P&RSF
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Appendix E
Detailed Risk Calculation Tables

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Table E-1
Incidental Ingestion of Site Surface Soil
Current/Future

Exposure Medium: Surface Soil
Receptor Population: On-site Worker
Receptor Age: Adult
Exposure Point: Surface Soil

Noncancer Hazard = CS x SIFnc x ABSo / RfD
Cancer Risk = CS x SIFc x ABSo x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (CS)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Soil (IR-S)	mg/day	100	50
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	25	6
Conversion Factor (CF)	kg/mg	1.0E-06	1.0E-06
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((IR-S*EF*ED*CF)/(BW*ATnc))		9.78E-07	4.29E-07
SIFc = ((IR-S*EF*ED*CF)/(BW*ATc))		3.49E-07	3.67E-08

Chemical	RfD (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ABSo unitless
n-Propylbenzene	1.0E-02	--	1
Benzo(a)anthracene	--	7.3E-01	1
Dibenzo(a,h)anthracene	--	7.3E+00	1
Naphthalene	2.0E-02	--	1
Benzo(a)pyrene	--	7.3E+00	1
Benzo(b)fluoranthene	--	7.3E-01	1
Indeno(1,2,3-cd)pyrene	--	7.3E-01	1
Benzene	3.0E-03	5.5E-02	1
Arsenic	3.0E-04	1.5E+00	1
Chromium	3.0E-03	--	1

Surface Soil	Reasonable Maximum Exposure					Central Tendency				
	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	1.0E+01	9.88E-06	3.53E-06	9.9E-04	--	1.0E+01	4.33E-06	3.71E-07	4.3E-04	--
Benzo(a)anthracene	2.1E+00	2.05E-06	7.34E-07	--	5.4E-07	2.1E+00	9.00E-07	7.71E-08	--	5.6E-08
Dibenzo(a,h)anthracene	7.5E-01	7.34E-07	2.62E-07	--	1.9E-06	7.5E-01	3.21E-07	2.76E-08	--	2.0E-07
Naphthalene	4.6E-01	4.49E-07	1.60E-07	2.2E-05	--	4.6E-01	1.97E-07	1.69E-08	9.8E-06	--
Benzo(a)pyrene	2.1E+00	2.06E-06	7.37E-07	--	5.4E-06	2.1E+00	9.04E-07	7.75E-08	--	5.7E-07
Benzo(b)fluoranthene	2.2E+00	2.20E-06	7.86E-07	--	5.7E-07	2.2E+00	9.64E-07	8.26E-08	--	6.0E-08
Indeno(1,2,3-cd)pyrene	1.7E+00	1.63E-06	5.84E-07	--	4.3E-07	1.7E+00	7.16E-07	6.13E-08	--	4.5E-08
Benzene	6.9E-02	6.74E-08	2.41E-08	2.2E-05	1.3E-09	6.9E-02	2.95E-08	2.53E-09	9.8E-06	1.4E-10
Arsenic	6.4E+00	6.28E-06	2.24E-06	2.1E-02	3.4E-06	6.4E+00	2.75E-06	2.36E-07	9.2E-03	3.5E-07
Chromium	2.6E+02	2.51E-04	8.97E-05	8.4E-02	--	2.6E+02	1.10E-04	9.43E-06	3.7E-02	--
TOTAL				1.1E-01	1.2E-05				4.6E-02	1.3E-06
Sum of all Pathways				1.3E-01	2.1E-05				6.5E-02	1.6E-06

Table E-2
Dermal Contact with Site Surface Soil
Current/Future

Exposure Medium: Surface Soil
Receptor Population: On-site Worker
Receptor Age: Adult
Exposure Point: Surface Soil

Noncancer Hazard = CS x SIFnc x Absd/ RfD
Cancer Risk = CS x SIFc x Absd x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (CS)	mg/kg	chem-specific	chem-specific
Adherence Factor (AF)	mg/cm^2-event	0.2	0.02
Exposure Frequency (EF)	events/year	250	219
Exposure Duration (ED)	years	25	6
Surface Area Available for Contact (SA)	cm^2	3,300	3,300
Conversion Factor (CF)	kg/mg	1.0E-06	1.0E-06
Dermal Absorption (AbsD)	unitless		
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((EF*ED*SA*AF*CF)/(BW*ATnc))		6.46E-06	5.66E-07
SIFc = ((EF*ED*SA*AF*CF)/(BW*ATc))		2.31E-06	4.85E-08

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	AbsD
n-Propylbenzene	1.0E-02	--	--
Benzo(a)anthracene	--	7.3E-01	1.3E-01
Dibenzo(a,h)anthracene	--	7.3E+00	1.3E-01
Naphthalene	2.0E-02	--	--
Benzo(a)pyrene	--	7.3E+00	1.3E-01
Benzo(b)fluoranthene	--	7.3E-01	1.3E-01
Indeno(1,2,3-cd)pyrene	--	7.3E-01	1.3E-01
Benzene	3.0E-03	5.5E-02	--
Arsenic	3.0E-04	1.5E+00	3.0E-02
Chromium	3.0E-03	--	--

	Reasonable Maximum Exposure					Central Tendency				
Surface Soil	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	1.0E+01	--	--	--	--	1.0E+01	--	--	--	--
Benzo(a)anthracene	2.1E+00	1.76E-06	6.30E-07	--	4.6E-07	2.1E+00	1.54E-07	1.32E-08	--	9.7E-09
Dibenzo(a,h)anthracene	7.5E-01	6.30E-07	2.25E-07	--	1.6E-06	7.5E-01	5.52E-08	4.73E-09	--	3.5E-08
Naphthalene	4.6E-01	--	--	--	--	4.6E-01	--	--	--	--
Benzo(a)pyrene	2.1E+00	1.77E-06	6.33E-07	--	4.6E-06	2.1E+00	1.55E-07	1.33E-08	--	9.7E-08
Benzo(b)fluoranthene	2.2E+00	1.89E-06	6.74E-07	--	4.9E-07	2.2E+00	1.65E-07	1.42E-08	--	1.0E-08
Indeno(1,2,3-cd)pyrene	1.7E+00	1.40E-06	5.01E-07	--	3.7E-07	1.7E+00	1.23E-07	1.05E-08	--	7.7E-09
Benzene	6.9E-02	--	--	--	--	6.9E-02	--	--	--	--
Arsenic	6.4E+00	1.24E-06	4.44E-07	4.1E-03	6.7E-07	6.4E+00	1.09E-07	9.34E-09	3.6E-04	1.4E-08
Chromium	2.6E+02	--	--	--	--	2.6E+02	--	--	--	--
TOTAL				4.1E-03	8.2E-06				3.6E-04	1.7E-07

Table E-3
Inhalation of Fugitive Dust or Soil Vapors
Current/Future

Exposure Medium: Surface Soil (Surface and Subsurface Soil for Inhalation of Soil Vapors)
Receptor Population: On-site Worker
Receptor Age: Adult
Exposure Point: Soil

Noncancer Hazard = (CS x SIFnc) / (PEF(VF) x RfD)
Cancer Risk = CS x SIFc x CSF/ PEF(VF)

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (Csoil)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Air (Inh)	m^3/hour	1.3	1.3
Exposure Time (ET)	hours/event	8	8
Exposure Frequency (EF)	events/year	250	219
Exposure Duration (ED)	years	25	6
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*ET*EF*ED)/(BW*ATnc))		1.02E-01	8.91E-02
SIFc = ((Inh*ET*EF*ED)/(BW*ATc))		3.63E-02	7.64E-03

Chemical	RfD (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	PEF(VF) m3/kg
n-Propylbenzene	1.0E-02	--	1.1E+04
Benzo(a)anthracene	--	3.1E-01	1.1E+09
Dibenzo(a,h)anthracene	--	3.1E+00	1.1E+09
Naphthalene	8.6E-04	--	5.4E+04
Benzo(a)pyrene	--	3.1E+00	1.1E+09
Benzo(b)fluoranthene	--	3.1E-01	1.1E+09
Indeno(1,2,3-cd)pyrene	--	3.1E-01	1.1E+09
Benzene	1.7E-03	2.7E-02	2.6E+03
Arsenic	--	1.5E+01	1.1E+09
Chromium	--	4.2E+01	1.1E+09

	Reasonable Maximum Exposure					Central Tendency				
Surface Soil	Csoil mg/kg	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Csoil (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	4.9E+00	4.53E-05	1.62E-05	4.5E-03	--	4.9E+00	3.97E-05	3.40E-06	4.0E-03	--
Benzo(a)anthracene	2.1E+00	2.02E-10	7.20E-11	--	2.2E-11	2.1E+00	1.77E-10	1.51E-11	--	4.7E-12
Dibenzo(a,h)anthracene	7.5E-01	7.20E-11	2.57E-11	--	8.0E-11	7.5E-01	6.31E-11	5.41E-12	--	1.7E-11
Naphthalene	2.8E+00	5.20E-06	1.86E-06	6.0E-03	--	2.8E+00	4.56E-06	3.91E-07	5.3E-03	--
Benzo(a)pyrene	2.1E+00	2.03E-10	7.23E-11	--	2.2E-10	2.1E+00	1.77E-10	1.52E-11	--	4.7E-11
Benzo(b)fluoranthene	2.2E+00	2.16E-10	7.71E-11	--	2.4E-11	2.2E+00	1.89E-10	1.62E-11	--	5.0E-12
Indeno(1,2,3-cd)pyrene	1.7E+00	1.60E-10	5.73E-11	--	1.8E-11	1.7E+00	1.40E-10	1.20E-11	--	3.7E-12
Benzene	4.4E-01	1.71E-05	6.12E-06	1.0E-02	1.7E-07	4.4E-01	1.50E-05	1.29E-06	8.8E-03	3.5E-08
Arsenic	6.4E+00	6.16E-10	2.20E-10	--	3.3E-09	6.4E+00	5.40E-10	4.63E-11	--	6.9E-10
Chromium	2.6E+02	2.46E-08	8.80E-09	--	3.7E-07	2.6E+02	2.16E-08	1.85E-09	--	7.8E-08
TOTAL				2.1E-02	5.4E-07				1.8E-02	1.1E-07

Table E-4
Inhalation of Indoor Air
Current/Future

Exposure Medium: Surface and Subsurface Soil
Receptor Population: On-Site Worker
Receptor Age: Adult
Exposure Point: Indoor Air

Noncancer Hazard = CS x SIFnc x ABSo / RfD
Cancer Risk = CS x SIFc x ABSo x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Indoor Air (Cair)	ug/m^3	chem-specific	chem-specific
Inhalation Rate of Air (Inh)	m^3/hour	1.3	1.3
Exposure Time (ET)	hours/day	8	8
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	25	6
Conversion Factor (CF)	mg/ug	1.0E-03	1.0E-03
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*ET*EF*ED*CF)/(BW*ATnc))		1.02E-04	8.91E-05
SIFc = ((Inh*ET*EF*ED*CF)/(BW*ATc))		3.63E-05	7.64E-06

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	ABSo unitless
Benzene	1.7E-03	2.7E-02	1
Naphthalene	8.6E-04	--	1

	Reasonable Maximum Exposure					Central Tendency				
Office Buildings	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
Benzene	1.5E+00	1.55E-04	5.52E-05	9.1E-02	1.5E-06	1.5E+00	1.35E-04	1.16E-05	8.0E-02	3.1E-07
Naphthalene	3.0E+00	3.05E-04	1.09E-04	3.5E-01	--	3.0E+00	2.67E-04	2.29E-05	3.1E-01	--
TOTAL				4.5E-01	1.5E-06				3.9E-01	3.1E-07

Table E-5
Inhalation of Indoor Air
Current/Future

Exposure Medium: Groundwater
Receptor Population: On-site Worker
Receptor Age: Adult
Exposure Point: Indoor Air

Noncancer Hazard = CS x SIFnc x ABSo / RfD
Cancer Risk = CS x SIFc x ABSo x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Indoor Air (Cair)	ug/m^3	chem-specific	chem-specific
Inhalation Rate of Air (Inh)	m^3/hour	1.3	1.3
Exposure Time (ET)	hours/day	8	8
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	25	6
Conversion Factor (CF)	mg/ug	1.0E-03	1.0E-03
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*ET*EF*ED*CF)/(BW*ATnc))		1.02E-04	8.91E-05
SIFc = ((Inh*ET*EF*ED*CF)/(BW*ATc))		3.63E-05	7.64E-06

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	ABSo unitless
1,2 Dichloroethane	1.4E-03	9.1E-02	1
Benzene	1.7E-03	2.7E-02	1
Naphthalene	8.6E-04	--	1

	Reasonable Maximum Exposure					Central Tendency				
Office Buildings	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
1,2 Dichloroethane	1.4E-04	1.39E-08	4.98E-09	1.0E-05	4.5E-10	1.4E-04	1.22E-08	1.05E-09	8.7E-06	9.5E-11
Benzene	3.4E-02	3.45E-06	1.23E-06	2.0E-03	3.3E-08	3.4E-02	3.02E-06	2.59E-07	1.8E-03	7.0E-09
Naphthalene	1.7E-01	1.71E-05	6.11E-06	2.0E-02	--	1.7E-01	1.50E-05	1.28E-06	1.7E-02	--
TOTAL				2.2E-02	3.4E-08				1.9E-02	7.1E-09

Table E-6
Inhalation of Outdoor Air
Current/Future

Exposure Medium: Groundwater
Receptor Population: On-site Workers
Receptor Age: Adults
Exposure Point: Outdoor Air

Noncancer Hazard = CS x SIFnc x ABSo / RfD
Cancer Risk = CS x SIFc x ABSo x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Indoor Air (Cair)	ug/m^3	chem-specific	chem-specific
Inhalation Rate of Air (Inh)	m^3/hour	1.3	1.3
Exposure Time (ET)	hours/day	8	8
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	25	6
Conversion Factor (CF)	mg/ug	1.0E-03	1.0E-03
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	9125	2190
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*ET*EF*ED*CF)/(BW*ATnc))		1.02E-04	8.91E-05
SIFc = ((Inh*ET*EF*ED*CF)/(BW*ATc))		3.63E-05	7.64E-06

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	ABSo unitless
1,2 Dichloroethane	1.7E-03	2.7E-02	1
Benzene	1.7E-03	2.7E-02	1
Naphthalene	8.6E-04	--	1

	Reasonable Maximum Exposure					Central Tendency				
Ambient Air	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
1,2 Dichloroethane	8.4E-06	8.50E-10	3.03E-10	5.0E-07	8.2E-12	8.4E-06	7.44E-10	6.38E-11	4.4E-07	1.7E-12
Benzene	1.3E-03	1.36E-07	4.87E-08	8.0E-05	1.3E-09	1.3E-03	1.19E-07	1.02E-08	7.0E-05	2.8E-10
Naphthalene	3.6E-04	3.63E-08	1.30E-08	4.2E-05	--	3.6E-04	3.18E-08	2.73E-09	3.7E-05	--
TOTAL				**1.2E-04**	**1.3E-09**				**1.1E-04**	**2.8E-10**

Table E-7
Incidental Ingestion of Construction Site Surface/Subsurface Soil
Current/Future

Exposure Medium: Surface/Subsurface Soil
Receptor Population: Construction Worker
Receptor Age: Adults
Exposure Point: Construction Site Soil

Noncancer Hazard = CS x SIFnc x ABSo / RfD
Cancer Risk = CS x SIFc x ABSo x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (CS)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Soil (IR-S)	mg/day	330	100
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	1	1
Conversion Factor (CF)	kg/mg	1.0E-06	1.0E-06
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	365	365
Averaging Time (cancer) (ATc)	days	25,550	25550
SIFnc = ((IR-S*EF*ED*CF)/(BW*ATnc))		3.23E-06	8.57E-07
SIFc = ((IR-S*EF*ED*CF)/(BW*ATc))		4.61E-08	1.22E-08

Chemical	RfD (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ABSo unitless
n-Propylbenzene	1.0E-02	--	1
Benzo(a)anthracene	--	7.3E-01	1
Dibenzo(a,h)anthracene	--	7.3E+00	1
Naphthalene	2.0E-02	--	1
Benzo(a)pyrene	--	7.3E+00	1
Benzo(b)fluoranthene	--	7.3E-01	1
Indeno(1,2,3-cd)pyrene	--	7.3E-01	1
Benzene	3.0E-03	5.5E-02	1
Arsenic	3.0E-04	1.5E+00	1
Chromium	3.0E-03	--	1

	Reasonable Maximum Exposure					Central Tendency				
Surface/subsurface Soil	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	4.9E+00	1.58E-05	2.26E-07	1.6E-03	--	4.9E+00	4.20E-06	6.00E-08	4.2E-04	--
Benzo(a)anthracene	1.1E+00	3.39E-06	4.84E-08	--	3.5E-08	1.1E+00	9.00E-07	1.29E-08	--	9.4E-09
Dibenzo(a,h)anthracene	4.0E-01	1.28E-06	1.83E-08	--	1.3E-07	4.0E-01	3.40E-07	4.86E-09	--	3.5E-08
Naphthalene	2.8E+00	8.91E-06	1.27E-07	4.5E-04	--	2.8E+00	2.37E-06	3.38E-08	1.2E-04	--
Benzo(a)pyrene	1.1E+00	3.42E-06	4.88E-08	--	3.6E-07	1.1E+00	9.07E-07	1.30E-08	--	9.5E-08
Benzo(b)fluoranthene	1.1E+00	3.61E-06	5.15E-08	--	3.8E-08	1.1E+00	9.57E-07	1.37E-08	--	1.0E-08
Indeno(1,2,3-cd)pyrene	8.3E-01	2.68E-06	3.83E-08	--	2.8E-08	8.3E-01	7.12E-07	1.02E-08	--	7.4E-09
Benzene	4.4E-01	1.41E-06	2.02E-08	4.7E-04	1.1E-09	4.4E-01	3.75E-07	5.36E-09	1.3E-04	2.9E-10
Arsenic	7.2E+00	2.31E-05	3.30E-07	7.7E-02	4.9E-07	7.2E+00	6.13E-06	8.76E-08	2.0E-02	1.3E-07
Chromium	2.3E+02	7.52E-04	1.07E-05	2.5E-01	--	2.3E+02	2.00E-04	2.85E-06	6.7E-02	--
TOTAL				3.3E-01	1.1E-06				8.8E-02	2.9E-07
Sum of all Pathways				5.3E-01	1.4E-06				1.7E-01	4.1E-07

Table E-8
Dermal Contact with Construction Site Surface/Subsurface Soil
Current/Future

Exposure Medium: Surface/Subsurface Soil
Receptor Population: Construction Worker
Receptor Age: Adults
Exposure Point: Construction Site Soil

Noncancer Hazard = CS x SIFnc x Absd/ RfD
Cancer Risk = CS x SIFc x Absd x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (CS)	mg/kg	chem-specific	chem-specific
Adherence Factor (AF)	mg/cm^2-event	0.3	0.1
Exposure Frequency (EF)	events/year	250	219
Exposure Duration (ED)	years	1	1
Surface Area Available for Contact (SA)	cm^2	3,300	3300
Conversion Factor (CF)	kg/mg	1.0E-06	1.0E-06
Dermal Absorption (AbsD)	unitless	chem-specific	chem-specific
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	365	365
Averaging Time (cancer) (ATc)	days	25,550	25550
SIFnc = ((EF*ED*SA*AF*CF)/(BW*ATnc))		9.69E-06	2.83E-06
SIFc = ((EF*ED*SA*AF*CF)/(BW*ATc))		1.38E-07	4.04E-08

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	AbsD
n-Propylbenzene	1.0E-02	--	--
Benzo(a)anthracene	--	7.3E-01	1.3E-01
Dibenzo(a,h)anthracene	--	7.3E+00	1.3E-01
Naphthalene	2.0E-02	--	--
Benzo(a)pyrene	--	7.3E+00	1.3E-01
Benzo(b)fluoranthene	--	7.3E-01	1.3E-01
Indeno(1,2,3-cd)pyrene	--	7.3E-01	1.3E-01
Benzene	3.0E-03	5.5E-02	--
Arsenic	3.0E-04	1.5E+00	3.0E-02
Chromium	3.0E-03	--	--

	Reasonable Maximum Exposure					Central Tendency				
Surface/subsurface Soil	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	CS (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	4.9E+00	--	--	--	--	4.9E+00	--	--	--	--
Benzo(a)anthracene	1.1E+00	1.32E-06	1.89E-08	--	1.4E-08	1.1E+00	3.86E-07	5.52E-09	--	4.0E-09
Dibenzo(a,h)anthracene	4.0E-01	5.00E-07	7.14E-09	--	5.2E-08	4.0E-01	1.46E-07	2.09E-09	--	1.5E-08
Naphthalene	2.8E+00	--	--	--	--	2.8E+00	--	--	--	--
Benzo(a)pyrene	1.1E+00	1.33E-06	1.90E-08	--	1.4E-07	1.1E+00	3.89E-07	5.56E-09	--	4.1E-08
Benzo(b)fluoranthene	1.1E+00	1.41E-06	2.01E-08	--	1.5E-08	1.1E+00	4.11E-07	5.87E-09	--	4.3E-09
Indeno(1,2,3-cd)pyrene	8.3E-01	1.05E-06	1.49E-08	--	1.1E-08	8.3E-01	3.06E-07	4.37E-09	--	3.2E-09
Benzene	4.4E-01	--	--	--	--	4.4E-01	--	--	--	--
Arsenic	7.2E+00	2.08E-06	2.97E-08	6.9E-03	4.5E-08	7.2E+00	6.07E-07	8.67E-09	2.0E-03	1.3E-08
Chromium	2.3E+02	--	--	--	--	2.3E+02	--	--	--	--
TOTAL				6.9E-03	2.7E-07				2.0E-03	8.0E-08

Table E-9
Inhalation of Fugitive Dust or Volatiles from Construction Site Surface/Subsurface Soil
Current/Future

Exposure Medium: Surface/Subsurface Soil
Receptor Population: Construction Worker
Receptor Age: Adults
Exposure Point: Construction Site Soil

Noncancer Hazard = (CS x SIFnc) / (RfD x PEF(or VF))
Cancer Risk = CS x SIFc x CSF / PEF(or VF)

Parameter	Units	RME Value	CT Value
Chemical Concentration in Soil (Csoil)	mg/kg	chem-specific	chem-specific
Ingestion Rate of Air (Inh)	m^3/day	20	10
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	1	1
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	365	365
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*EF*ED)/(BW*ATnc))		1.96E-01	8.57E-02
SIFc = ((Inh*EF*ED)/(BW*ATc))		2.80E-03	1.22E-03

Chemical	RfD (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	PEF/VF m3/kg
n-Propylbenzene	1.0E-02	--	2.3E+03
Benzo(a)anthracene	--	3.1E-01	1.1E+09
Dibenzo(a,h)anthracene	--	3.1E+00	1.1E+09
Naphthalene	8.6E-04	--	1.1E+04
Benzo(a)pyrene	--	3.1E+00	1.1E+09
Benzo(b)fluoranthene	--	3.1E-01	1.1E+09
Indeno(1,2,3-cd)pyrene	--	3.1E-01	1.1E+09
Benzene	1.7E-03	2.7E-02	5.6E+02
Arsenic	--	1.5E+01	1.1E+09
Chromium	--	4.2E+01	1.1E+09

	Reasonable Maximum Exposure					Central Tendency				
Surface/subsurface Soil	Csoil mg/kg	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Csoil (mg/kg)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
n-Propylbenzene	4.9E+00	4.17E-04	5.96E-06	4.2E-02	--	4.9E+00	1.83E-04	2.61E-06	1.8E-02	--
Benzo(a)anthracene	1.1E+00	1.94E-10	2.77E-12	--	8.6E-13	1.1E+00	8.49E-11	1.21E-12	--	3.8E-13
Dibenzo(a,h)anthracene	4.0E-01	7.33E-11	1.05E-12	--	3.2E-12	4.0E-01	3.21E-11	4.59E-13	--	1.4E-12
Naphthalene	2.8E+00	4.91E-05	7.01E-07	5.7E-02	--	2.8E+00	2.15E-05	3.07E-07	2.5E-02	--
Benzo(a)pyrene	1.1E+00	1.95E-10	2.79E-12	--	8.7E-12	1.1E+00	8.56E-11	1.22E-12	--	3.8E-12
Benzo(b)fluoranthene	1.1E+00	2.06E-10	2.95E-12		9.1E-13	1.1E+00	9.03E-11	1.29E-12	--	4.0E-13
Indeno(1,2,3-cd)pyrene	8.3E-01	1.53E-10	2.19E-12	--	6.8E-13	8.3E-01	6.72E-11	9.60E-13	--	3.0E-13
Benzene	4.4E-01	1.53E-04	2.19E-06	9.0E-02	5.9E-08	4.4E-01	6.70E-05	9.58E-07	3.9E-02	2.6E-08
Arsenic	7.2E+00	1.32E-09	1.89E-11	--	2.8E-10	7.2E+00	5.78E-10	8.26E-12	--	1.2E-10
Chromium	2.3E+02	4.30E-08	6.15E-10	--	2.6E-08	2.3E+02	1.88E-08	2.69E-10	--	1.1E-08
TOTAL				1.9E-01	8.5E-08				8.3E-02	3.7E-08

Table E-10
Inhalation of Outdoor Air
Current/Future

Exposure Medium: Groundwater
Receptor Population: Construction Worker
Receptor Age: Adults
Exposure Point: Outdoor Air

Noncancer Hazard = CS x SIFnc / RfD
Cancer Risk = CS x SIFc x CSF

Parameter	Units	RME Value	CT Value
Chemical Concentration in Indoor Air (Cair)	ug/m^3	chem-specific	chem-specific
Inhalation Rate of Air (Inh)	m^3/day	20	10
Exposure Frequency (EF)	days/year	250	219
Exposure Duration (ED)	years	1	1
Conversion Factor (CF)	mg/ug	1.0E-03	1.0E-03
Body Weight (BW)	kg	70	70
Averaging Time (noncancer) (ATnc)	days	365	365
Averaging Time (cancer) (ATc)	days	25,550	25,550
SIFnc = ((Inh*EF*ED*CF)/(BW*ATnc))		1.96E-04	8.57E-05
SIFc = ((Inh*EF*ED*CF)/(BW*ATc))		2.80E-06	1.22E-06

Chemical	RfD (mg/kg-d)	CSF (mg/kg-d)$^{-1}$
1,2 Dichloroethane	1.4E-03	9.1E-02
Benzene	1.7E-03	2.7E-02
Naphthalene	8.6E-04	--

	Reasonable Maximum Exposure					Central Tendency				
Ambient Air	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk	Cair (ug/m3)	Intake nc (mg/kg-d)	Intake c (mg/kg-d)	Hazard Quotient	Cancer Risk
Chemical										
1,2 Dichloroethane	9.0E-06	1.76E-09	2.52E-11	1.3E-06	2.3E-12	9.0E-06	7.71E-10	1.10E-11	5.5E-07	1.0E-12
Benzene	1.4E-03	2.74E-07	3.91E-09	1.6E-04	1.1E-10	1.4E-03	1.20E-07	1.71E-09	7.1E-05	4.6E-11
Naphthalene	4.1E-04	8.02E-08	1.15E-09	9.3E-05	--	4.1E-04	3.51E-08	5.02E-10	4.1E-05	--
TOTAL				**2.6E-04**	**1.1E-10**				**1.1E-04**	**4.7E-11**

Table E-11
On-Site Worker

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 8/14/01

Exposure Variable	PbB Equation[1] 1*	2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = 1.9	Using Equation 1, GSDi = 2.3	Using Equation 2, GSDi = 1.9	Using Equation 2, GSDi = 2.3
PbS	X	X	Soil lead concentration	ug/g or ppm	535	535	535	535
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.9	2.3	1.9	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.4	1.8	1.4	1.8
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.050	0.050
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	219	219	219	219
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**			**ug/dL**	**2.2**	**2.6**	**2.2**	**2.6**
$PbB_{fetal,0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.6**	**9.1**	**5.6**	**9.1**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**			**%**	**0.5%**	**3.9%**	**0.5%**	**3.9%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Table E-12
Future Construction Worker

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 8/14/01

Exposure Variable	PbB Equation[1] 1*	2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = 1.9	Using Equation 1, GSDi = 2.3	Using Equation 2, GSDi = 1.9	Using Equation 2, GSDi = 2.3
PbS	X	X	Soil lead concentration	ug/g or ppm	486.34	486.34	486.34	486.34
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.9	2.3	1.9	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.4	1.8	1.4	1.8
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.100	0.100
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	219	219	219	219
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**			**ug/dL**	**2.8**	**3.2**	**2.8**	**3.2**
$PbB_{fetal,0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**7.2**	**11.3**	**7.2**	**11.3**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**			**%**	**1.6%**	**6.8%**	**1.6%**	**6.8%**

[1] *Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).*
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil