	1.8E-02	3.3E-02	3.5E+00	6.4E+00	3.5E+00	6.4E+00
Isopropylbenzene	Soil	1.8E-01	5.3E-01	1.6E+00	4.8E+00	1.6E+00	4.8E+00
Methylene Chloride	Soil	3.0E-02	3.4E-02	9.6E-01	1.1E+00	9.6E-01	1.1E+00
Tetrachloroethene	Soil	2.7E-02	7.5E-02	1.3E+00	3.6E+00	1.3E+00	3.6E+00
Toluene	Soil	2.3E+00	5.5E+00	4.1E+01	9.6E+01	4.1E+01	9.6E+01
Naphthalene	Soil	1.5E+00	3.5E+00	1.5E-01	3.6E-01	1.5E-01	3.6E-01
Acetone	Soil	1.1E-01	1.4E-01	8.4E-02	1.1E-01	8.4E-02	1.1E-01

Lot 4

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.2E-03	6.0E-03	1.2E-02	2.4E-02	1.2E-02	2.4E-02
1 2-Dichloroethane	Soil	2.7E-03	5.0E-03	3.2E-02	6.0E-02	3.2E-02	6.0E-02
1 3 5-Trimethylbenzene	Soil	1.1E-03	2.0E-03	6.9E-03	1.2E-02	6.9E-03	1.2E-02
Benzene	Soil	1.1E-03	2.0E-03	3.9E-02	7.1E-02	3.9E-02	7.1E-02
Cis-1 2-Dichloroethene	Soil	2.0E-04	2.0E-04	7.2E-03	7.2E-03	7.2E-03	7.2E-03
Ethylbenzene	Soil	6.8E-03	1.1E-02	7.2E-02	1.2E-01	7.2E-02	1.2E-01
Hexane	Soil	5.3E-03	8.0E-03	1.0E+00	1.6E+00	1.0E+00	1.6E+00
Isopropylbenzene	Soil	2.0E-04	2.0E-04	1.8E-03	1.8E-03	1.8E-03	1.8E-03
Methylene Chloride	Soil	2.5E-02	2.5E-02	8.0E-01	8.0E-01	8.0E-01	8.0E-01
Tetrachloroethene	Soil	1.0E-03	1.0E-03	4.8E-02	4.8E-02	4.8E-02	4.8E-02
Toluene	Soil	4.3E-03	6.0E-03	7.5E-02	1.1E-01	7.5E-02	1.1E-01
Naphthalene	Soil	4.5E-04	4.5E-04	4.6E-05	4.6E-05	4.6E-05	4.6E-05
Acetone	Soil	2.2E-01	3.8E-01	1.7E-01	3.0E-01	1.7E-01	3.0E-01

Lot 5

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.2E-03	3.0E-03	4.7E-03	1.2E-02	4.7E-03	1.2E-02
1 2-Dichloroethane	Soil	8.7E-04	2.0E-03	1.0E-02	2.4E-02	1.0E-02	2.4E-02
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	1.5E-03	1.5E-03	1.5E-03	1.5E-03
Benzene	Soil	2.0E-04	2.0E-04	7.1E-03	7.1E-03	7.1E-03	7.1E-03
Cis-1 2-Dichloroethene	Soil	2.0E-04	2.0E-04	7.2E-03	7.2E-03	7.2E-03	7.2E-03
Ethylbenzene	Soil	1.4E-03	4.0E-03	1.5E-02	4.3E-02	1.5E-02	4.3E-02
Hexane	Soil	1.6E-03	2.5E-03	3.2E-01	4.9E-01	3.2E-01	4.9E-01
Isopropylbenzene	Soil	2.0E-04	2.0E-04	1.8E-03	1.8E-03	1.8E-03	1.8E-03
Methylene Chloride	Soil	2.5E-02	2.5E-02	8.0E-01	8.0E-01	8.0E-01	8.0E-01
Tetrachloroethene	Soil	1.0E-03	1.0E-03	4.8E-02	4.8E-02	4.8E-02	4.8E-02
Toluene	Soil	1.4E-02	3.6E-02	2.4E-01	6.3E-01	2.4E-01	6.3E-01
Naphthalene	Soil	4.5E-04	4.5E-04	4.6E-05	4.6E-05	4.6E-05	4.6E-05
Acetone	Soil	5.2E-02	1.0E-01	4.1E-02	8.0E-02	4.1E-02	8.0E-02

Lot 6

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene (a)	Soil						
1 2-Dichloroethane (a)	Soil	5.5E-03	5.5E-03	6.5E-02	6.5E-02	6.5E-02	6.5E-02
1 3 5-Trimethylbenzene	Soil						
Benzene	Soil	5.5E-03	5.5E-03	1.9E-01	1.9E-01	1.9E-01	1.9E-01
Cis-1 2-Dichloroethene	Soil	5.5E-03	5.5E-03	2.0E-01	2.0E-01	2.0E-01	2.0E-01
Ethylbenzene	Soil	5.5E-03	5.5E-03	5.9E-02	5.9E-02	5.9E-02	5.9E-02
Hexane (a)	Soil						
Isopropylbenzene	Soil	5.5E-03	5.5E-03	5.0E-02	5.0E-02	5.0E-02	5.0E-02
Methylene Chloride	Soil	5.5E-03	5.5E-03	1.8E-01	1.8E-01	1.8E-01	1.8E-01
Tetrachloroethene	Soil	5.5E-03	5.5E-03	2.6E-01	2.6E-01	2.6E-01	2.6E-01
Toluene	Soil	5.5E-03	5.5E-03	9.7E-02	9.7E-02	9.7E-02	9.7E-02
Naphthalene	Soil	1.8E-01	1.8E-01	1.8E-02	1.8E-02	1.8E-02	1.8E-02
Acetone	Soil	5.5E-03	5.5E-03	4.4E-03	4.4E-03	4.4E-03	4.4E-03

(a) Not analyzed

Lot 7: No soil samples were collected in Lot 7 at depths > 2 feet.

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil						
1 2-Dichloroethane	Soil						
1 3 5-Trimethylbenzene	Soil						
Benzene	Soil						
Cis-1 2-Dichloroethene	Soil						
Ethylbenzene	Soil						
Hexane	Soil						
Isopropylbenzene	Soil						
Methylene Chloride	Soil						
Tetrachloroethene	Soil						
Toluene	Soil						
Naphthalene	Soil						
Acetone	Soil						

Lot 8

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.9E-03	1.1E-02	1.5E-02	4.3E-02	1.5E-02	4.3E-02
1 2-Dichloroethane	Soil	7.0E-04	1.5E-03	8.3E-03	1.8E-02	8.3E-03	1.8E-02
1 3 5-Trimethylbenzene	Soil	6.5E-03	1.9E-02	4.0E-02	1.2E-01	4.0E-02	1.2E-01
Benzene	Soil	4.7E-04	1.0E-03	1.6E-02	3.5E-02	1.6E-02	3.5E-02
Cis-1 2-Dichloroethene	Soil	4.7E-04	1.0E-03	1.7E-02	3.6E-02	1.7E-02	3.6E-02
Ethylbenzene	Soil	2.3E-04	5.0E-04	2.5E-03	5.3E-03	2.5E-03	5.3E-03
Hexane	Soil	5.7E-03	1.3E-02	1.1E+00	2.5E+00	1.1E+00	2.5E+00
Isopropylbenzene	Soil	4.7E-04	1.0E-03	4.2E-03	9.0E-03	4.2E-03	9.0E-03
Methylene Chloride	Soil	5.3E-02	1.3E-01	1.7E+00	4.0E+00	1.7E+00	4.0E+00
Tetrachloroethene	Soil	2.0E-03	4.0E-03	9.6E-02	1.9E-01	9.6E-02	1.9E-01
Toluene	Soil	4.3E-04	1.0E-03	7.6E-03	1.8E-02	7.6E-03	1.8E-02
Naphthalene	Soil	1.2E-02	3.5E-02	1.2E-03	3.6E-03	1.2E-03	3.6E-03
Acetone	Soil	2.2E-01	3.7E-01	1.7E-01	3.0E-01	1.7E-01	3.0E-01

Lot 9

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.6E-02	7.1E-02	1.4E-01	2.8E-01	1.4E-01	2.8E-01
1 2-Dichloroethane	Soil	9.0E-04	1.5E-03	1.1E-02	1.8E-02	1.1E-02	1.8E-02
1 3 5-Trimethylbenzene	Soil	1.3E-02	2.5E-02	7.7E-02	1.5E-01	7.7E-02	1.5E-01
Benzene	Soil	6.0E-04	1.0E-03	2.1E-02	3.5E-02	2.1E-02	3.5E-02
Cis-1 2-Dichloroethene	Soil	6.0E-04	1.0E-03	2.1E-02	3.6E-02	2.1E-02	3.6E-02
Ethylbenzene	Soil	2.7E-02	5.4E-02	2.9E-01	5.8E-01	2.9E-01	5.8E-01
Hexane	Soil	5.5E-03	1.0E-02	1.1E+00	2.0E+00	1.1E+00	2.0E+00
Isopropylbenzene	Soil	8.1E-03	1.6E-02	7.3E-02	1.4E-01	7.3E-02	1.4E-01
Methylene Chloride	Soil	7.6E-02	1.3E-01	2.4E+00	4.1E+00	2.4E+00	4.1E+00
Tetrachloroethene	Soil	2.5E-03	4.0E-03	1.2E-01	1.9E-01	1.2E-01	1.9E-01
Toluene	Soil	7.6E-03	1.5E-02	1.3E-01	2.6E-01	1.3E-01	2.6E-01
Naphthalene	Soil	4.6E-02	9.1E-02	4.7E-03	9.4E-03	4.7E-03	9.4E-03
Acetone	Soil	7.5E-02	9.8E-02	6.0E-02	7.8E-02	6.0E-02	7.8E-02

Lot 10

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.0E-04	3.0E-04	1.2E-03	1.2E-03	1.2E-03	1.2E-03
1 2-Dichloroethane	Soil	3.0E-04	3.0E-04	3.6E-03	3.6E-03	3.6E-03	3.6E-03
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	1.5E-03	1.5E-03	1.5E-03	1.5E-03
Benzene	Soil	2.0E-04	2.0E-04	7.1E-03	7.1E-03	7.1E-03	7.1E-03
Cis-1 2-Dichloroethene	Soil	2.0E-04	2.0E-04	7.2E-03	7.2E-03	7.2E-03	7.2E-03
Ethylbenzene	Soil	1.0E-04	1.0E-04	1.1E-03	1.1E-03	1.1E-03	1.1E-03
Hexane	Soil	2.0E-03	2.0E-03	3.9E-01	3.9E-01	3.9E-01	3.9E-01
Isopropylbenzene	Soil	2.0E-04	2.0E-04	1.8E-03	1.8E-03	1.8E-03	1.8E-03
Methylene Chloride	Soil	2.5E-02	2.5E-02	8.0E-01	8.0E-01	8.0E-01	8.0E-01
Tetrachloroethene	Soil	1.0E-03	1.0E-03	4.8E-02	4.8E-02	4.8E-02	4.8E-02
Toluene	Soil	1.5E-04	1.5E-04	2.6E-03	2.6E-03	2.6E-03	2.6E-03
Naphthalene	Soil	4.5E-04	4.5E-04	4.6E-05	4.6E-05	4.6E-05	4.6E-05
Acetone	Soil	6.5E-02	6.5E-02	5.2E-02	5.2E-02	5.2E-02	5.2E-02

Predicted Concentration of VOCs in Indoor Air (ug/m3)
Slab Scenario

Lot 1

VOC	Media	Media Conc (ppm)		Intrusion (ug/m3)		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	8.9E-02	3.5E-01	5.1E-01	2.0E+00	5.1E-01	2.0E+00
1 2-Dichloroethane	Soil	1.9E-03	5.5E-03	3.3E-02	9.5E-02	3.3E-02	9.5E-02
1 3 5-Trimethylbenzene	Soil	8.4E-02	3.6E-01	7.4E-01	3.2E+00	7.4E-01	3.2E+00
Benzene	Soil	2.8E-03	8.0E-03	1.4E-01	4.1E-01	1.4E-01	4.1E-01
Cis-1 2-Dichloroethene	Soil	1.8E-03	5.5E-03	9.1E-02	2.9E-01	9.1E-02	2.9E-01
Ethylbenzene	Soil	5.6E-03	1.8E-02	8.7E-02	2.8E-01	8.7E-02	2.8E-01
Hexane	Soil	1.2E-02	4.9E-02	3.4E+00	1.4E+01	3.4E+00	1.4E+01
Isopropylbenzene	Soil	1.8E-03	5.5E-03	2.3E-02	7.2E-02	2.3E-02	7.2E-02
Methylene Chloride	Soil	1.9E-02	3.1E-02	8.9E-01	1.4E+00	8.9E-01	1.4E+00
Tetrachloroethene	Soil	5.8E-03	2.0E-02	4.0E-01	1.4E+00	4.0E-01	1.4E+00
Toluene	Soil	1.7E-02	7.5E-02	4.5E-01	1.9E+00	4.5E-01	1.9E+00
Naphthalene	Soil	8.7E-01	5.0E+00	1.3E-01	7.5E-01	1.3E-01	7.5E-01
Acetone	Soil	1.1E-01	2.7E-01	1.3E-01	3.1E-01	1.3E-01	3.1E-01

Lot 2

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	8.2E-04	2.0E-03	4.7E-03	1.1E-02	4.7E-03	1.1E-02
1 2-Dichloroethane	Soil	2.0E-03	6.0E-03	3.4E-02	1.0E-01	3.4E-02	1.0E-01
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	2.2E-03	2.2E-03	2.2E-03	2.2E-03
Benzene	Soil	1.9E-03	6.0E-03	9.8E-02	3.1E-01	9.8E-02	3.1E-01
Cis-1 2-Dichloroethene	Soil	1.9E-03	6.0E-03	9.9E-02	3.1E-01	9.9E-02	3.1E-01
Ethylbenzene	Soil	2.6E-03	6.0E-03	4.0E-02	9.3E-02	4.0E-02	9.3E-02
Hexane	Soil	2.9E-03	4.0E-03	8.2E-01	1.1E+00	8.2E-01	1.1E+00
Isopropylbenzene	Soil	2.1E-03	6.0E-03	2.8E-02	7.9E-02	2.8E-02	7.9E-02
Methylene Chloride	Soil	1.6E-02	3.3E-02	7.2E-01	1.5E+00	7.2E-01	1.5E+00
Tetrachloroethene	Soil	2.4E-03	6.0E-03	1.7E-01	4.2E-01	1.7E-01	4.2E-01
Toluene	Soil	1.3E-02	4.3E-02	3.4E-01	1.1E+00	3.4E-01	1.1E+00
Naphthalene	Soil	3.1E-01	1.7E+00	4.6E-02	2.6E-01	4.6E-02	2.6E-01
Acetone	Soil	4.1E-02	1.3E-01	4.8E-02	1.5E-01	4.8E-02	1.5E-01

Lot 3

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.3E+00	8.6E+00	7.6E+00	4.9E+01	7.6E+00	4.9E+01
1 2-Dichloroethane	Soil	5.2E-03	3.3E-02	9.0E-02	5.6E-01	9.0E-02	5.6E-01
1 3 5-Trimethylbenzene	Soil	8.1E-01	4.4E+00	7.2E+00	3.9E+01	7.2E+00	3.9E+01
Benzene	Soil	3.7E-03	2.0E-02	1.9E-01	1.0E+00	1.9E-01	1.0E+00
Cis-1 2-Dichloroethene	Soil	4.1E-03	2.3E-02	2.2E-01	1.2E+00	2.2E-01	1.2E+00
Ethylbenzene	Soil	1.4E-01	8.0E-01	2.2E+00	1.2E+01	2.2E+00	1.2E+01
Hexane	Soil	1.0E-02	3.3E-02	2.9E+00	9.3E+00	2.9E+00	9.3E+00
Isopropylbenzene	Soil	6.0E-02	5.3E-01	7.9E-01	7.0E+00	7.9E-01	7.0E+00
Methylene Chloride	Soil	1.9E-02	3.4E-02	8.8E-01	1.6E+00	8.8E-01	1.6E+00
Tetrachloroethene	Soil	9.9E-03	7.5E-02	6.9E-01	5.2E+00	6.9E-01	5.2E+00
Toluene	Soil	1.0E+00	5.5E+00	2.7E+01	1.4E+02	2.7E+01	1.4E+02
Naphthalene	Soil	4.2E+00	3.9E+01	6.3E-01	5.8E+00	6.3E-01	5.8E+00
Acetone	Soil	7.0E-02	1.6E-01	8.1E-02	1.9E-01	8.1E-02	1.9E-01

Lot 4

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.3E+00	8.8E+00	7.3E+00	5.1E+01	7.3E+00	5.1E+01
1 2-Dichloroethane	Soil	5.4E-03	3.3E-02	9.4E-02	5.6E-01	9.4E-02	5.6E-01
1 3 5-Trimethylbenzene	Soil	4.0E-01	2.9E+00	3.6E+00	2.6E+01	3.6E+00	2.6E+01
Benzene	Soil	3.7E-03	2.0E-02	1.9E-01	1.0E+00	1.9E-01	1.0E+00
Cis-1 2-Dichloroethene	Soil	3.7E-03	2.3E-02	1.9E-01	1.2E+00	1.9E-01	1.2E+00
Ethylbenzene	Soil	8.4E-02	7.3E-01	1.3E+00	1.1E+01	1.3E+00	1.1E+01
Hexane	Soil	1.4E-02	7.7E-02	4.1E+00	2.2E+01	4.1E+00	2.2E+01
Isopropylbenzene	Soil	3.0E-02	2.6E-01	4.0E-01	3.4E+00	4.0E-01	3.4E+00
Methylene Chloride	Soil	3.0E-01	2.5E+00	1.4E+01	1.2E+02	1.4E+01	1.2E+02
Tetrachloroethene	Soil	2.4E-02	1.5E-01	1.7E+00	1.0E+01	1.7E+00	1.0E+01
Toluene	Soil	3.2E-01	2.1E+00	8.2E+00	5.3E+01	8.2E+00	5.3E+01
Naphthalene	Soil	5.8E+00	4.6E+01	8.7E-01	6.8E+00	8.7E-01	6.8E+00
Acetone	Soil	6.2E-01	5.0E+00	7.2E-01	5.8E+00	7.2E-01	5.8E+00

Lot 5

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	5.8E-01	2.8E+00	3.3E+00	1.6E+01	3.3E+00	1.6E+01
1 2-Dichloroethane	Soil	8.0E-03	3.3E-02	1.4E-01	5.6E-01	1.4E-01	5.6E-01
1 3 5-Trimethylbenzene	Soil	1.8E-01	8.4E-01	1.6E+00	7.5E+00	1.6E+00	7.5E+00
Benzene	Soil	5.3E-03	2.0E-02	2.7E-01	1.0E+00	2.7E-01	1.0E+00
Cis-1 2-Dichloroethene	Soil	2.7E-01	1.4E+00	1.4E+01	7.3E+01	1.4E+01	7.3E+01
Ethylbenzene	Soil	1.9E-01	1.3E+00	2.9E+00	2.0E+01	2.9E+00	2.0E+01
Hexane	Soil	2.9E-01	1.3E+00	8.3E+01	3.7E+02	8.3E+01	3.7E+02
Isopropylbenzene	Soil	8.5E-02	5.5E-01	1.1E+00	7.2E+00	1.1E+00	7.2E+00
Methylene Chloride	Soil	2.9E-02	5.0E-02	1.3E+00	2.3E+00	1.3E+00	2.3E+00
Tetrachloroethene	Soil	1.7E-02	7.5E-02	1.2E+00	5.2E+00	1.2E+00	5.2E+00
Toluene	Soil	8.1E-02	5.6E-01	2.1E+00	1.4E+01	2.1E+00	1.4E+01
Naphthalene	Soil	2.2E+00	9.5E+00	3.3E-01	1.4E+00	3.3E-01	1.4E+00
Acetone	Soil	1.8E-01	7.7E-01	2.1E-01	9.0E-01	2.1E-01	9.0E-01

Lot 6

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.0E-04	3.0E-04	1.7E-03	1.7E-03	1.7E-03	1.7E-03
1 2-Dichloroethane	Soil	2.8E-03	5.5E-03	4.8E-02	9.5E-02	4.8E-02	9.5E-02
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	2.2E-03	2.2E-03	2.2E-03	2.2E-03
Benzene	Soil	2.7E-03	5.5E-03	1.4E-01	2.8E-01	1.4E-01	2.8E-01
Cis-1 2-Dichloroethene	Soil	2.7E-03	5.5E-03	1.4E-01	2.9E-01	1.4E-01	2.9E-01
Ethylbenzene	Soil	4.4E-03	5.5E-03	6.8E-02	8.5E-02	6.8E-02	8.5E-02
Hexane	Soil	4.5E-03	5.0E-03	1.3E+00	1.4E+00	1.3E+00	1.4E+00
Isopropylbenzene	Soil	2.7E-03	5.5E-03	3.6E-02	7.2E-02	3.6E-02	7.2E-02
Methylene Chloride	Soil	2.0E-02	4.0E-02	9.2E-01	1.9E+00	9.2E-01	1.9E+00
Tetrachloroethene	Soil	3.1E-03	5.5E-03	2.2E-01	3.8E-01	2.2E-01	3.8E-01
Toluene	Soil	3.1E-03	5.5E-03	8.0E-02	1.4E-01	8.0E-02	1.4E-01
Naphthalene	Soil	1.3E-01	3.3E-01	1.9E-02	5.0E-02	1.9E-02	5.0E-02
Acetone	Soil	4.3E-02	1.2E-01	5.0E-02	1.4E-01	5.0E-02	1.4E-01

Lot 7

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.7E-03	3.0E-03	9.5E-03	1.7E-02	9.5E-03	1.7E-02
1 2-Dichloroethane	Soil	2.0E-03	5.5E-03	3.5E-02	9.5E-02	3.5E-02	9.5E-02
1 3 5-Trimethylbenzene	Soil	2.5E-04	2.5E-04	2.2E-03	2.2E-03	2.2E-03	2.2E-03
Benzene	Soil	2.0E-03	5.5E-03	1.0E-01	2.8E-01	1.0E-01	2.8E-01
Cis-1 2-Dichloroethene	Soil	2.0E-03	5.5E-03	1.0E-01	2.9E-01	1.0E-01	2.9E-01
Ethylbenzene	Soil	4.2E-03	5.5E-03	6.5E-02	8.5E-02	6.5E-02	8.5E-02
Hexane	Soil	3.0E-03	4.0E-03	8.6E-01	1.1E+00	8.6E-01	1.1E+00
Isopropylbenzene	Soil	2.0E-03	5.5E-03	2.6E-02	7.2E-02	2.6E-02	7.2E-02
Methylene Chloride	Soil	1.3E-02	2.0E-02	5.9E-01	9.3E-01	5.9E-01	9.3E-01
Tetrachloroethene	Soil	2.5E-03	5.5E-03	1.7E-01	3.8E-01	1.7E-01	3.8E-01
Toluene	Soil	5.0E-03	7.0E-03	1.3E-01	1.8E-01	1.3E-01	1.8E-01
Naphthalene	Soil	2.7E-01	8.0E-01	4.0E-02	1.2E-01	4.0E-02	1.2E-01
Acetone	Soil	4.8E-02	1.0E-01	5.6E-02	1.2E-01	5.6E-02	1.2E-01

Lot 8

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	1.7E+00	6.0E+00	9.8E+00	3.4E+01	9.8E+00	3.4E+01
1 2-Dichloroethane	Soil	1.3E-03	5.0E-03	2.2E-02	8.7E-02	2.2E-02	8.7E-02
1 3 5-Trimethylbenzene	Soil	6.4E-01	2.2E+00	5.7E+00	2.0E+01	5.7E+00	2.0E+01
Benzene	Soil	1.1E-03	5.0E-03	5.8E-02	2.6E-01	5.8E-02	2.6E-01
Cis-1 2-Dichloroethene	Soil	1.1E-03	5.0E-03	5.9E-02	2.6E-01	5.9E-02	2.6E-01
Ethylbenzene	Soil	2.7E-01	1.1E+00	4.2E+00	1.7E+01	4.2E+00	1.7E+01
Hexane	Soil	4.4E-03	1.3E-02	1.3E+00	3.6E+00	1.3E+00	3.6E+00
Isopropylbenzene	Soil	1.1E-03	5.0E-03	1.5E-02	6.6E-02	1.5E-02	6.6E-02
Methylene Chloride	Soil	3.3E-02	1.3E-01	1.5E+00	5.8E+00	1.5E+00	5.8E+00
Tetrachloroethene	Soil	2.2E-03	5.0E-03	1.5E-01	3.5E-01	1.5E-01	3.5E-01
Toluene	Soil	5.7E-02	2.2E-01	1.4E+00	5.5E+00	1.4E+00	5.5E+00
Naphthalene	Soil	2.5E-01	1.7E+00	3.7E-02	2.5E-01	3.7E-02	2.5E-01
Acetone	Soil	4.6E-01	2.0E+00	5.3E-01	2.3E+00	5.3E-01	2.3E+00

Lot 9

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	2.0E-02	7.1E-02	1.2E-01	4.1E-01	1.2E-01	4.1E-01
1 2-Dichloroethane	Soil	1.5E-03	5.0E-03	2.6E-02	8.7E-02	2.6E-02	8.7E-02
1 3 5-Trimethylbenzene	Soil	7.1E-03	2.5E-02	6.3E-02	2.2E-01	6.3E-02	2.2E-01
Benzene	Soil	1.3E-03	5.0E-03	6.8E-02	2.6E-01	6.8E-02	2.6E-01
Cis-1 2-Dichloroethene	Soil	1.3E-03	5.0E-03	6.9E-02	2.6E-01	6.9E-02	2.6E-01
Ethylbenzene	Soil	1.2E-02	5.4E-02	1.9E-01	8.4E-01	1.9E-01	8.4E-01
Hexane	Soil	4.0E-03	1.0E-02	1.1E+00	2.9E+00	1.1E+00	2.9E+00
Isopropylbenzene	Soil	4.3E-03	1.6E-02	5.7E-02	2.1E-01	5.7E-02	2.1E-01
Methylene Chloride	Soil	3.5E-02	1.3E-01	1.6E+00	6.0E+00	1.6E+00	6.0E+00
Tetrachloroethene	Soil	2.4E-03	5.0E-03	1.7E-01	3.5E-01	1.7E-01	3.5E-01
Toluene	Soil	4.5E-03	1.5E-02	1.1E-01	3.8E-01	1.1E-01	3.8E-01
Naphthalene	Soil	3.5E-01	1.7E+00	5.2E-02	2.5E-01	5.2E-02	2.5E-01
Acetone	Soil	3.7E-02	9.8E-02	4.3E-02	1.1E-01	4.3E-02	1.1E-01

Lot 10

VOC	Media	Media Conc (ppm)		Intrusion		Total Intrusion(ug/m3)	
		Average	Max	Average	Max	Average	Max
1 2 4-Trimethylbenzene	Soil	3.5E-03	1.0E-02	2.0E-02	5.7E-02	2.0E-02	5.7E-02
1 2-Dichloroethane	Soil	2.8E-03	5.5E-03	4.9E-02	9.5E-02	4.9E-02	9.5E-02
1 3 5-Trimethylbenzene	Soil	1.2E-03	3.0E-03	1.0E-02	2.7E-02	1.0E-02	2.7E-02
Benzene	Soil	2.8E-03	5.5E-03	1.4E-01	2.8E-01	1.4E-01	2.8E-01
Cis-1 2-Dichloroethene	Soil	2.8E-03	5.5E-03	1.4E-01	2.9E-01	1.4E-01	2.9E-01
Ethylbenzene	Soil	3.2E-03	5.5E-03	5.0E-02	8.5E-02	5.0E-02	8.5E-02
Hexane	Soil	2.0E-03	2.0E-03	5.7E-01	5.7E-01	5.7E-01	5.7E-01
Isopropylbenzene	Soil	2.8E-03	5.5E-03	3.6E-02	7.2E-02	3.6E-02	7.2E-02
Methylene Chloride	Soil	2.0E-02	3.7E-02	9.3E-01	1.7E+00	9.3E-01	1.7E+00
Tetrachloroethene	Soil	3.2E-03	5.5E-03	2.2E-01	3.8E-01	2.2E-01	3.8E-01
Toluene	Soil	6.5E-03	1.9E-02	1.7E-01	4.9E-01	1.7E-01	4.9E-01
Naphthalene	Soil	5.7E-01	1.7E+00	8.5E-02	2.6E-01	8.5E-02	2.6E-01
Acetone	Soil	2.3E-02	6.5E-02	2.6E-02	7.6E-02	2.6E-02	7.6E-02

APPENDIX F

DETAILED EXPOSURE AND RISK CALCULATIONS

Appendix F1 **Soil Ingestion**

Appendix F2 **Groundwater Ingestion**

Appendix F3 **Groundwater Inhalation from Indoor Release**

Appendix F4 **VOC Inhalation**

Appendix F1. Soil Ingestion

Exposure Parameters

Scenario	Variable	Units	On-Site Worker				Future Resident			
			CTE	Source	RME	Source	CTE	Source	RME	Source
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[3]	1.0	[1]	1.4	[2]	2	[2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	L/kg-d	6.00E-03	[4]	9.78E-03	[4]	1.92E-02	[4]	2.74E-02	[4]
	HIF(cancer)	L/kg-d	4.29E-04	[4]	3.49E-03	[4]	2.47E-03	[4]	1.17E-02	[4]
Inhalation of Indoor Air	Inhalation rate (indoors)	m^3/day	10	[5]	20	[1,2]	13	[5]	20	[1,2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	m3/kg-d	8.57E-02	[4]	1.96E-01	[4]	1.78E-01	[4]	2.74E-01	[4]
	HIF(cancer)	m3/kg-d	6.12E-03	[4]	6.99E-02	[4]	2.29E-02	[4]	1.17E-01	[4]
Ingestion of Soil	Ingestion rate as child	mg/day	--		--		100	[1,2]	200	[1,2]
	Body weight as child	kg	--		--		15	[1,2]	15	[1,2]
	Exposure frequency as child	days/yr	--		--		350	[2]	350	[1,2]
	Exposure duration as child	yrs	--		--		2	[2]	6	[1,2]
	Ingestion rate as adult	mg/day	50	[2]	100	[2]	50	[2]	100	[2]
	Body weight as adult	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency as adult	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration as adult	yrs	5	[2]	25	[1,2]	7	[2]	24	[1]
	Exposure duration (total)	yrs	5	[4]	25	[4]	9	[4]	30	[4]
	HIF(noncancer)	kg/kg-d	4.29E-07	[4]	9.78E-07	[4]	1.95E-06	[4]	3.65E-06	[4]
	HIF(cancer)	kg/kg-d	3.06E-08	[4]	3.49E-07	[4]	2.51E-07	[4]	1.57E-06	[4]

In accordance with USEPA guidelines, averaging time for cancer = 25,550 days (365 days/yr * 70 yrs). For noncancer, averaging time = exposure duration (yrs) * 365 days/yr.

Soil ingestion HIFs are time weighted averages for children and adults. Refer to section 3.4.1 for equations and discussion.

Sources:

[1] U.S. Environmental Protection Agency. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[3] Professional judgement; Intake by worker assumed to be 1/2 that of resident.

[4] Calculated value

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

Non-Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	Characteristic Non-cancer effects	oRfD (mg/kg-day)	Source
Inorganics	Manganese	Central nervous system effects	4.7E-02	a,c
PAHs	Benzo(a)Anthracene	Decreased body weight gain	2E-02	a,b
	Benzo(a)Pyrene	Decreased body weight gain	2E-02	a,b
	Benzo(b)Fluoranthene	Decreased body weight gain	2E-02	a,b
SVOCs	Bis(2-Ethylhexyl)Phthalate	Increased relative liver weight	2E-02	a
VOCs	Acetophenone	General toxicity	1E-01	a
	Trichloroethylene	Renal toxicity	3E-04	d

(a) IRIS
(b) RfD values are not established for the PAHs shown; the value employed is the RfD for naphthalene, which has the lowest RfD of any PAH.
(c) RfD for food (1.4E-01 mg/kg-day) divided by Modifying Factor of 3 as recommended by IRIS.
(d) USEPA (2001)

Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	WOE	Characteristic Cancer Effects	oSF (mg/kg-day)$^{-1}$	Source
Inorganics	Manganese	D	--	--	
PAHs	Benzo(a)Anthracene	B2	Stomach tumors	7.3E-01	a,b
	Benzo(a)Pyrene	B2	Stomach tumors	7.3E+00	a
	Benzo(b)Fluoranthene	B2	Stomach tumors	7.3E-01	a,b
SVOCs	Bis(2-Ethylhexyl)Phthalate	B2	Hepatocellular carcinoma and adenoma	1.4E-02	a
VOCs	Acetophenone	D	--	--	
	Trichloroethylene	--	Pulmonary and liver tumors	9.0E-02	c

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.
D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans.
– = No data

Data Source:
(a) IRIS
(b) oSF values are based on benzo(a)pyrene and relative potency factors recommended by EPA (1994).
(c) USEPA (2001)

Risk Calculations for Direct Contact with Surface Soil
Sitewide Average

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.2E+00	4.3E-07	9.8E-07	2.0E-02	9E-05	2E-04	3.1E-08	3.5E-07	0.73	9E-08	1E-06
Benzo(a)Pyrene	3.7E+00	4.3E-07	9.8E-07	2.0E-02	8E-05	2E-04	3.1E-08	3.5E-07	7.3	8E-07	9E-06
Benzo(b)Fluoranthene	7.6E+00	4.3E-07	9.8E-07	2.0E-02	2E-04	4E-04	3.1E-08	3.5E-07	0.73	2E-07	2E-06
Bis(2-Ethylhexyl)Phthalate	1.9E+01	4.3E-07	9.8E-07	2.0E-02	4E-04	9E-04	3.1E-08	3.5E-07	0.014	8E-09	9E-08
Total					**7E-04**	**2E-03**				**1E-06**	**1E-05**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.2E+00	2.0E-06	3.7E-06	2.0E-02	4E-04	8E-04	2.5E-07	1.6E-06	0.73	8E-07	5E-06
Benzo(a)Pyrene	3.7E+00	2.0E-06	3.7E-06	2.0E-02	4E-04	7E-04	2.5E-07	1.6E-06	7.3	7E-06	4E-05
Benzo(b)Fluoranthene	7.6E+00	2.0E-06	3.7E-06	2.0E-02	7E-04	1E-03	2.5E-07	1.6E-06	0.73	1E-06	9E-06
Bis(2-Ethylhexyl)Phthalate	1.9E+01	2.0E-06	3.7E-06	2.0E-02	2E-03	3E-03	2.5E-07	1.6E-06	0.014	7E-08	4E-07
Total					**3E-03**	**6E-03**				**9E-06**	**6E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 1

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.7E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	8E-06	3.1E-08	3.5E-07	0.73	4E-09	4E-08
Benzo(a)Pyrene	1.7E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	8E-06	3.1E-08	3.5E-07	7.3	4E-08	4E-07
Benzo(b)Fluoranthene	1.7E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	8E-06	3.1E-08	3.5E-07	0.73	4E-09	4E-08
Bis(2-Ethylhexyl)Phthalate	2.5E-01	4.3E-07	9.8E-07	2.0E-02	5E-06	1E-05	3.1E-08	3.5E-07	0.014	1E-10	1E-09
Total					**2E-05**	**4E-05**				**5E-08**	**5E-07**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.7E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.73	3E-08	2E-07
Benzo(a)Pyrene	1.7E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	7.3	3E-07	2E-06
Benzo(b)Fluoranthene	1.7E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.73	3E-08	2E-07
Bis(2-Ethylhexyl)Phthalate	2.5E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	5E-05	2.5E-07	1.6E-06	0.014	9E-10	5E-09
Total					**8E-05**	**1E-04**				**4E-07**	**2E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 2

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.7E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Benzo(a)Pyrene	4.7E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	7.3	1E-07	1E-06
Benzo(b)Fluoranthene	4.7E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Bis(2-Ethylhexyl)Phthalate	1.9E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	9E-06	3.1E-08	3.5E-07	0.014	8E-11	9E-10
Total					**3E-05**	**8E-05**				**1E-07**	**1E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.7E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	5E-07
Benzo(a)Pyrene	4.7E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	7.3	9E-07	5E-06
Benzo(b)Fluoranthene	4.7E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	5E-07
Bis(2-Ethylhexyl)Phthalate	1.9E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.014	7E-10	4E-09
Total					**2E-04**	**3E-04**				**1E-06**	**6E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 3

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Benzo(a)Pyrene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	7.3	1E-07	1E-06
Benzo(b)Fluoranthene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Bis(2-Ethylhexyl)Phthalate	9.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	5E-05	3.1E-08	3.5E-07	0.014	4E-10	5E-09
Total					**5E-05**	**1E-04**				**1E-07**	**1E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	6E-07
Benzo(a)Pyrene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	7.3	9E-07	6E-06
Benzo(b)Fluoranthene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	6E-07
Bis(2-Ethylhexyl)Phthalate	9.4E-01	2.0E-06	3.7E-06	2.0E-02	9E-05	2E-04	2.5E-07	1.6E-06	0.014	3E-09	2E-08
Total					**2E-04**	**4E-04**				**1E-06**	**7E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 4

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	7.7E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Benzo(a)Pyrene	7.7E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	7.3	2E-07	2E-06
Benzo(b)Fluoranthene	7.7E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Bis(2-Ethylhexyl)Phthalate	7.7E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.014	3E-10	4E-09
Total					**7E-05**	**2E-04**				**2E-07**	**2E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	7.7E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	1E-04	2.5E-07	1.6E-06	0.73	1E-07	9E-07
Benzo(a)Pyrene	7.7E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	1E-04	2.5E-07	1.6E-06	7.3	1E-06	9E-06
Benzo(b)Fluoranthene	7.7E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	1E-04	2.5E-07	1.6E-06	0.73	1E-07	9E-07
Bis(2-Ethylhexyl)Phthalate	7.7E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	1E-04	2.5E-07	1.6E-06	0.014	3E-09	2E-08
Total					**3E-04**	**6E-04**				**2E-06**	**1E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 5

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	0.73	3E-08	3E-07
Benzo(a)Pyrene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	7.3	3E-07	3E-06
Benzo(b)Fluoranthene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	0.73	3E-08	3E-07
Bis(2-Ethylhexyl)Phthalate	1.3E-01	4.3E-07	9.8E-07	2.0E-02	3E-06	6E-06	3.1E-08	3.5E-07	0.014	6E-11	6E-10
Total					**8E-05**	**2E-04**				**3E-07**	**4E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Benzo(a)Pyrene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	7.3	2E-06	1E-05
Benzo(b)Fluoranthene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Bis(2-Ethylhexyl)Phthalate	1.3E-01	2.0E-06	3.7E-06	2.0E-02	1E-05	2E-05	2.5E-07	1.6E-06	0.014	5E-10	3E-09
Total					**4E-04**	**7E-04**				**3E-06**	**2E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 6

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.8E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	9E-06	3.1E-08	3.5E-07	0.73	4E-09	5E-08
Benzo(a)Pyrene	1.8E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	9E-06	3.1E-08	3.5E-07	7.3	4E-08	5E-07
Benzo(b)Fluoranthene	1.8E-01	4.3E-07	9.8E-07	2.0E-02	4E-06	9E-06	3.1E-08	3.5E-07	0.73	4E-09	5E-08
Bis(2-Ethylhexyl)Phthalate	1.6E-01	4.3E-07	9.8E-07	2.0E-02	3E-06	8E-06	3.1E-08	3.5E-07	0.014	7E-11	8E-10
Total					**2E-05**	**3E-05**				**5E-08**	**6E-07**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.8E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.73	3E-08	2E-07
Benzo(a)Pyrene	1.8E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	7.3	3E-07	2E-06
Benzo(b)Fluoranthene	1.8E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.73	3E-08	2E-07
Bis(2-Ethylhexyl)Phthalate	1.6E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	3E-05	2.5E-07	1.6E-06	0.014	6E-10	4E-09
Total					**7E-05**	**1E-04**				**4E-07**	**2E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 7

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Benzo(a)Pyrene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	7.3	1E-07	1E-06
Benzo(b)Fluoranthene	4.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	2E-05	3.1E-08	3.5E-07	0.73	1E-08	1E-07
Bis(2-Ethylhexyl)Phthalate	2.3E-01	4.3E-07	9.8E-07	2.0E-02	5E-06	1E-05	3.1E-08	3.5E-07	0.014	1E-10	1E-09
Total					**4E-05**	**8E-05**				**1E-07**	**1E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	6E-07
Benzo(a)Pyrene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	7.3	9E-07	6E-06
Benzo(b)Fluoranthene	4.8E-01	2.0E-06	3.7E-06	2.0E-02	5E-05	9E-05	2.5E-07	1.6E-06	0.73	9E-08	6E-07
Bis(2-Ethylhexyl)Phthalate	2.3E-01	2.0E-06	3.7E-06	2.0E-02	2E-05	4E-05	2.5E-07	1.6E-06	0.014	8E-10	5E-09
Total					**2E-04**	**3E-04**				**1E-06**	**7E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 8

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	8.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Benzo(a)Pyrene	8.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	7.3	2E-07	2E-06
Benzo(b)Fluoranthene	8.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Bis(2-Ethylhexyl)Phthalate	8.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.014	4E-10	4E-09
Total					**7E-05**	**2E-04**				**2E-07**	**3E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	8.4E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Benzo(a)Pyrene	8.4E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	7.3	2E-06	1E-05
Benzo(b)Fluoranthene	8.4E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Bis(2-Ethylhexyl)Phthalate	8.4E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	0.014	3E-09	2E-08
Total					**3E-04**	**6E-04**				**2E-06**	**1E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 9

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	6.8E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	3E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Benzo(a)Pyrene	6.3E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	3E-05	3.1E-08	3.5E-07	7.3	1E-07	2E-06
Benzo(b)Fluoranthene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	0.73	3E-08	3E-07
Bis(2-Ethylhexyl)Phthalate	8.4E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.014	4E-10	4E-09
Total					**7E-05**	**2E-04**				**2E-07**	**2E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	6.8E-01	2.0E-06	3.7E-06	2.0E-02	7E-05	1E-04	2.5E-07	1.6E-06	0.73	1E-07	8E-07
Benzo(a)Pyrene	6.3E-01	2.0E-06	3.7E-06	2.0E-02	6E-05	1E-04	2.5E-07	1.6E-06	7.3	1E-06	7E-06
Benzo(b)Fluoranthene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Bis(2-Ethylhexyl)Phthalate	8.4E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	0.014	3E-09	2E-08
Total					**3E-04**	**6E-04**				**2E-06**	**9E-06**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Lot 10

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	0.73	3E-08	3E-07
Benzo(a)Pyrene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	7.3	3E-07	3E-06
Benzo(b)Fluoranthene	1.3E+00	4.3E-07	9.8E-07	2.0E-02	3E-05	6E-05	3.1E-08	3.5E-07	0.73	3E-08	3E-07
Bis(2-Ethylhexyl)Phthalate	4.4E-01	4.3E-07	9.8E-07	2.0E-02	9E-06	2E-05	3.1E-08	3.5E-07	0.014	2E-10	2E-09
Total					**9E-05**	**2E-04**				**3E-07**	**4E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Benzo(a)Pyrene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	7.3	2E-06	1E-05
Benzo(b)Fluoranthene	1.3E+00	2.0E-06	3.7E-06	2.0E-02	1E-04	2E-04	2.5E-07	1.6E-06	0.73	2E-07	1E-06
Bis(2-Ethylhexyl)Phthalate	4.4E-01	2.0E-06	3.7E-06	2.0E-02	4E-05	8E-05	2.5E-07	1.6E-06	0.014	2E-09	1E-08
Total					**4E-04**	**8E-04**				**3E-06**	**2E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Risk Calculations for Direct Contact with Surface Soil
Waste Pile

WORKER

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	8.3E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	0.73	2E-08	2E-07
Benzo(a)Pyrene	8.6E-01	4.3E-07	9.8E-07	2.0E-02	2E-05	4E-05	3.1E-08	3.5E-07	7.3	2E-07	2E-06
Benzo(b)Fluoranthene	6.3E-01	4.3E-07	9.8E-07	2.0E-02	1E-05	3E-05	3.1E-08	3.5E-07	0.73	1E-08	2E-07
Bis(2-Ethylhexyl)Phthalate	7.2E+01	4.3E-07	9.8E-07	2.0E-02	2E-03	4E-03	3.1E-08	3.5E-07	0.014	3E-08	4E-07
Total					**2E-03**	**4E-03**				**3E-07**	**3E-06**

RESIDENT

COPC	EPC mg/kg	Noncancer HIF CTE	Noncancer HIF RME	RfD mg/kg-d	Noncancer HI CTE	Noncancer HI RME	Cancer HIF CTE	Cancer HIF RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
Benzo(a)Anthracene	8.3E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	0.73	2E-07	9E-07
Benzo(a)Pyrene	8.6E-01	2.0E-06	3.7E-06	2.0E-02	8E-05	2E-04	2.5E-07	1.6E-06	7.3	2E-06	1E-05
Benzo(b)Fluoranthene	6.3E-01	2.0E-06	3.7E-06	2.0E-02	6E-05	1E-04	2.5E-07	1.6E-06	0.73	1E-07	7E-07
Bis(2-Ethylhexyl)Phthalate	7.2E+01	2.0E-06	3.7E-06	2.0E-02	7E-03	1E-02	2.5E-07	1.6E-06	0.014	3E-07	2E-06
Total					**7E-03**	**1E-02**				**2E-06**	**1E-05**

COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
HIF = Human Intake Factor
RfD =Reference Dose
HI = Hazard Index
oSF = oral Slope Factor
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Appendix F2. Groundwater Ingestion

Exposure Parameters

Scenario	Variable	Units	On-Site Worker				Future Resident			
			CTE	Source	RME	Source	CTE	Source	RME	Source
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[3]	1.0	[1]	1.4	[2]	2	[2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	L/kg-d	6.00E-03	[4]	9.78E-03	[4]	1.92E-02	[4]	2.74E-02	[4]
	HIF(cancer)	L/kg-d	4.29E-04	[4]	3.49E-03	[4]	2.47E-03	[4]	1.17E-02	[4]
Inhalation of Indoor Air	Inhalation rate (indoors)	m^3/day	10	[5]	20	[1,2]	13	[5]	20	[1,2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	m3/kg-d	8.57E-02	[4]	1.96E-01	[4]	1.78E-01	[4]	2.74E-01	[4]
	HIF(cancer)	m3/kg-d	6.12E-03	[4]	6.99E-02	[4]	2.29E-02	[4]	1.17E-01	[4]
Ingestion of Soil	Ingestion rate as child	mg/day	--		--		100	[1,2]	200	[1,2]
	Body weight as child	kg	--		--		15	[1,2]	15	[1,2]
	Exposure frequency as child	days/yr	--		--		350	[2]	350	[1,2]
	Exposure duration as child	yrs	--		--		2	[2]	6	[1,2]
	Ingestion rate as adult	mg/day	50	[2]	100	[2]	50	[2]	100	[2]
	Body weight as adult	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency as adult	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration as adult	yrs	5	[2]	25	[1,2]	7	[2]	24	[1]
	Exposure duration (total)	yrs	5	[4]	25	[4]	9	[4]	30	[4]
	HIF(noncancer)	kg/kg-d	4.29E-07	[4]	9.78E-07	[4]	1.95E-06	[4]	3.65E-06	[4]
	HIF(cancer)	kg/kg-d	3.06E-08	[4]	3.49E-07	[4]	2.51E-07	[4]	1.57E-06	[4]

In accordance with USEPA guidelines, averaging time for cancer = 25,550 days (365 days/yr * 70 yrs). For noncancer, averaging time = exposure duration (yrs) * 365 days/yr.

Soil ingestion HIFs are time weighted averages for children and adults. Refer to section 3.4.1 for equations and discussion.

Sources:

[1] U.S. Environmental Protection Agency. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[3] Professional judgement; Intake by worker assumed to be 1/2 that of resident.

[4] Calculated value

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

Non-Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	Characteristic Non-cancer effects	oRfD (mg/kg-day)	Source
Inorganics	Manganese	Central nervous system effects	4.7E-02	a,c
PAHs	Benzo(a)Anthracene	Decreased body weight gain	2E-02	a,b
	Benzo(a)Pyrene	Decreased body weight gain	2E-02	a,b
	Benzo(b)Fluoranthene	Decreased body weight gain	2E-02	a,b
SVOCs	Bis(2-Ethylhexyl)Phthalate	Increased relative liver weight	2E-02	a
VOCs	Acetophenone	General toxicity	1E-01	a
	Trichloroethylene	Renal toxicity	3E-04	d

(a) IRIS
(b) RfD values are not established for the PAHs shown; the value employed is the RfD for naphthalene, which has the lowest RfD of any PAH.
(c) RfD for food (1.4E-01 mg/kg-day) divided by Modifying Factor of 3 as recommended by IRIS.
(d) USEPA (2001)

Cancer Toxicity Summary for Chemicals of Potential Concern by Oral Exposure

Group	COPC	WOE	Characteristic Cancer Effects	oSF (mg/kg-day)$^{-1}$	Source
Inorganics	Manganese	D	--	--	
PAHs	Benzo(a)Anthracene	B2	Stomach tumors	7.3E-01	a,b
	Benzo(a)Pyrene	B2	Stomach tumors	7.3E+00	a
	Benzo(b)Fluoranthene	B2	Stomach tumors	7.3E-01	a,b
SVOCs	Bis(2-Ethylhexyl)Phthalate	B2	Hepatocellular carcinoma and adenoma	1.4E-02	a
VOCs	Acetophenone	D	--	--	
	Trichloroethylene	--	Pulmonary and liver tumors	9.0E-02	c

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.
D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans.
– = No data

Data Source:
(a) IRIS
(b) oSF values are based on benzo(a)pyrene and relative potency factors recommended by EPA (1994).
(c) USEPA (2001)

Risk Calculations for Ingestion of Groundwater

MW-01/PZ-01

Lot 8

WORKER

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4E-04	6.00E-03	9.78E-03	1.0E-01	2E-05	4E-05	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	6E-03	6.00E-03	9.78E-03	2.0E-02	2E-03	3E-03	4.3E-04	3.5E-03	0.014	4E-08	3E-07
MANGANESE	2E-01	6.00E-03	9.78E-03	4.7E-02	3E-02	5E-02	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	1E-03	6.00E-03	9.78E-03	3.0E-04	2E-02	3E-02	4.3E-04	3.5E-03	0.089	4E-08	3E-07
Total					**5E-02**	**8E-02**				**7E-08**	**6E-07**

RESIDENT

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4E-04	1.92E-02	2.74E-02	1.0E-01	8E-05	1E-04	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	6E-03	1.92E-02	2.74E-02	2.0E-02	6E-03	8E-03	2.5E-03	1.2E-02	0.014	2E-07	1E-06
MANGANESE	2E-01	1.92E-02	2.74E-02	4.7E-02	9E-02	1E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	1E-03	1.92E-02	2.74E-02	3.0E-04	6E-02	9E-02	2.5E-03	1.2E-02	0.089	2E-07	1E-06
Total					**2E-01**	**2E-01**				**4E-07**	**2E-06**

* N=2, so exposure is based on maximum concentration of two samples.

Risk Calculations for Ingestion of Groundwater

MW-02/PZ-02

Lot 1

WORKER

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	3.0E-04	6.0E-03	9.8E-03	1.0E-01	2E-05	3E-05	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	5.0E-03	6.0E-03	9.8E-03	2.0E-02	2E-03	2E-03	4.3E-04	3.5E-03	0.014	3E-08	2E-07
MANGANESE	1.2E+00	6.0E-03	9.8E-03	4.7E-02	1E-01	2E-01	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	7.0E-03	6.0E-03	9.8E-03	3.0E-04	1E-01	2E-01	4.3E-04	3.5E-03	0.089	3E-07	2E-06
Total					**3E-01**	**5E-01**				**3E-07**	**2E-06**

RESIDENT

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	3.0E-04	1.9E-02	2.7E-02	1.0E-01	6E-05	8E-05	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	5.0E-03	1.9E-02	2.7E-02	2.0E-02	5E-03	7E-03	2.5E-03	1.2E-02	0.014	2E-07	8E-07
MANGANESE	1.2E+00	1.9E-02	2.7E-02	4.7E-02	5E-01	7E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	7.0E-03	1.9E-02	2.7E-02	3.0E-04	4E-01	6E-01	2.5E-03	1.2E-02	0.089	2E-06	7E-06
Total					**9E-01**	**1E+00**				**2E-06**	**8E-06**

* N=2, so exposure is based on maximum concentration of two samples.

Risk Calculations for Ingestion of Groundwater

MW-03/PZ-03

Lot 10

WORKER

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4.0E-04	6.0E-03	9.8E-03	1.0E-01	2E-05	4E-05	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	4.0E-03	6.0E-03	9.8E-03	2.0E-02	1E-03	2E-03	4.3E-04	3.5E-03	0.014	2E-08	2E-07
MANGANESE	5.5E-01	6.0E-03	9.8E-03	4.7E-02	7E-02	1E-01	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	5.0E-03	6.0E-03	9.8E-03	3.0E-04	1E-01	2E-01	4.3E-04	3.5E-03	0.089	2E-07	2E-06
Total					**2E-01**	**3E-01**				**2E-07**	**2E-06**

RESIDENT

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4.0E-04	1.9E-02	2.7E-02	1.0E-01	8E-05	1E-04	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	4.0E-03	1.9E-02	2.7E-02	2.0E-02	4E-03	5E-03	2.5E-03	1.2E-02	0.014	1E-07	7E-07
MANGANESE	5.5E-01	1.9E-02	2.7E-02	4.7E-02	2E-01	3E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	5.0E-03	1.9E-02	2.7E-02	3.0E-04	3E-01	5E-01	2.5E-03	1.2E-02	0.089	1E-06	5E-06
Total					**6E-01**	**8E-01**				**1E-06**	**6E-06**

* N=2, so exposure is based on maximum concentration of two samples.

Risk Calculations for Ingestion of Groundwater

MW-04

Lot 2

WORKER

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	5.0E-03	6.0E-03	9.8E-03	1.0E-01	3E-04	5E-04	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	5.0E-03	6.0E-03	9.8E-03	2.0E-02	2E-03	2E-03	4.3E-04	3.5E-03	0.014	3E-08	2E-07
MANGANESE	2.4E-01	6.0E-03	9.8E-03	4.7E-02	3E-02	5E-02	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	9.0E-04	6.0E-03	9.8E-03	3.0E-04	2E-02	3E-02	4.3E-04	3.5E-03	0.089	3E-08	3E-07
Total					**5E-02**	**8E-02**				**6E-08**	**5E-07**

RESIDENT

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	5.0E-03	1.9E-02	2.7E-02	1.0E-01	1E-03	1E-03	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	5.0E-03	1.9E-02	2.7E-02	2.0E-02	5E-03	7E-03	2.5E-03	1.2E-02	0.014	2E-07	8E-07
MANGANESE	2.4E-01	1.9E-02	2.7E-02	4.7E-02	1E-01	1E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	9.0E-04	1.9E-02	2.7E-02	3.0E-04	6E-02	8E-02	2.5E-03	1.2E-02	0.089	2E-07	9E-07
Total					**2E-01**	**2E-01**				**4E-07**	**2E-06**

* N=1, so exposure is based on concentration of one sample.

Risk Calculations for Ingestion of Groundwater

MW-05

Lot 6

WORKER

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	2.0E-04	6.0E-03	9.8E-03	1.0E-01	1E-05	2E-05	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	2.0E-03	6.0E-03	9.8E-03	2.0E-02	6E-04	1E-03	4.3E-04	3.5E-03	0.014	1E-08	1E-07
MANGANESE	9.0E-02	6.0E-03	9.8E-03	4.7E-02	1E-02	2E-02	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	5.0E-03	6.0E-03	9.8E-03	3.0E-04	1E-01	2E-01	4.3E-04	3.5E-03	0.089	2E-07	2E-06
Total					**1E-01**	**2E-01**				**2E-07**	**2E-06**

RESIDENT

COPC	Conc in Water* (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	2.0E-04	1.9E-02	2.7E-02	1.0E-01	4E-05	5E-05	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	2.0E-03	1.9E-02	2.7E-02	2.0E-02	2E-03	3E-03	2.5E-03	1.2E-02	0.014	7E-08	3E-07
MANGANESE	9.0E-02	1.9E-02	2.7E-02	4.7E-02	4E-02	5E-02	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	5.0E-03	1.9E-02	2.7E-02	3.0E-04	3E-01	5E-01	2.5E-03	1.2E-02	0.089	1E-06	5E-06
Total					**4E-01**	**5E-01**				**1E-06**	**6E-06**

* N=1, so exposure is based on concentration of one sample.

Risk Calculations for Ingestion of Groundwater

Sitewide Average

WORKER

COPC	Conc in Water (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	1.3E-03	6.0E-03	9.8E-03	1.0E-01	8E-05	1E-04	4.3E-04	3.5E-03	na		
BIS(2-ETHYLHEXYL)PHTHA	3.8E-03	6.0E-03	9.8E-03	2.0E-02	1E-03	2E-03	4.3E-04	3.5E-03	0.014	2E-08	2E-07
MANGANESE	4.2E-01	6.0E-03	9.8E-03	4.7E-02	5E-02	9E-02	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	1.0E-01	6.0E-03	9.8E-03	3.0E-04	2E+00	3E+00	4.3E-04	3.5E-03	0.089	4E-06	3E-05
Total					**2E+00**	**3E+00**				**4E-06**	**3E-05**

RESIDENT

COPC	Conc in Water (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	1.3E-03	1.9E-02	2.7E-02	1.0E-01	2E-04	3E-04	2.5E-03	1.2E-02	na		
BIS(2-ETHYLHEXYL)PHTHA	3.8E-03	1.9E-02	2.7E-02	2.0E-02	4E-03	5E-03	2.5E-03	1.2E-02	0.014	1E-07	6E-07
MANGANESE	4.2E-01	1.9E-02	2.7E-02	4.7E-02	2E-01	2E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	1.0E-01	1.9E-02	2.7E-02	3.0E-04	6E+00	9E+00	2.5E-03	1.2E-02	0.089	2E-05	1E-04
Total					**7E+00**	**9E+00**				**2E-05**	**1E-04**

Risk Calculations for Ingestion of Groundwater

IW-GW-04 (a)

Lot 3

WORKER

COPC	Conc in Water (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
1,2-Dichloroethene	5.0E-01	6.0E-03	9.8E-03	9.0E-03	3E-01	5E-01	4.3E-04	3.5E-03	na		
ACETONE	2.5E-02	6.0E-03	9.8E-03	1.0E-01	2E-03	2E-03	4.3E-04	3.5E-03	na		
ACETOPHENONE	--	6.0E-03	9.8E-03				4.3E-04	3.5E-03			
BETA-BHC	1.0E-04	6.0E-03	9.8E-03	na			4.3E-04	3.5E-03	1.8	8E-08	6E-07
BIS(2-ETHYLHEXYL)PHTHA	1.0E-03	6.0E-03	9.8E-03	2.0E-02	3E-04	5E-04	4.3E-04	3.5E-03	0.014	6E-09	5E-08
GAMMA-BHC	3.3E-04	6.0E-03	9.8E-03	3.0E-04	7E-03	1E-02	4.3E-04	3.5E-03	1.3	2E-07	1E-06
HEPTACHLOR	1.6E-04	6.0E-03	9.8E-03	5.0E-04	2E-03	3E-03	4.3E-04	3.5E-03	4.5	3E-07	3E-06
MANGANESE	2.8E-01	6.0E-03	9.8E-03	4.7E-02	4E-02	6E-02	4.3E-04	3.5E-03	na		
TRICHLOROETHYLENE	8.7E-01	6.0E-03	9.8E-03	3.0E-04	2E+01	3E+01	4.3E-04	3.5E-03	0.089	3E-05	3E-04
Total					**1.8E+01**	**2.9E+01**				**3E-05**	**3E-04**

RESIDENT

COPC	Conc in Water (mg/L)	Noncancer HIF (L/kg-d) CTE	Noncancer HIF (L/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (L/kg-d) CTE	Cancer HIF (L/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
1,2-Dichloroethene	5.0E-01	1.9E-02	2.7E-02	9.0E-03	1E+00	2E+00	2.5E-03	1.2E-02	na		
ACETONE	2.5E-02	1.9E-02	2.7E-02	1.0E-01	5E-03	7E-03	2.5E-03	1.2E-02	na		
ACETOPHENONE	--	1.9E-02	2.7E-02				2.5E-03	1.2E-02			
BETA-BHC	1.0E-04	1.9E-02	2.7E-02	na			2.5E-03	1.2E-02	1.8	4E-07	2E-06
BIS(2-ETHYLHEXYL)PHTHA	1.0E-03	1.9E-02	2.7E-02	2.0E-02	1E-03	1E-03	2.5E-03	1.2E-02	0.014	3E-08	2E-07
GAMMA-BHC	3.3E-04	1.9E-02	2.7E-02	3.0E-04	2E-02	3E-02	2.5E-03	1.2E-02	1.3	1E-06	5E-06
HEPTACHLOR	1.6E-04	1.9E-02	2.7E-02	5.0E-04	6E-03	9E-03	2.5E-03	1.2E-02	4.5	2E-06	8E-06
MANGANESE	2.8E-01	1.9E-02	2.7E-02	4.7E-02	1E-01	2E-01	2.5E-03	1.2E-02	na		
TRICHLOROETHYLENE	8.7E-01	1.9E-02	2.7E-02	3.0E-04	6E+01	8E+01	2.5E-03	1.2E-02	0.089	2E-04	9E-04
Total					**6E+01**	**8E+01**				**2E-04**	**9E-04**

* N=1, so exposure is based on concentration of one sample.

(a) This well was sampled by URS (1998) but has since dried up and is considered historical data.

Appendix F3. Groundwater Inhalation from Indoor Release

Exposure Parameters

Scenario	Variable	Units	On-Site Worker				Future Resident			
			CTE	Source	RME	Source	CTE	Source	RME	Source
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[3]	1.0	[1]	1.4	[2]	2	[2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	L/kg-d	6.00E-03	[4]	9.78E-03	[4]	1.92E-02	[4]	2.74E-02	[4]
	HIF(cancer)	L/kg-d	4.29E-04	[4]	3.49E-03	[4]	2.47E-03	[4]	1.17E-02	[4]
Inhalation of Indoor Air	Inhalation rate (indoors)	m^3/day	10	[5]	20	[1,2]	13	[5]	20	[1,2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	m3/kg-d	8.57E-02	[4]	1.96E-01	[4]	1.78E-01	[4]	2.74E-01	[4]
	HIF(cancer)	m3/kg-d	6.12E-03	[4]	6.99E-02	[4]	2.29E-02	[4]	1.17E-01	[4]
Ingestion of Soil	Ingestion rate as child	mg/day	--		--		100	[1,2]	200	[1,2]
	Body weight as child	kg	--		--		15	[1,2]	15	[1,2]
	Exposure frequency as child	days/yr	--		--		350	[2]	350	[1,2]
	Exposure duration as child	yrs	--		--		2	[2]	6	[1,2]
	Ingestion rate as adult	mg/day	50	[2]	100	[2]	50	[2]	100	[2]
	Body weight as adult	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency as adult	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration as adult	yrs	5	[2]	25	[1,2]	7	[2]	24	[1]
	Exposure duration (total)	yrs	5	[4]	25	[4]	9	[4]	30	[4]
	HIF(noncancer)	kg/kg-d	4.29E-07	[4]	9.78E-07	[4]	1.95E-06	[4]	3.65E-06	[4]
	HIF(cancer)	kg/kg-d	3.06E-08	[4]	3.49E-07	[4]	2.51E-07	[4]	1.57E-06	[4]

In accordance with USEPA guidelines, averaging time for cancer = 25,550 days (365 days/yr * 70 yrs). For noncancer, averaging time = exposure duration (yrs) * 365 days/yr.

Soil ingestion HIFs are time weighted averages for children and adults. Refer to section 3.4.1 for equations and discussion.

Sources:

[1] U.S. Environmental Protection Agency. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[3] Professional judgement; Intake by worker assumed to be 1/2 that of resident.

[4] Calculated value

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

Inhalation Toxicity Factors

Parameter	Inhalation Toxicity Factors				
	Non-Cancer		Cancer		
	iRfD (mg/kg-d)	Source	WOE	iSF (mg/kg-d)-1	Source
1 2 4-Trimethylbenzene	1.7E-03	b	--	--	
1 2-Dichloroethane	1.4E-03	b	B2	9.1E-02	a
1 3 5-Trimethylbenzene	1.7E-03	b	--	--	
Benzene	1.7E-03	b	A	2.7E-02	a
cis-1 2-Dichloroethylene	1.0E-02	c	D	--	
Ethylbenzene	2.9E-01	a	D	--	
Hexane	5.7E-02	a	--	--	
Isopropylbenzene	1.1E-01	a	D	--	
Methylene Chloride	8.6E-01	b	B2	1.6E-03	a
Tetrachloroethylene	1.4E-01	b	--	2.0E-03	c
Toluene	1.1E-01	a	D	--	
Naphthalene	8.6E-04	a	C	--	
Acetone	1.0E-01	c	D	--	
Trichloroethylene	1.1E-02	d	--	6.0E-03	b
Acetphenone	--	--	--	--	

-- = No data

A = Known human carcinogen: Sufficient evidence of cancer in humans.

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.

C = Possible human carcinogen: Suggestive evidence of carcinogenicity in animals.

D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans.

(a) Values from IRIS
(b) Values from Region 3 Table (USEPA 2002)
(c) Values from USEPA 2000
(d) Values from USEPA 2001

Risk Calculations for Inhalation from Groundwater

MW-01/PZ-01

Lot 8

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4E-04	2E-04	8.57E-02	1.96E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	1E-03	5E-04	8.57E-02	1.96E-01	6.0E-03	7E-03	2E-02	6.1E-03	7.0E-02	1.14E-02	3.49E-08	3.98379E-07
Total						**7E-03**	**2E-02**				**3E-08**	**4E-07**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4E-04	2E-04	1.78E-01	2.74E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	1E-03	5E-04	1.78E-01	2.74E-01	6.0E-03	0.0149649	0.0230229	2.3E-02	1.2E-01	1.14E-02	1.31E-07	6.69276E-07
Total						**1E-02**	**2E-02**				**1E-07**	**7E-07**

* N=2, so exposure is based on maximum concentration of two samples.

Risk Calculations for Inhalation from Groundwater

MW-02/PZ-02

Lot 1

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	3.0E-04	1.5E-04	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	7.0E-03	3.5E-03	8.6E-02	2.0E-01	6.0E-03	5E-02	1E-01	6.1E-03	7.0E-02	1.14E-02	2E-07	3E-06
Total						**5E-02**	**1E-01**				**2E-07**	**3E-06**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	3.0E-04	1.5E-04	1.8E-01	2.7E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	7.0E-03	3.5E-03	1.8E-01	2.7E-01	6.0E-03	1E-01	2E-01	2.3E-02	1.2E-01	1.14E-02	9E-07	5E-06
Total						**1E-01**	**2E-01**				**9E-07**	**5E-06**

* N=2, so risk is driven from concentration of two samples.

Risk Calculations for Inhalation from Groundwater

MW-03/PZ-03

Lot 10

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4.0E-04	2.0E-04	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	5.0E-03	2.5E-03	8.6E-02	2.0E-01	6.0E-03	4E-02	8E-02	6.1E-03	7.0E-02	1.14E-02	2E-07	2E-06
Total						**4E-02**	**8E-02**				**2E-07**	**2E-06**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	4.0E-04	2.0E-04	1.8E-01	2.7E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	5.0E-03	2.5E-03	1.8E-01	2.7E-01	6.0E-03	7E-02	1E-01	2.3E-02	1.2E-01	1.14E-02	7E-07	3E-06
Total						**7E-02**	**1E-01**				**7E-07**	**3E-06**

* N=2, so risk is driven from concentration of two samples.

Risk Calculations for Inhalation from Groundwater

MW-04

Lot 2

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	5.0E-03	2.5E-03	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	9.0E-04	4.5E-04	8.6E-02	2.0E-01	6.0E-03	6E-03	1E-02	6.1E-03	7.0E-02	1.14E-02	3E-08	4E-07
Total						**6E-03**	**1E-02**				**3E-08**	**4E-07**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	5.0E-03	2.5E-03	1.8E-01	2.7E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	9.0E-04	4.5E-04	1.8E-01	2.7E-01	6.0E-03	1E-02	2E-02	2.3E-02	1.2E-01	1.14E-02	1E-07	6E-07
Total						**1E-02**	**2E-02**				**1E-07**	**6E-07**

* N=1, so risk is driven from concentration of one sample.

Risk Calculations for Inhalation from Groundwater

MW-05

Lot 6

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	2.0E-04	1.0E-04	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	5.0E-03	2.5E-03	8.6E-02	2.0E-01	6.0E-03	4E-02	8E-02	6.1E-03	7.0E-02	1.14E-02	2E-07	2E-06
Total						**4E-02**	**8E-02**				**2E-07**	**2E-06**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	2.0E-04	1.0E-04	1.8E-01	2.7E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	5.0E-03	2.5E-03	1.8E-01	2.7E-01	6.0E-03	7E-02	1E-01	2.3E-02	1.2E-01	1.14E-02	7E-07	3E-06
Total						**7E-02**	**1E-01**				**7E-07**	**3E-06**

* N=1, so risk is driven from concentration of one sample.

Risk Calculations for Inhalation from Groundwater

Sitewide Average

WORKER

COPC	Conc. in Water (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	1.3E-03	6.3E-04	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	1.0E-01	5.0E-02	8.6E-02	2.0E-01	6.0E-03	7E-01	2E+00	6.1E-03	7.0E-02	1.14E-02	3E-06	4E-05
Total						**7E-01**	**2E+00**				**3E-06**	**4E-05**

RESIDENT

COPC	Conc. in Water (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
ACETOPHENONE	1.3E-03	6.3E-04	1.8E-01	2.7E-01	na			2.3E-02	1.2E-01	na		
TRICHLOROETHYLENE	1.0E-01	5.0E-02	1.8E-01	2.7E-01	6.0E-03	1E+00	2E+00	2.3E-02	1.2E-01	1.14E-02	1E-05	7E-05
Total						**1E+00**	**2E+00**				**1E-05**	**7E-05**

Risk Calculations for Inhalation from Groundwater

IW-GW-04 (a)

WORKER

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
1,2-DICHLOROETHENE	5.0E-01	2.5E-01	8.6E-02	2.0E-01	1.0E-02	2E+00	5E+00	6.1E-03	7.0E-02	na		
ACETONE	2.5E-02	1.3E-02	8.6E-02	2.0E-01	1.0E-01	1E-02	2E-02	6.1E-03	7.0E-02	na		
ACETOPHENONE	0.0E+00	0.0E+00	8.6E-02	2.0E-01	na			6.1E-03	7.0E-02	na		
TRICHLOROETHYLENE	8.7E-01	4.4E-01	8.6E-02	2.0E-01	6.0E-03	6E+00	1E+01	6.1E-03	7.0E-02	1.14E-02	3E-05	3E-04
Total						**8E+00**	**2E+01**				**3E-05**	**3E-04**

RESIDENT

COPC	Conc. in Water* (mg/L)	Conc. in Air (mg/m3)	Noncancer HIF (m3/kg-d) CTE	Noncancer HIF (m3/kg-d) RME	RfD (mg/kg-d)	Noncancer HI CTE	Noncancer HI RME	Cancer HIF (m3/kg-d) CTE	Cancer HIF (m3/kg-d) RME	oSF (mg/kg-d)-1	Cancer Risk CTE	Cancer Risk RME
1,2-DICHLOROETHENE	5.0E-01	2.5E-01	1.8E-01	2.7E-01	1.0E-02	4E+00	7E+00	2.3E-02	1.2E-01	na		
ACETONE	2.5E-02	1.3E-02	1.8E-01	2.7E-01	1.0E-01	2E-02	3E-02	2.3E-02	1.2E-01	na		
ACETOPHENONE	0.0E+00	0.0E+00	1.8E-01	2.7E-01				2.3E-02	1.2E-01		0E+00	0E+00
TRICHLOROETHYLENE	8.7E-01	4.4E-01	1.8E-01	2.7E-01	6.0E-03	1E+01	2E+01	2.3E-02	1.2E-01	1.14E-02	1E-04	6E-04
Total						**2E+01**	**3E+01**				**1E-04**	**6E-04**

* N=1, so risk is driven from concentration of one sample.

(a) This well was sampled by URS (1998) but since then has dried up and is considered histoical data.

Appendix F4. VOC Inhalation

Exposure Parameters

Scenario	Variable	Units	On-Site Worker				Future Resident			
			CTE	Source	RME	Source	CTE	Source	RME	Source
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[3]	1.0	[1]	1.4	[2]	2	[2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	L/kg-d	6.00E-03	[4]	9.78E-03	[4]	1.92E-02	[4]	2.74E-02	[4]
	HIF(cancer)	L/kg-d	4.29E-04	[4]	3.49E-03	[4]	2.47E-03	[4]	1.17E-02	[4]
Inhalation of Indoor Air	Inhalation rate (indoors)	m^3/day	10	[5]	20	[1,2]	13	[5]	20	[1,2]
	Body weight	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration	yrs	5	[2]	25	[2]	9	[2]	30	[2]
	HIF(noncancer)	m3/kg-d	8.57E-02	[4]	1.96E-01	[4]	1.78E-01	[4]	2.74E-01	[4]
	HIF(cancer)	m3/kg-d	6.12E-03	[4]	6.99E-02	[4]	2.29E-02	[4]	1.17E-01	[4]
Ingestion of Soil	Ingestion rate as child	mg/day	--		--		100	[1,2]	200	[1,2]
	Body weight as child	kg	--		--		15	[1,2]	15	[1,2]
	Exposure frequency as child	days/yr	--		--		350	[2]	350	[1,2]
	Exposure duration as child	yrs	--		--		2	[2]	6	[1,2]
	Ingestion rate as adult	mg/day	50	[2]	100	[2]	50	[2]	100	[2]
	Body weight as adult	kg	70	[1,2]	70	[1,2]	70	[1,2]	70	[1,2]
	Exposure frequency as adult	days/yr	219	[2]	250	[1,2]	350	[1,2]	350	[1,2]
	Exposure duration as adult	yrs	5	[2]	25	[1,2]	7	[2]	24	[1]
	Exposure duration (total)	yrs	5	[4]	25	[4]	9	[4]	30	[4]
	HIF(noncancer)	kg/kg-d	4.29E-07	[4]	9.78E-07	[4]	1.95E-06	[4]	3.65E-06	[4]
	HIF(cancer)	kg/kg-d	3.06E-08	[4]	3.49E-07	[4]	2.51E-07	[4]	1.57E-06	[4]

In accordance with USEPA guidelines, averaging time for cancer = 25,550 days (365 days/yr * 70 yrs). For noncancer, averaging time = exposure duration (yrs) * 365 days/yr.

Soil ingestion HIFs are time weighted averages for children and adults. Refer to section 3.4.1 for equations and discussion.

Sources:

[1] U.S. Environmental Protection Agency. 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] U.S. Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. [DRAFT]. November 4, 1993.

[3] Professional judgement; Intake by worker assumed to be 1/2 that of resident.

[4] Calculated value

[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook.

Inhalation TRVs

VOC	CAS #	Inhalation Toxicity Factors				
		Non-Cancer		Cancer		
		iRfD (mg/kg-d)	Source	WOE	iSF (mg/kg-d)	Source
1 2 4-Trimethylbenzene	95636	1.70E-03	b		na	
1 2-Dichloroethane	107062	1.40E-03	b	B2	9.10E-02	a
1 3 5-Trimethylbenzene	108678	1.70E-03	b		na	
Benzene	71432	1.70E-03	b	A	2.73E-02	a
Cis-1 2-Dichloroethene	156592	1.00E-02	c	D	na	
Ethylbenzene	100414	2.86E-01	a	D	na	
Hexane	110543	5.71E-02	a		na	
Isopropylbenzene	98828	1.14E-01	a	D	na	
Methylene Chloride	75092	8.60E-01	b	B2	1.65E-03	a
Tetrachloroethene	127184	1.40E-01	b		2.03E-03	c
Toluene	108883	1.14E-01	a	D	na	
Naphthalene	91203	8.57E-04	a	C	na	
Acetone	67641	1.00E-01	c	D	na	

WOE Categories:

A = Known human carcinogen: Sufficient evidence of cancer in humans.

B2 = Probable human carcinogen: Sufficient evidence of cancer in animals, but lack of data or insufficient data from humans.

C = Possible human carcinogen: Suggestive evidence of carcinogenicity in animals.

D = Cannot be evaluated: No evidence or inadequate evidence of cancer in animals or humans.

(a) Values from IRIS
(b) Values from Region 3 Table
(c) Values from USEPA 2000
(d) Value from USEPA 2001

Inputs Used in Modeling Indoor Air Concentrations for VOCs Released from Soil

Parameter	Value	Basis
Concentration in source (soil, water)	Chemical and location specific	Site data
Depth below grade to bottom of enclosed space floor	15 cm 200 cm	Model default for slab-on-grade building Model default for structure with basement
Depth below grade to top of soil contamination	15 cm 200 cm	Slab-on-grade scenario Basement scenario
Average soil temperature	10°C	Model default
Vadose zone SCS soil type	Sandy loam	Site specific data (Washington Group 2001d)
Vadose zone soil dry bulk density	1.5 g/cm^3	Assumed value for sandy loam
Vadose zone soil total porosity	0.43	Assumed value for sandy loam
Vadose zone soil water-filled porosity	0.10 cm^3/cm^3	Conservative estimate
Vadose zone soil organic carbon fraction	0.002	Mean of site-specific data for depths greater than 5 feet (Washington Group 2001d)

Johnson and Ettinger (1991) model calculations implemented using spreadsheet developed by USEPA (2000).

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 1

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-06	1E-06	8.57E-02	1.96E-01	1.70E-03	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	4E-06	4E-06	8.57E-02	1.96E-01	1.40E-03	2E-04	5E-04	2E-04	5E-04	6.12E-03	6.99E-02	9.10E-02	2E-09	2E-08	2E-09	2E-08
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	7E-06	7E-06	8.57E-02	1.96E-01	1.70E-03	4E-04	8E-04	4E-04	8E-04	6.12E-03	6.99E-02	2.73E-02	1E-09	1E-08	1E-09	1E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	8.57E-02	1.96E-01	1.00E-02	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	1E-06	1E-06	8.57E-02	1.96E-01	2.86E-01	3E-07	7E-07	3E-07	7E-07	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	4E-04	4E-04	8.57E-02	1.96E-01	5.71E-02	6E-04	1E-03	6E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.14E-01	1E-06	3E-06	1E-06	3E-06	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	3E-04	3E-04	8.57E-02	1.96E-01	8.60E-01	3E-05	6E-05	3E-05	6E-05	6.12E-03	6.99E-02	1.65E-03	3E-09	3E-08	3E-09	3E-08
Tetrachloroethene	5E-05	5E-05	8.57E-02	1.96E-01	1.40E-01	3E-05	7E-05	3E-05	7E-05	6.12E-03	6.99E-02	2.03E-03	6E-10	7E-09	6E-10	7E-09
Toluene	3E-06	3E-06	8.57E-02	1.96E-01	1.14E-01	2E-06	5E-06	2E-06	5E-06	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-08	5E-08	8.57E-02	1.96E-01	8.57E-04	5E-06	1E-05	5E-06	1E-05	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	1E-04	1E-04	8.57E-02	1.96E-01	1.00E-01	1E-04	2E-04	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-03	3E-03	2E-03	3E-03				6E-09	7E-08	6E-09	7E-08

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-06	1E-06	1.78E-01	2.74E-01	1.70E-03	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	4E-06	4E-06	1.78E-01	2.74E-01	1.40E-03	5E-04	7E-04	5E-04	7E-04	2.29E-02	1.17E-01	9.10E-02	7E-09	4E-08	7E-09	4E-08
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	2E-04	2E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	7E-06	7E-06	1.78E-01	2.74E-01	1.70E-03	7E-04	1E-03	7E-04	1E-03	2.29E-02	1.17E-01	2.73E-02	4E-09	2E-08	4E-09	2E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	1.78E-01	2.74E-01	1.00E-02	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	1E-06	1E-06	1.78E-01	2.74E-01	2.86E-01	7E-07	1E-06	7E-07	1E-06	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	4E-04	4E-04	1.78E-01	2.74E-01	5.71E-02	1E-03	2E-03	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.14E-01	3E-06	4E-06	3E-06	4E-06	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	3E-04	3E-04	1.78E-01	2.74E-01	8.60E-01	5E-05	8E-05	5E-05	8E-05	2.29E-02	1.17E-01	1.65E-03	1E-08	5E-08	1E-08	5E-08
Tetrachloroethene	5E-05	5E-05	1.78E-01	2.74E-01	1.40E-01	6E-05	9E-05	6E-05	9E-05	2.29E-02	1.17E-01	2.03E-03	2E-09	1E-08	2E-09	1E-08
Toluene	3E-06	3E-06	1.78E-01	2.74E-01	1.14E-01	4E-06	6E-06	4E-06	6E-06	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-08	5E-08	1.78E-01	2.74E-01	8.57E-04	1E-05	1E-05	1E-05	1E-05	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	1E-04	1E-04	1.78E-01	2.74E-01	1.00E-01	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-03	5E-03	3E-03	5E-03				2E-08	1E-07	2E-08	1E-07

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-04	2E-03	8.57E-02	1.96E-01	1.70E-03	3E-02	6E-02	1E-01	2E-01	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	3E-05	1E-04	8.57E-02	1.96E-01	1.40E-03	2E-03	5E-03	6E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	2E-08	2E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	7E-04	3E-03	8.57E-02	1.96E-01	1.70E-03	4E-02	9E-02	2E-01	4E-01	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	1E-04	4E-04	8.57E-02	1.96E-01	1.70E-03	7E-03	2E-02	2E-02	5E-02	6.12E-03	6.99E-02	2.73E-02	2E-08	3E-07	7E-08	8E-07
Cis-1 2-Dichloroethene	9E-05	3E-04	8.57E-02	1.96E-01	1.00E-02	8E-04	2E-03	2E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	9E-05	3E-04	8.57E-02	1.96E-01	2.86E-01	3E-05	6E-05	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	3E-03	1E-02	8.57E-02	1.96E-01	5.71E-02	5E-03	1E-02	2E-02	5E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-05	7E-05	8.57E-02	1.96E-01	1.14E-01	2E-05	4E-05	5E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	9E-04	1E-03	8.57E-02	1.96E-01	8.60E-01	9E-05	2E-04	1E-04	3E-04	6.12E-03	6.99E-02	1.65E-03	9E-09	1E-07	1E-08	2E-07
Tetrachloroethene	4E-04	1E-03	8.57E-02	1.96E-01	1.40E-01	2E-04	6E-04	9E-04	2E-03	6.12E-03	6.99E-02	2.03E-03	5E-09	6E-08	2E-08	2E-07
Toluene	4E-04	2E-03	8.57E-02	1.96E-01	1.14E-01	3E-04	8E-04	1E-03	3E-03	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	1E-04	8E-04	8.57E-02	1.96E-01	8.57E-04	1E-02	3E-02	8E-02	2E-01	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	1E-04	3E-04	8.57E-02	1.96E-01	1.00E-01	1E-04	3E-04	3E-04	6E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						9E-02	2E-01	4E-01	9E-01				6E-08	6E-07	2E-07	2E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-04	2E-03	1.78E-01	2.74E-01	1.70E-03	5E-02	8E-02	2E-01	3E-01	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	3E-05	1E-04	1.78E-01	2.74E-01	1.40E-03	4E-03	6E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	7E-08	3E-07	2E-07	1E-06
1 3 5-Trimethylbenzene	7E-04	3E-03	1.78E-01	2.74E-01	1.70E-03	8E-02	1E-01	3E-01	5E-01	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	1E-04	4E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	4E-02	7E-02	2.29E-02	1.17E-01	2.73E-02	9E-08	5E-07	3E-07	1E-06
Cis-1 2-Dichloroethene	9E-05	3E-04	1.78E-01	2.74E-01	1.00E-02	2E-03	3E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	9E-05	3E-04	1.78E-01	2.74E-01	2.86E-01	5E-05	8E-05	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	3E-03	1E-02	1.78E-01	2.74E-01	5.71E-02	1E-02	2E-02	4E-02	7E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-05	7E-05	1.78E-01	2.74E-01	1.14E-01	4E-05	6E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	9E-04	1E-03	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	3E-04	5E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	5E-08	3E-07
Tetrachloroethene	4E-04	1E-03	1.78E-01	2.74E-01	1.40E-01	5E-04	8E-04	2E-03	3E-03	2.29E-02	1.17E-01	2.03E-03	2E-08	1E-07	6E-08	3E-07
Toluene	4E-04	2E-03	1.78E-01	2.74E-01	1.14E-01	7E-04	1E-03	3E-03	5E-03	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	1E-04	8E-04	1.78E-01	2.74E-01	8.57E-04	3E-02	4E-02	2E-01	2E-01	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	1E-04	3E-04	1.78E-01	2.74E-01	1.00E-01	2E-04	4E-04	6E-04	9E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						2E-01	3E-01	8E-01	1E+00				2E-07	1E-06	6E-07	3E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 2

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	8E-06	8.57E-02	1.96E-01	1.70E-03	2E-04	5E-04	4E-04	9E-04	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	3E-05	7E-05	8.57E-02	1.96E-01	1.40E-03	2E-03	4E-03	4E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	1E-08	2E-07	4E-08	5E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	8E-05	2E-04	8.57E-02	1.96E-01	1.70E-03	4E-03	9E-03	1E-02	2E-02	6.12E-03	6.99E-02	2.73E-02	1E-08	1E-07	4E-08	4E-07
Cis-1 2-Dichloroethene	8E-05	2E-04	8.57E-02	1.96E-01	1.00E-02	7E-04	1E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	2E-05	6E-05	8.57E-02	1.96E-01	2.86E-01	7E-06	2E-05	2E-05	4E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	6E-05	6E-05	8.57E-02	1.96E-01	5.71E-02	9E-05	2E-04	9E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	3E-05	5E-05	8.57E-02	1.96E-01	1.14E-01	2E-05	5E-05	4E-05	9E-05	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	5E-04	8E-04	8.57E-02	1.96E-01	8.60E-01	5E-05	1E-04	8E-05	2E-04	6.12E-03	6.99E-02	1.65E-03	5E-09	5E-08	8E-09	9E-08
Tetrachloroethene	1E-04	3E-04	8.57E-02	1.96E-01	1.40E-01	8E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	2.03E-03	2E-09	2E-08	4E-09	4E-08
Toluene	4E-05	1E-04	8.57E-02	1.96E-01	1.14E-01	3E-05	6E-05	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	8E-06	2E-05	8.57E-02	1.96E-01	8.57E-04	8E-04	2E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	5E-05	1E-04	8.57E-02	1.96E-01	1.00E-01	4E-05	1E-04	9E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						7E-03	2E-02	2E-02	5E-02				3E-08	4E-07	9E-08	1E-06

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	8E-06	1.78E-01	2.74E-01	1.70E-03	5E-04	7E-04	8E-04	1E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	3E-05	7E-05	1.78E-01	2.74E-01	1.40E-03	3E-03	5E-03	9E-03	1E-02	2.29E-02	1.17E-01	9.10E-02	5E-08	3E-07	1E-07	8E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	2E-04	2E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	8E-05	2E-04	1.78E-01	2.74E-01	1.70E-03	8E-03	1E-02	2E-02	3E-02	2.29E-02	1.17E-01	2.73E-02	5E-08	2E-07	1E-07	7E-07
Cis-1 2-Dichloroethene	8E-05	2E-04	1.78E-01	2.74E-01	1.00E-02	1E-03	2E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	2E-05	6E-05	1.78E-01	2.74E-01	2.86E-01	1E-05	2E-05	4E-05	6E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	6E-05	6E-05	1.78E-01	2.74E-01	5.71E-02	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	3E-05	5E-05	1.78E-01	2.74E-01	1.14E-01	4E-05	7E-05	8E-05	1E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	5E-04	8E-04	1.78E-01	2.74E-01	8.60E-01	1E-04	1E-04	2E-04	2E-04	2.29E-02	1.17E-01	1.65E-03	2E-08	9E-08	3E-08	1E-07
Tetrachloroethene	1E-04	3E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	3E-04	4E-04	6E-04	2.29E-02	1.17E-01	2.03E-03	6E-09	3E-08	1E-08	7E-08
Toluene	4E-05	1E-04	1.78E-01	2.74E-01	1.14E-01	6E-05	9E-05	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	8E-06	2E-05	1.78E-01	2.74E-01	8.57E-04	2E-03	2E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	5E-05	1E-04	1.78E-01	2.74E-01	1.00E-01	9E-05	1E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						2E-02	2E-02	4E-02	6E-02				1E-07	6E-07	3E-07	2E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	1E-05	8.57E-02	1.96E-01	1.70E-03	2E-04	5E-04	6E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	3E-05	1E-04	8.57E-02	1.96E-01	1.40E-03	2E-03	5E-03	6E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	2E-08	2E-07	6E-08	7E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	1E-04	3E-04	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	1E-04	3E-04	8.57E-02	1.96E-01	1.70E-03	5E-03	1E-02	2E-02	4E-02	6.12E-03	6.99E-02	2.73E-02	2E-08	2E-07	5E-08	6E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	8.57E-02	1.96E-01	1.00E-02	9E-04	2E-03	3E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	4E-05	9E-05	8.57E-02	1.96E-01	2.86E-01	1E-05	3E-05	3E-05	6E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	8E-04	1E-03	8.57E-02	1.96E-01	5.71E-02	1E-03	3E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	3E-05	8E-05	8.57E-02	1.96E-01	1.14E-01	2E-05	5E-05	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	7E-04	2E-03	8.57E-02	1.96E-01	8.60E-01	7E-05	2E-04	2E-04	3E-04	6.12E-03	6.99E-02	1.65E-03	7E-09	8E-08	2E-08	2E-07
Tetrachloroethene	2E-04	4E-04	8.57E-02	1.96E-01	1.40E-01	1E-04	2E-04	3E-04	6E-04	6.12E-03	6.99E-02	2.03E-03	2E-09	2E-08	5E-09	6E-08
Toluene	3E-04	1E-03	8.57E-02	1.96E-01	1.14E-01	3E-04	6E-04	8E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-05	3E-04	8.57E-02	1.96E-01	8.57E-04	5E-03	1E-02	3E-02	6E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	5E-05	2E-04	8.57E-02	1.96E-01	1.00E-01	4E-05	9E-05	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						1E-02	3E-02	5E-02	1E-01				4E-08	5E-07	1E-07	1E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	1E-05	1.78E-01	2.74E-01	1.70E-03	5E-04	8E-04	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	3E-05	1E-04	1.78E-01	2.74E-01	1.40E-03	4E-03	7E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	7E-08	4E-07	2E-07	1E-06
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	4E-04	2E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	1E-04	3E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	3E-02	5E-02	2.29E-02	1.17E-01	2.73E-02	6E-08	3E-07	2E-07	1E-06
Cis-1 2-Dichloroethene	1E-04	3E-04	1.78E-01	2.74E-01	1.00E-02	2E-03	3E-03	6E-03	9E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	4E-05	9E-05	1.78E-01	2.74E-01	2.86E-01	2E-05	4E-05	6E-05	9E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	8E-04	1E-03	1.78E-01	2.74E-01	5.71E-02	3E-03	4E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	3E-05	8E-05	1.78E-01	2.74E-01	1.14E-01	4E-05	7E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	7E-04	2E-03	1.78E-01	2.74E-01	8.60E-01	1E-04	2E-04	3E-04	5E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	1E-07	6E-08	3E-07
Tetrachloroethene	2E-04	4E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	3E-04	5E-04	8E-04	2.29E-02	1.17E-01	2.03E-03	8E-09	4E-08	2E-08	1E-07
Toluene	3E-04	1E-03	1.78E-01	2.74E-01	1.14E-01	5E-04	8E-04	2E-03	3E-03	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-05	3E-04	1.78E-01	2.74E-01	8.57E-04	1E-02	1E-02	5E-02	8E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	5E-05	2E-04	1.78E-01	2.74E-01	1.00E-01	9E-05	1E-04	3E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-02	5E-02	1E-01	2E-01				2E-07	9E-07	5E-07	2E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 3

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-02	3E-02	8.57E-02	1.96E-01	1.70E-03	7E-01	**2E+00**	**2E+00**	**4E+00**	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	1E-04	4E-04	8.57E-02	1.96E-01	1.40E-03	8E-03	2E-02	2E-02	5E-02	6.12E-03	6.99E-02	9.10E-02	8E-08	9E-07	2E-07	2E-06
1 3 5-Trimethylbenzene	1E-02	3E-02	8.57E-02	1.96E-01	1.70E-03	5E-01	1E+00	1E+00	**3E+00**	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-04	7E-04	8.57E-02	1.96E-01	1.70E-03	1E-02	3E-02	4E-02	8E-02	6.12E-03	6.99E-02	2.73E-02	4E-08	5E-07	1E-07	1E-06
Cis-1 2-Dichloroethene	3E-04	8E-04	8.57E-02	1.96E-01	1.00E-02	2E-03	6E-03	7E-03	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	3E-03	9E-03	8.57E-02	1.96E-01	2.86E-01	1E-03	2E-03	3E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	3E-03	6E-03	8.57E-02	1.96E-01	5.71E-02	5E-03	1E-02	1E-02	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-03	5E-03	8.57E-02	1.96E-01	1.14E-01	1E-03	3E-03	4E-03	8E-03	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	1E-03	1E-03	8.57E-02	1.96E-01	8.60E-01	1E-04	2E-04	1E-04	2E-04	6.12E-03	6.99E-02	1.65E-03	1E-08	1E-07	1E-08	1E-07
Tetrachloroethene	1E-03	4E-03	8.57E-02	1.96E-01	1.40E-01	8E-04	2E-03	2E-03	5E-03	6.12E-03	6.99E-02	2.03E-03	2E-08	2E-07	4E-08	5E-07
Toluene	4E-02	1E-01	8.57E-02	1.96E-01	1.14E-01	3E-02	7E-02	7E-02	2E-01	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	2E-04	4E-04	8.57E-02	1.96E-01	8.57E-04	2E-02	3E-02	4E-02	8E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	8E-05	1E-04	8.57E-02	1.96E-01	1.00E-01	7E-05	2E-04	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						1E+00	**3E+00**	**3E+00**	**7E+00**				1E-07	2E-06	4E-07	4E-06

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-02	3E-02	1.78E-01	2.74E-01	1.70E-03	1E+00	**2E+00**	**4E+00**	**5E+00**	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	1E-04	4E-04	1.78E-01	2.74E-01	1.40E-03	2E-02	3E-02	5E-02	8E-02	2.29E-02	1.17E-01	9.10E-02	3E-07	1E-06	8E-07	4E-06
1 3 5-Trimethylbenzene	1E-02	3E-02	1.78E-01	2.74E-01	1.70E-03	1E+00	**2E+00**	**3E+00**	**4E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-04	7E-04	1.78E-01	2.74E-01	1.70E-03	3E-02	4E-02	7E-02	1E-01	2.29E-02	1.17E-01	2.73E-02	2E-07	8E-07	4E-07	2E-06
Cis-1 2-Dichloroethene	3E-04	8E-04	1.78E-01	2.74E-01	1.00E-02	5E-03	8E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	3E-03	9E-03	1.78E-01	2.74E-01	2.86E-01	2E-03	3E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	3E-03	6E-03	1.78E-01	2.74E-01	5.71E-02	1E-02	2E-02	2E-02	3E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-03	5E-03	1.78E-01	2.74E-01	1.14E-01	2E-03	4E-03	7E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	1E-03	1E-03	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	1.65E-03	4E-08	2E-07	4E-08	2E-07
Tetrachloroethene	1E-03	4E-03	1.78E-01	2.74E-01	1.40E-01	2E-03	3E-03	5E-03	7E-03	2.29E-02	1.17E-01	2.03E-03	6E-08	3E-07	2E-07	9E-07
Toluene	4E-02	1E-01	1.78E-01	2.74E-01	1.14E-01	6E-02	1E-01	2E-01	2E-01	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	2E-04	4E-04	1.78E-01	2.74E-01	8.57E-04	3E-02	5E-02	8E-02	1E-01	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	8E-05	1E-04	1.78E-01	2.74E-01	1.00E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						**3E+00**	**4E+00**	**7E+00**	**1E+01**				5E-07	3E-06	1E-06	7E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	8E-03	5E-02	8.57E-02	1.96E-01	1.70E-03	4E-01	9E-01	2E+00	6E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	9E-05	6E-04	8.57E-02	1.96E-01	1.40E-03	6E-03	1E-02	3E-02	8E-02	6.12E-03	6.99E-02	9.10E-02	5E-08	6E-07	3E-07	4E-06
1 3 5-Trimethylbenzene	7E-03	4E-02	8.57E-02	1.96E-01	1.70E-03	4E-01	8E-01	2E+00	5E+00	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-04	1E-03	8.57E-02	1.96E-01	1.70E-03	1E-02	2E-02	5E-02	1E-01	6.12E-03	6.99E-02	2.73E-02	3E-08	4E-07	2E-07	2E-06
Cis-1 2-Dichloroethene	2E-04	1E-03	8.57E-02	1.96E-01	1.00E-02	2E-03	4E-03	1E-02	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	2E-03	1E-02	8.57E-02	1.96E-01	2.86E-01	6E-04	1E-03	4E-03	8E-03	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	3E-03	9E-03	8.57E-02	1.96E-01	5.71E-02	4E-03	1E-02	1E-02	3E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	8E-04	7E-03	8.57E-02	1.96E-01	1.14E-01	6E-04	1E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	8.57E-02	1.96E-01	8.60E-01	9E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	1.65E-03	9E-09	1E-07	2E-08	2E-07
Tetrachloroethene	7E-04	5E-03	8.57E-02	1.96E-01	1.40E-01	4E-04	1E-03	3E-03	7E-03	6.12E-03	6.99E-02	2.03E-03	9E-09	1E-07	6E-08	7E-07
Toluene	3E-02	1E-01	8.57E-02	1.96E-01	1.14E-01	2E-02	5E-02	1E-01	2E-01	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	6E-04	6E-03	8.57E-02	1.96E-01	8.57E-04	6E-02	1E-01	6E-01	1E+00	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	8E-05	2E-04	8.57E-02	1.96E-01	1.00E-01	7E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						9E-01	**2E+00**	**5E+00**	**1E+01**				1E-07	1E-06	6E-07	6E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	8E-03	5E-02	1.78E-01	2.74E-01	1.70E-03	8E-01	1E+00	**5E+00**	**8E+00**	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	9E-05	6E-04	1.78E-01	2.74E-01	1.40E-03	1E-02	2E-02	7E-02	1E-01	2.29E-02	1.17E-01	9.10E-02	2E-07	1E-06	1E-06	6E-06
1 3 5-Trimethylbenzene	7E-03	4E-02	1.78E-01	2.74E-01	1.70E-03	8E-01	1E+00	**4E+00**	**6E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-04	1E-03	1.78E-01	2.74E-01	1.70E-03	2E-02	3E-02	1E-01	2E-01	2.29E-02	1.17E-01	2.73E-02	1E-07	6E-07	6E-07	3E-06
Cis-1 2-Dichloroethene	2E-04	1E-03	1.78E-01	2.74E-01	1.00E-02	4E-03	6E-03	2E-02	3E-02	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	2E-03	1E-02	1.78E-01	2.74E-01	2.86E-01	1E-03	2E-03	8E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	3E-03	9E-03	1.78E-01	2.74E-01	5.71E-02	9E-03	1E-02	3E-02	4E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	8E-04	7E-03	1.78E-01	2.74E-01	1.14E-01	1E-03	2E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	3E-04	5E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	6E-08	3E-07
Tetrachloroethene	7E-04	5E-03	1.78E-01	2.74E-01	1.40E-01	9E-04	1E-03	7E-03	1E-02	2.29E-02	1.17E-01	2.03E-03	3E-08	2E-07	2E-07	1E-06
Toluene	3E-02	1E-01	1.78E-01	2.74E-01	1.14E-01	4E-02	6E-02	2E-01	3E-01	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	6E-04	6E-03	1.78E-01	2.74E-01	8.57E-04	1E-01	2E-01	1E+00	**2E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	8E-05	2E-04	1.78E-01	2.74E-01	1.00E-01	1E-04	2E-04	3E-04	5E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						**2E+00**	**3E+00**	**1E+01**	**2E+01**				4E-07	2E-06	2E-06	1E-05

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 4

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-05	2E-05	8.57E-02	1.96E-01	1.70E-03	6E-04	1E-03	1E-03	3E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	3E-05	6E-05	8.57E-02	1.96E-01	1.40E-03	2E-03	4E-03	4E-03	8E-03	6.12E-03	6.99E-02	9.10E-02	2E-08	2E-07	3E-08	4E-07
1 3 5-Trimethylbenzene	7E-06	1E-05	8.57E-02	1.96E-01	1.70E-03	3E-04	8E-04	6E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	4E-05	7E-05	8.57E-02	1.96E-01	1.70E-03	2E-03	4E-03	4E-03	8E-03	6.12E-03	6.99E-02	2.73E-02	6E-09	7E-08	1E-08	1E-07
Cis-1 2-Dichloroethene	7E-06	7E-06	8.57E-02	1.96E-01	1.00E-02	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	7E-05	1E-04	8.57E-02	1.96E-01	2.86E-01	2E-05	5E-05	4E-05	8E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	2E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.14E-01	1E-06	3E-06	1E-06	3E-06	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	8.57E-02	1.96E-01	8.60E-01	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	1.65E-03	8E-09	9E-08	8E-09	9E-08
Tetrachloroethene	5E-05	5E-05	8.57E-02	1.96E-01	1.40E-01	3E-05	7E-05	3E-05	7E-05	6.12E-03	6.99E-02	2.03E-03	6E-10	7E-09	6E-10	7E-09
Toluene	7E-05	1E-04	8.57E-02	1.96E-01	1.14E-01	6E-05	1E-04	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-08	5E-08	8.57E-02	1.96E-01	8.57E-04	5E-06	1E-05	5E-06	1E-05	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	2E-04	3E-04	8.57E-02	1.96E-01	1.00E-01	1E-04	3E-04	3E-04	6E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						7E-03	2E-02	1E-02	3E-02				3E-08	4E-07	5E-08	6E-07

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-05	2E-05	1.78E-01	2.74E-01	1.70E-03	1E-03	2E-03	2E-03	4E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	3E-05	6E-05	1.78E-01	2.74E-01	1.40E-03	4E-03	6E-03	8E-03	1E-02	2.29E-02	1.17E-01	9.10E-02	7E-08	3E-07	1E-07	6E-07
1 3 5-Trimethylbenzene	7E-06	1E-05	1.78E-01	2.74E-01	1.70E-03	7E-04	1E-03	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	4E-05	7E-05	1.78E-01	2.74E-01	1.70E-03	4E-03	6E-03	7E-03	1E-02	2.29E-02	1.17E-01	2.73E-02	2E-08	1E-07	4E-08	2E-07
Cis-1 2-Dichloroethene	7E-06	7E-06	1.78E-01	2.74E-01	1.00E-02	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	7E-05	1E-04	1.78E-01	2.74E-01	2.86E-01	4E-05	7E-05	7E-05	1E-04	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	2E-03	1.78E-01	2.74E-01	5.71E-02	3E-03	5E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.14E-01	3E-06	4E-06	3E-06	4E-06	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	3E-08	2E-07
Tetrachloroethene	5E-05	5E-05	1.78E-01	2.74E-01	1.40E-01	6E-05	9E-05	6E-05	9E-05	2.29E-02	1.17E-01	2.03E-03	2E-09	1E-08	2E-09	1E-08
Toluene	7E-05	1E-04	1.78E-01	2.74E-01	1.14E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-08	5E-08	1.78E-01	2.74E-01	8.57E-04	1E-05	1E-05	1E-05	1E-05	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	2E-04	3E-04	1.78E-01	2.74E-01	1.00E-01	3E-04	5E-04	5E-04	8E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						1E-02	2E-02	2E-02	4E-02				1E-07	6E-07	2E-07	1E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	7E-03	5E-02	8.57E-02	1.96E-01	1.70E-03	4E-01	8E-01	3E+00	6E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	9E-05	6E-04	8.57E-02	1.96E-01	1.40E-03	6E-03	1E-02	3E-02	8E-02	6.12E-03	6.99E-02	9.10E-02	5E-08	6E-07	3E-07	4E-06
1 3 5-Trimethylbenzene	4E-03	3E-02	8.57E-02	1.96E-01	1.70E-03	2E-01	4E-01	1E+00	3E+00	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-04	1E-03	8.57E-02	1.96E-01	1.70E-03	9E-03	2E-02	5E-02	1E-01	6.12E-03	6.99E-02	2.73E-02	3E-08	4E-07	2E-07	2E-06
Cis-1 2-Dichloroethene	2E-04	1E-03	8.57E-02	1.96E-01	1.00E-02	2E-03	4E-03	1E-02	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	1E-03	1E-02	8.57E-02	1.96E-01	2.86E-01	4E-04	9E-04	3E-03	8E-03	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	4E-03	2E-02	8.57E-02	1.96E-01	5.71E-02	6E-03	1E-02	3E-02	8E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	4E-04	3E-03	8.57E-02	1.96E-01	1.14E-01	3E-04	7E-04	3E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	1E-02	1E-01	8.57E-02	1.96E-01	8.60E-01	1E-03	3E-03	1E-02	3E-02	6.12E-03	6.99E-02	1.65E-03	1E-07	2E-06	1E-06	1E-05
Tetrachloroethene	2E-03	1E-02	8.57E-02	1.96E-01	1.40E-01	1E-03	2E-03	6E-03	1E-02	6.12E-03	6.99E-02	2.03E-03	2E-08	2E-07	1E-07	1E-06
Toluene	8E-03	5E-02	8.57E-02	1.96E-01	1.14E-01	6E-03	1E-02	4E-02	9E-02	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	9E-04	7E-03	8.57E-02	1.96E-01	8.57E-04	9E-02	2E-01	7E-01	**2E+00**	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	7E-04	6E-03	8.57E-02	1.96E-01	1.00E-01	6E-04	1E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Total						7E-01	**2E+00**	**5E+00**	**1E+01**				2E-07	3E-06	2E-06	2E-05

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	7E-03	5E-02	1.78E-01	2.74E-01	1.70E-03	8E-01	1E+00	**5E+00**	**8E+00**	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	9E-05	6E-04	1.78E-01	2.74E-01	1.40E-03	1E-02	2E-02	7E-02	1E-01	2.29E-02	1.17E-01	9.10E-02	2E-07	1E-06	1E-06	6E-06
1 3 5-Trimethylbenzene	4E-03	3E-02	1.78E-01	2.74E-01	1.70E-03	4E-01	6E-01	**3E+00**	**4E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-04	1E-03	1.78E-01	2.74E-01	1.70E-03	2E-02	3E-02	1E-01	2E-01	2.29E-02	1.17E-01	2.73E-02	1E-07	6E-07	6E-07	3E-06
Cis-1 2-Dichloroethene	2E-04	1E-03	1.78E-01	2.74E-01	1.00E-02	3E-03	5E-03	2E-02	3E-02	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	1E-03	1E-02	1.78E-01	2.74E-01	2.86E-01	8E-04	1E-03	7E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	4E-03	2E-02	1.78E-01	2.74E-01	5.71E-02	1E-02	2E-02	7E-02	1E-01	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	4E-04	3E-03	1.78E-01	2.74E-01	1.14E-01	6E-04	1E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	1E-02	1E-01	1.78E-01	2.74E-01	8.60E-01	3E-03	4E-03	2E-02	4E-02	2.29E-02	1.17E-01	1.65E-03	5E-07	3E-06	4E-06	2E-05
Tetrachloroethene	2E-03	1E-02	1.78E-01	2.74E-01	1.40E-01	2E-03	3E-03	1E-02	2E-02	2.29E-02	1.17E-01	2.03E-03	8E-08	4E-07	5E-07	2E-06
Toluene	8E-03	5E-02	1.78E-01	2.74E-01	1.14E-01	1E-02	2E-02	8E-02	1E-01	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	9E-04	7E-03	1.78E-01	2.74E-01	8.57E-04	2E-01	3E-01	1E+00	**2E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	7E-04	6E-03	1.78E-01	2.74E-01	1.00E-01	1E-03	2E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Total						1E+00	**2E+00**	**1E+01**	**2E+01**				9E-07	5E-06	7E-06	3E-05

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 5

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	1E-05	8.57E-02	1.96E-01	1.70E-03	2E-04	5E-04	6E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	1E-05	2E-05	8.57E-02	1.96E-01	1.40E-03	6E-04	1E-03	1E-03	3E-03	6.12E-03	6.99E-02	9.10E-02	6E-09	7E-08	1E-08	2E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	7E-06	7E-06	8.57E-02	1.96E-01	1.70E-03	4E-04	8E-04	4E-04	8E-04	6.12E-03	6.99E-02	2.73E-02	1E-09	1E-08	1E-09	1E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	8.57E-02	1.96E-01	1.00E-02	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	1E-05	4E-05	8.57E-02	1.96E-01	2.86E-01	4E-06	1E-05	1E-05	3E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	3E-04	5E-04	8.57E-02	1.96E-01	5.71E-02	5E-04	1E-03	7E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.14E-01	1E-06	3E-06	1E-06	3E-06	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	8.57E-02	1.96E-01	8.60E-01	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	1.65E-03	8E-09	9E-08	8E-09	9E-08
Tetrachloroethene	5E-05	5E-05	8.57E-02	1.96E-01	1.40E-01	3E-05	7E-05	3E-05	7E-05	6.12E-03	6.99E-02	2.03E-03	6E-10	7E-09	6E-10	7E-09
Toluene	2E-04	6E-04	8.57E-02	1.96E-01	1.14E-01	2E-04	4E-04	5E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-08	5E-08	8.57E-02	1.96E-01	8.57E-04	5E-06	1E-05	5E-06	1E-05	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	4E-05	8E-05	8.57E-02	1.96E-01	1.00E-01	4E-05	8E-05	7E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-03	5E-03	4E-03	9E-03				2E-08	2E-07	2E-08	3E-07

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	5E-06	1E-05	1.78E-01	2.74E-01	1.70E-03	5E-04	8E-04	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	1E-05	2E-05	1.78E-01	2.74E-01	1.40E-03	1E-03	2E-03	3E-03	5E-03	2.29E-02	1.17E-01	9.10E-02	2E-08	1E-07	5E-08	3E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	2E-04	2E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	7E-06	7E-06	1.78E-01	2.74E-01	1.70E-03	7E-04	1E-03	7E-04	1E-03	2.29E-02	1.17E-01	2.73E-02	4E-09	2E-08	4E-09	2E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	1.78E-01	2.74E-01	1.00E-02	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	1E-05	4E-05	1.78E-01	2.74E-01	2.86E-01	9E-06	1E-05	3E-05	4E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	3E-04	5E-04	1.78E-01	2.74E-01	5.71E-02	1E-03	2E-03	2E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.14E-01	3E-06	4E-06	3E-06	4E-06	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	3E-08	2E-07
Tetrachloroethene	5E-05	5E-05	1.78E-01	2.74E-01	1.40E-01	6E-05	9E-05	6E-05	9E-05	2.29E-02	1.17E-01	2.03E-03	2E-09	1E-08	2E-09	1E-08
Toluene	2E-04	6E-04	1.78E-01	2.74E-01	1.14E-01	4E-04	6E-04	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-08	5E-08	1.78E-01	2.74E-01	8.57E-04	1E-05	1E-05	1E-05	1E-05	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	4E-05	8E-05	1.78E-01	2.74E-01	1.00E-01	7E-05	1E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						5E-03	7E-03	8E-03	1E-02				6E-08	3E-07	9E-08	4E-07

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	3E-03	2E-02	8.57E-02	1.96E-01	1.70E-03	2E-01	4E-01	8E-01	2E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	1E-04	6E-04	8.57E-02	1.96E-01	1.40E-03	8E-03	2E-02	3E-02	8E-02	6.12E-03	6.99E-02	9.10E-02	8E-08	9E-07	3E-07	4E-06
1 3 5-Trimethylbenzene	2E-03	7E-03	8.57E-02	1.96E-01	1.70E-03	8E-02	2E-01	4E-01	9E-01	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	3E-04	1E-03	8.57E-02	1.96E-01	1.70E-03	1E-02	3E-02	5E-02	1E-01	6.12E-03	6.99E-02	2.73E-02	5E-08	5E-07	2E-07	2E-06
Cis-1 2-Dichloroethene	1E-02	7E-02	8.57E-02	1.96E-01	1.00E-02	1E-01	3E-01	6E-01	1E+00	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	3E-03	2E-02	8.57E-02	1.96E-01	2.86E-01	9E-04	2E-03	6E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	8E-02	4E-01	8.57E-02	1.96E-01	5.71E-02	1E-01	3E-01	6E-01	1E+00	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	1E-03	7E-03	8.57E-02	1.96E-01	1.14E-01	8E-04	2E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	1E-03	2E-03	8.57E-02	1.96E-01	8.60E-01	1E-04	3E-04	2E-04	5E-04	6.12E-03	6.99E-02	1.65E-03	1E-08	2E-07	2E-08	3E-07
Tetrachloroethene	1E-03	5E-03	8.57E-02	1.96E-01	1.40E-01	7E-04	2E-03	3E-03	7E-03	6.12E-03	6.99E-02	2.03E-03	1E-08	2E-07	6E-08	7E-07
Toluene	2E-03	1E-02	8.57E-02	1.96E-01	1.14E-01	2E-03	4E-03	1E-02	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	3E-04	1E-03	8.57E-02	1.96E-01	8.57E-04	3E-02	8E-02	1E-01	3E-01	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	2E-04	9E-04	8.57E-02	1.96E-01	1.00E-01	2E-04	4E-04	8E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
Total						6E-01	1E+00	**3E+00**	**6E+00**				2E-07	2E-06	6E-07	7E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	3E-03	2E-02	1.78E-01	2.74E-01	1.70E-03	3E-01	5E-01	**2E+00**	**3E+00**	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	1E-04	6E-04	1.78E-01	2.74E-01	1.40E-03	2E-02	3E-02	7E-02	1E-01	2.29E-02	1.17E-01	9.10E-02	3E-07	1E-06	1E-06	6E-06
1 3 5-Trimethylbenzene	2E-03	7E-03	1.78E-01	2.74E-01	1.70E-03	2E-01	3E-01	8E-01	1E+00	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	3E-04	1E-03	1.78E-01	2.74E-01	1.70E-03	3E-02	4E-02	1E-01	2E-01	2.29E-02	1.17E-01	2.73E-02	2E-07	9E-07	6E-07	3E-06
Cis-1 2-Dichloroethene	1E-02	7E-02	1.78E-01	2.74E-01	1.00E-02	3E-01	4E-01	1E+00	**2E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	3E-03	2E-02	1.78E-01	2.74E-01	2.86E-01	2E-03	3E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	8E-02	4E-01	1.78E-01	2.74E-01	5.71E-02	3E-01	4E-01	1E+00	**2E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	1E-03	7E-03	1.78E-01	2.74E-01	1.14E-01	2E-03	3E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	1E-03	2E-03	1.78E-01	2.74E-01	8.60E-01	3E-04	4E-04	5E-04	7E-04	2.29E-02	1.17E-01	1.65E-03	5E-08	3E-07	9E-08	4E-07
Tetrachloroethene	1E-03	5E-03	1.78E-01	2.74E-01	1.40E-01	1E-03	2E-03	7E-03	1E-02	2.29E-02	1.17E-01	2.03E-03	5E-08	3E-07	2E-07	1E-06
Toluene	2E-03	1E-02	1.78E-01	2.74E-01	1.14E-01	3E-03	5E-03	2E-02	3E-02	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	3E-04	1E-03	1.78E-01	2.74E-01	8.57E-04	7E-02	1E-01	3E-01	5E-01	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	2E-04	9E-04	1.78E-01	2.74E-01	1.00E-01	4E-04	6E-04	2E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Total						1E+00	**2E+00**	**5E+00**	**8E+00**				6E-07	3E-06	2E-06	1E-05

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 6

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	7E-05	7E-05	8.57E-02	1.96E-01	1.40E-03	4E-03	9E-03	4E-03	9E-03	6.12E-03	6.99E-02	9.10E-02	4E-08	4E-07	4E-08	4E-07
1 3 5-Trimethylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-04	2E-04	8.57E-02	1.96E-01	1.70E-03	1E-02	2E-02	1E-02	2E-02	6.12E-03	6.99E-02	2.73E-02	3E-08	4E-07	3E-08	4E-07
Cis-1 2-Dichloroethene	2E-04	2E-04	8.57E-02	1.96E-01	1.00E-02	2E-03	4E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	6E-05	6E-05	8.57E-02	1.96E-01	2.86E-01	2E-05	4E-05	2E-05	4E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	0E+00	0E+00	8.57E-02	1.96E-01	5.71E-02	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	5E-05	5E-05	8.57E-02	1.96E-01	1.14E-01	4E-05	9E-05	4E-05	9E-05	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	2E-04	2E-04	8.57E-02	1.96E-01	8.60E-01	2E-05	4E-05	2E-05	4E-05	6.12E-03	6.99E-02	1.65E-03	2E-09	2E-08	2E-09	2E-08
Tetrachloroethene	3E-04	3E-04	8.57E-02	1.96E-01	1.40E-01	2E-04	4E-04	2E-04	4E-04	6.12E-03	6.99E-02	2.03E-03	3E-09	4E-08	3E-09	4E-08
Toluene	1E-04	1E-04	8.57E-02	1.96E-01	1.14E-01	7E-05	2E-04	7E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	2E-05	2E-05	8.57E-02	1.96E-01	8.57E-04	2E-03	4E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	4E-06	4E-06	8.57E-02	1.96E-01	1.00E-01	4E-06	9E-06	4E-06	9E-06	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-02	4E-02	2E-02	4E-02				7E-08	8E-07	7E-08	8E-07

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	7E-05	7E-05	1.78E-01	2.74E-01	1.40E-03	8E-03	1E-02	8E-03	1E-02	2.29E-02	1.17E-01	9.10E-02	1E-07	7E-07	1E-07	7E-07
1 3 5-Trimethylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-04	2E-04	1.78E-01	2.74E-01	1.70E-03	2E-02	3E-02	2E-02	3E-02	2.29E-02	1.17E-01	2.73E-02	1E-07	6E-07	1E-07	6E-07
Cis-1 2-Dichloroethene	2E-04	2E-04	1.78E-01	2.74E-01	1.00E-02	4E-03	5E-03	4E-03	5E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	6E-05	6E-05	1.78E-01	2.74E-01	2.86E-01	4E-05	6E-05	4E-05	6E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	0E+00	0E+00	1.78E-01	2.74E-01	5.71E-02	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	5E-05	5E-05	1.78E-01	2.74E-01	1.14E-01	8E-05	1E-04	8E-05	1E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	2E-04	2E-04	1.78E-01	2.74E-01	8.60E-01	4E-05	6E-05	4E-05	6E-05	2.29E-02	1.17E-01	1.65E-03	7E-09	3E-08	7E-09	3E-08
Tetrachloroethene	3E-04	3E-04	1.78E-01	2.74E-01	1.40E-01	3E-04	5E-04	3E-04	5E-04	2.29E-02	1.17E-01	2.03E-03	1E-08	6E-08	1E-08	6E-08
Toluene	1E-04	1E-04	1.78E-01	2.74E-01	1.14E-01	2E-04	2E-04	2E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	2E-05	2E-05	1.78E-01	2.74E-01	8.57E-04	4E-03	6E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	4E-06	4E-06	1.78E-01	2.74E-01	1.00E-01	8E-06	1E-05	8E-06	1E-05	2.29E-02	1.17E-01	na	--	--	--	--
Total						4E-02	6E-02	4E-02	6E-02				3E-07	1E-06	3E-07	1E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	9E-05	2E-04	9E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	5E-05	1E-04	8.57E-02	1.96E-01	1.40E-03	3E-03	7E-03	6E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	3E-08	3E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	1E-04	3E-04	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	1E-04	3E-04	8.57E-02	1.96E-01	1.70E-03	7E-03	2E-02	1E-02	3E-02	6.12E-03	6.99E-02	2.73E-02	2E-08	3E-07	5E-08	5E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	8.57E-02	1.96E-01	1.00E-02	1E-03	3E-03	2E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	7E-05	9E-05	8.57E-02	1.96E-01	2.86E-01	2E-05	5E-05	3E-05	6E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	1E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	4E-05	7E-05	8.57E-02	1.96E-01	1.14E-01	3E-05	6E-05	5E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	8.57E-02	1.96E-01	8.60E-01	9E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	1.65E-03	9E-09	1E-07	2E-08	2E-07
Tetrachloroethene	2E-04	4E-04	8.57E-02	1.96E-01	1.40E-01	1E-04	3E-04	2E-04	5E-04	6.12E-03	6.99E-02	2.03E-03	3E-09	3E-08	5E-09	5E-08
Toluene	8E-05	1E-04	8.57E-02	1.96E-01	1.14E-01	6E-05	1E-04	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	2E-05	5E-05	8.57E-02	1.96E-01	8.57E-04	2E-03	4E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	5E-05	1E-04	8.57E-02	1.96E-01	1.00E-01	4E-05	1E-04	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-02	4E-02	3E-02	7E-02				6E-08	7E-07	1E-07	1E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	5E-05	1E-04	1.78E-01	2.74E-01	1.40E-03	6E-03	9E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	1E-07	5E-07	2E-07	1E-06
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	4E-04	2E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	1E-04	3E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	3E-02	5E-02	2.29E-02	1.17E-01	2.73E-02	9E-08	4E-07	2E-07	9E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	1.78E-01	2.74E-01	1.00E-02	3E-03	4E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	7E-05	9E-05	1.78E-01	2.74E-01	2.86E-01	4E-05	6E-05	5E-05	8E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	1E-03	1.78E-01	2.74E-01	5.71E-02	4E-03	6E-03	4E-03	7E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	4E-05	7E-05	1.78E-01	2.74E-01	1.14E-01	6E-05	9E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	4E-04	6E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	7E-08	4E-07
Tetrachloroethene	2E-04	4E-04	1.78E-01	2.74E-01	1.40E-01	3E-04	4E-04	5E-04	7E-04	2.29E-02	1.17E-01	2.03E-03	1E-08	5E-08	2E-08	9E-08
Toluene	8E-05	1E-04	1.78E-01	2.74E-01	1.14E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	2E-05	5E-05	1.78E-01	2.74E-01	8.57E-04	4E-03	6E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	5E-05	1E-04	1.78E-01	2.74E-01	1.00E-01	9E-05	1E-04	2E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-02	5E-02	6E-02	1E-01				2E-07	1E-06	5E-07	2E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 7
No soil samples were collected in Lot 7 at depths > 2 feet.

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	0E+00	0E+00	8.57E-02	1.96E-01	1.40E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	9.10E-02	0E+00	0E+00	0E+00	0E+00
1 3 5-Trimethylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	0E+00	0E+00	8.57E-02	1.96E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	2.73E-02	0E+00	0E+00	0E+00	0E+00
Cis-1 2-Dichloroethene	0E+00	0E+00	8.57E-02	1.96E-01	1.00E-02	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	2.86E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	0E+00	0E+00	8.57E-02	1.96E-01	5.71E-02	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	0E+00	0E+00	8.57E-02	1.96E-01	1.14E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	0E+00	0E+00	8.57E-02	1.96E-01	8.60E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	1.65E-03	0E+00	0E+00	0E+00	0E+00
Tetrachloroethene	0E+00	0E+00	8.57E-02	1.96E-01	1.40E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	2.03E-03	0E+00	0E+00	0E+00	0E+00
Toluene	0E+00	0E+00	8.57E-02	1.96E-01	1.14E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	0E+00	0E+00	8.57E-02	1.96E-01	8.57E-04	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	0E+00	0E+00	8.57E-02	1.96E-01	1.00E-01	0E+00	0E+00	0E+00	0E+00	6.12E-03	6.99E-02	na	--	--	--	--
Total						0E+00	0E+00	0E+00	0E+00				0E+00	0E+00	0E+00	0E+00

No soil samples were collected in Lot 7 at depths > 2 feet.

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	0E+00	0E+00	1.78E-01	2.74E-01	1.40E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	9.10E-02	0E+00	0E+00	0E+00	0E+00
1 3 5-Trimethylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	0E+00	0E+00	1.78E-01	2.74E-01	1.70E-03	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	2.73E-02	0E+00	0E+00	0E+00	0E+00
Cis-1 2-Dichloroethene	0E+00	0E+00	1.78E-01	2.74E-01	1.00E-02	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	2.86E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	0E+00	0E+00	1.78E-01	2.74E-01	5.71E-02	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	0E+00	0E+00	1.78E-01	2.74E-01	1.14E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	0E+00	0E+00	1.78E-01	2.74E-01	8.60E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	1.65E-03	0E+00	0E+00	0E+00	0E+00
Tetrachloroethene	0E+00	0E+00	1.78E-01	2.74E-01	1.40E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	2.03E-03	0E+00	0E+00	0E+00	0E+00
Toluene	0E+00	0E+00	1.78E-01	2.74E-01	1.14E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	0E+00	0E+00	1.78E-01	2.74E-01	8.57E-04	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	0E+00	0E+00	1.78E-01	2.74E-01	1.00E-01	0E+00	0E+00	0E+00	0E+00	2.29E-02	1.17E-01	na	--	--	--	--
Total						0E+00	0E+00	0E+00	0E+00				0E+00	0E+00	0E+00	0E+00

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	9E-06	2E-05	8.57E-02	1.96E-01	1.70E-03	5E-04	1E-03	9E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	4E-05	1E-04	8.57E-02	1.96E-01	1.40E-03	2E-03	5E-03	6E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	2E-08	2E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	1E-04	3E-04	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	1E-04	3E-04	8.57E-02	1.96E-01	1.70E-03	5E-03	1E-02	1E-02	3E-02	6.12E-03	6.99E-02	2.73E-02	2E-08	2E-07	5E-08	5E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	8.57E-02	1.96E-01	1.00E-02	9E-04	2E-03	2E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	6E-05	9E-05	8.57E-02	1.96E-01	2.86E-01	2E-05	4E-05	3E-05	6E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	9E-04	1E-03	8.57E-02	1.96E-01	5.71E-02	1E-03	3E-03	2E-03	4E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	3E-05	7E-05	8.57E-02	1.96E-01	1.14E-01	2E-05	4E-05	5E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	6E-04	9E-04	8.57E-02	1.96E-01	8.60E-01	6E-05	1E-04	9E-05	2E-04	6.12E-03	6.99E-02	1.65E-03	6E-09	7E-08	9E-09	1E-07
Tetrachloroethene	2E-04	4E-04	8.57E-02	1.96E-01	1.40E-01	1E-04	2E-04	2E-04	5E-04	6.12E-03	6.99E-02	2.03E-03	2E-09	2E-08	5E-09	5E-08
Toluene	1E-04	2E-04	8.57E-02	1.96E-01	1.14E-01	1E-04	2E-04	1E-04	3E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	4E-05	1E-04	8.57E-02	1.96E-01	8.57E-04	4E-03	9E-03	1E-02	3E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	6E-05	1E-04	8.57E-02	1.96E-01	1.00E-01	5E-05	1E-04	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						1E-02	3E-02	4E-02	9E-02				4E-08	5E-07	1E-07	1E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	9E-06	2E-05	1.78E-01	2.74E-01	1.70E-03	1E-03	2E-03	2E-03	3E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	4E-05	1E-04	1.78E-01	2.74E-01	1.40E-03	4E-03	7E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	7E-08	4E-07	2E-07	1E-06
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	4E-04	2E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	1E-04	3E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	3E-02	5E-02	2.29E-02	1.17E-01	2.73E-02	6E-08	3E-07	2E-07	9E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	1.78E-01	2.74E-01	1.00E-02	2E-03	3E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	6E-05	9E-05	1.78E-01	2.74E-01	2.86E-01	4E-05	6E-05	5E-05	8E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	9E-04	1E-03	1.78E-01	2.74E-01	5.71E-02	3E-03	4E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	3E-05	7E-05	1.78E-01	2.74E-01	1.14E-01	4E-05	6E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	6E-04	9E-04	1.78E-01	2.74E-01	8.60E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	1.65E-03	2E-08	1E-07	3E-08	2E-07
Tetrachloroethene	2E-04	4E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	3E-04	5E-04	7E-04	2.29E-02	1.17E-01	2.03E-03	8E-09	4E-08	2E-08	9E-08
Toluene	1E-04	2E-04	1.78E-01	2.74E-01	1.14E-01	2E-04	3E-04	3E-04	4E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	4E-05	1E-04	1.78E-01	2.74E-01	8.57E-04	8E-03	1E-02	2E-02	4E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	6E-05	1E-04	1.78E-01	2.74E-01	1.00E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-02	5E-02	8E-02	1E-01				2E-07	9E-07	4E-07	2E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 8

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-05	4E-05	8.57E-02	1.96E-01	1.70E-03	8E-04	2E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	8E-06	2E-05	8.57E-02	1.96E-01	1.40E-03	5E-04	1E-03	1E-03	2E-03	6.12E-03	6.99E-02	9.10E-02	5E-09	5E-08	1E-08	1E-07
1 3 5-Trimethylbenzene	4E-05	1E-04	8.57E-02	1.96E-01	1.70E-03	2E-03	5E-03	6E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-05	4E-05	8.57E-02	1.96E-01	1.70E-03	8E-04	2E-03	2E-03	4E-03	6.12E-03	6.99E-02	2.73E-02	3E-09	3E-08	6E-09	7E-08
Cis-1 2-Dichloroethene	2E-05	4E-05	8.57E-02	1.96E-01	1.00E-02	1E-04	3E-04	3E-04	7E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	2E-06	5E-06	8.57E-02	1.96E-01	2.86E-01	7E-07	2E-06	2E-06	4E-06	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	2E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	4E-03	8E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	4E-06	9E-06	8.57E-02	1.96E-01	1.14E-01	3E-06	7E-06	7E-06	2E-05	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	2E-03	4E-03	8.57E-02	1.96E-01	8.60E-01	2E-04	4E-04	4E-04	9E-04	6.12E-03	6.99E-02	1.65E-03	2E-08	2E-07	4E-08	5E-07
Tetrachloroethene	1E-04	2E-04	8.57E-02	1.96E-01	1.40E-01	6E-05	1E-04	1E-04	3E-04	6.12E-03	6.99E-02	2.03E-03	1E-09	1E-08	2E-09	3E-08
Toluene	8E-06	2E-05	8.57E-02	1.96E-01	1.14E-01	6E-06	1E-05	1E-05	3E-05	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	1E-06	4E-06	8.57E-02	1.96E-01	8.57E-04	1E-04	3E-04	4E-04	8E-04	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	2E-04	3E-04	8.57E-02	1.96E-01	1.00E-01	1E-04	3E-04	3E-04	6E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						6E-03	1E-02	2E-02	4E-02				3E-08	3E-07	6E-08	7E-07

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-05	4E-05	1.78E-01	2.74E-01	1.70E-03	2E-03	2E-03	5E-03	7E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	8E-06	2E-05	1.78E-01	2.74E-01	1.40E-03	1E-03	2E-03	2E-03	3E-03	2.29E-02	1.17E-01	9.10E-02	2E-08	9E-08	4E-08	2E-07
1 3 5-Trimethylbenzene	4E-05	1E-04	1.78E-01	2.74E-01	1.70E-03	4E-03	6E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-05	4E-05	1.78E-01	2.74E-01	1.70E-03	2E-03	3E-03	4E-03	6E-03	2.29E-02	1.17E-01	2.73E-02	1E-08	5E-08	2E-08	1E-07
Cis-1 2-Dichloroethene	2E-05	4E-05	1.78E-01	2.74E-01	1.00E-02	3E-04	5E-04	6E-04	1E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	2E-06	5E-06	1.78E-01	2.74E-01	2.86E-01	2E-06	2E-06	3E-06	5E-06	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	2E-03	1.78E-01	2.74E-01	5.71E-02	3E-03	5E-03	8E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	4E-06	9E-06	1.78E-01	2.74E-01	1.14E-01	7E-06	1E-05	1E-05	2E-05	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	2E-03	4E-03	1.78E-01	2.74E-01	8.60E-01	3E-04	5E-04	8E-04	1E-03	2.29E-02	1.17E-01	1.65E-03	6E-08	3E-07	1E-07	8E-07
Tetrachloroethene	1E-04	2E-04	1.78E-01	2.74E-01	1.40E-01	1E-04	2E-04	2E-04	4E-04	2.29E-02	1.17E-01	2.03E-03	4E-09	2E-08	9E-09	5E-08
Toluene	8E-06	2E-05	1.78E-01	2.74E-01	1.14E-01	1E-05	2E-05	3E-05	4E-05	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	1E-06	4E-06	1.78E-01	2.74E-01	8.57E-04	3E-04	4E-04	8E-04	1E-03	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	2E-04	3E-04	1.78E-01	2.74E-01	1.00E-01	3E-04	5E-04	5E-04	8E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						1E-02	2E-02	3E-02	5E-02				1E-07	5E-07	2E-07	1E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-02	3E-02	8.57E-02	1.96E-01	1.70E-03	5E-01	1E+00	2E+00	4E+00	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	2E-05	9E-05	8.57E-02	1.96E-01	1.40E-03	1E-03	3E-03	5E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	1E-08	1E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	6E-03	2E-02	8.57E-02	1.96E-01	1.70E-03	3E-01	7E-01	1E+00	2E+00	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	6E-05	3E-04	8.57E-02	1.96E-01	1.70E-03	3E-03	7E-03	1E-02	3E-02	6.12E-03	6.99E-02	2.73E-02	1E-08	1E-07	4E-08	5E-07
Cis-1 2-Dichloroethene	6E-05	3E-04	8.57E-02	1.96E-01	1.00E-02	5E-04	1E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	4E-03	2E-02	8.57E-02	1.96E-01	2.86E-01	1E-03	3E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	4E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	5E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	1E-05	7E-05	8.57E-02	1.96E-01	1.14E-01	1E-05	3E-05	5E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	2E-03	6E-03	8.57E-02	1.96E-01	8.60E-01	2E-04	3E-04	6E-04	1E-03	6.12E-03	6.99E-02	1.65E-03	2E-08	2E-07	6E-08	7E-07
Tetrachloroethene	2E-04	3E-04	8.57E-02	1.96E-01	1.40E-01	9E-05	2E-04	2E-04	5E-04	6.12E-03	6.99E-02	2.03E-03	2E-09	2E-08	4E-09	5E-08
Toluene	1E-03	5E-03	8.57E-02	1.96E-01	1.14E-01	1E-03	2E-03	4E-03	9E-03	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	4E-05	2E-04	8.57E-02	1.96E-01	8.57E-04	4E-03	8E-03	2E-02	6E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	5E-04	2E-03	8.57E-02	1.96E-01	1.00E-01	5E-04	1E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
Total						8E-01	**2E+00**	**3E+00**	**6E+00**				4E-08	5E-07	2E-07	2E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-02	3E-02	1.78E-01	2.74E-01	1.70E-03	1E+00	**2E+00**	**4E+00**	**6E+00**	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	2E-05	9E-05	1.78E-01	2.74E-01	1.40E-03	3E-03	4E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	5E-08	2E-07	2E-07	9E-07
1 3 5-Trimethylbenzene	6E-03	2E-02	1.78E-01	2.74E-01	1.70E-03	6E-01	9E-01	**2E+00**	**3E+00**	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	6E-05	3E-04	1.78E-01	2.74E-01	1.70E-03	6E-03	9E-03	3E-02	4E-02	2.29E-02	1.17E-01	2.73E-02	4E-08	2E-07	2E-07	8E-07
Cis-1 2-Dichloroethene	6E-05	3E-04	1.78E-01	2.74E-01	1.00E-02	1E-03	2E-03	5E-03	7E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	4E-03	2E-02	1.78E-01	2.74E-01	2.86E-01	3E-03	4E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	4E-03	1.78E-01	2.74E-01	5.71E-02	4E-03	6E-03	1E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	1E-05	7E-05	1.78E-01	2.74E-01	1.14E-01	2E-05	4E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	2E-03	6E-03	1.78E-01	2.74E-01	8.60E-01	3E-04	5E-04	1E-03	2E-03	2.29E-02	1.17E-01	1.65E-03	6E-08	3E-07	2E-07	1E-06
Tetrachloroethene	2E-04	3E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	3E-04	4E-04	7E-04	2.29E-02	1.17E-01	2.03E-03	7E-09	4E-08	2E-08	8E-08
Toluene	1E-03	5E-03	1.78E-01	2.74E-01	1.14E-01	2E-03	3E-03	9E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	4E-05	2E-04	1.78E-01	2.74E-01	8.57E-04	8E-03	1E-02	5E-02	8E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	5E-04	2E-03	1.78E-01	2.74E-01	1.00E-01	1E-03	1E-03	4E-03	6E-03	2.29E-02	1.17E-01	na	--	--	--	--
Total						**2E+00**	**3E+00**	**6E+00**	**9E+00**				1E-07	8E-07	6E-07	3E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 9

Scenario = Basement **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-04	3E-04	8.57E-02	1.96E-01	1.70E-03	7E-03	2E-02	1E-02	3E-02	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	1E-05	2E-05	8.57E-02	1.96E-01	1.40E-03	7E-04	1E-03	1E-03	2E-03	6.12E-03	6.99E-02	9.10E-02	6E-09	7E-08	1E-08	1E-07
1 3 5-Trimethylbenzene	8E-05	2E-04	8.57E-02	1.96E-01	1.70E-03	4E-03	9E-03	8E-03	2E-02	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	2E-05	4E-05	8.57E-02	1.96E-01	1.70E-03	1E-03	2E-03	2E-03	4E-03	6.12E-03	6.99E-02	2.73E-02	4E-09	4E-08	6E-09	7E-08
Cis-1 2-Dichloroethene	2E-05	4E-05	8.57E-02	1.96E-01	1.00E-02	2E-04	4E-04	3E-04	7E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	3E-04	6E-04	8.57E-02	1.96E-01	2.86E-01	9E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	2E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	3E-03	7E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	7E-05	1E-04	8.57E-02	1.96E-01	1.14E-01	5E-05	1E-04	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	2E-03	4E-03	8.57E-02	1.96E-01	8.60E-01	2E-04	6E-04	4E-04	9E-04	6.12E-03	6.99E-02	1.65E-03	2E-08	3E-07	4E-08	5E-07
Tetrachloroethene	1E-04	2E-04	8.57E-02	1.96E-01	1.40E-01	7E-05	2E-04	1E-04	3E-04	6.12E-03	6.99E-02	2.03E-03	1E-09	2E-08	2E-09	3E-08
Toluene	1E-04	3E-04	8.57E-02	1.96E-01	1.14E-01	1E-04	2E-04	2E-04	5E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-06	9E-06	8.57E-02	1.96E-01	8.57E-04	5E-04	1E-03	9E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	6E-05	8E-05	8.57E-02	1.96E-01	1.00E-01	5E-05	1E-04	7E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-02	4E-02	3E-02	7E-02				4E-08	4E-07	6E-08	7E-07

Scenario = Basement **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-04	3E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	3E-02	5E-02	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	1E-05	2E-05	1.78E-01	2.74E-01	1.40E-03	1E-03	2E-03	2E-03	3E-03	2.29E-02	1.17E-01	9.10E-02	2E-08	1E-07	4E-08	2E-07
1 3 5-Trimethylbenzene	8E-05	2E-04	1.78E-01	2.74E-01	1.70E-03	8E-03	1E-02	2E-02	2E-02	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	2E-05	4E-05	1.78E-01	2.74E-01	1.70E-03	2E-03	3E-03	4E-03	6E-03	2.29E-02	1.17E-01	2.73E-02	1E-08	7E-08	2E-08	1E-07
Cis-1 2-Dichloroethene	2E-05	4E-05	1.78E-01	2.74E-01	1.00E-02	4E-04	6E-04	6E-04	1E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	3E-04	6E-04	1.78E-01	2.74E-01	2.86E-01	2E-04	3E-04	4E-04	6E-04	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	2E-03	1.78E-01	2.74E-01	5.71E-02	3E-03	5E-03	6E-03	9E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	7E-05	1E-04	1.78E-01	2.74E-01	1.14E-01	1E-04	2E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	2E-03	4E-03	1.78E-01	2.74E-01	8.60E-01	5E-04	8E-04	9E-04	1E-03	2.29E-02	1.17E-01	1.65E-03	9E-08	5E-07	2E-07	8E-07
Tetrachloroethene	1E-04	2E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	2E-04	2E-04	4E-04	2.29E-02	1.17E-01	2.03E-03	6E-09	3E-08	9E-09	5E-08
Toluene	1E-04	3E-04	1.78E-01	2.74E-01	1.14E-01	2E-04	3E-04	4E-04	6E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-06	9E-06	1.78E-01	2.74E-01	8.57E-04	1E-03	2E-03	2E-03	3E-03	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	6E-05	8E-05	1.78E-01	2.74E-01	1.00E-01	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-02	5E-02	6E-02	1E-01				1E-07	7E-07	2E-07	1E-06

Scenario = Slab **Receptor = Worker**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-04	4E-04	8.57E-02	1.96E-01	1.70E-03	6E-03	1E-02	2E-02	5E-02	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	3E-05	9E-05	8.57E-02	1.96E-01	1.40E-03	2E-03	4E-03	5E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	1E-08	2E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	6E-05	2E-04	8.57E-02	1.96E-01	1.70E-03	3E-03	7E-03	1E-02	3E-02	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	7E-05	3E-04	8.57E-02	1.96E-01	1.70E-03	3E-03	8E-03	1E-02	3E-02	6.12E-03	6.99E-02	2.73E-02	1E-08	1E-07	4E-08	5E-07
Cis-1 2-Dichloroethene	7E-05	3E-04	8.57E-02	1.96E-01	1.00E-02	6E-04	1E-03	2E-03	5E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	2E-04	8E-04	8.57E-02	1.96E-01	2.86E-01	6E-05	1E-04	3E-04	6E-04	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	1E-03	3E-03	8.57E-02	1.96E-01	5.71E-02	2E-03	4E-03	4E-03	1E-02	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	6E-05	2E-04	8.57E-02	1.96E-01	1.14E-01	4E-05	1E-04	2E-04	4E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	2E-03	6E-03	8.57E-02	1.96E-01	8.60E-01	2E-04	4E-04	6E-04	1E-03	6.12E-03	6.99E-02	1.65E-03	2E-08	2E-07	6E-08	7E-07
Tetrachloroethene	2E-04	3E-04	8.57E-02	1.96E-01	1.40E-01	1E-04	2E-04	2E-04	5E-04	6.12E-03	6.99E-02	2.03E-03	2E-09	2E-08	4E-09	5E-08
Toluene	1E-04	4E-04	8.57E-02	1.96E-01	1.14E-01	9E-05	2E-04	3E-04	7E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-05	2E-04	8.57E-02	1.96E-01	8.57E-04	5E-03	1E-02	2E-02	6E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	4E-05	1E-04	8.57E-02	1.96E-01	1.00E-01	4E-05	8E-05	1E-04	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-02	5E-02	8E-02	2E-01				4E-08	5E-07	2E-07	2E-06

Scenario = Slab **Receptor = Resident**

	Total Conc (mg/m3)		Noncancer							Cancer						
			Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-04	4E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	4E-02	7E-02	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	3E-05	9E-05	1.78E-01	2.74E-01	1.40E-03	3E-03	5E-03	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	5E-08	3E-07	2E-07	9E-07
1 3 5-Trimethylbenzene	6E-05	2E-04	1.78E-01	2.74E-01	1.70E-03	7E-03	1E-02	2E-02	4E-02	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	7E-05	3E-04	1.78E-01	2.74E-01	1.70E-03	7E-03	1E-02	3E-02	4E-02	2.29E-02	1.17E-01	2.73E-02	4E-08	2E-07	2E-07	8E-07
Cis-1 2-Dichloroethene	7E-05	3E-04	1.78E-01	2.74E-01	1.00E-02	1E-03	2E-03	5E-03	7E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	2E-04	8E-04	1.78E-01	2.74E-01	2.86E-01	1E-04	2E-04	5E-04	8E-04	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	1E-03	3E-03	1.78E-01	2.74E-01	5.71E-02	4E-03	6E-03	9E-03	1E-02	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	6E-05	2E-04	1.78E-01	2.74E-01	1.14E-01	9E-05	1E-04	3E-04	5E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	2E-03	6E-03	1.78E-01	2.74E-01	8.60E-01	3E-04	5E-04	1E-03	2E-03	2.29E-02	1.17E-01	1.65E-03	6E-08	3E-07	2E-07	1E-06
Tetrachloroethene	2E-04	3E-04	1.78E-01	2.74E-01	1.40E-01	2E-04	3E-04	4E-04	7E-04	2.29E-02	1.17E-01	2.03E-03	8E-09	4E-08	2E-08	8E-08
Toluene	1E-04	4E-04	1.78E-01	2.74E-01	1.14E-01	2E-04	3E-04	6E-04	9E-04	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-05	2E-04	1.78E-01	2.74E-01	8.57E-04	1E-02	2E-02	5E-02	8E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	4E-05	1E-04	1.78E-01	2.74E-01	1.00E-01	8E-05	1E-04	2E-04	3E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						5E-02	7E-02	2E-01	3E-01				2E-07	8E-07	6E-07	3E-06

RISK CALCS - Soil Gas Intrusion from Soil (assumed to be sandy loam)
LOT 10

Scenario = Basement **Receptor = Worker**

			Noncancer							Cancer						
	Total Conc (mg/m3)		Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-06	1E-06	8.57E-02	1.96E-01	1.70E-03	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	4E-06	4E-06	8.57E-02	1.96E-01	1.40E-03	2E-04	5E-04	2E-04	5E-04	6.12E-03	6.99E-02	9.10E-02	2E-09	2E-08	2E-09	2E-08
1 3 5-Trimethylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.70E-03	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	7E-06	7E-06	8.57E-02	1.96E-01	1.70E-03	4E-04	8E-04	4E-04	8E-04	6.12E-03	6.99E-02	2.73E-02	1E-09	1E-08	1E-09	1E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	8.57E-02	1.96E-01	1.00E-02	6E-05	1E-04	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	1E-06	1E-06	8.57E-02	1.96E-01	2.86E-01	3E-07	7E-07	3E-07	7E-07	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	4E-04	4E-04	8.57E-02	1.96E-01	5.71E-02	6E-04	1E-03	6E-04	1E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	8.57E-02	1.96E-01	1.14E-01	1E-06	3E-06	1E-06	3E-06	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	8.57E-02	1.96E-01	8.60E-01	8E-05	2E-04	8E-05	2E-04	6.12E-03	6.99E-02	1.65E-03	8E-09	9E-08	8E-09	9E-08
Tetrachloroethene	5E-05	5E-05	8.57E-02	1.96E-01	1.40E-01	3E-05	7E-05	3E-05	7E-05	6.12E-03	6.99E-02	2.03E-03	6E-10	7E-09	6E-10	7E-09
Toluene	3E-06	3E-06	8.57E-02	1.96E-01	1.14E-01	2E-06	5E-06	2E-06	5E-06	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	5E-08	5E-08	8.57E-02	1.96E-01	8.57E-04	5E-06	1E-05	5E-06	1E-05	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	5E-05	5E-05	8.57E-02	1.96E-01	1.00E-01	4E-05	1E-04	4E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-03	3E-03	2E-03	3E-03				1E-08	1E-07	1E-08	1E-07

Scenario = Basement **Receptor = Resident**

			Noncancer							Cancer						
	Total Conc (mg/m3)		Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	1E-06	1E-06	1.78E-01	2.74E-01	1.70E-03	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	4E-06	4E-06	1.78E-01	2.74E-01	1.40E-03	5E-04	7E-04	5E-04	7E-04	2.29E-02	1.17E-01	9.10E-02	7E-09	4E-08	7E-09	4E-08
1 3 5-Trimethylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.70E-03	2E-04	2E-04	2E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	7E-06	7E-06	1.78E-01	2.74E-01	1.70E-03	7E-04	1E-03	7E-04	1E-03	2.29E-02	1.17E-01	2.73E-02	4E-09	2E-08	4E-09	2E-08
Cis-1 2-Dichloroethene	7E-06	7E-06	1.78E-01	2.74E-01	1.00E-02	1E-04	2E-04	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	1E-06	1E-06	1.78E-01	2.74E-01	2.86E-01	7E-07	1E-06	7E-07	1E-06	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	4E-04	4E-04	1.78E-01	2.74E-01	5.71E-02	1E-03	2E-03	1E-03	2E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	2E-06	2E-06	1.78E-01	2.74E-01	1.14E-01	3E-06	4E-06	3E-06	4E-06	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	8E-04	8E-04	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	2E-04	3E-04	2.29E-02	1.17E-01	1.65E-03	3E-08	2E-07	3E-08	2E-07
Tetrachloroethene	5E-05	5E-05	1.78E-01	2.74E-01	1.40E-01	6E-05	9E-05	6E-05	9E-05	2.29E-02	1.17E-01	2.03E-03	2E-09	1E-08	2E-09	1E-08
Toluene	3E-06	3E-06	1.78E-01	2.74E-01	1.14E-01	4E-06	6E-06	4E-06	6E-06	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	5E-08	5E-08	1.78E-01	2.74E-01	8.57E-04	1E-05	1E-05	1E-05	1E-05	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	5E-05	5E-05	1.78E-01	2.74E-01	1.00E-01	9E-05	1E-04	9E-05	1E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						3E-03	5E-03	3E-03	5E-03				4E-08	2E-07	4E-08	2E-07

Scenario = Slab **Receptor = Worker**

			Noncancer							Cancer						
	Total Conc (mg/m3)		Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-05	6E-05	8.57E-02	1.96E-01	1.70E-03	1E-03	2E-03	3E-03	7E-03	6.12E-03	6.99E-02	na	--	--	--	--
1 2-Dichloroethane	5E-05	1E-04	8.57E-02	1.96E-01	1.40E-03	3E-03	7E-03	6E-03	1E-02	6.12E-03	6.99E-02	9.10E-02	3E-08	3E-07	5E-08	6E-07
1 3 5-Trimethylbenzene	1E-05	3E-05	8.57E-02	1.96E-01	1.70E-03	5E-04	1E-03	1E-03	3E-03	6.12E-03	6.99E-02	na	--	--	--	--
Benzene	1E-04	3E-04	8.57E-02	1.96E-01	1.70E-03	7E-03	2E-02	1E-02	3E-02	6.12E-03	6.99E-02	2.73E-02	2E-08	3E-07	5E-08	5E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	8.57E-02	1.96E-01	1.00E-02	1E-03	3E-03	2E-03	6E-03	6.12E-03	6.99E-02	na	--	--	--	--
Ethylbenzene	5E-05	9E-05	8.57E-02	1.96E-01	2.86E-01	1E-05	3E-05	3E-05	6E-05	6.12E-03	6.99E-02	na	--	--	--	--
Hexane	6E-04	6E-04	8.57E-02	1.96E-01	5.71E-02	9E-04	2E-03	9E-04	2E-03	6.12E-03	6.99E-02	na	--	--	--	--
Isopropylbenzene	4E-05	7E-05	8.57E-02	1.96E-01	1.14E-01	3E-05	6E-05	5E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	8.57E-02	1.96E-01	8.60E-01	9E-05	2E-04	2E-04	4E-04	6.12E-03	6.99E-02	1.65E-03	9E-09	1E-07	2E-08	2E-07
Tetrachloroethene	2E-04	4E-04	8.57E-02	1.96E-01	1.40E-01	1E-04	3E-04	2E-04	5E-04	6.12E-03	6.99E-02	2.03E-03	3E-09	3E-08	5E-09	5E-08
Toluene	2E-04	5E-04	8.57E-02	1.96E-01	1.14E-01	1E-04	3E-04	4E-04	8E-04	6.12E-03	6.99E-02	na	--	--	--	--
Naphthalene	9E-05	3E-04	8.57E-02	1.96E-01	8.57E-04	9E-03	2E-02	3E-02	6E-02	6.12E-03	6.99E-02	na	--	--	--	--
Acetone	3E-05	8E-05	8.57E-02	1.96E-01	1.00E-01	2E-05	5E-05	6E-05	1E-04	6.12E-03	6.99E-02	na	--	--	--	--
Total						2E-02	5E-02	5E-02	1E-01				6E-08	7E-07	1E-07	1E-06

Scenario = Slab **Receptor = Resident**

			Noncancer							Cancer						
	Total Conc (mg/m3)		Noncancer HIF (m3/kg-d)		iRfD	HQ				Cancer HIF (m3/kg-d)		iSF	Cancer Risk			
VOC	Avg	Max	CTE	RME	mg/kg-d	Avg CTE	Avg RME	Max CTE	Max RME	CTE	RME	(mg/kg-d)-1	Avg CTE	Avg RME	Max CTE	Max RME
1 2 4-Trimethylbenzene	2E-05	6E-05	1.78E-01	2.74E-01	1.70E-03	2E-03	3E-03	6E-03	9E-03	2.29E-02	1.17E-01	na	--	--	--	--
1 2-Dichloroethane	5E-05	1E-04	1.78E-01	2.74E-01	1.40E-03	6E-03	1E-02	1E-02	2E-02	2.29E-02	1.17E-01	9.10E-02	1E-07	5E-07	2E-07	1E-06
1 3 5-Trimethylbenzene	1E-05	3E-05	1.78E-01	2.74E-01	1.70E-03	1E-03	2E-03	3E-03	4E-03	2.29E-02	1.17E-01	na	--	--	--	--
Benzene	1E-04	3E-04	1.78E-01	2.74E-01	1.70E-03	1E-02	2E-02	3E-02	5E-02	2.29E-02	1.17E-01	2.73E-02	9E-08	5E-07	2E-07	9E-07
Cis-1 2-Dichloroethene	1E-04	3E-04	1.78E-01	2.74E-01	1.00E-02	3E-03	4E-03	5E-03	8E-03	2.29E-02	1.17E-01	na	--	--	--	--
Ethylbenzene	5E-05	9E-05	1.78E-01	2.74E-01	2.86E-01	3E-05	5E-05	5E-05	8E-05	2.29E-02	1.17E-01	na	--	--	--	--
Hexane	6E-04	6E-04	1.78E-01	2.74E-01	5.71E-02	2E-03	3E-03	2E-03	3E-03	2.29E-02	1.17E-01	na	--	--	--	--
Isopropylbenzene	4E-05	7E-05	1.78E-01	2.74E-01	1.14E-01	6E-05	9E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Methylene Chloride	9E-04	2E-03	1.78E-01	2.74E-01	8.60E-01	2E-04	3E-04	4E-04	5E-04	2.29E-02	1.17E-01	1.65E-03	4E-08	2E-07	6E-08	3E-07
Tetrachloroethene	2E-04	4E-04	1.78E-01	2.74E-01	1.40E-01	3E-04	4E-04	5E-04	7E-04	2.29E-02	1.17E-01	2.03E-03	1E-08	5E-08	2E-08	9E-08
Toluene	2E-04	5E-04	1.78E-01	2.74E-01	1.14E-01	3E-04	4E-04	8E-04	1E-03	2.29E-02	1.17E-01	na	--	--	--	--
Naphthalene	9E-05	3E-04	1.78E-01	2.74E-01	8.57E-04	2E-02	3E-02	5E-02	8E-02	2.29E-02	1.17E-01	na	--	--	--	--
Acetone	3E-05	8E-05	1.78E-01	2.74E-01	1.00E-01	5E-05	7E-05	1E-04	2E-04	2.29E-02	1.17E-01	na	--	--	--	--
Total						5E-02	7E-02	1E-01	2E-01				2E-07	1E-06	5E-07	2E-06