Attachment F1

WRRTF-13 RBCA Analysis Output

SUMMARY OF RISK AND HAZARD INDEX

Source	Pathway		Resident Adult		Commercial Worker	
			Risk	HI	Risk	HI
Surficial Soil	Dermal Contact, Ingestion, and Inhalation		**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
Subsurface Soil	Indoor Inhalation		0.00E+00	9.36E-01	0.00E+00	4.02E-01
	Outdoor Inhalation		0.00E+00	7.22E-04	0.00E+00	8.45E-04
	Sub-total		**0.00E+00**	**9.37E-01**	**0.00E+00**	**4.03E-01**
Groundwater	Ingestion		1.17E-08	2.36E-02	2.65E-09	1.20E-02
	Indoor Inhalation		0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Outdoor Inhalation		0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Sub-total		**1.17E-08**	**2.36E-02**	**2.65E-09**	**1.20E-02**
TOTAL			**1.17E-08**	**9.61E-01**	**2.65E-09**	**4.15E-01**

Chemical of Concern	CARCINOGENIC RISK FOR RESIDENT ADULT						
	Surficial Soil: Ingestion, Inhalation, and Dermal Contact	Subsurface Soil: Indoor Inhalation	Subsurface Soil: Outdoor Inhalation	Groundwater: Ingestion	Groundwater: Indoor Inhalation	Groundwater: Outdoor Inhalation	Cumulative Risk
Volatile Organic Compounds							
Benzene	NC	NC	NC	NC	NC	NC	**NC**
Toluene	NC	NC	NC	NC	NC	NC	**NC**
Ethylbenzene	-	-	-	-	-	-	**0.00E+00**
Xylenes (mixed)	-	-	-	-	-	-	**0.00E+00**
Ethylene Dibromide (EDB)	NC	NC	NC	NC	NC	NC	**NC**
1,2 Dichloroethane (EDC)	NC	NC	NC	NC	NC	NC	**NC**
Methyl Tert-Butyl Ether (MTBE)	NC	NC	NC	NC	NC	NC	**NC**
PAH Compounds							
Acenapthene	NC	NC	NC	NC	NC	NC	**NC**
Anthracene	-	-	-	-	-	-	**0.00E+00**
Benzo(a)pyrene	NC	NC	NC	NC	NC	NC	**NC**
Benzo(b)fluoranthene	0.00E+00	0.00E+00	0.00E+00	6.12E-09	0.00E+00	0.00E+00	**6.12E-09**
Benzo(k)fluoranthene	0.00E+00	0.00E+00	0.00E+00	2.54E-10	0.00E+00	0.00E+00	**2.54E-10**
Benzo(a)anthracene	0.00E+00	0.00E+00	0.00E+00	5.06E-09	0.00E+00	0.00E+00	**5.06E-09**
Benzo(g,h,i)perylene	NC	NC	NC	NC	NC	NC	**NC**
Chrysene	0.00E+00	0.00E+00	0.00E+00	2.30E-10	0.00E+00	0.00E+00	**2.30E-10**
Fluorene	-	-	-	-	-	-	**0.00E+00**
Fluoranthene	-	-	-	-	-	-	**0.00E+00**
Naphthalene	-	-	-	-	-	-	**0.00E+00**
Phenanthrene	-	-	-	-	-	-	**0.00E+00**
Pyrene	NC	NC	NC	NC	NC	NC	**NC**
User-specified Compounds							
Chemical 1	NC	NC	NC	NC	NC	NC	**NC**
Chemical 2	NC	NC	NC	NC	NC	NC	**NC**
Chemical 3	NC	NC	NC	NC	NC	NC	**NC**
Chemical 4	NC	NC	NC	NC	NC	NC	**NC**
Chemical 5	NC	NC	NC	NC	NC	NC	**NC**
TOTAL	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.17E-08**	**0.00E+00**	**0.00E+00**	**1.17E-08**

Chemical of Concern	HAZARD QUOTIENTS FOR RESIDENT ADULT						
	Surficial Soil: Ingestion, Inhalation, and Dermal Contact	Subsurface Soil: Indoor Inhalation	Subsurface Soil: Outdoor Inhalation	Groundwater: Ingestion	Groundwater: Indoor Inhalation	Groundwater: Outdoor Inhalation	Cumulative Hazard Index
Volatile Organic Compounds							
Benzene	NC	NC	NC	NC	NC	NC	**NC**
Toluene	NC	NC	NC	NC	NC	NC	**NC**
Ethylbenzene	0.00E+00	1.66E-01	1.45E-04	3.70E-03	0.00E+00	0.00E+00	**1.70E-01**
Xylenes (mixed)	0.00E+00	6.03E-01	5.22E-04	4.86E-04	0.00E+00	0.00E+00	**6.04E-01**
Ethylene Dibromide (EDB)	NC	NC	NC	NC	NC	NC	**NC**
1,2 Dichloroethane (EDC)	NC	NC	NC	NC	NC	NC	**NC**
Methyl Tert-Butyl Ether (MTBE)	NC	NC	NC	NC	NC	NC	**NC**
PAH Compounds							
Acenapthene	NC	NC	NC	NC	NC	NC	**NC**
Anthracene	0.00E+00	0.00E+00	0.00E+00	1.28E-05	0.00E+00	0.00E+00	**1.28E-05**
Benzo(a)pyrene	NC	NC	NC	NC	NC	NC	**NC**
Benzo(b)fluoranthene	-	-	-	-	-	-	**0.00E+00**
Benzo(k)fluoranthene	-	-	-	-	-	-	**0.00E+00**
Benzo(a)anthracene	-	-	-	-	-	-	**0.00E+00**
Benzo(g,h,i)perylene	NC	NC	NC	NC	NC	NC	**NC**
Chrysene	-	-	-	-	-	-	**0.00E+00**
Fluorene	0.00E+00	0.00E+00	0.00E+00	1.91E-03	0.00E+00	0.00E+00	**1.91E-03**
Fluoranthene	0.00E+00	0.00E+00	0.00E+00	4.39E-04	0.00E+00	0.00E+00	**4.39E-04**
Naphthalene	0.00E+00	1.68E-01	5.48E-05	1.57E-02	0.00E+00	0.00E+00	**1.83E-01**
Phenanthrene	0.00E+00	0.00E+00	0.00E+00	1.32E-03	0.00E+00	0.00E+00	**1.32E-03**
Pyrene	NC	NC	NC	NC	NC	NC	**NC**
User-specified Compounds							
Chemical 1	NC	NC	NC	NC	NC	NC	**NC**
Chemical 2	NC	NC	NC	NC	NC	NC	**NC**
Chemical 3	NC	NC	NC	NC	NC	NC	**NC**
Chemical 4	NC	NC	NC	NC	NC	NC	**NC**
Chemical 5	NC	NC	NC	NC	NC	NC	**NC**
TOTAL	**0.00E+00**	**9.36E-01**	**7.22E-04**	**2.36E-02**	**0.00E+00**	**0.00E+00**	**9.61E-01**

Chemical of Concern	CARCINOGENIC RISK FOR COMMERCIAL WORKER						
	Surficial Soil: Ingestion, Inhalation, and Dermal Contact	Subsurface Soil: Indoor Inhalation	Subsurface Soil: Outdoor Inhalation	Groundwater: Ingestion	Groundwater: Indoor Inhalation	Groundwater: Outdoor Inhalation	Cumulative Risk
Volatile Organic Compounds							
Benzene	NC	NC	NC	NC	NC	NC	**NC**
Toluene	NC	NC	NC	NC	NC	NC	**NC**
Ethylbenzene	-	-	-	-	-	-	**NC**
Xylenes (mixed)	-	-	-	-	-	-	**NC**
Ethylene Dibromide (EDB)	NC	NC	NC	NC	NC	NC	**NC**
1,2 Dichloroethane (EDC)	NC	NC	NC	NC	NC	NC	**NC**
Methyl Tert-Butyl Ether (MTBE)	NC	NC	NC	NC	NC	NC	**NC**
PAH Compounds							
Acenapthene	NC	NC	NC	NC	NC	NC	**NC**
Anthracene	-	-	-	-	-	-	**NC**
Benzo(a)pyrene	NC	NC	NC	NC	NC	NC	**NC**
Benzo(b)fluoranthene	0.00E+00	0.00E+00	0.00E+00	1.39E-09	0.00E+00	0.00E+00	**NC**
Benzo(k)fluoranthene	0.00E+00	0.00E+00	0.00E+00	5.76E-11	0.00E+00	0.00E+00	**NC**
Benzo(a)anthracene	0.00E+00	0.00E+00	0.00E+00	1.15E-09	0.00E+00	0.00E+00	**NC**
Benzo(g,h,i)perylene	NC	NC	NC	NC	NC	NC	**NC**
Chrysene	0.00E+00	0.00E+00	0.00E+00	5.22E-11	0.00E+00	0.00E+00	**NC**
Fluorene	-	-	-	-	-	-	**NC**
Fluoranthene	-	-	-	-	-	-	**NC**
Naphthalene	-	-	-	-	-	-	**NC**
Phenanthrene	-	-	-	-	-	-	**NC**
Pyrene	NC	NC	NC	NC	NC	NC	**NC**
User-specified Compounds							
Chemical 1	NC	NC	NC	NC	NC	NC	**NC**
Chemical 2	NC	NC	NC	NC	NC	NC	**NC**
Chemical 3	NC	NC	NC	NC	NC	NC	**NC**
Chemical 4	NC	NC	NC	NC	NC	NC	**NC**
Chemical 5	NC	NC	NC	NC	NC	NC	**NC**
TOTAL	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.65E-09**	**0.00E+00**	**0.00E+00**	**2.65E-09**

Chemical of Concern	HAZARD QUOTIENTS FOR COMMERCIAL WORKER						
	Surficial Soil: Ingestion, Inhalation, and Dermal Contact	Subsurface Soil: Indoor Inhalation	Subsurface Soil: Outdoor Inhalation	Groundwater: Ingestion	Groundwater: Indoor Inhalation	Groundwater: Outdoor Inhalation	Cumulative Hazard Index
Volatile Organic Compounds							
Benzene	NC	NC	NC	NC	NC	NC	**NC**
Toluene	NC	NC	NC	NC	NC	NC	**NC**
Ethylbenzene	0.00E+00	8.55E-02	1.85E-04	1.89E-03	0.00E+00	0.00E+00	**NC**
Xylenes (mixed)	0.00E+00	3.02E-01	6.46E-04	2.48E-04	0.00E+00	0.00E+00	**NC**
Ethylene Dibromide (EDB)	NC	NC	NC	NC	NC	NC	**NC**
1,2 Dichloroethane (EDC)	NC	NC	NC	NC	NC	NC	**NC**
Methyl Tert-Butyl Ether (MTBE)	NC	NC	NC	NC	NC	NC	**NC**
PAH Compounds							
Acenapthene	NC	NC	NC	NC	NC	NC	**NC**
Anthracene	0.00E+00	0.00E+00	0.00E+00	6.54E-06	0.00E+00	0.00E+00	**NC**
Benzo(a)pyrene	NC	NC	NC	NC	NC	NC	**NC**
Benzo(b)fluoranthene	-	-	-	-	-	-	**NC**
Benzo(k)fluoranthene	-	-	-	-	-	-	**NC**
Benzo(a)anthracene	-	-	-	-	-	-	**NC**
Benzo(g,h,i)perylene	NC	NC	NC	NC	NC	NC	**NC**
Chrysene	-	-	-	-	-	-	**NC**
Fluorene	0.00E+00	0.00E+00	0.00E+00	9.75E-04	0.00E+00	0.00E+00	**NC**
Fluoranthene	0.00E+00	0.00E+00	0.00E+00	2.24E-04	0.00E+00	0.00E+00	**NC**
Naphthalene	0.00E+00	1.50E-02	1.40E-05	8.01E-03	0.00E+00	0.00E+00	**NC**
Phenanthrene	0.00E+00	0.00E+00	0.00E+00	6.74E-04	0.00E+00	0.00E+00	**NC**
Pyrene	NC	NC	NC	NC	NC	NC	**NC**
User-specified Compounds							
Chemical 1	NC	NC	NC	NC	NC	NC	**NC**
Chemical 2	NC	NC	NC	NC	NC	NC	**NC**
Chemical 3	NC	NC	NC	NC	NC	NC	**NC**
Chemical 4	NC	NC	NC	NC	NC	NC	**NC**
Chemical 5	NC	NC	NC	NC	NC	NC	**NC**
TOTAL	**0.00E+00**	**4.02E-01**	**8.45E-04**	**1.20E-02**	**0.00E+00**	**0.00E+00**	**4.15E-01**

SUMMARY OF REPRESENTATIVE CONCENTRATIONS OF CHEMICALS IN SOIL AND GROUNDWATER

Chemical of Concern	Surficial Soil			Subsurface Soil			Groundwater			CRF unsat zone [-]	Loading to Groundwater (from External Model)	
	Conc. [mg/kg]	No. of Samples	Method of Calculation	Conc. [mg/kg]	No. of Samples	Method of Calculation	Conc. [mg/L]	No. of Samples	Method of Calculation		Wet Soil Conc. [mg/kg]	Mass Loading [g/yr]
Volatile Organic Compounds												
☐ Benzene					32	Not Detected				1	1	35.01
☐ Toluene					32	Not Detected				1	1	27.44
☑ Ethylbenzene				6	32	Max Detected				1	1	10.79
☑ Xylenes (mixed)				16	32	Max Detected				1	1	11.42
☐ Ethylene Dibromide (EDB)										1	1	70.12
☐ 1,2 Dichloroethane (EDC)										1	1	65.41
☐ Methyl Tert-Butyl Ether (MTBE)										1	1	70.33
PAH Compounds												
☐ Acenapthene					30	Not Detected				1	1	3.98
☑ Anthracene				1.397	30	Max Detected				1	1	
☐ Benzo(a)pyrene					30	Not Detected				1	1	
☑ Benzo(b)fluoranthene				0.6948	30	Max Detected				1	1	
☑ Benzo(k)fluoranthene				0.5372	30	Max Detected				1	1	
☑ Benzo(a)anthracene				1.443	30	Max Detected				1	1	
☐ Benzo(g,h,i)perylene					30	Not Detected				1	1	
☑ Chrysene				1.167	30	Max Detected				1	1	
☑ Fluorene				11	30	Max Detected				1	1	3.98
☑ Fluoranthene				12.97	30	Max Detected				1	1	
☑ Naphthalene				17.26	30	Max Detected				1	1	16.82
☑ Phenanthrene				14.6	30	Max Detected				1	1	2.11
☐ Pyrene					30	Not Detected				1	1	
User-specified Compounds												
☐ Chemical 1												
☐ Chemical 2												
☐ Chemical 3												
☐ Chemical 4												
☐ Chemical 5												

Note: See Guidance Document or discuss with IDEQ Project Officer for definition of Representative Concentrations
CRF = Concentration Reduction Factor. Refer to Guidance Document for details. Default value = 1

COMPLETE PATHWAY(S) AND ROUTE(S) OF EXPOSURE

Receptor, Source, and Route	Residental (Child and Adult)	Commercial
Surficial Soil (Ingestion, Inhalation, and Dermal Contact)	☑ YES	☑ YES
Subsurface Soil		
Outdoor Inhalation of Volatile Emission	☑ YES	☑ YES
Indoor Inhalation of Volatile Emission	☑ YES	☑ YES
Groundwater		
Outdoor Inhalation of Volatile Emission	☑ YES	☑ YES
Indoor Inhalation of Volatile Emission	☑ YES	☑ YES
Protection of Groundwater	☑ YES	☑ YES
Distance to the Target Well [ft] **500.0**		
Groundwater Class: ○ 1 ◉ 2 ○ 3		
Estimation of groundwater source concentration (choose 1 of the 3 options)		
1. Known Subsurface Soil Conc. and known CRFunsaturated ◉		
2. Specified Loading from an External Model ○		
3. Known On-site (Source) Groundwater Concentration ○		
Protection of Surface Water	☐ NO	
Distance to the Target Surface Water [ft] **10000.0**		
Surface Water Class: ◉ Domestic Water Supplies ○ Other		
Estimation of groundwater source concentration (choose 1 of the 3 options)		
1. Known Subsurface Soil Conc. and known CRFunsaturated ◉		
2. Specified Loading from an External Model ○		
3. Known On-site (Source) Groundwater Concentration ○		

EXPOSURE PARAMETERS FOR ROUTES OF EXPOSURE

Parameter	Symbol	Units	Tier 1 Default Values	Values Used	Comment
Page 1 of 2					
GLOBAL PARAMETERS:					
Acceptable Risk Level	TR	-	1.00E-06	1.00E-05	= Tier 2
Acceptable Hazard Quotient (Tier 1) / Index (Tier 2)	THQ/THI	-	0.2	1	= Tier 2
Body Weight - Adult	BW	kg	70	70	=Tier 1
Body Weight - Child	BW	kg	35	35	=Tier 1
ROUTE-SPECIFIC PARAMETERS:					
INGESTION OF, DERMAL CONTACT WITH, AND INHALATION OF VAPORS FROM SURFICIAL SOIL					
Exposure Duration:					
Residential - Adult	ED	year	9	9	=Tier 1
Residential - Child	ED	year	9	9	=Tier 1
Commercial	ED	year	4	4	=Tier 1
Exposure Frequency:					
Residential - Adult	EF	day/year	180	180	=Tier 1
Residential - Child	EF	day/year	180	180	=Tier 1
Commercial	EF	day/year	40	40	=Tier 1
Inhalation Rate:					
Residential - Adult	IRa	m^3/day	20	20	=Tier 1
Residential - Child	IRa	m^3/day	15	15	=Tier 1
Commercial	IRa	m^3/day	20	20	=Tier 1
Ingestion Rate:					
Residential - Adult	IRs	mg/day	100	100	=Tier 1
Residential - Child	IRs	mg/day	200	200	=Tier 1
Commercial	IRs	mg/day	50	50	=Tier 1
Soil to Skin Adherence Factor	M	mg/cm^2	1	1	=Tier 1
Skin Surface Area:					
Residential - Adult	SA	cm^2/day	4538	4538	=Tier 1
Residential - Child	SA	cm^2/day	2328	2328	=Tier 1
Commercial	SA	cm^2/day	1815	1815	=Tier 1

EXPOSURE PARAMETERS FOR ROUTES OF EXPOSURE

Parameter	Symbol	Units	Tier 1 Default Values	Values Used	Comment
Page 2 of 2					
INHALATION OF VAPORS FROM SUBSURFACE SOIL AND GROUNDWATER					
Inhalation Rate:					
Residential - Adult	IRa	m^3/day	20	20	=Tier 1
Residential - Child	IRa	m^3/day	15	15	=Tier 1
Commercial	IRa	m^3/day	20	20	=Tier 1
Exposure Duration:					
Residential - Adult	ED	year	9	9	=Tier 1
Residential - Child	ED	year	9	9	=Tier 1
Commercial	ED	year	4	4	=Tier 1
Exposure Frequency:					
Residential - Adult	EF	day/year	350	350	=Tier 1
Residential - Child	EF	day/year	350	350	=Tier 1
Commercial	EF	day/year	250	250	=Tier 1
INGESTION OF GROUNDWATER					
Ingestion Rate:					
Residential - Adult	IRw	L/day	1.4	1.4	=Tier 1
Residential - Child	IRw	L/day	1	1	=Tier 1
Commercial	IRw	L/day	1	1	=Tier 1
Exposure Duration:					
Residential - Adult	ED	year	9	9	=Tier 1
Residential - Child	ED	year	9	9	=Tier 1
Commercial	ED	year	4	4	=Tier 1
Exposure Frequency:					
Residential - Adult	EF	day/year	350	350	=Tier 1
Residential - Child	EF	day/year	350	350	=Tier 1
Commercial	EF	day/year	250	250	=Tier 1

Ref.: IDEQ, 1996. RBCA Guidance Document for Petroleum Releases

FATE AND TRANSPORT PARAMETERS FOR PATHWAYS

Parameter	Symbol	Units	Tier 1 Default Values	Values Used	Comment
Page 1 of 2					
SITE PARAMETERS:					
Source Area	A	cm^2	2250000	2250000	=Tier 1
Width of Source Area	W	cm	1500	1500	=Tier 1
Depth to Subsurface Soil Sources	Ls	ft	3 or 15	3	=Tier 1
Thickness of Subsurface Soil Source	ds	ft	6	6	=Tier 1
AMBIENT AIR PARAMETERS:					
Ambient Air Mixing Zone Height	δ_a	cm	200	200	=Tier 1
Wind Speed in Ambient Air Mixing Zone	Ua	cm/s	225	225	=Tier 1
Averaging Time for Vapor Flux - Residential	τ	sec	283800000	283800000	=Tier 1
Averaging Time for Vapor Flux - Commercial	τ	sec	126130000	126130000	=Tier 1
SOIL PARAMETERS:					
Dry Soil Bulk Density	ρ_s	g/cm^3	1.64	1.64	=Tier 1
Fractional Organic Carbon Content					
Surficial Soil	foc	g-C/g-soil	0.01	0.01	=Tier 1
Subsurface Soil	foc	g-C/g-soil	0.001	0.001	=Tier 1
Thickness of Capillary Fringe	hcapi	cm	5	5	=Tier 1
Thickness of Vadose Zone	hv	cm	variable	205	Calculated
Total Soil Porosity	θ_T	-	0.38	0.38	=Tier 1
Volumetric Water Content in Capillary Fringe	θ_{wcap}	-	0.342	0.342	=Tier 1
Volumetric Water Content in Vadose Zone	θ_{ws}	-	0.21 / 0.26	0.21	=Tier 1
Volumetric Water Content in Foundation/Wall Cracks	θ_{wcrack}	-	0.21 / 0.26	0.21	=Tier 1
Volumetric Air Content in Capillary Fringe	θ_{acap}	-	0.038	0.038	Calculated
Volumetric Air Content in Vadose Zone	θ_{as}	-	0.17 / 0.12	0.17	Calculated
Volumetric Air Content in Foundation/Wall Cracks	θ_{acrack}	-	0.17 / 0.12	0.17	Calculated

FATE AND TRANSPORT PARAMETERS FOR PATHWAYS

Parameter	Symbol	Units	Tier 1 Default Values	Values Used	Comment
Page 2 of 2					
GROUNDWATER PARAMETERS:					
Depth to Groundwater	Lgw	cm	variable	210	Calculated
Total Soil Porosity in the Saturated Zone	θ_T	-	0.38	0.38	=Tier 1
Dry Soil Bulk Density in the Saturated Zone	ρ_s	g/cm^3	1.64	1.64	=Tier 1
Fractional Organic Carbon Content in the Sat. Zone	foc	g-C/g-soil	0.001	0.001	=Tier 1
Dispersivities for Groundwater Modeling					
Longitudinal	α_x	cm	variable	1524	Calculated
Transverse	α_y	cm	variable	508	Calculated
Vertical	α_z	cm	variable	76.2	Calculated
Dispersivities for Surface Water Modeling					
Longitudinal	α_x	cm	variable	30480	Calculated
Transverse	α_y	cm	variable	10160	Calculated
Vertical	α_z	cm	variable	1524	Calculated
Groundwater Darcy Velocity	Ugw	cm/year	Zone-specific	150	Zone-specific
Groundwater Mixing Zone Thickness	δ_{gw}	cm	152	152	=Tier 1
Infiltration Rate of Water through Soil	IR	cm/year	Zone-specific	10	Zone-specific
ENCLOSED SPACE PARAMETERS:					
Enclosed Space Air Exchange Rate:					
Residential	ER	1/sec	0.00014	0.00014	=Tier 1
Commercial	ER	1/sec	0.00023	0.00023	=Tier 1
Enclosed Space Volume/Infiltration Area Ratio:					
Residential	Lb	cm	200	200	=Tier 1
Commercial	Lb	cm	300	300	=Tier 1
Enclosed Space Foundation or Wall Thickness					
Residential	Lcrack	cm	15	15	=Tier 1
Commercial	Lcrack	cm	15	15	=Tier 1
Areal Fraction of Cracks in Foundation/Walls					
Residential	η	-	0.01	0.01	=Tier 1
Commercial	η	-	0.01	0.01	=Tier 1

Ref.: IDEQ, 1996. RBCA Guidance Document for Petrolcum Rcleases

Toxicological Properties of Chemicals of Concern

Chemical of Concern	Weight of Evidence	Slope Factor [kg-day/mg]			Reference Dose [1/(kg-day/mg)]			Oral Absorption Factor	Dermal Absorption Fraction
		Oral (Sfo)	Inhalation (Sfi)	Source	Oral (RfDo)	Inhalation (RfDi)	Source	(RAFo)	(RAFd)
Volatile Organic Compounds									
Benzene	A	0.029	0.029	IRIS	NA	0.00171	IRIS	1	0.08
Toluene	D	NAP	NAP		0.2	0.114	IRIS	1	0.12
Ethylbenzene	D	NAP	NAP		0.1	0.286	IRIS	1	0.2
Xylenes (mixed)	D	NAP	NAP		2	0.2	IRIS	1	0.12
Ethylene Dibromide (EDB)	B2	85	0.76	IRIS	NA	0.000057	IRIS	1	0.1
1,2 Dichloroethane (EDC)	B2	0.091	0.091	IRIS	NA	0.00286	IRIS	1	0.1
Methyl Tert-Butyl Ether (MTBE)	ND	NAP	NAP		0.005	0.857	ECAO	1	0.1
PAH Compounds									
Acenapthene	ND	NAP	NAP		0.06	NA	IRIS	1	0.18
Anthracene	D	NAP	NAP		0.3	NA	IRIS	1	0.26
Benzo(a)pyrene	B2	7.3	6.1	IRIS	NAP	NAP		1	0.18
Benzo(b)fluoranthene	B2	0.73	0.61	ECAOb	NAP	NAP		1	0.18
Benzo(k)fluoranthene	B2	0.073	0.061	ECAOb	NAP	NAP		1	0.18
Benzo(a)anthracene	B2	0.73	0.61	ECAOb	NAP	NAP		1	0.18
Benzo(g,h,i)perylene	D	NAP	NAP		0.03	NA	TPHCWG	1	0.18
Chrysene	B2	0.0073	0.0061	ECAOb	NAP	NAP		1	0.18
Fluorene	D	NAP	NAP		0.04	NA	IRIS	1	0.18
Fluoranthene	D	NAP	NAP		0.04	NA	IRIS	1	0.18
Naphthalene	D	NAP	NAP		0.04	NA	ECAOa	1	0.18
Phenanthrene	D	NAP	NAP		0.04	NA	TPHCWG	1	0.18
Pyrene	D	NAP	NAP		0.03	NA	IRIS	1	0.18
User-specified Compounds									
Chemical 1		NA	NA		NA	NA			
Chemical 2		NA	NA		NA	NA			
Chemical 3		NA	NA		NA	NA			
Chemical 4		NA	NA		NA	NA			
Chemical 5		NA	NA		NA	NA			

Note:

The oral slope factor or reference dose is used to quantify inhalation and dermal exposure where specific values are not available.

NA : Not available

NAP: Not applicable

Sources:

IRIS, 1996. Integrated Risk Information System. United States Environmental Protection Agency. July 1996

ECAO. March 1997. US EPA Region 3. Risk Based Concentration Table.

ECAOa. 1995. Information provided via the EPA Risk Hotline.

ECAOb, 1993. United States Environmental Protection Agency. Provisional Guidance for Quantitative Risk Assessment of PAHs. EPA/600/R-93/089.

TPHCWG,1996. Total Petroleum Hydrocarbon Criteria Working Group. Methodology.Volume 6. Draft. May 17, 1996.

(*): Dermal Absorption Fraction: Massachusetts Dept. of Environmental Protection , 1992. Documentation for the Risk Assessment Shortform-Residential Scenario, Policy #WSC/ORS-142-92. Appendix C- Relative Absorption Factors.

Physical and Chemical Properties of Chemicals of Concern

Chemical of Concern	CAS Reg. Number	Molecular Weight (g/mole)	First Order Degradation Rate [1/day]	Water Solubility (mg/L)	Vapor Pressure (mm Hg)	Henry's Law Constant (unitless)	Organic Carbon Adsorption Coefficient Koc (mL/g)	Diffusion Coefficient in air (cm^2/s)	Diffusion Coefficient in water (cm^2/s)	Density (g/cm^3)
Volatile Organic Compounds										
Benzene	71-43-2	78.11	0.00E+00	1780	95	0.22	83	0.092	1.10E-05	0.877
Toluene	108-88-3	92.1	0.00E+00	515	28	0.28	135	0.085	9.40E-06	0.867
Ethylbenzene	100-41-4	106.2	0.00E+00	152	7	0.321	676	0.076	8.50E-06	0.867
Xylenes (mixed)	1330-20-7	106.2	0.00E+00	198	8	0.286	692	0.071	8.50E-06	0.88
Ethylene Dibromide (EDB)	106-93-4	187.9	0.00E+00	3400	11	0.0129	44	0.083	8.00E-06	2.17
1,2 Dichloroethane (EDC)	107-06-2	99	0.00E+00	8690	64	0.0447	14.1	0.091	9.90E-06	1.253
Methyl Tert-Butyl Ether (MTBE)	1634-04--4	88.2	0.00E+00	51000	245	0.0239	11.2	0.0791	9.41E-05	0.74
PAH Compounds										
Acenapthene	83-32-9	154.2	0.00E+00	3.47	4.50E-03	9.70E-02	4.60E+03	0.0421	7.69E-06	1.23
Anthracene	120-12-7	178.2	0.00E+00	0.045	1.08E-05	2.60E-03	1.86E+04	0.0324	7.74E-06	1.24
Benzo(a)pyrene	50-32-8	252.3	0.00E+00	0.003	5.50E-09	4.80E-05	1.95E+06	0.043	9.00E-06	1.35
Benzo(b)fluoranthene	205-99-2	252.3	0.00E+00	0.014	5.00E-07	4.84E-04	5.50E+05	0.0226	5.56E-06	ND
Benzo(k)fluoranthene	207-08-9	252.3	0.00E+00	0.0043	9.59E-11	1.60E-03	1.02E+06	0.0226	5.56E-06	ND
Benzo(a)anthracene	56-55-3	228.3	0.00E+00	0.014	2.20E-08	1.83E-04	1.38E+06	0.051	9.00E-06	1.274
Benzo(g,h,i)perylene	191-24-2	276.3	0.00E+00	0.00026	1.01E-10	5.70E-06	1.58E+06	0.049	5.65E-05	ND
Chrysene	218-01-9	228.3	0.00E+00	0.002	6.30E-09	4.27E-05	2.45E+05	0.0248	6.21E-06	1.274
Fluorene	86-73-7	166.2	0.00E+00	1.82	6.67E-04	3.11E-03	7.30E+03	0.0363	7.88E-06	1.203
Fluoranthene	206-44-0	202.3	0.00E+00	0.237	1.00E-05	2.64E-04	3.80E+04	0.0302	6.35E-06	1.252
Naphthalene	91-20-3	128.2	0.00E+00	31	8.20E-02	1.75E-02	1.29E+03	0.059	7.50E-06	1.162
Phenanthrene	85-01-8	178.2	0.00E+00	1.07	2.10E-04	1.62E-03	1.41E+04	0.0333	7.47E-06	0.98
Pyrene	129-0-0	202.3	0.00E+00	0.148	5.00E-06	4.88E-04	6.46E+04	0.0272	7.24E-06	1.271
User-specified Compounds										
Chemical 1										
Chemical 2										
Chemical 3										
Chemical 4										
Chemical 5										

Attachment F2

WRRTF-13 Post-ROD Sampling Data Summary

SAMPLE ID	1RD064		1RD065		1RD066		1RD092		1RD067		1RD068		1RD069		1RD070	
Borehole Number	Borehole 1		Borehole 1		Borehole 1		Borehole 1		Borehole 1		Borehole 2		Borehole 2		Borehole 2	
Sample Date	3/2/00		3/2/00		3/2/00		3/2/00		3/2/00		3/1/00		3/1/00		3/1/00	
Interval Depth	20 - 23 ft		23 - 25 ft		31 - 33 ft		Basalt (34.5 - 35 ft)		Composite (8 - 35 ft)		14 - 17 ft		17 - 20 ft		20 - 23 ft	
PID/FID readings	2500 ppm		2800 ppm		1401 ppm		1401 ppm		No reading		562 ppm		619 ppm		606 ppm	
Date BTEX analyze																
Date PAH analyze																
	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag
Benzene	1.1	U	1.1	U	1.1	U	1.3	U	1.2	U	1.2	U	1.2	U	1.2	U
Ethylbenzene	4.9		2.8		3.5		1.5		1.4		2.7		2.6		**6.0**	
Toluene	1.1	U	1.1	U	1.1	U	1.3	U	1.2	U	1.2	U	1.2	U	1.2	U
Total Xylenes	15		11		6.4		1.7		3.8		1.2	U	1.2	U	7.9	
Acenapthene	0.6592	U	0.6632	U	0.6567	U	0.7985	U	0.7033	U	0.03518	U	0.03607	U	0.6484	U
Anthracene	0.8838		**1.397**		1.154		0.7985	U	0.7033	U	0.2091		0.1816		0.7449	
Benzo(a)anthracene	0.9412		1.134		**1.443**		0.6856		0.4341		0.2268		0.1944		0.8225	
Benzo(b)fluoranthene	**0.6948**		0.4404		0.3335		0.5186		0.3731		0.01759	U	0.01804	U	0.3242	U
Benzo(k)fluoranthene	**0.5372**		0.3329		0.3283	U	0.4651		0.3516	U	0.01759	U	0.01804	U	0.3242	U
Benzo(a)pyrene	0.3296	U	0.3316	U	0.3283	U	0.3992	U	0.3516	U	0.01759	U	0.01804	U	0.3242	U
Benzo(g,h,i)perylene	0.6592	U	0.6632	U	0.6567	U	0.7985	U	0.7033	U	0.03518	U	0.03607	U	0.6484	U
Chrysene	0.3296	U	0.3316	U	0.3283	U	0.6150	U	0.4510		0.01759	U	0.01804	U	0.3242	U
Fluorene	2.807		3.037		3.482		1.252		1.122		0.4367		0.3209		1.710	
Fluoranthene	8.096		**12.970**		10.020		4.573		3.802		1.510		1.374		7.574	
Napthalene	11.270		**17.260**		14.570		5.777		4.681		0.2982		0.2944		5.801	
Phenanthrene	10.100		14.600		12.590		5.039		4.092		1.438		1.395		7.957	
Pyrene	0.6592	U	0.8936		0.6567	U	0.7985	U	0.7033	U	0.03518	U	0.03607	U	0.6484	U

SAMPLE ID	1RD07101		1RD07102		1RD072		1RD072 - Mistake		1RD073		1RD074		1RD075		1RD076	
Borehole Number	Borehole 2		Borehole 2		Borehole 3		Borehole 3		Borehole 3		Borehole 3		Borehole 3		Borehole 4	
Sample Date	3/1/00		3/1/00		3/1/00		3/1/00		3/1/00		3/1/00		3/1/00		2/29/00	
Interval Depth	Composite (2.5 - 33 ft)		Composite (2.5 - 33 ft)		8 - 11 ft		8 - 11 ft		14 - 17 ft		20 - 23 ft		Composite (2.5 - 33 ft)		11 - 14 ft	
PID/FID readings	No reading		No reading		2800 ppm		2800 ppm		1200 ppm		1583 ppm		w		138 ppm	
Date BTEX analyze															3/6/00	
Date PAH analyze															3/8/00	
	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag
Benzene	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U
Ethylbenzene	1.8		1.4		3.2		2.8		2.7	U	5.3		3.8		2.7	
Toluene	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U
Total Xylenes	1.2	U	1.1	U	6.0		5.8		5.3		**16**		14		4.7	
Acenapthene	0.7186	U	0.6884	U					0.7022	U	0.6821	U	0.7076	U	0.35	U
Anthracene	0.7186	U	0.6884	U					0.7022	U	0.8798		0.7076	U	0.35	U
Benzo(a)anthracene	0.413		0.3442	U					0.4395		0.9651		0.6497		0.18	U
Benzo(b)fluoranthene	0.4472		0.3442	U					0.3511	U	0.3411	U	0.3538	U	0.18	U
Benzo(k)fluoranthene	0.3593	U	0.3442	U					0.3511	U	0.3411	U	0.3538	U	0.18	U
Benzo(a)pyrene	0.3593	U	0.3442	U					0.3511	U	0.3411	U	0.3538	U	0.18	U
Benzo(g,h,i)perylene	0.7186	U	0.6884	U					0.7022	U	0.6821	U	0.7076	U	0.35	U
Chrysene	0.3593	U	0.3442	U					**1.167**		0.3411		0.3538	U	0.18	U
Fluorene	0.7186	U	0.8967						0.7022	U	2.119		1.001		1.8	
Fluoranthene	2.646		3.320						2.629		7.748		3.670		1.4	
Napthalene	1.596		2.443						3.808		10.58		5.280		1.4	
Phenanthrene	2.635		3.268						2.244		7.839		3.779		1.4	
Pyrene	0.7186	U	0.6884	U					0.7022	U	0.6821	U	0.7076	U	0.35	U

SAMPLE ID	1RD077		1RD078		1RD079		1RD080		1RD081		1RD082		1RD08301		IRD08302	
Borehole Number	Borehole 4		Borehole 4		Borehole 4		Borehole 5		Borehole 5		Borehole 5		Borehole 5		Borehole 5	
Sample Date	2/29/00		2/29/00		2/29/00		2/29/00		2/29/00		2/29/00		2/29/00		2/29/00	
Interval Depth	14 - 17 ft		17 - 20 ft		Composite (5 - 34 ft)		14 - 17 ft		17 - 20 ft		22 - 25 ft		Composite (5 - 25 ft)		Composite (5 - 25 ft)	
PID/FID readings	158 ppm		163 ppm		No reading		68 ppm		60 ppm		82 ppm		No reading		No reading	
Date BTEX analyze	3/7/00		3/7/00		3/7/00		3/7/00		3/7/00		3/7/00		3/7/00		3/7/00	
Date PAH analyze	3/8/00		3/8/00		3/8/00		3/8/00		3/8/00		3/8/00		3/8/00		3/8/00	
	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag
Benzene	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U
Ethylbenzene	5.9		1.9		1.2	U	1.2	U	1.2	U	1.7		1.2	U	1.2	U
Toluene	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U
Total Xylenes	11		4.3		1.2	U	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U
Acenapthene	0.35	U	0.9	U	0.86	U	0.9	U	0.92	U	0.85	U	0.88	U	0.36	U
Anthracene	0.35	U	0.9	U	0.86	U	0.9	U	0.92	U	0.85	U	0.88	U	0.36	U
Benzo(a)anthracene	0.23		0.45	U	0.43	U	0.45	U	0.46	U	0.68		0.44	U	0.18	U
Benzo(b)fluoranthene	0.17	U	0.45	U	0.43	U	0.45	U	0.46	U	0.43	U	0.44	U	0.18	U
Benzo(k)fluoranthene	0.17	U	0.45	U	0.43	U	0.45	U	0.46	U	0.43	U	0.44	U	0.18	U
Benzo(a)pyrene	0.17	U	0.45	U	0.43	U	0.45	U	0.46	U	0.43	U	0.44	U	0.18	U
Benzo(g,h,i)perylene	0.35	U	0.9	U	0.86	U	0.9	U	0.92	U	0.85	U	0.88	U	0.36	U
Chrysene	0.17	U	0.45	U	0.43	U	0.45	U	0.46	U	0.43	U	0.44	U	0.18	U
Fluorene	0.35	U	0.9	U	0.86	U	0.9	U	0.92	U	0.85	U	0.88	U	0.36	U
Fluoranthene	2.3		3.3	U	2.1		1.7		4.5		7.5		2.4		1.7	
Napthalene	2.4		2.5	U	1.5		0.9	U	1.5		6.2		1.1		0.6	
Phenanthrene	2.1		2.5	U	2.3		0.94		2.2		8		1.9		1	
Pyrene	0.35	U	0.9	U	0.86	U	0.9	U	0.92	U	0.85	U	0.88	U	0.36	U

SAMPLE ID	1RD084		1RD085		1RD086		1RD087		1RD088		1RD089		1RD090		1RD091	
Borehole Number	Borehole 6		Borehole 6		Borehole 6		Borehole 6		Borehole 7		Borehole 7		Borehole 7		Borehole 7	
Sample Date	2/28/00		2/28/00		2/28/00		2/28/00		2/28/00		2/28/00		2/28/00		2/28/00	
Interval Depth	8 - 11 ft		14 - 17 ft		17 - 21.5 ft		Composite (5 - 24 ft)		12 - 15 ft		18 - 21 ft		23 - 26 ft		Composite (12 - 26 ft)	
PID/FID readings	4 ppm		4.1 ppm		7 ppm		No reading		59 ppm		47 ppm		68 ppm		No reading	
Date BTEX analyze	3/6/00		3/6/00		3/6/00		3/6/00		3/6/00		3/6/00		3/6/00		3/6/00	
Date PAH analyze	3/6/00		3/6/00		3/6/00		3/6/00		3/8/00		3/8/00		3/8/00		3/8/00	
	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag	Contaminant Concentration (mg/kg)	Flag
Benzene	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U
Ethylbenzene	1.2	U	1.2	U	1.1	U	1.2	U	2.9		1.5		4.5		2.2	
Toluene	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.1	U	1.2	U
Total Xylenes	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U	1.6		1.2	U
Acenapthene	0.035	U	0.036	U	0.034	U	0.035	U	0.89	U	0.88	U	0.84	U	0.9	U
Anthracene	0.035	U	0.036	U	0.034	U	0.035	U	0.89	U	0.88	U	0.95		0.9	U
Benzo(a)anthracene	0.017	U	0.018	U	0.017	U	0.018	U	0.48		0.69		0.79		0.45	U
Benzo(b)fluoranthene	0.017	U	0.018	U	0.017	U	0.018	U	0.45	U	0.44	U	0.42	U	0.45	U
Benzo(k)fluoranthene	0.017	U	0.018	U	0.017	U	0.018	U	0.45	U	0.44	U	0.42	U	0.45	U
Benzo(a)pyrene	0.017	U	0.018	U	0.017	U	0.018	U	0.45	U	0.44	U	0.42	U	0.45	U
Benzo(g,h,i)perylene	0.035	U	0.036	U	0.034	U	0.035	U	0.89	U	0.88	U	0.84	U	0.9	U
Chrysene	0.017	U	0.018	U	0.017	U	0.018	U	0.45	U	0.44	U	0.42	U	0.45	U
Fluorene	0.035	U	0.036	U	0.034	U	0.035	U	6.6		8.5		**11**		6.3	
Fluoranthene	0.035	U	0.036	U	0.034	U	0.035	U	9.2		9.4		10		7.3	
Napthalene	0.035	U	0.036	U	0.034	U	0.035	U	4.4		7.2		10		5.2	
Phenanthrene	0.035	U	0.036	U	0.034	U	0.035	U	6.7		7.8		10		6.2	
Pyrene	0.035	U	0.036	U	0.034	U	0.035	U	0.89	U	0.88	U	0.84	U	0.9	U