Table 1
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Sediments
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sed} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sed}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	2.00E-02	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Acenaphthene	NC	=	(	1.37E+02	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzene	7.49E-13	=	(	8.02E-03	×	5.50E-02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)anthracene	7.95E-08	=	(	6.41E+01	×	7.30E-01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	6.74E-07	=	(	5.44E+01	×	7.30E+00	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	7.50E-08	=	(	6.05E+01	×	7.30E-01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	2.64E-09	=	(	2.13E+01	×	7.30E-02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	1.07E-09	=	(	8.66E+01	×	7.30E-03	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Cyanide, Total	NC	=	(	1.47E+00	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	7.55E-08	=	(	6.09E+00	×	7.30E+00	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Ethylbenzene	3.29E-13	=	(	1.76E-02	×	1.10E-02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluoranthene	NC	=	(	1.65E+02	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluorene	NC	=	(	9.91E+01	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.56E-08	=	(	2.06E+01	×	7.30E-01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	9.09E+00	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Phenanthrene	NC	=	(	1.46E+02	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	1.53E+02	×		×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Sediment Ingestion Rate

Table 2
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Sediments
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sed} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sed}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	4.95E-08	=	(	2.00E-02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	2.27E-05	=	(	1.37E+02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzene	1.99E-08	=	(	8.02E-03	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-03	)
Benzo(a)anthracene	NC	=	(	6.41E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	5.44E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	6.05E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	2.13E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	8.66E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Cyanide, Total	2.43E-05	=	(	1.47E+00	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	6.09E+00	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Ethylbenzene	1.75E-09	=	(	1.76E-02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-01	)
Fluoranthene	4.10E-05	=	(	1.65E+02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	2.46E-05	=	(	9.91E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.06E+01	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	4.50E-06	=	(	9.09E+00	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	4.81E-06	=	(	1.46E+02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	5.06E-05	=	(	1.53E+02	×	1E-06	×	10	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Sediment Ingestion Rate

Table 3
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Sediments
EA1
Vertellus

$$\text{Derm - Risk} = \frac{\text{Csed} \times \text{SFabs} \times \text{CF} \times \text{EF} \times \text{ED} \times \text{EV} \times \text{SA} \times \text{SSAF} \times \text{ABSd}}{\text{BW} \times \text{AT}_c}$$

Equation Units	Derm - Risk unitless	=	(	Csed mg/kg	×	SF_{abs} kg-day/mg	×	CF kg/mg	×	EF days/year	×	ED years	×	EV events/day	×	SA cm²	×	SSAF mg/cm²-event	×	ABS_d unitless	)	÷	(	BW kg	×	AT_c days	)
2-Methylnaphthalene	NC	=	(	2.00E-02	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Acenaphthene	NC	=	(	1.37E+02	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Benzene	NC	=	(	8.02E-03	×	5.50E-02		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×		)	÷	(	47	×	25,550	)
Benzo(a)anthracene	7.98E-07	=	(	6.41E+01	×	7.30E-01		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	6.76E-06	=	(	5.44E+01	×	7.30E+00		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	7.52E-07	=	(	6.05E+01	×	7.30E-01		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	2.65E-08	=	(	2.13E+01	×	7.30E-02		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Chrysene	1.08E-08	=	(	8.66E+01	×	7.30E-03		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Cyanide, Total	NC	=	(	1.47E+00	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×		)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	7.58E-07	=	(	6.09E+00	×	7.30E+00		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Ethylbenzene	NC	=	(	1.76E-02	×	1.10E-02		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×		)	÷	(	47	×	25,550	)
Fluoranthene	NC	=	(	1.65E+02	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Fluorene	NC	=	(	9.91E+01	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.57E-07	=	(	2.06E+01	×	7.30E-01		1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	9.09E+00	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Phenanthrene	NC	=	(	1.46E+02	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	1.53E+02	×			1.00E-06	×	10	×	12	×	1	×	4,373	×	0.3	×	1.30E-01	)	÷	(	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 4
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Sediments
EA1
Vertellus

$$\text{Derm - HQ} = \frac{\text{Csed} \times \text{CF} \times \text{EF} \times \text{ED} \times \text{EV} \times \text{SA} \times \text{SSAF} \times \text{ABSd}}{\text{BW} \times \text{AT}_{nc} \times \text{RfD}_{abs}}$$

Equation	Derm - HQ	=	(	Csed	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2-Methylnaphthalene	4.97E-07	=	(	2.00E-02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	2.27E-04	=	(	1.37E+02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzene	NC	=	(	8.02E-03	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×		)	÷	(	47	×	4,380	×	4.00E-03	)
Benzo(a)anthracene	NC	=	(	6.41E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	5.44E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	6.05E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	2.13E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	8.66E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Cyanide, Total	NC	=	(	1.47E+00	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×		)	÷	(	47	×	4,380	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	6.09E+00	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Ethylbenzene	NC	=	(	1.76E-02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×		)	÷	(	47	×	4,380	×	1.00E-01	)
Fluoranthene	4.11E-04	=	(	1.65E+02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	2.46E-04	=	(	9.91E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.06E+01	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	4.52E-05	=	(	9.09E+00	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	4.82E-05	=	(	1.46E+02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	5.08E-04	=	(	1.53E+02	×	1E-06	×	10	×	12	×	1	×	4,373	×	0.30	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 5
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Sediments
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	5.47E-07	=	4.95E-08	+	4.97E-07
Acenaphthene	NC	=	NC	+	NC	2.50E-04	=	2.27E-05	+	2.27E-04
Benzene	7.49E-13	=	7.49E-13	+	NC	1.99E-08	=	1.99E-08	+	NC
Benzo(a)anthracene	8.77E-07	=	7.95E-08	+	7.98E-07	NC	=	NC	+	NC
Benzo(a)pyrene	7.44E-06	=	6.74E-07	+	6.76E-06	NC	=	NC	+	NC
Benzo(b)fluoranthene	8.27E-07	=	7.50E-08	+	7.52E-07	NC	=	NC	+	NC
Benzo(k)fluoranthene	2.91E-08	=	2.64E-09	+	2.65E-08	NC	=	NC	+	NC
Chrysene	1.18E-08	=	1.07E-09	+	1.08E-08	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	2.43E-05	=	2.43E-05	+	NC
Dibenz(a,h)anthracene	8.33E-07	=	7.55E-08	+	7.58E-07	NC	=	NC	+	NC
Ethylbenzene	3.29E-13	=	3.29E-13	+	NC	1.75E-09	=	1.75E-09	+	NC
Fluoranthene	NC	=	NC	+	NC	4.52E-04	=	4.10E-05	+	4.11E-04
Fluorene	NC	=	NC	+	NC	2.71E-04	=	2.46E-05	+	2.46E-04
Indeno(1,2,3-c,d)pyrene	2.82E-07	=	2.56E-08	+	2.57E-07	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	4.97E-05	=	4.50E-06	+	4.52E-05
Phenanthrene	NC	=	NC	+	NC	5.30E-05	=	4.81E-06	+	4.82E-05
Pyrene	NC	=	NC	+	NC	5.58E-04	=	5.06E-05	+	5.08E-04
Total CR	**1.03E-05**	=	**9.34E-07**	+	**9.37E-06**	**Soil HI**	**1.66E-03**	=	**1.72E-04**	+	**1.49E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 6
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sw} \times SF_o \times EF \times ED \times ET \times SWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sw}	×	SF_o	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		days/year		years		hours/day		L/hour				kg		days	
3&4-Methylphenol	NC	=	(	3.74E-01	×		×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	
Benzene	4.89E-10	=	(	1.78E-02	×	5.50E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Benzo(a)anthracene	7.29E-12	=	(	2.00E-05	×	7.30E-01	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	8.94E-11	=	(	2.45E-05	×	7.30E+00	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	9.23E-12	=	(	2.53E-05	×	7.30E-01	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	6.49E-13	=	(	1.78E-05	×	7.30E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Chrysene	9.23E-14	=	(	2.53E-05	×	7.30E-03	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Cyanide, Total	NC	=	(	1.13E-02	×		×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Ethylbenzene	5.50E-12	=	(	1.00E-03	×	1.10E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.29E-12	=	(	2.00E-05	×	7.30E-01	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	1.20E-02	×		×	10	×	12	×	1	×	0.005	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 7
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sw} \times EF \times ED \times ET \times SWIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sw}	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/L		days/year		years		hours/day		L/hour				kg		days		mg/kg-day	
3&4-Methylphenol	2.18E-05	=	(	3.74E-01	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×	5.00E-02	)
Benzene	1.30E-05	=	(	1.78E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×	4.00E-03	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.53E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Cyanide, Total	5.48E-05	=	(	1.13E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×	6.00E-04	)
Ethylbenzene	2.91E-08	=	(	1.00E-03	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×		)
Naphthalene	1.74E-06	=	(	1.20E-02	×	10	×	12	×	1	×	0.005	)	÷	(	47	×	4,380	×	2.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
mg/kg-day – milligrams per kilogram-day
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 8
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - Risk} = \frac{C_{sw} \times SFabs \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{sw}	×	SF_{abs}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		L/cm^3		days/year		years		hours/day		cm^2		cm/hour				kg		days	
3&4-Methylphenol	NC	=	(	3.74E-01	×			1.00E-03	×	10	×	12	×	1	×	4,373	×	7.80E-03	)	÷	(	47	×	25,550	)
Benzene	6.42E-09	=	(	1.78E-02	×	5.50E-02		1.00E-03	×	10	×	12	×	1	×	4,373	×	1.50E-02	)	÷	(	47	×	25,550	)
Benzo(a)anthracene	3.00E-09	=	(	2.00E-05	×	7.30E-01		1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-01	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	5.47E-08	=	(	2.45E-05	×	7.30E+00		1.00E-03	×	10	×	12	×	1	×	4,373	×	7.00E-01	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	5.65E-09	=	(	2.53E-05	×	7.30E-01		1.00E-03	×	10	×	12	×	1	×	4,373	×	7.00E-01	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	3.92E-10	=	(	1.78E-05	×	7.30E-02		1.00E-03	×	10	×	12	×	1	×	4,373	×	6.91E-01	)	÷	(	47	×	25,550	)
Chrysene	3.79E-11	=	(	2.53E-05	×	7.30E-03		1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-01	)	÷	(	47	×	25,550	)
Cyanide, Total	NC	=	(	1.13E-02	×			1.00E-03	×	10	×	12	×	1	×	4,373	×	1.00E-03	)	÷	(	47	×	25,550	)
Ethylbenzene	2.36E-10	=	(	1.00E-03	×	1.10E-02		1.00E-03	×	10	×	12	×	1	×	4,373	×	4.90E-02	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	6.38E-09	=	(	2.00E-05	×	7.30E-01		1.00E-03	×	10	×	12	×	1	×	4,373	×	1.00E+00	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	1.20E-02	×			1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-02	)	÷	(	47	×	25,550	)

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 9
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - HQ} = \frac{C_{sw} \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{sw}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		L/cm^3		days/year		years		hours/day		cm^2		cm/hour				kg		days		mg/kg-day	
3&4-Methylphenol	1.49E-04	=	(	3.74E-01	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	7.80E-03	)	÷	(	47	×	4,380	×	5.00E-02	)
Benzene	1.70E-04	=	(	1.78E-02	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	1.50E-02	)	÷	(	47	×	4,380	×	4.00E-03	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	7.00E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	7.00E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	6.91E-01	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.53E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-01	)	÷	(	47	×	4,380	×		)
Cyanide, Total	4.80E-05	=	(	1.13E-02	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	1.00E-03	)	÷	(	47	×	4,380	×	6.00E-04	)
Ethylbenzene	1.25E-06	=	(	1.00E-03	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	4.90E-02	)	÷	(	47	×	4,380	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	1.00E+00	)	÷	(	47	×	4,380	×		)
Naphthalene	7.17E-05	=	(	1.20E-02	×	1.00E-03	×	10	×	12	×	1	×	4,373	×	4.70E-02	)	÷	(	47	×	4,380	×	2.00E-02	)

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose

Table 10
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Water
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
3&4-Methylphenol	NC	=	NC	+	NC	1.70E-04	=	2.18E-05	+	1.49E-04
Benzene	6.91E-09	=	4.89E-10	+	6.42E-09	1.83E-04	=	1.30E-05	+	1.70E-04
Benzo(a)anthracene	3.01E-09	=	7.29E-12	+	3.00E-09	NC	=	NC	+	NC
Benzo(a)pyrene	5.48E-08	=	8.94E-11	+	5.47E-08	NC	=	NC	+	NC
Benzo(b)fluoranthene	5.66E-09	=	9.23E-12	+	5.65E-09	NC	=	NC	+	NC
Benzo(k)fluoranthene	3.93E-10	=	6.49E-13	+	3.92E-10	NC	=	NC	+	NC
Chrysene	3.80E-11	=	9.23E-14	+	3.79E-11	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	1.03E-04	=	5.48E-05	+	4.80E-05
Ethylbenzene	2.41E-10	=	5.50E-12	+	2.36E-10	1.28E-06	=	2.91E-08	+	1.25E-06
Indeno(1,2,3-c,d)pyrene	6.39E-09	=	7.29E-12	+	6.38E-09	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	7.34E-05	=	1.74E-06	+	7.17E-05
Total CR	**7.74E-08**	=	**6.09E-10**	+	**7.68E-08**	**Total HI**	**5.31E-04**	=	**9.14E-05**	+	**4.40E-04**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 11
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Incidental Ingestion of Sediments Pathway – Carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sed} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sed}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2,4-Dimethylphenol	NC	=	(	6.03E-01	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	7.70E+02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	1.137E+03	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzene	1.68E-09	=	(	2.65E+00	×	5.50E-02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzenethiol	NC	=	(	4.70E-02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	8.11E-07	=	(	9.63E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	5.06E-06	=	(	6.01E+01	×	7.30E+00	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	4.96E-07	=	(	5.89E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	4.11E-08	=	(	4.89E+01	×	7.30E-02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Chrysene	8.47E-09	=	(	1.01E+02	×	7.30E-03	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	1.22E+00	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	8.61E-07	=	(	1.02E+01	×	7.30E+00	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Ethylbenzene	2.11E-09	=	(	1.66E+01	×	1.10E-02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	3.49E+02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.35E+02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.17E-07	=	(	2.58E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.728E+03	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	6.38E+02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	3.00E+02	×		×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Sediment Ingestion Rate

Table 12
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Incidental Ingestion of Sediments Pathway – Noncarcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sed} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sed}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	4.87E-05	=	(	6.03E-01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	2.00E-02	)
2-Methylnaphthalene	3.11E-01	=	(	7.70E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	4.00E-03	)
Acenaphthene	9.17E-03	=	(	1.137E+03	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	2.00E-01	)
Benzene	4.27E-04	=	(	2.65E+00	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	1.00E-02	)
Benzenethiol	7.59E-06	=	(	4.70E-02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	9.63E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Benzo(a)pyrene	NC	=	(	6.01E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Benzo(b)fluoranthene	NC	=	(	5.89E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Benzo(k)fluoranthene	NC	=	(	4.89E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Chrysene	NC	=	(	1.01E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Cyanide, Total	3.95E-05	=	(	1.22E+00	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.02E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Ethylbenzene	2.69E-04	=	(	1.66E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	1.00E-01	)
Fluoranthene	5.63E-03	=	(	3.49E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	1.00E-01	)
Fluorene	9.50E-04	=	(	2.35E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.58E+01	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×		)
Naphthalene	4.65E-03	=	(	1.728E+03	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	6.00E-01	)
Phenanthrene	3.43E-03	=	(	6.38E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	3.00E-01	)
Pyrene	1.61E-03	=	(	3.00E+02	×	1E-06	×	125	×	0.5	×	330	)	÷	(	70	×	183	×	3.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Sediment Ingestion Rate

Table 13
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Dermal Contact with Sediments Pathway – Carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Derm - Risk} = \frac{C_{sed} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{sed}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	6.03E-01	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	7.70E+02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	1.137E+03	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzene	NC	= (	2.65E+00	×	5.50E-02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzenethiol	NC	= (	4.70E-02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzo(a)anthracene	3.16E-07	= (	9.63E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.97E-06	= (	6.01E+01	×	7.30E+00	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.93E-07	= (	5.89E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	1.60E-08	= (	4.89E+01	×	7.30E-02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Chrysene	3.30E-09	= (	1.01E+02	×	7.30E-03	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	1.22E+00	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	3.36E-07	= (	1.02E+01	×	7.30E+00	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	1.66E+01	×	1.10E-02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	3.49E+02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	2.35E+02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	8.46E-08	= (	2.58E+01	×	7.30E-01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	1.728E+03	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	6.38E+02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	3.00E+02	×		×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events

kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 14
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Dermal Contact with Sediments Pathway – Non-carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Derm - HQ} = \frac{C_{sed} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{sed}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2,4-Dimethylphenol	1.46E-05	=	(	6.03E-01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	183	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	7.70E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	4.00E-03	)
Acenaphthene	3.58E-03	=	(	1.137E+03	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×	2.00E-01	)
Benzene	NC	=	(	2.65E+00	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	1.00E-02	)
Benzenethiol	NC	=	(	4.70E-02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	9.63E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Benzo(a)pyrene	NC	=	(	6.01E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Benzo(b)fluoranthene	NC	=	(	5.89E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Benzo(k)fluoranthene	NC	=	(	4.89E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Chrysene	NC	=	(	1.01E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Cyanide, Total	NC	=	(	1.22E+00	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.02E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Ethylbenzene	NC	=	(	1.66E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	1.00E-01	)
Fluoranthene	2.20E-03	=	(	3.49E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×	1.00E-01	)
Fluorene	3.70E-04	=	(	2.35E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.58E+01	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×		)
Naphthalene	NC	=	(	1.728E+03	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	183	×	6.00E-01	)
Phenanthrene	1.34E-03	=	(	6.38E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×	3.00E-01	)
Pyrene	6.29E-04	=	(	3.00E+02	×	1E-06	×	125	×	0.5	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	183	×	3.00E-01	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events

kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 15
Construction Worker Scenario 1 Risk Summary
Reasonable Maximum Exposure
Surface and Subsurface Sediments
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	6.32E-05	=	4.87E-05	+	1.46E-05
2-Methylnaphthalene	NC	=	NC	+	NC	3.11E-01	=	3.11E-01	+	NC
Acenaphthene	NC	=	NC	+	NC	1.28E-02	=	9.17E-03	+	3.58E-03
Benzene	1.68E-09	=	1.68E-09	+	NC	4.27E-04	=	4.27E-04	+	NC
Benzenethiol	NC	=	NC	+	NC	7.59E-06	=	7.59E-06	+	NC
Benzo(a)anthracene	1.13E-06	=	8.11E-07	+	3.16E-07	NC	=	NC	+	NC
Benzo(a)pyrene	7.03E-06	=	5.06E-06	+	1.97E-06	NC	=	NC	+	NC
Benzo(b)fluoranthene	6.89E-07	=	4.96E-07	+	1.93E-07	NC	=	NC	+	NC
Benzo(k)fluoranthene	5.72E-08	=	4.11E-08	+	1.60E-08	NC	=	NC	+	NC
Chrysene	1.18E-08	=	8.47E-09	+	3.30E-09	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	3.95E-05	=	3.95E-05	+	NC
Dibenz(a,h)anthracene	1.20E-06	=	8.61E-07	+	3.36E-07	NC	=	NC	+	NC
Ethylbenzene	2.11E-09	=	2.11E-09	+	NC	2.69E-04	=	2.69E-04	+	NC
Fluoranthene	NC	=	NC	+	NC	7.83E-03	=	5.63E-03	+	2.20E-03
Fluorene	NC	=	NC	+	NC	1.32E-03	=	9.50E-04	+	3.70E-04
Indeno(1,2,3-c,d)pyrene	3.02E-07	=	2.17E-07	+	8.46E-08	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	4.65E-03	=	4.65E-03	+	NC
Phenanthrene	NC	=	NC	+	NC	4.77E-03	=	3.43E-03	+	1.34E-03
Pyrene	NC	=	NC	+	NC	2.24E-03	=	1.61E-03	+	6.29E-04
Total CR	**1.04E-05**	=	**7.49E-06**	+	**2.92E-06**	**Total HI**	**3.45E-01**	=	**3.37E-01**	+	**8.13E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 16
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sw} \times SF_o \times EF \times ED \times ET \times SWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sw}	×	SF_o	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		days/year		years		hours/day		L/hour				kg		days	
3&4-Methylphenol	NC	=	(	3.74E-01	×		×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzene	1.71E-10	=	(	1.78E-02	×	5.50E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(a)anthracene	2.55E-12	=	(	2.00E-05	×	7.30E-01	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(a)pyrene	3.13E-11	=	(	2.45E-05	×	7.30E+00	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.23E-12	=	(	2.53E-05	×	7.30E-01	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(k)fluoranthene	2.27E-13	=	(	1.78E-05	×	7.30E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)
Chrysene	3.23E-14	=	(	2.53E-05	×	7.30E-03	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	1.13E-02	×		×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)
Ethylbenzene	1.92E-12	=	(	1.00E-03	×	1.10E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.55E-12	=	(	2.00E-05	×	7.30E-01	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	
Naphthalene	NC	=	(	1.20E-02	×		×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 17
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sw} \times EF \times ED \times ET \times SWIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sw}	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/L		days/year		years		hours/day		L/hour				kg		days		mg/kg-day	
3&4-Methylphenol	1.83E-04	=	(	3.74E-01	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×	5.00E-02	)
Benzene	4.35E-05	=	(	1.78E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Chrysene	NC	=	(	2.53E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Cyanide, Total	5.52E-06	=	(	1.13E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×	5.00E-02	)
Ethylbenzene	2.45E-07	=	(	1.00E-03	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×		)
Naphthalene	4.88E-07	=	(	1.20E-02	×	125	×	0.5	×	1	×	0.005	)	÷	(	70	×	183	×	6.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
mg/kg-day – milligrams per kilogram-day
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 18
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Dermal Contact Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - Risk} = \frac{C_{sw} \times SFabs \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{sw}	×	SF_{abs}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/L		kg-day/mg		L/cm^3		days/year		years		hours/day		cm^2		cm/hour		kg		days	
3&4-Methylphenol	NC	= (	3.74E-01	×			1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.80E-03	) ÷ (	70	×	25,550	)
Benzene	1.69E-09	= (	1.78E-02	×	5.50E-02		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.50E-02	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	7.91E-10	= (	2.00E-05	×	7.30E-01		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.44E-08	= (	2.45E-05	×	7.30E+00		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.00E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.49E-09	= (	2.53E-05	×	7.30E-01		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.00E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	1.04E-10	= (	1.78E-05	×	7.30E-02		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	6.91E-01	) ÷ (	70	×	25,550	)
Chrysene	1.00E-11	= (	2.53E-05	×	7.30E-03		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	1.13E-02	×			1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.00E-03	) ÷ (	70	×	25,550	)
Ethylbenzene	6.22E-11	= (	1.00E-03	×	1.10E-02		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.90E-02	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.68E-09	= (	2.00E-05	×	7.30E-01		1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.00E+00	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	1.20E-02	×			1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-02	) ÷ (	70	×	25,550	)

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 19
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 1: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - HQ} = \frac{C_{sw} \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{sw}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		L/cm³		days/year		years		hours/day		cm²		cm/hour				kg		days		mg/kg-day	
3&4-Methylphenol	9.41E-04	=	(	3.74E-01	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.80E-03	)	÷	(	70	×	183	×	5.00E-02	)
Benzene	4.31E-04	=	(	1.78E-02	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.50E-02	)	÷	(	70	×	183	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	183	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	183	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	183	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	6.91E-01	)	÷	(	70	×	183	×		)
Chrysene	NC	=	(	2.53E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	183	×		)
Cyanide, Total	3.65E-06	=	(	1.13E-02	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.00E-03	)	÷	(	70	×	183	×	5.00E-02	)
Ethylbenzene	7.91E-06	=	(	1.00E-03	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.90E-02	)	÷	(	70	×	183	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	1.00E+00	)	÷	(	70	×	183	×		)
Naphthalene	1.51E-05	=	(	1.20E-02	×	1.00E-03	×	125	×	0.5	×	1	×	3,300	×	4.70E-02	)	÷	(	70	×	183	×	6.00E-01	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose

Table 20
Construction Worker Scenario 1 Risk Summary
Reasonable Maximum Exposure
Surface Water
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
3&4-Methylphenol	NC	=	NC	+	NC	1.12E-03	=	1.83E-04	+	9.41E-04
Benzene	1.86E-09	=	1.71E-10	+	1.69E-09	4.75E-04	=	4.35E-05	+	4.31E-04
Benzo(a)anthracene	7.94E-10	=	2.55E-12	+	7.91E-10	NC	=	NC	+	NC
Benzo(a)pyrene	1.45E-08	=	3.13E-11	+	1.44E-08	NC	=	NC	+	NC
Benzo(b)fluoranthene	1.49E-09	=	3.23E-12	+	1.49E-09	NC	=	NC	+	NC
Benzo(k)fluoranthene	1.04E-10	=	2.27E-13	+	1.04E-10	NC	=	NC	+	NC
Chrysene	1.00E-11	=	3.23E-14	+	1.00E-11	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	9.17E-06	=	5.52E-06	+	3.65E-06
Ethylbenzene	6.41E-11	=	1.92E-12	+	6.22E-11	8.16E-06	=	2.45E-07	+	7.91E-06
Indeno(1,2,3-c,d)pyrene	1.69E-09	=	2.55E-12	+	1.68E-09	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	1.56E-05	=	4.88E-07	+	1.51E-05
Total CR	**2.05E-08**	=	**2.13E-10**	+	**2.03E-08**	**Total HI**	**1.63E-03**	=	**2.33E-04**	+	**1.40E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 21
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA2
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
3&4-Methylphenol	NC	=	(	6.28E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	1.078E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	2.57E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Anthracene	NC	=	(	2.603E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzene	1.19E-07	=	(	9.37E+01	×	5.50E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	3.57E-05	=	(	2.123E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.05E-04	=	(	6.25E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.12E-05	=	(	6.67E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	6.26E-07	=	(	3.72E+02	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbon disulfide	NC	=	(	7.20E-03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chloroform	8.58E-12	=	(	1.20E-02	×	3.10E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	4.06E-07	=	(	2.412E+03	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	4.264E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	2.57E-05	=	(	1.52E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Ethylbenzene	5.81E-10	=	(	2.29E+00	×	1.10E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	2.530E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	6.20E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.42E-06	=	(	3.22E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Methylene chloride	1.33E-12	=	(	2.88E-02	×	2.00E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	7.949E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	3.587E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenol	NC	=	(	4.75E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	1.853E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Toluene	NC	=	(	1.45E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	1.68E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 22
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Subsurface Soil
EA2
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
3&4-Methylphenol	2.03E-02	=	(	6.28E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	8.70E-03	=	(	1.078E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Acenaphthylene	2.07E-03	=	(	2.57E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Anthracene	1.40E-02	=	(	2.603E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Benzene	1.51E-02	=	(	9.37E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.123E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	6.25E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	6.67E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	3.72E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbon disulfide	1.16E-07	=	(	7.20E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Chloroform	1.94E-06	=	(	1.20E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Chrysene	NC	=	(	2.412E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Cyanide, Total	1.38E-01	=	(	4.264E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.52E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Ethylbenzene	3.70E-05	=	(	2.29E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	4.09E-02	=	(	2.530E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	2.50E-03	=	(	6.20E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.22E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Methylene chloride	7.74E-06	=	(	2.88E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-03	)
Naphthalene	2.14E-02	=	(	7.949E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	1.93E-02	=	(	3.587E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Phenol	2.56E-03	=	(	4.75E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	9.97E-03	=	(	1.853E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Toluene	2.92E-03	=	(	1.45E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	8.00E-02	)
Xylenes (Total)	1.35E-03	=	(	1.68E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 23
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA2
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
3&4-Methylphenol	NC	= (	6.28E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	1.078E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Acenaphthylene	NC	= (	2.57E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Anthracene	NC	= (	2.603E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzene	NC	= (	9.37E+01	×	5.50E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzo(a)anthracene	1.39E-05	= (	2.123E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.11E-05	= (	6.25E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	4.38E-06	= (	6.67E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.44E-07	= (	3.72E+02	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbon disulfide	NC	= (	7.20E-03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chloroform	NC	= (	1.20E-02	×	3.10E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	1.58E-07	= (	2.412E+03	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	4.264E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	1.00E-05	= (	1.52E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	2.29E+00	×	1.10E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	2.530E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	6.20E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.11E-06	= (	3.22E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Methylene chloride	NC	= (	2.88E-02	×	2.00E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	7.949E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	3.587E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Phenol	NC	= (	4.75E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	1.853E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Toluene	NC	= (	1.45E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Xylenes (Total)	NC	= (	1.68E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 24
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Subsurface Soil
EA2
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
3&4-Methylphenol	6.08E-03	=	(	6.28E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	3.39E-03	=	(	1.078E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Acenaphthylene	8.08E-04	=	(	2.57E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Anthracene	5.46E-03	=	(	2.603E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Benzene	NC	=	(	9.37E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.123E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	6.25E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	6.67E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	3.72E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbon disulfide	NC	=	(	7.20E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-01	)
Chloroform	NC	=	(	1.20E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Chrysene	NC	=	(	2.412E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Cyanide, Total	NC	=	(	4.264E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.52E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Ethylbenzene	NC	=	(	2.29E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	1.59E-02	=	(	2.530E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	9.76E-04	=	(	6.20E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.22E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Methylene chloride	NC	=	(	2.88E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-03	)
Naphthalene	NC	=	(	7.949E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	7.53E-03	=	(	3.587E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Phenol	7.67E-04	=	(	4.75E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	3.89E-03	=	(	1.853E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Toluene	NC	=	(	1.45E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	8.00E-02	)
Xylenes (Total)	NC	=	(	1.68E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	2.00E-01	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 25
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
EA2
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_c hours	)
3&4-Methylphenol	1.02E-06	=	(	6.28E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthene	1.76E-06	=	(	1.078E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthylene	4.19E-07	=	(	2.57E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Anthracene	4.24E-06	=	(	2.603E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzene	1.53E-07	=	(	9.37E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)anthracene	3.46E-06	=	(	2.123E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	1.02E-06	=	(	6.25E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	1.09E-06	=	(	6.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	6.07E-07	=	(	3.72E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Carbon disulfide	1.17E-11	=	(	7.20E-03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chloroform	1.96E-11	=	(	1.20E-02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chrysene	3.93E-06	=	(	2.412E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Cyanide, Total	6.95E-06	=	(	4.264E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	2.48E-07	=	(	1.52E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Ethylbenzene	3.73E-09	=	(	2.29E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluoranthene	4.13E-06	=	(	2.530E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluorene	1.01E-06	=	(	6.20E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	5.25E-07	=	(	3.22E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Methylene chloride	4.69E-11	=	(	2.88E-02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Naphthalene	1.30E-05	=	(	7.949E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Phenanthrene	5.85E-06	=	(	3.587E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Phenol	7.75E-07	=	(	4.75E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Pyrene	3.02E-06	=	(	1.853E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Toluene	2.36E-07	=	(	1.45E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Xylenes (Total)	2.74E-07	=	(	1.68E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 26
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Subsurface Soil
EA2
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
3&4-Methylphenol	NC	=	(	1.02E-06	×		×	1000	)
Acenaphthene	NC	=	(	1.76E-06	×		×	1000	)
Acenaphthylene	NC	=	(	4.19E-07	×		×	1000	)
Anthracene	NC	=	(	4.24E-06	×		×	1000	)
Benzene	1.19E-09	=	(	1.53E-07	×	7.80E-06	×	1000	)
Benzo(a)anthracene	3.81E-07	=	(	3.46E-06	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.12E-06	=	(	1.02E-06	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.20E-07	=	(	1.09E-06	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	6.67E-08	=	(	6.07E-07	×	1.10E-04	×	1000	)
Carbon disulfide	NC	=	(	1.17E-11	×		×	1000	)
Chloroform	4.50E-13	=	(	1.96E-11	×	2.30E-05	×	1000	)
Chrysene	4.33E-08	=	(	3.93E-06	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	6.95E-06	×		×	1000	)
Dibenz(a,h)anthracene	2.98E-07	=	(	2.48E-07	×	1.20E-03	×	1000	)
Ethylbenzene	9.34E-12	=	(	3.73E-09	×	2.50E-06	×	1000	)
Fluoranthene	NC	=	(	4.13E-06	×		×	1000	)
Fluorene	NC	=	(	1.01E-06	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	5.77E-08	=	(	5.25E-07	×	1.10E-04	×	1000	)
Methylene chloride	4.69E-16	=	(	4.69E-11	×	1.00E-08	×	1000	)
Naphthalene	4.41E-07	=	(	1.30E-05	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	5.85E-06	×		×	1000	)
Phenol	NC	=	(	7.75E-07	×		×	1000	)
Pyrene	NC	=	(	3.02E-06	×		×	1000	)
Toluene	NC	=	(	2.36E-07	×		×	1000	)
Xylenes (Total)	NC	=	(	2.74E-07	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 27
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
EA2
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_{nc}}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
3&4-Methylphenol	7.16E-05	=	(	6.28E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthene	1.23E-04	=	(	1.078E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthylene	2.93E-05	=	(	2.57E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Anthracene	2.97E-04	=	(	2.603E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzene	1.07E-05	=	(	9.37E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)anthracene	2.42E-04	=	(	2.123E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	7.14E-05	=	(	6.25E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	7.61E-05	=	(	6.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	4.25E-05	=	(	3.72E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Carbon disulfide	8.22E-10	=	(	7.20E-03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chloroform	1.37E-09	=	(	1.20E-02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chrysene	2.75E-04	=	(	2.412E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Cyanide, Total	4.87E-04	=	(	4.264E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	1.74E-05	=	(	1.52E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Ethylbenzene	2.61E-07	=	(	2.29E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluoranthene	2.89E-04	=	(	2.530E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluorene	7.08E-05	=	(	6.20E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	3.67E-05	=	(	3.22E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Methylene chloride	3.29E-09	=	(	2.88E-02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Naphthalene	9.07E-04	=	(	7.949E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Phenanthrene	4.09E-04	=	(	3.587E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Phenol	5.42E-05	=	(	4.75E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Pyrene	2.12E-04	=	(	1.853E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Toluene	1.65E-05	=	(	1.45E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Xylenes (Total)	1.92E-05	=	(	1.68E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 28
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Subsurface Soil
EA2
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
3&4-Methylphenol	1.19E-04	=	(	7.16E-05	÷	6.00E-01	)
Acenaphthene	NC	=	(	1.23E-04	÷		)
Acenaphthylene	NC	=	(	2.93E-05	÷		)
Anthracene	NC	=	(	2.97E-04	÷		)
Benzene	3.57E-04	=	(	1.07E-05	÷	3.00E-02	)
Benzo(a)anthracene	NC	=	(	2.42E-04	÷		)
Benzo(a)pyrene	NC	=	(	7.14E-05	÷		)
Benzo(b)fluoranthene	NC	=	(	7.61E-05	÷		)
Benzo(k)fluoranthene	NC	=	(	4.25E-05	÷		)
Carbon disulfide	1.17E-09	=	(	8.22E-10	÷	7.00E-01	)
Chloroform	1.40E-08	=	(	1.37E-09	÷	9.80E-02	)
Chrysene	NC	=	(	2.75E-04	÷		)
Cyanide, Total	6.08E-01	=	(	4.87E-04	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	1.74E-05	÷		)
Ethylbenzene	2.61E-07	=	(	2.61E-07	÷	1.00E+00	)
Fluoranthene	NC	=	(	2.89E-04	÷		)
Fluorene	NC	=	(	7.08E-05	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.67E-05	÷		)
Methylene chloride	5.48E-09	=	(	3.29E-09	÷	6.00E-01	)
Naphthalene	3.02E-01	=	(	9.07E-04	÷	3.00E-03	)
Phenanthrene	NC	=	(	4.09E-04	÷		)
Phenol	2.71E-04	=	(	5.42E-05	÷	2.00E-01	)
Pyrene	NC	=	(	2.12E-04	÷		)
Toluene	3.30E-06	=	(	1.65E-05	÷	5.00E+00	)
Xylenes (Total)	1.92E-04	=	(	1.92E-05	÷	1.00E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 29
Construction Worker Risk Summary
Reasonable Maximum Exposure
Subsurface Soil
EA2
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	2.65E-02	=	2.03E-02	+	6.08E-03	+	1.19E-04
Acenaphthene	NC	=	NC	+	NC	+	NC	1.21E-02	=	8.70E-03	+	3.39E-03	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	2.88E-03	=	2.07E-03	+	8.08E-04	+	NC
Anthracene	NC	=	NC	+	NC	+	NC	1.95E-02	=	1.40E-02	+	5.46E-03	+	NC
Benzene	1.20E-07	=	1.19E-07	+	NC	+	1.19E-09	1.55E-02	=	1.51E-02	+	NC	+	3.57E-04
Benzo(a)anthracene	5.01E-05	=	3.57E-05	+	1.39E-05	+	3.81E-07	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.47E-04	=	1.05E-04	+	4.11E-05	+	1.12E-06	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.57E-05	=	1.12E-05	+	4.38E-06	+	1.20E-07	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	9.37E-07	=	6.26E-07	+	2.44E-07	+	6.67E-08	NC	=	NC	+	NC	+	NC
Carbon disulfide	NC	=	NC	+	NC	+	NC	1.17E-07	=	1.16E-07	+	NC	+	1.17E-09
Chloroform	9.03E-12	=	8.58E-12	+	NC	+	4.50E-13	1.95E-06	=	1.94E-06	+	NC	+	1.40E-08
Chrysene	6.08E-07	=	4.06E-07	+	1.58E-07	+	4.33E-08	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	7.46E-01	=	1.38E-01	+	NC	+	6.08E-01
Dibenz(a,h)anthracene	3.60E-05	=	2.57E-05	+	1.00E-05	+	2.98E-07	NC	=	NC	+	NC	+	NC
Ethylbenzene	5.90E-10	=	5.81E-10	+	NC	+	9.34E-12	3.72E-05	=	3.70E-05	+	NC	+	2.61E-07
Fluoranthene	NC	=	NC	+	NC	+	NC	5.68E-02	=	4.09E-02	+	1.59E-02	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	3.48E-03	=	2.50E-03	+	9.76E-04	+	NC
Indeno(1,2,3-c,d)pyrene	7.59E-06	=	5.42E-06	+	2.11E-06	+	5.77E-08	NC	=	NC	+	NC	+	NC
Methylene chloride	1.33E-12	=	1.33E-12	+	NC	+	4.69E-16	7.75E-06	=	7.74E-06	+	NC	+	5.48E-09
Naphthalene	4.41E-07	=	NC	+	NC	+	4.41E-07	3.24E-01	=	2.14E-02	+	NC	+	3.02E-01
Phenanthrene	NC	=	NC	+	NC	+	NC	2.68E-02	=	1.93E-02	+	7.53E-03	+	NC
Phenol	NC	=	NC	+	NC	+	NC	3.59E-03	=	2.56E-03	+	7.67E-04	+	2.71E-04
Pyrene	NC	=	NC	+	NC	+	NC	1.39E-02	=	9.97E-03	+	3.89E-03	+	NC
Toluene	NC	=	NC	+	NC	+	NC	2.92E-03	=	2.92E-03	+	NC	+	3.30E-06
Xylenes (Total)	NC	=	NC	+	NC	+	NC	1.55E-03	=	1.35E-03	+	NC	+	1.92E-04
Total CR	**2.59E-04**	=	**1.84E-04**	+	**7.19E-05**	+	**2.53E-06**	**Total HI**	**1.26E+00**	=	**2.99E-01**	+	**4.48E-02**	+	**9.12E-01**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 30
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Carcinogenic Effects
Groundwater
EA8
Vertellus

$$\text{Ing-Risk} = \frac{C_{water} \times SF_o \times ET \times EF \times ED \times GWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{water}	×	SF_o	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		hours/day		days/year		years		L/hour				kg		days	
2,4-Dimethylphenol	NC	=	(	2.99E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Chlorophenol	NC	=	(	5.00E-03	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	4.71E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylphenol	NC	=	(	6.23E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
3&4-Methylphenol	NC	=	(	1.70E+01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	2.50E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	3.93E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acetone	NC	=	(	5.58E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Anthracene	NC	=	(	3.44E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzene	7.97E-09	=	(	1.15E+00	×	5.5E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzenethiol	NC	=	(	3.43E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	8.04E-10	=	(	8.76E-03	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.46E-09	=	(	3.77E-03	×	7.3E+00	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	6.74E-10	=	(	7.34E-03	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(g,h,i)perylene	NC	=	(	1.44E-03	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.96E-11	=	(	3.22E-03	×	7.3E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Carbon disulfide	NC	=	(	2.39E-03	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Chrysene	9.16E-12	=	(	9.97E-03	×	7.3E-03	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	3.43E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	5.07E-10	=	(	5.52E-04	×	7.3E+00	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	1.21E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Ethylbenzene	2.33E-10	=	(	1.69E-01	×	1.1E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	3.11E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	1.64E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.48E-10	=	(	1.61E-03	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Methyl ethyl ketone	NC	=	(	2.84E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Methylene chloride	1.71E-12	=	(	6.80E-03	×	2.0E-03	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	4.81E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	6.56E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Phenol	NC	=	(	1.08E+02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	2.35E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Toluene	NC	=	(	5.87E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	6.32E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)

Table 30
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Carcinogenic Effects
Groundwater
EA8
Vertellus

Notes:
AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate
Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 31
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

$$\text{Ing - HQ} = \frac{C_{water} \times ET \times EF \times ED \times GWIR}{BW \times AT_n \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_n	×	RfD_o	)
Units	unitless			mg/L		hours/day		days/year		years		L/hour				kg		days		mg/kg-day	
2,4-Dimethylphenol	5.26E-04	=	(	2.99E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
2-Chlorophenol	8.81E-06	=	(	5.00E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-03	)
2-Methylnaphthalene	1.04E-03	=	(	4.71E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
2-Methylphenol	1.10E-03	=	(	6.23E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
3&4-Methylphenol	3.00E-03	=	(	1.70E+01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Acenaphthene	1.10E-05	=	(	2.50E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)
Acenaphthylene	1.73E-06	=	(	3.93E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)
Acetone	5.46E-07	=	(	5.58E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	9.0E-01	)
Anthracene	1.01E-06	=	(	3.44E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Benzene	1.01E-03	=	(	1.15E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-02	)
Benzenethiol	3.02E-05	=	(	3.43E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	8.76E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	3.77E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	7.34E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(g,h,i)perylene	4.23E-08	=	(	1.44E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Benzo(k)fluoranthene	NC	=	(	3.22E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Carbon disulfide	2.11E-07	=	(	2.39E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-01	)
Chrysene	NC	=	(	9.97E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Cyanide, Total	6.04E-05	=	(	3.43E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Dibenz(a,h)anthracene	NC	=	(	5.52E-04	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Dibenzofuran	2.67E-04	=	(	1.21E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
Ethylbenzene	1.49E-05	=	(	1.69E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-01	)
Fluoranthene	2.74E-06	=	(	3.11E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-01	)
Fluorene	3.62E-06	=	(	1.64E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.61E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Methyl ethyl ketone	4.17E-07	=	(	2.84E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	6.0E-01	)
Methylene chloride	9.98E-06	=	(	6.80E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	6.0E-03	)
Naphthalene	7.06E-05	=	(	4.81E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	6.0E-01	)
Phenanthrene	1.93E-06	=	(	6.56E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Phenol	3.16E-03	=	(	1.08E+02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Pyrene	6.90E-07	=	(	2.35E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Toluene	6.47E-05	=	(	5.87E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	8.0E-02	)
Xylenes (Total)	2.78E-05	=	(	6.32E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)

Table 31
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

Notes:
AT_n – Averaging Time for Noncarcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
L/hour – liters per hour
mg/kg-day – milligram per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 32
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Carcinogenic Effects
Groundwater
EA8
Vertellus

$$\text{Derm - Risk} = \frac{C_{water} \times SF_{abs} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{water}	×	SF_{abs}	×	ET	×	EF	×	ED	×	SA	×	PC	) ÷ (	CF	×	BW	×	AT_c	)
Units	unitless		mg/L		kg-day/mg		hours/day		days/year		years		cm²		cm/hour		cm³/L		kg		days	
2,4-Dimethylphenol	NC	= (	2.99E+00	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
2-Chlorophenol	NC	= (	5.00E-03	×		×	1	x	45	×	1	×	3,300	×	8.00E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
2-Methylnaphthalene	NC	= (	4.71E-01	×		×	1	x	45	×	1	×	3,300	×	9.17E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
2-Methylphenol	NC	= (	6.23E+00	×		×	1	x	45	×	1	×	3,300	×	7.70E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
3&4-Methylphenol	NC	= (	1.70E+01	×		×	1	x	45	×	1	×	3,300	×	7.80E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Acenaphthene	NC	= (	2.50E-01	×		×	1	x	45	×	1	×	3,300	×	8.60E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Acenaphthylene	NC	= (	3.93E-02	×		×	1	x	45	×	1	×	3,300	×	9.11E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Acetone	NC	= (	5.58E-02	×		×	1	x	45	×	1	×	3,300	×	5.12E-04	) ÷ (	1.00E+03	×	70	×	25,550	)
Anthracene	NC	= (	3.44E-02	×		×	1	x	45	×	1	×	3,300	×	1.42E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzene	7.89E-08	= (	1.15E+00	×	5.5E-02	×	1	x	45	×	1	×	3,300	×	1.50E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzenethiol	NC	= (	3.43E-02	×		×	1	x	45	×	1	×	3,300	×	1.78E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(a)anthracene	2.50E-07	= (	8.76E-03	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	4.70E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(a)pyrene	1.60E-06	= (	3.77E-03	×	7.3E+00	×	1	x	45	×	1	×	3,300	×	7.00E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(b)fluoranthene	3.11E-07	= (	7.34E-03	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	7.00E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(g,h,i)perylene	NC	= (	1.44E-03	×		×	1	x	45	×	1	×	3,300	×	1.12E+00	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(k)fluoranthene	1.35E-08	= (	3.22E-03	×	7.3E-02	×	1	x	45	×	1	×	3,300	×	6.91E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Carbon disulfide	NC	= (	2.39E-03	×		×	1	x	45	×	1	×	3,300	×	1.70E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Chrysene	2.84E-09	= (	9.97E-03	×	7.3E-03	×	1	x	45	×	1	×	3,300	×	4.70E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Cyanide, Total	NC	= (	3.43E-01	×		×	1	x	45	×	1	×	3,300	×	1.00E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Dibenz(a,h)anthracene	5.02E-07	= (	5.52E-04	×	7.3E+00	×	1	x	45	×	1	×	3,300	×	1.50E+00	) ÷ (	1.00E+03	×	70	×	25,550	)
Dibenzofuran	NC	= (	1.21E-01	×		×	1	x	45	×	1	×	3,300	×	9.75E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Ethylbenzene	7.55E-09	= (	1.69E-01	×	1.1E-02	×	1	x	45	×	1	×	3,300	×	4.90E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Fluoranthene	NC	= (	3.11E-02	×		×	1	x	45	×	1	×	3,300	×	2.20E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Fluorene	NC	= (	1.64E-01	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	9.77E-08	= (	1.61E-03	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	1.00E+00	) ÷ (	1.00E+03	×	70	×	25,550	)
Methyl ethyl ketone	NC	= (	2.84E-02	×		×	1	x	45	×	1	×	3,300	×	9.60E-04	) ÷ (	1.00E+03	×	70	×	25,550	)
Methylene chloride	3.95E-12	= (	6.80E-03	×	2.0E-03	×	1	x	45	×	1	×	3,300	×	3.50E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Naphthalene	NC	= (	4.81E+00	×		×	1	x	45	×	1	×	3,300	×	4.70E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Phenanthrene	NC	= (	6.56E-02	×		×	1	x	45	×	1	×	3,300	×	1.40E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Phenol	NC	= (	1.08E+02	×		×	1	x	45	×	1	×	3,300	×	4.30E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Pyrene	NC	= (	2.35E-02	×		×	1	x	45	×	1	×	3,300	×	2.01E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Toluene	NC	= (	5.87E-01	×		×	1	x	45	×	1	×	3,300	×	3.10E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Xylenes (Total)	NC	= (	6.32E-01	×		×	1	x	45	×	1	×	3,300	×	5.00E-02	) ÷ (	1.00E+03	×	70	×	25,550	)

Table 32
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Carcinogenic Effects
Groundwater
EA8
Vertellus

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET - Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 33
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

$$\text{Derm - HQ} = \frac{C_{water} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	SA	×	PC	)	÷	(	CF	×	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		hours/event		days/year		years		cm²		cm/hour				cm³/L		kg		days		mg/kg-day	
2,4-Dimethylphenol	3.82E-02	=	(	2.99E+00	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
2-Chlorophenol	4.65E-05	=	(	5.00E-03	×	1	×	45	×	1	×	3,300	×	8.00E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-03	)
2-Methylnaphthalene	6.27E-02	=	(	4.71E-01	×	1	×	45	×	1	×	3,300	×	9.17E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
2-Methylphenol	5.58E-03	=	(	6.23E+00	×	1	×	45	×	1	×	3,300	×	7.70E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
3&4-Methylphenol	1.54E-02	=	(	1.70E+01	×	1	×	45	×	1	×	3,300	×	7.80E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Acenaphthene	6.24E-04	=	(	2.50E-01	×	1	×	45	×	1	×	3,300	×	8.60E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)
Acenaphthylene	1.04E-04	=	(	3.93E-02	×	1	×	45	×	1	×	3,300	×	9.11E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)
Acetone	1.84E-07	=	(	5.58E-02	×	1	×	45	×	1	×	3,300	×	5.12E-04	)	÷	(	1.00E+03	×	70	×	365	×	9.0E-01	)
Anthracene	9.46E-05	=	(	3.44E-02	×	1	×	45	×	1	×	3,300	×	1.42E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Benzene	1.00E-02	=	(	1.15E+00	×	1	×	45	×	1	×	3,300	×	1.50E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-02	)
Benzenethiol	3.55E-04	=	(	3.43E-02	×	1	×	45	×	1	×	3,300	×	1.78E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	8.76E-03	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	3.77E-03	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	7.34E-03	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(g,h,i)perylene	3.12E-05	=	(	1.44E-03	×	1	×	45	×	1	×	3,300	×	1.12E+00	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Benzo(k)fluoranthene	NC	=	(	3.22E-03	×	1	×	45	×	1	×	3,300	×	6.91E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Carbon disulfide	2.36E-06	=	(	2.39E-03	×	1	×	45	×	1	×	3,300	×	1.70E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-01	)
Chrysene	NC	=	(	9.97E-03	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Cyanide, Total	3.98E-05	=	(	3.43E-01	×	1	×	45	×	1	×	3,300	×	1.00E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Dibenz(a,h)anthracene	NC	=	(	5.52E-04	×	1	×	45	×	1	×	3,300	×	1.50E+00	)	÷	(	1.00E+03	×	70	×	365	×		)
Dibenzofuran	1.72E-02	=	(	1.21E-01	×	1	×	45	×	1	×	3,300	×	9.75E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
Ethylbenzene	4.80E-04	=	(	1.69E-01	×	1	×	45	×	1	×	3,300	×	4.90E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-01	)
Fluoranthene	3.97E-04	=	(	3.11E-02	×	1	×	45	×	1	×	3,300	×	2.20E-01	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-01	)
Fluorene	2.63E-04	=	(	1.64E-01	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.61E-03	×	1	×	45	×	1	×	3,300	×	1.00E+00	)	÷	(	1.00E+03	×	70	×	365	×		)
Methyl ethyl ketone	2.64E-07	=	(	2.84E-02	×	1	×	45	×	1	×	3,300	×	9.60E-04	)	÷	(	1.00E+03	×	70	×	365	×	6.0E-01	)
Methylene chloride	2.31E-05	=	(	6.80E-03	×	1	×	45	×	1	×	3,300	×	3.50E-03	)	÷	(	1.00E+03	×	70	×	365	×	6.0E-03	)
Naphthalene	2.19E-03	=	(	4.81E+00	×	1	×	45	×	1	×	3,300	×	4.70E-02	)	÷	(	1.00E+03	×	70	×	365	×	6.0E-01	)
Phenanthrene	1.78E-04	=	(	6.56E-02	×	1	×	45	×	1	×	3,300	×	1.40E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Phenol	8.96E-03	=	(	1.08E+02	×	1	×	45	×	1	×	3,300	×	4.30E-03	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Pyrene	9.16E-05	=	(	2.35E-02	×	1	×	45	×	1	×	3,300	×	2.01E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Toluene	1.32E-03	=	(	5.87E-01	×	1	×	45	×	1	×	3,300	×	3.10E-02	)	÷	(	1.00E+03	×	70	×	365	×	8.0E-02	)
Xylenes (Total)	9.18E-04	=	(	6.32E-01	×	1	×	45	×	1	×	3,300	×	5.00E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)

Table 33
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SA – Skin Surface Area

Table 34
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA8
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_c}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_c hours	)
2,4-Dimethylphenol	NC	=	(	2.99E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
2-Chlorophenol	NC	=	(	5.00E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
2-Methylnaphthalene	7.95E-07	=	(	4.71E-01	×	1	×	45	×	1	×	2.30E-02	]	)	÷	(	613,200	)
2-Methylphenol	NC	=	(	6.23E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
3&4-Methylphenol	NC	=	(	1.70E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Acenaphthene	NC	=	(	2.50E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Acenaphthylene	NC	=	(	3.93E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Acetone	4.32E-08	=	(	5.58E-02	×	1	×	45	×	1	×	1.06E-02	]	)	÷	(	613,200	)
Anthracene	NC	=	(	3.44E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzene	2.77E-06	=	(	1.15E+00	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	613,200	)
Benzenethiol	NC	=	(	3.43E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzo(a)anthracene	NC	=	(	8.76E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(a)pyrene	NC	=	(	3.77E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	NC	=	(	7.34E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(g,h,i)perylene	NC	=	(	1.44E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	NC	=	(	3.22E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Carbon disulfide	6.79E-09	=	(	2.39E-03	×	1	×	45	×	1	×	3.87E-02	]	)	÷	(	613,200	)
Chrysene	NC	=	(	9.97E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Cyanide, Total	NC	=	(	3.43E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	NC	=	(	5.52E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Dibenzofuran	NC	=	(	1.21E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Ethylbenzene	3.57E-07	=	(	1.69E-01	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	613,200	)
Fluoranthene	NC	=	(	3.11E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Fluorene	NC	=	(	1.64E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.61E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Methyl ethyl ketone	2.76E-08	=	(	2.84E-02	×	1	×	45	×	1	×	1.32E-02	]	)	÷	(	613,200	)
Methylene chloride	1.84E-08	=	(	6.80E-03	×	1	×	45	×	1	×	3.69E-02	]	)	÷	(	613,200	)
Naphthalene	8.37E-06	=	(	4.81E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	613,200	)
Phenanthrene	NC	=	(	6.56E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Phenol	NC	=	(	1.08E+02	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Pyrene	NC	=	(	2.35E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Toluene	1.32E-06	=	(	5.87E-01	×	1	×	45	×	1	×	3.05E-02	]	)	÷	(	613,200	)
Xylenes (Total)	1.48E-06	=	(	6.32E-01	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	613,200	)

Table 34
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA8
Vertellus

Notes:

AT_c – Averaging Time for Carcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m^3 – liters per cubic meter
mg/L – milligrams per liter
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 35
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA8
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	NC	×		×	1000	)
2-Chlorophenol	NC	=	(	NC	×		×	1000	)
2-Methylnaphthalene	NC	=	(	7.95E-07	×		×	1000	)
2-Methylphenol	NC	=	(	NC	×		×	1000	)
3&4-Methylphenol	NC	=	(	NC	×		×	1000	)
Acenaphthene	NC	=	(	NC	×		×	1000	)
Acenaphthylene	NC	=	(	NC	×		×	1000	)
Acetone	NC	=	(	4.32E-08	×		×	1000	)
Anthracene	NC	=	(	NC	×		×	1000	)
Benzene	2.16E-08	=	(	2.77E-06	×	7.8E-06	×	1000	)
Benzenethiol	NC	=	(	NC	×		×	1000	)
Benzo(a)anthracene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(a)pyrene	NC	=	(	NC	×	1.1E-03	×	1000	)
Benzo(b)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(g,h,i)perylene	NC	=	(	NC	×		×	1000	)
Benzo(k)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Carbon disulfide	NC	=	(	6.79E-09	×		×	1000	)
Chrysene	NC	=	(	NC	×	1.1E-05	×	1000	)
Cyanide, Total	NC	=	(	NC	×		×	1000	)
Dibenz(a,h)anthracene	NC	=	(	NC	×	1.2E-03	×	1000	)
Dibenzofuran	NC	=	(	NC	×		×	1000	)
Ethylbenzene	8.94E-10	=	(	3.57E-07	×	2.5E-06	×	1000	)
Fluoranthene	NC	=	(	NC	×		×	1000	)
Fluorene	NC	=	(	NC	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	NC	×	1.1E-04	×	1000	)
Methyl ethyl ketone	NC	=	(	2.76E-08	×		×	1000	)
Methylene chloride	1.84E-13	=	(	1.84E-08	×	1.0E-08	×	1000	)
Naphthalene	2.85E-07	=	(	8.37E-06	×	3.4E-05	×	1000	)
Phenanthrene	NC	=	(	NC	×		×	1000	)
Phenol	NC	=	(	NC	×		×	1000	)
Pyrene	NC	=	(	NC	×		×	1000	)
Toluene	NC	=	(	1.32E-06	×		×	1000	)
Xylenes (Total)	NC	=	(	1.48E-06	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 36
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_n}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_n hours	)
2,4-Dimethylphenol	NC	=	(	2.99E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
2-Chlorophenol	NC	=	(	5.00E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
2-Methylnaphthalene	5.57E-05	=	(	4.71E-01	×	1	×	45	×	1	×	2.30E-02	]	)	÷	(	8,760	)
2-Methylphenol	NC	=	(	6.23E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
3&4-Methylphenol	NC	=	(	1.70E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Acenaphthene	NC	=	(	2.50E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Acenaphthylene	NC	=	(	3.93E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Acetone	3.02E-06	=	(	5.58E-02	×	1	×	45	×	1	×	1.06E-02	]	)	÷	(	8,760	)
Anthracene	NC	=	(	3.44E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzene	1.94E-04	=	(	1.15E+00	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	8,760	)
Benzenethiol	NC	=	(	3.43E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzo(a)anthracene	NC	=	(	8.76E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(a)pyrene	NC	=	(	3.77E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	NC	=	(	7.34E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(g,h,i)perylene	NC	=	(	1.44E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	NC	=	(	3.22E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Carbon disulfide	4.76E-07	=	(	2.39E-03	×	1	×	45	×	1	×	3.87E-02	]	)	÷	(	8,760	)
Chrysene	NC	=	(	9.97E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Cyanide, Total	NC	=	(	3.43E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	NC	=	(	5.52E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Dibenzofuran	NC	=	(	1.21E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Ethylbenzene	2.50E-05	=	(	1.69E-01	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	8,760	)
Fluoranthene	NC	=	(	3.11E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Fluorene	NC	=	(	1.64E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.61E-03	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Methyl ethyl ketone	1.93E-06	=	(	2.84E-02	×	1	×	45	×	1	×	1.32E-02	]	)	÷	(	8,760	)
Methylene chloride	1.29E-06	=	(	6.80E-03	×	1	×	45	×	1	×	3.69E-02	]	)	÷	(	8,760	)
Naphthalene	5.86E-04	=	(	4.81E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	8,760	)
Phenanthrene	NC	=	(	6.56E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Phenol	NC	=	(	1.08E+02	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Pyrene	NC	=	(	2.35E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Toluene	9.21E-05	=	(	5.87E-01	×	1	×	45	×	1	×	3.05E-02	]	)	÷	(	8,760	)
Xylenes (Total)	1.04E-04	=	(	6.32E-01	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	8,760	)

Table 36
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

Notes:
AT_n – Averaging Time for Noncarcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m^3 – liters per cubic meter
mg/L – milligrams per liter
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 37
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA8
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m³	÷	RfC mg/m³	)
2,4-Dimethylphenol	NC	=	(	NC	÷		)
2-Chlorophenol	NC	=	(	NC	÷		)
2-Methylnaphthalene	NC	=	(	5.57E-05	÷		)
2-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
3&4-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
Acenaphthene	NC	=	(	NC	÷		)
Acenaphthylene	NC	=	(	NC	÷		)
Acetone	9.76E-08	=	(	3.02E-06	÷	3.1E+01	)
Anthracene	NC	=	(	NC	÷		)
Benzene	6.47E-03	=	(	1.94E-04	÷	3.0E-02	)
Benzenethiol	NC	=	(	NC	÷		)
Benzo(a)anthracene	NC	=	(	NC	÷		)
Benzo(a)pyrene	NC	=	(	NC	÷		)
Benzo(b)fluoranthene	NC	=	(	NC	÷		)
Benzo(g,h,i)perylene	NC	=	(	NC	÷		)
Benzo(k)fluoranthene	NC	=	(	NC	÷		)
Carbon disulfide	6.79E-07	=	(	4.76E-07	÷	7.0E-01	)
Chrysene	NC	=	(	NC	÷		)
Cyanide, Total	NC	=	(	NC	÷	8.0E-04	)
Dibenz(a,h)anthracene	NC	=	(	NC	÷		)
Dibenzofuran	NC	=	(	NC	÷		)
Ethylbenzene	2.50E-05	=	(	2.50E-05	÷	1.0E+00	)
Fluoranthene	NC	=	(	NC	÷		)
Fluorene	NC	=	(	NC	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	NC	÷		)
Methyl ethyl ketone	3.86E-07	=	(	1.93E-06	÷	5.0E+00	)
Methylene chloride	2.15E-06	=	(	1.29E-06		6.0E-01	)
Naphthalene	1.95E-01	=	(	5.86E-04		3.0E-03	)
Phenanthrene	NC	=	(	NC			)
Phenol	NC	=	(	NC		2.0E-01	)
Pyrene	NC	=	(	NC			)
Toluene	1.84E-05	=	(	9.21E-05		5.0E+00	)
Xylenes (Total)	1.04E-03	=	(	1.04E-04		1.0E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 38
Hypothetical Future Construction Worker: Summary
Reasonable Maximum Exposure
Groundwater
EA8
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	3.87E-02	=	5.26E-04	+	3.82E-02	+	NC
2-Chlorophenol	NC	=	NC	+	NC	+	NC	5.53E-05	=	8.81E-06	+	4.65E-05	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	6.37E-02	=	1.04E-03	+	6.27E-02	+	NC
2-Methylphenol	NC	=	NC	+	NC	+	NC	6.68E-03	=	1.10E-03	+	5.58E-03	+	NC
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	1.84E-02	=	3.00E-03	+	1.54E-02	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	6.35E-04	=	1.10E-05	+	6.24E-04	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	1.06E-04	=	1.73E-06	+	1.04E-04	+	NC
Acetone	NC	=	NC	+	NC	+	NC	8.28E-07	=	5.46E-07	+	1.84E-07	+	9.76E-08
Anthracene	NC	=	NC	+	NC	+	NC	9.56E-05	=	1.01E-06	+	9.46E-05	+	NC
Benzene	1.09E-07	=	7.97E-09	+	7.89E-08	+	2.16E-08	1.75E-02	=	1.01E-03		1.00E-02	+	6.47E-03
Benzenethiol	NC	=	NC	+	NC	+	NC	3.85E-04	=	3.02E-05		3.55E-04	+	NC
Benzo(a)anthracene	2.50E-07	=	8.04E-10	+	2.50E-07	+	NC	NC	=	NC		NC	+	NC
Benzo(a)pyrene	1.60E-06	=	3.46E-09	+	1.60E-06	+	NC	NC	=	NC		NC	+	NC
Benzo(b)fluoranthene	3.12E-07	=	6.74E-10	+	3.11E-07	+	NC	NC	=	NC		NC	+	NC
Benzo(g,h,i)perylene	NC		NC		NC		NC	3.13E-05		4.23E-08		3.12E-05		NC
Benzo(k)fluoranthene	1.35E-08		2.96E-11		1.35E-08		NC	NC		NC		NC		NC
Carbon disulfide	NC		NC		NC		NC	3.25E-06		2.11E-07		2.36E-06		6.79E-07
Chrysene	2.85E-09		9.16E-12		2.84E-09		NC	NC		NC		NC		NC
Cyanide, Total	NC		NC		NC		NC	1.00E-04		6.04E-05		3.98E-05		NC
Dibenz(a,h)anthracene	5.02E-07		5.07E-10		5.02E-07		NC	NC		NC		NC		NC
Dibenzofuran	NC		NC		NC		NC	1.74E-02		2.67E-04		1.72E-02		NC
Ethylbenzene	8.68E-09		2.33E-10		7.55E-09		8.94E-10	5.20E-04		1.49E-05		4.80E-04		2.50E-05
Fluoranthene	NC		NC		NC		NC	4.00E-04		2.74E-06		3.97E-04		NC
Fluorene	NC		NC		NC		NC	2.66E-04		3.62E-06		2.63E-04		NC
Indeno(1,2,3-c,d)pyrene	9.79E-08		1.48E-10		9.77E-08		NC	NC		NC		NC		NC
Methyl ethyl ketone	NC		NC		NC		NC	1.07E-06		4.17E-07		2.64E-07		3.86E-07
Methylene chloride	5.85E-12		1.71E-12		3.95E-12		1.84E-13	3.52E-05		9.98E-06		2.31E-05		2.15E-06
Naphthalene	2.85E-07		NC		NC		2.85E-07	1.98E-01		7.06E-05		2.19E-03		1.95E-01
Phenanthrene	NC		NC		NC		NC	1.80E-04		1.93E-06		1.78E-04		NC
Phenol	NC		NC		NC		NC	1.21E-02		3.16E-03		8.96E-03		NC
Pyrene	NC		NC		NC		NC	9.23E-05		6.90E-07		9.16E-05		NC
Toluene	NC		NC		NC		NC	1.41E-03		6.47E-05		1.32E-03		1.84E-05
Xylenes (Total)	NC		NC		NC		NC	1.98E-03		2.78E-05		9.18E-04		1.04E-03
Total CR	**3.18E-06**	=	**1E-08**	+	**3E-06**	+	**3E-07**	**Total HI**	**3.79E-01**	=	**1E-02**	+	**2E-01**	+ **2E-01**

Notes:

CR – Cancer Risk

GW – Groundwater

HI – Hazard Index

NC – Not Calculated

Table 39
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
2,4-Dimethylphenol	NC	=	(	9.27E-01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Acenaphthene	NC	=	(	2.49E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Acenaphthylene	NC	=	(	4.56E+00	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)anthracene	1.02E-06	=	(	1.59E+02	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	1.25E-05	=	(	1.94E+02	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	1.37E-06	=	(	2.13E+02	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	9.49E-08	=	(	1.47E+02	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	NC	=	(	1.70E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	1.31E-08	=	(	2.03E+02	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Cyanide, Total	NC	=	(	3.85E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	1.96E-06	=	(	3.04E+01	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenzofuran	NC	=	(	1.10E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Ethylbenzene	3.89E-13	=	(	4.00E-03	×	1.10E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluoranthene	NC	=	(	2.75E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluorene	NC	=	(	2.22E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	8.38E-07	=	(	1.30E+02	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Methylene chloride	3.13E-11	=	(	1.77E+00	×	2.00E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	7.19E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Phenanthrene	NC	=	(	2.29E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	3.96E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Xylenes (Total)	NC	=	(	3.27E-01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf - Exposure Time Fraction
Ing - Risk – Ingestion Risk

kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 40
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	2.39E-06	=	(	9.27E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
2-Methylnaphthalene	1.21E-04	=	(	9.40E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	2.14E-05	=	(	2.49E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-02	)
Acenaphthylene	3.92E-06	=	(	4.56E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Cyanide, Total	3.31E-03	=	(	3.85E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenzofuran	5.67E-04	=	(	1.10E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-03	)
Ethylbenzene	2.06E-09	=	(	4.00E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-01	)
Fluoranthene	3.55E-04	=	(	2.75E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	2.86E-05	=	(	2.22E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Methylene chloride	1.52E-05	=	(	1.77E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-03	)
Naphthalene	1.85E-04	=	(	7.19E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	3.94E-05	=	(	2.29E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	6.81E-04	=	(	3.96E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)
Xylenes (Total)	8.43E-08	=	(	3.27E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 41
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	9.27E-01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.00E-01	) ÷ (	47	×	25,550	)
2-Methylnaphthalene	NC	= (	9.40E+00	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Acenaphthene	NC	= (	2.49E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Acenaphthylene	NC	= (	4.56E+00	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)anthracene	2.39E-06	= (	1.59E+02	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	2.93E-05	= (	1.94E+02	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	3.21E-06	= (	2.13E+02	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	2.22E-07	= (	1.47E+02	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	1.70E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	3.07E-08	= (	2.03E+02	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Cyanide, Total	NC	= (	3.85E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	4.60E-06	= (	3.04E+01	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenzofuran	NC	= (	1.10E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Ethylbenzene	NC	= (	4.00E-03	×	1.10E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Fluoranthene	NC	= (	2.75E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Fluorene	NC	= (	2.22E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.96E-06	= (	1.30E+02	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Methylene chloride	NC	= (	1.77E+00	×	2.00E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Naphthalene	NC	= (	7.19E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Phenanthrene	NC	= (	2.29E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Pyrene	NC	= (	3.96E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Xylenes (Total)	NC	= (	3.27E-01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 42
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation Units	Derm - HQ unitless	=	(	C_{soil} mg/kg	×	CF kg/mg	×	EF days/year	×	ED years	×	EV events/day	×	SA cm²	×	SSAF mg/cm²-event	×	ABS_d unitless	)	÷	(	BW kg	×	AT_{nc} days	×	RfD_{abs} mg/kg-day	)
2,4-Dimethylphenol	4.30E-06	=	(	9.27E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.00E-01	)	÷	(	47	×	4,380	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	5.00E-05	=	(	2.49E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	6.00E-02	)
Acenaphthylene	9.17E-06	=	(	4.56E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Cyanide, Total	NC	=	(	3.85E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenzofuran	NC	=	(	1.10E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-03	)
Ethylbenzene	NC	=	(	4.00E-03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-01	)
Fluoranthene	8.30E-04	=	(	2.75E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	6.69E-05	=	(	2.22E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Methylene chloride	NC	=	(	1.77E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	6.00E-03	)
Naphthalene	NC	=	(	7.19E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	9.22E-05	=	(	2.29E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	1.59E-03	=	(	3.96E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)
Xylenes (Total)	NC	=	(	3.27E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-01	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV - Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 43
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2,4-Dimethylphenol	2.86E-12	=	(	9.27E-01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	2.90E-11	=	(	9.40E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	7.67E-11	=	(	2.49E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthylene	1.41E-11	=	(	4.56E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	4.89E-10	=	(	1.59E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	5.98E-10	=	(	1.94E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	6.55E-10	=	(	2.13E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	4.54E-10	=	(	1.47E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	5.24E-11	=	(	1.70E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	6.27E-10	=	(	2.03E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Cyanide, Total	1.19E-10	=	(	3.85E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	9.39E-11	=	(	3.04E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	3.39E-11	=	(	1.10E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Ethylbenzene	1.23E-14	=	(	4.00E-03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	8.49E-10	=	(	2.75E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	6.84E-11	=	(	2.22E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	4.01E-10	=	(	1.30E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Methylene chloride	5.47E-12	=	(	1.77E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.22E-10	=	(	7.19E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	7.07E-10	=	(	2.29E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.22E-09	=	(	3.96E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Xylenes (Total)	1.01E-12	=	(	3.27E-01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 44
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	2.86E-12	×		×	1000	)
2-Methylnaphthalene	NC	=	(	2.90E-11	×		×	1000	)
Acenaphthene	NC	=	(	7.67E-11	×		×	1000	)
Acenaphthylene	NC	=	(	1.41E-11	×		×	1000	)
Benzo(a)anthracene	5.38E-11	=	(	4.89E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	6.58E-10	=	(	5.98E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	7.21E-11	=	(	6.55E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.99E-11	=	(	4.54E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	5.24E-11	×		×	1000	)
Chrysene	6.90E-12	=	(	6.27E-10	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	1.19E-10	×		×	1000	)
Dibenz(a,h)anthracene	1.13E-10	=	(	9.39E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	3.39E-11	×		×	1000	)
Ethylbenzene	3.08E-17	=	(	1.23E-14	×	2.50E-06	×	1000	)
Fluoranthene	NC	=	(	8.49E-10	×		×	1000	)
Fluorene	NC	=	(	6.84E-11	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	4.41E-11	=	(	4.01E-10	×	1.10E-04	×	1000	)
Methylene chloride	5.47E-17	=	(	5.47E-12	×	1.00E-08	×	1000	)
Naphthalene	7.54E-12	=	(	2.22E-10	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	7.07E-10	×		×	1000	)
Pyrene	NC	=	(	1.22E-09	×		×	1000	)
Xylenes (Total)	NC	=	(	1.01E-12	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 45
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
2,4-Dimethylphenol	1.67E-11	=	(	9.27E-01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
2-Methylnaphthalene	1.69E-10	=	(	9.40E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Acenaphthene	4.47E-10	=	(	2.49E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Acenaphthylene	8.20E-11	=	(	4.56E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)anthracene	2.85E-09	=	(	1.59E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	3.49E-09	=	(	1.94E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	3.82E-09	=	(	2.13E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	2.65E-09	=	(	1.47E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	3.06E-10	=	(	1.70E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	3.66E-09	=	(	2.03E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Cyanide, Total	6.93E-10	=	(	3.85E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	5.48E-10	=	(	3.04E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenzofuran	1.98E-10	=	(	1.10E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Ethylbenzene	7.20E-14	=	(	4.00E-03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Fluoranthene	4.95E-09	=	(	2.75E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Fluorene	3.99E-10	=	(	2.22E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	2.34E-09	=	(	1.30E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Methylene chloride	3.19E-11	=	(	1.77E+00	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Naphthalene	1.29E-09	=	(	7.19E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Phenanthrene	4.13E-09	=	(	2.29E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Pyrene	7.13E-09	=	(	3.96E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Xylenes (Total)	5.88E-12	=	(	3.27E-01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 46
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2,4-Dimethylphenol	NC	=	(	1.67E-11	÷		)
2-Methylnaphthalene	NC	=	(	1.69E-10	÷		)
Acenaphthene	NC	=	(	4.47E-10	÷		)
Acenaphthylene	NC	=	(	8.20E-11	÷		)
Benzo(a)anthracene	NC	=	(	2.85E-09	÷		)
Benzo(a)pyrene	NC	=	(	3.49E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	3.82E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	2.65E-09	÷		)
Carbazole	NC	=	(	3.06E-10	÷		)
Chrysene	NC	=	(	3.66E-09	÷		)
Cyanide, Total	8.66E-07	=	(	6.93E-10	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	5.48E-10	÷		)
Dibenzofuran	NC	=	(	1.98E-10	÷		)
Ethylbenzene	7.20E-14	=	(	7.20E-14	÷	1.00E+00	)
Fluoranthene	NC	=	(	4.95E-09	÷		)
Fluorene	NC	=	(	3.99E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.34E-09	÷		)
Methylene chloride	5.32E-11	=	(	3.19E-11	÷	6.00E-01	)
Naphthalene	4.31E-07	=	(	1.29E-09	÷	3.00E-03	)
Phenanthrene	NC	=	(	4.13E-09	÷		)
Pyrene	NC	=	(	7.13E-09	÷		)
Xylenes (Total)	5.88E-11	=	(	5.88E-12	÷	1.00E-01	)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 47
Child Trespasser: Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA3
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	6.69E-06	=	2.39E-06	+	4.30E-06	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	1.21E-04	=	1.21E-04	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	7.13E-05	=	2.14E-05	+	5.00E-05	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	1.31E-05	=	3.92E-06	+	9.17E-06	+	NC
Benzo(a)anthracene	3.42E-06	=	1.02E-06	+	2.39E-06	+	5.38E-11	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	4.18E-05	=	1.25E-05	+	2.93E-05	+	6.58E-10	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	4.58E-06	=	1.37E-06	+	3.21E-06	+	7.21E-11	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	3.17E-07	=	9.49E-08	+	2.22E-07	+	4.99E-11	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	4.38E-08	=	1.31E-08	+	3.07E-08	+	6.90E-12	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	3.31E-03	=	3.31E-03	+	NC	+	8.66E-07
Dibenz(a,h)anthracene	6.56E-06	=	1.96E-06	+	4.60E-06	+	1.13E-10	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	5.67E-04	=	5.67E-04	+	NC	+	NC
Ethylbenzene	3.89E-13	=	3.89E-13	+	NC	+	3.08E-17	2.06E-09	=	2.06E-09	+	NC	+	7.20E-14
Fluoranthene	NC	=	NC	+	NC	+	NC	1.19E-03	=	3.55E-04	+	8.30E-04	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	9.55E-05	=	2.86E-05	+	6.69E-05	+	NC
Indeno(1,2,3-c,d)pyrene	2.80E-06	=	8.38E-07	+	1.96E-06	+	4.41E-11	NC	=	NC	+	NC	+	NC
Methylene chloride	3.13E-11	=	3.13E-11	+	NC	+	5.47E-17	1.52E-05	=	1.52E-05	+	NC	+	5.32E-11
Naphthalene	7.54E-12	=	NC	+	NC	+	7.54E-12	1.86E-04	=	1.85E-04	+	NC	+	4.31E-07
Phenanthrene	NC	=	NC	+	NC	+	NC	1.32E-04	=	3.94E-05	+	9.22E-05	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	2.27E-03	=	6.81E-04	+	1.59E-03	+	NC
Xylenes (Total)	NC	=	NC	+	NC	+	NC	8.43E-08	=	8.43E-08	+	NC	+	5.88E-11
Total CR	**5.95E-05**	=	**1.78E-05**	+	**4.17E-05**	+	**1.00E-09**	**Total HI**	**7.98E-03**	=	**5.33E-03**	+	**2.65E-03**	+	**1.30E-06**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 48
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation Units	Ing - Risk unitless	=	(	C_{soil} mg/kg	×	SF_o kg-day/mg	×	CF kg/mg	×	EF days/year	×	ED years	×	SIR mg/day	)	÷	(	BW kg	×	AT_c days	)
2,4-Dimethylphenol	NC	=	(	9.27E-01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	2.49E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	4.56E+00	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	1.94E-06	=	(	1.59E+02	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.38E-05	=	(	1.94E+02	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	2.60E-06	=	(	2.13E+02	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.80E-07	=	(	1.47E+02	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	1.70E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	2.49E-08	=	(	2.03E+02	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	3.85E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	3.73E-06	=	(	3.04E+01	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	1.10E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Ethylbenzene	7.38E-13	=	(	4.00E-03	×	1.10E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	2.75E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.22E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.59E-06	=	(	1.30E+02	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Methylene chloride	5.95E-11	=	(	1.77E+00	×	2.00E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	7.19E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	2.29E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	3.96E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	3.27E-01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 49
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	2.18E-06	=	(	9.27E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	1.10E-04	=	(	9.40E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	1.95E-05	=	(	2.49E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	6.00E-02	)
Acenaphthylene	3.57E-06	=	(	4.56E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Cyanide, Total	3.01E-03	=	(	3.85E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenzofuran	5.17E-04	=	(	1.10E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-03	)
Ethylbenzene	1.88E-09	=	(	4.00E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-01	)
Fluoranthene	3.23E-04	=	(	2.75E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	2.60E-05	=	(	2.22E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Methylene chloride	1.39E-05	=	(	1.77E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	6.00E-03	)
Naphthalene	1.69E-04	=	(	7.19E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	3.59E-05	=	(	2.29E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	6.21E-04	=	(	3.96E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-02	)
Xylenes (Total)	7.68E-08	=	(	3.27E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 50
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	9.27E-01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.00E-01	) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	9.40E+00	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	2.49E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Acenaphthylene	NC	= (	4.56E+00	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	8.33E-07	= (	1.59E+02	×	7.30E-01		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.02E-05	= (	1.94E+02	×	7.30E+00		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.12E-06	= (	2.13E+02	×	7.30E-01		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	7.73E-08	= (	1.47E+02	×	7.30E-02		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	1.70E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Chrysene	1.07E-08	= (	2.03E+02	×	7.30E-03		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	3.85E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	1.60E-06	= (	3.04E+01	×	7.30E+00		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	1.10E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	4.00E-03	×	1.10E-02		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	2.75E+02	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	2.22E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	6.83E-07	= (	1.30E+02	×	7.30E-01		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Methylene chloride	NC	= (	1.77E+00	×	2.00E-03		1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	7.19E+01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	2.29E+02	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	3.96E+02	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Xylenes (Total)	NC	= (	3.27E-01	×			1.00E-06	×	12	×	25.0		1	×	3300		0.1	×		) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 51
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED		EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2,4-Dimethylphenol	7.19E-07	=	(	9.27E-01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.00E-01	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	8.35E-06	=	(	2.49E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Acenaphthylene	1.53E-06	=	(	4.56E+00	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Cyanide, Total	NC	=	(	3.85E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	1.10E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Ethylbenzene	NC	=	(	4.00E-03	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	1.00E-01	)
Fluoranthene	1.39E-04	=	(	2.75E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	1.12E-05	=	(	2.22E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Methylene chloride	NC	=	(	1.77E+00	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	6.00E-03	)
Naphthalene	NC	=	(	7.19E+01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	1.54E-05	=	(	2.29E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	2.66E-04	=	(	3.96E+02	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)
Xylenes (Total)	NC	=	(	3.27E-01	×	1E-06	×	12	×	25.0		1	×	3300		0.1	×		)	÷	(	70	×	9,125	×	2.00E-01	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 52
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2,4-Dimethylphenol	2.75E-12	=	(	9.27E-01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	2.79E-11	=	(	9.40E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	7.37E-11	=	(	2.49E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthylene	1.35E-11	=	(	4.56E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	4.70E-10	=	(	1.59E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	5.75E-10	=	(	1.94E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	6.30E-10	=	(	2.13E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	4.37E-10	=	(	1.47E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	5.04E-11	=	(	1.70E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	6.03E-10	=	(	2.03E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Cyanide, Total	1.14E-10	=	(	3.85E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	9.03E-11	=	(	3.04E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	3.26E-11	=	(	1.10E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Ethylbenzene	1.19E-14	=	(	4.00E-03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	8.17E-10	=	(	2.75E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	6.58E-11	=	(	2.22E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	3.85E-10	=	(	1.30E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Methylene chloride	5.26E-12	=	(	1.77E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.13E-10	=	(	7.19E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	6.80E-10	=	(	2.29E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.18E-09	=	(	3.96E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Xylenes (Total)	9.70E-13	=	(	3.27E-01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 53
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	2.75E-12	×		×	1000	)
2-Methylnaphthalene	NC	=	(	2.79E-11	×		×	1000	)
Acenaphthene	NC	=	(	7.37E-11	×		×	1000	)
Acenaphthylene	NC	=	(	1.35E-11	×		×	1000	)
Benzo(a)anthracene	5.17E-11	=	(	4.70E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	6.33E-10	=	(	5.75E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	6.93E-11	=	(	6.30E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.80E-11	=	(	4.37E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	5.04E-11	×		×	1000	)
Chrysene	6.63E-12	=	(	6.03E-10	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	1.14E-10	×		×	1000	)
Dibenz(a,h)anthracene	1.08E-10	=	(	9.03E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	3.26E-11	×		×	1000	)
Ethylbenzene	2.97E-17	=	(	1.19E-14	×	2.50E-06	×	1000	)
Fluoranthene	NC	=	(	8.17E-10	×		×	1000	)
Fluorene	NC	=	(	6.58E-11	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	4.24E-11	=	(	3.85E-10	×	1.10E-04	×	1000	)
Methylene chloride	5.26E-17	=	(	5.26E-12	×	1.00E-08	×	1000	)
Naphthalene	7.25E-12	=	(	2.13E-10	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	6.80E-10	×		×	1000	)
Pyrene	NC	=	(	1.18E-09	×		×	1000	)
Xylenes (Total)	NC	=	(	9.70E-13	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 54
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	x	AT_n hours	)
2,4-Dimethylphenol	7.70E-12	=	(	9.27E-01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
2-Methylnaphthalene	7.80E-11	=	(	9.40E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthene	2.06E-10	=	(	2.49E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthylene	3.79E-11	=	(	4.56E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)anthracene	1.32E-09	=	(	1.59E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	1.61E-09	=	(	1.94E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	1.76E-09	=	(	2.13E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	1.22E-09	=	(	1.47E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	1.41E-10	=	(	1.70E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	1.69E-09	=	(	2.03E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Cyanide, Total	3.20E-10	=	(	3.85E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	2.53E-10	=	(	3.04E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	9.13E-11	=	(	1.10E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Ethylbenzene	3.32E-14	=	(	4.00E-03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	2.29E-09	=	(	2.75E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluorene	1.84E-10	=	(	2.22E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	1.08E-09	=	(	1.30E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Methylene chloride	1.47E-11	=	(	1.77E+00	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	5.97E-10	=	(	7.19E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Phenanthrene	1.90E-09	=	(	2.29E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	3.29E-09	=	(	3.96E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Xylenes (Total)	2.71E-12	=	(	3.27E-01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 55
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2,4-Dimethylphenol	NC	=	(	7.70E-12	÷		)
2-Methylnaphthalene	NC	=	(	7.80E-11	÷		)
Acenaphthene	NC	=	(	2.06E-10	÷		)
Acenaphthylene	NC	=	(	3.79E-11	÷		)
Benzo(a)anthracene	NC	=	(	1.32E-09	÷		)
Benzo(a)pyrene	NC	=	(	1.61E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	1.76E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	1.22E-09	÷		)
Carbazole	NC	=	(	1.41E-10	÷		)
Chrysene	NC	=	(	1.69E-09	÷		)
Cyanide, Total	4.00E-07	=	(	3.20E-10	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	2.53E-10	÷		)
Dibenzofuran	NC	=	(	9.13E-11	÷		)
Ethylbenzene	3.32E-14	=	(	3.32E-14	÷	1.00E+00	)
Fluoranthene	NC	=	(	2.29E-09	÷		)
Fluorene	NC	=	(	1.84E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.08E-09	÷		)
Methylene chloride	2.45E-11	=	(	1.47E-11	÷	6.00E-01	)
Naphthalene	1.99E-07	=	(	5.97E-10	÷	3.00E-03	)
Phenanthrene	NC	=	(	1.90E-09	÷		)
Pyrene	NC	=	(	3.29E-09	÷		)
Xylenes (Total)	2.71E-11	=	(	2.71E-12	÷	1.00E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 56
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA3
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	2.90E-06	=	2.18E-06	+	7.19E-07	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	1.10E-04	=	1.10E-04	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	2.78E-05	=	1.95E-05	+	8.35E-06	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	5.10E-06	=	3.57E-06	+	1.53E-06	+	NC
Benzo(a)anthracene	2.78E-06	=	1.94E-06	+	8.33E-07	+	5.17E-11	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	3.39E-05	=	2.38E-05	+	1.02E-05	+	6.33E-10	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	3.72E-06	=	2.60E-06	+	1.12E-06	+	6.93E-11	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	2.58E-07	=	1.80E-07	+	7.73E-08	+	4.80E-11	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	3.56E-08	=	2.49E-08	+	1.07E-08	+	6.63E-12	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	3.01E-03	=	3.01E-03	+	NC	+	4.00E-07
Dibenz(a,h)anthracene	5.33E-06	=	3.73E-06	+	1.60E-06	+	1.08E-10	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	5.17E-04	=	5.17E-04	+	NC	+	NC
Ethylbenzene	7.38E-13	=	7.38E-13	+	NC	+	2.97E-17	1.88E-09	=	1.88E-09	+	NC	+	3.32E-14
Fluoranthene	NC	=	NC	+	NC	+	NC	4.62E-04	=	3.23E-04	+	1.39E-04	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	3.72E-05	=	2.60E-05	+	1.12E-05	+	NC
Indeno(1,2,3-c,d)pyrene	2.27E-06	=	1.59E-06	+	6.83E-07	+	4.24E-11	NC	=	NC	+	NC	+	NC
Methylene chloride	5.95E-11	=	5.95E-11	+	NC	+	5.26E-17	1.39E-05	=	1.39E-05	+	NC	+	2.45E-11
Naphthalene	7.25E-12	=	NC	+	NC	+	7.25E-12	1.69E-04	=	1.69E-04	+	NC	+	1.99E-07
Phenanthrene	NC	=	NC	+	NC	+	NC	5.13E-05	=	3.59E-05	+	1.54E-05	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	8.87E-04	=	6.21E-04	+	2.66E-04	+	NC
Xylenes (Total)	NC	=	NC	+	NC	+	NC	7.68E-08	=	7.68E-08	+	NC	+	2.71E-11
Total CR	**4.83E-05**	=	**3.38E-05**	+	**1.45E-05**	+	**9.66E-10**	**Total HI**	**5.30E-03**	=	**4.86E-03**	+	**4.42E-04**	+	**5.99E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 57
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation Units	Ing - Risk unitless	=	(	C_{soil} mg/kg	×	SF_o kg-day/mg	×	CF kg/mg	×	EF days/year	×	ED years	×	SIR mg/day	)	÷	(	BW kg	×	AT_c days	)
2,4-Dimethylphenol	NC	=	(	9.27E-01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	2.49E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	4.56E+00	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	2.02E-05	=	(	1.59E+02	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.47E-04	=	(	1.94E+02	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	2.71E-05	=	(	2.13E+02	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.88E-06	=	(	1.47E+02	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	1.70E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	2.59E-07	=	(	2.03E+02	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	3.85E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	3.88E-05	=	(	3.04E+01	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	1.10E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Ethylbenzene	7.69E-12	=	(	4.00E-03	×	1.10E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	2.75E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.22E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.66E-05	=	(	1.30E+02	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Methylene chloride	6.20E-10	=	(	1.77E+00	×	2.00E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	7.19E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	2.29E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	3.96E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	3.27E-01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms peer milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 58
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	2.27E-05	=	(	9.27E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	1.15E-03	=	(	9.40E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	2.03E-04	=	(	2.49E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	6.00E-02	)
Acenaphthylene	3.72E-05	=	(	4.56E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Cyanide, Total	3.14E-02	=	(	3.85E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenzofuran	5.38E-03	=	(	1.10E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-03	)
Ethylbenzene	1.96E-08	=	(	4.00E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-01	)
Fluoranthene	3.37E-03	=	(	2.75E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	2.71E-04	=	(	2.22E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Methylene chloride	1.45E-04	=	(	1.77E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	6.00E-03	)
Naphthalene	1.76E-03	=	(	7.19E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	3.74E-04	=	(	2.29E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	6.46E-03	=	(	3.96E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-02	)
Xylenes (Total)	8.00E-07	=	(	3.27E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 59
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	9.27E-01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.00E-01	) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	9.40E+00	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	2.49E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Acenaphthylene	NC	= (	4.56E+00	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	3.47E-05	= (	1.59E+02	×	7.30E-01		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.25E-04	= (	1.94E+02	×	7.30E+00		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	4.65E-05	= (	2.13E+02	×	7.30E-01		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	3.22E-06	= (	1.47E+02	×	7.30E-02		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	1.70E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Chrysene	4.45E-07	= (	2.03E+02	×	7.30E-03		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	3.85E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	6.66E-05	= (	3.04E+01	×	7.30E+00		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	1.10E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	4.00E-03	×	1.10E-02		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	2.75E+02	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	2.22E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.84E-05	= (	1.30E+02	×	7.30E-01		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Methylene chloride	NC	= (	1.77E+00	×	2.00E-03		1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	7.19E+01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	2.29E+02	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	3.96E+02	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Xylenes (Total)	NC	= (	3.27E-01	×			1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 60
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA3
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2,4-Dimethylphenol	2.99E-05	=	(	9.27E-01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.00E-01	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	9.40E+00	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	3.48E-04	=	(	2.49E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Acenaphthylene	6.38E-05	=	(	4.56E+00	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	1.59E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	1.94E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.13E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	1.47E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.03E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Cyanide, Total	NC	=	(	3.85E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	6.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.04E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	1.10E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Ethylbenzene	NC	=	(	4.00E-03	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	1.00E-01	)
Fluoranthene	5.78E-03	=	(	2.75E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	4.66E-04	=	(	2.22E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.30E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Methylene chloride	NC	=	(	1.77E+00	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	6.00E-03	)
Naphthalene	NC	=	(	7.19E+01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	6.42E-04	=	(	2.29E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	1.11E-02	=	(	3.96E+02	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)
Xylenes (Total)	NC	=	(	3.27E-01	×	1E-06	×	250		25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-01	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per millilgram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 61
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2,4-Dimethylphenol	5.73E-11	=	(	9.27E-01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	5.81E-10	=	(	9.40E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	1.54E-09	=	(	2.49E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthylene	2.82E-10	=	(	4.56E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	9.80E-09	=	(	1.59E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.20E-08	=	(	1.94E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	1.31E-08	=	(	2.13E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	9.09E-09	=	(	1.47E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.05E-09	=	(	1.70E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	1.26E-08	=	(	2.03E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Cyanide, Total	2.38E-09	=	(	3.85E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.88E-09	=	(	3.04E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	6.79E-10	=	(	1.10E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Ethylbenzene	2.47E-13	=	(	4.00E-03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	1.70E-08	=	(	2.75E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	1.37E-09	=	(	2.22E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	8.03E-09	=	(	1.30E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Methylene chloride	1.10E-10	=	(	1.77E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	4.44E-09	=	(	7.19E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	1.42E-08	=	(	2.29E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	2.45E-08	=	(	3.96E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Xylenes (Total)	2.02E-11	=	(	3.27E-01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 62
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	5.73E-11	×		×	1000	)
2-Methylnaphthalene	NC	=	(	5.81E-10	×		×	1000	)
Acenaphthene	NC	=	(	1.54E-09	×		×	1000	)
Acenaphthylene	NC	=	(	2.82E-10	×		×	1000	)
Benzo(a)anthracene	1.08E-09	=	(	9.80E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.32E-08	=	(	1.20E-08	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.44E-09	=	(	1.31E-08	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.00E-09	=	(	9.09E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.05E-09	×		×	1000	)
Chrysene	1.38E-10	=	(	1.26E-08	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	2.38E-09	×		×	1000	)
Dibenz(a,h)anthracene	2.26E-09	=	(	1.88E-09	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	6.79E-10	×		×	1000	)
Ethylbenzene	6.18E-16	=	(	2.47E-13	×	2.50E-06	×	1000	)
Fluoranthene	NC	=	(	1.70E-08	×		×	1000	)
Fluorene	NC	=	(	1.37E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	8.83E-10	=	(	8.03E-09	×	1.10E-04	×	1000	)
Methylene chloride	1.10E-15	=	(	1.10E-10	×	1.00E-08	×	1000	)
Naphthalene	1.51E-10	=	(	4.44E-09	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	1.42E-08	×		×	1000	)
Pyrene	NC	=	(	2.45E-08	×		×	1000	)
Xylenes (Total)	NC	=	(	2.02E-11	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 63
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times Edt}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED_t year	]	)	÷	(	VF m^3/kg	]	AT_n hours	)
2,4-Dimethylphenol	1.60E-10	=	(	9.27E-01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
2-Methylnaphthalene	1.63E-09	=	(	9.40E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthene	4.30E-09	=	(	2.49E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthylene	7.89E-10	=	(	4.56E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)anthracene	2.74E-08	=	(	1.59E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	3.35E-08	=	(	1.94E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	3.68E-08	=	(	2.13E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	2.55E-08	=	(	1.47E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	2.94E-09	=	(	1.70E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	3.52E-08	=	(	2.03E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Cyanide, Total	6.66E-09	=	(	3.85E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	5.27E-09	=	(	3.04E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	1.90E-09	=	(	1.10E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Ethylbenzene	6.92E-13	=	(	4.00E-03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	4.76E-08	=	(	2.75E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluorene	3.84E-09	=	(	2.22E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	2.25E-08	=	(	1.30E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Methylene chloride	3.07E-10	=	(	1.77E+00	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	1.24E-08	=	(	7.19E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Phenanthrene	3.97E-08	=	(	2.29E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	6.86E-08	=	(	3.96E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Xylenes (Total)	5.66E-11	=	(	3.27E-01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 64
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA3
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2,4-Dimethylphenol	NC	=	(	1.60E-10	÷		)
2-Methylnaphthalene	NC	=	(	1.63E-09	÷		)
Acenaphthene	NC	=	(	4.30E-09	÷		)
Acenaphthylene	NC	=	(	7.89E-10	÷		)
Benzo(a)anthracene	NC	=	(	2.74E-08	÷		)
Benzo(a)pyrene	NC	=	(	3.35E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	3.68E-08	÷		)
Benzo(k)fluoranthene	NC	=	(	2.55E-08	÷		)
Carbazole	NC	=	(	2.94E-09	÷		)
Chrysene	NC	=	(	3.52E-08	÷		)
Cyanide, Total	8.33E-06	=	(	6.66E-09	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	5.27E-09	÷		)
Dibenzofuran	NC	=	(	1.90E-09	÷		)
Ethylbenzene	6.92E-13	=	(	6.92E-13	÷	1.00E+00	)
Fluoranthene	NC	=	(	4.76E-08	÷		)
Fluorene	NC	=	(	3.84E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.25E-08	÷		)
Methylene chloride	5.11E-10	=	(	3.07E-10	÷	6.00E-01	)
Naphthalene	4.15E-06	=	(	1.24E-08	÷	3.00E-03	)
Phenanthrene	NC	=	(	3.97E-08	÷		)
Pyrene	NC	=	(	6.86E-08	÷		)
Xylenes (Total)	5.66E-10	=	(	5.66E-11	÷	1.00E-01	)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 65
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA3
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	5.26E-05	=	2.27E-05	+	2.99E-05	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	1.15E-03	=	1.15E-03	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	5.51E-04	=	2.03E-04	+	3.48E-04	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	1.01E-04	=	3.72E-05	+	6.38E-05	+	NC
Benzo(a)anthracene	5.49E-05	=	2.02E-05	+	3.47E-05	+	1.08E-09	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	6.72E-04	=	2.47E-04	+	4.25E-04	+	1.32E-08	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	7.36E-05	=	2.71E-05	+	4.65E-05	+	1.44E-09	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	5.10E-06	=	1.88E-06	+	3.22E-06	+	1.00E-09	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	7.05E-07	=	2.59E-07	+	4.45E-07	+	1.38E-10	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	3.14E-02	=	3.14E-02	+	NC	+	8.33E-06
Dibenz(a,h)anthracene	1.05E-04	=	3.88E-05	+	6.66E-05	+	2.26E-09	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	5.38E-03	=	5.38E-03	+	NC	+	NC
Ethylbenzene	7.69E-12	=	7.69E-12	+	NC	+	6.18E-16	1.96E-08	=	1.96E-08	+	NC	+	6.92E-13
Fluoranthene	NC	=	NC	+	NC	+	NC	9.15E-03	=	3.37E-03	+	5.78E-03	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	7.37E-04	=	2.71E-04	+	4.66E-04	+	NC
Indeno(1,2,3-c,d)pyrene	4.50E-05	=	1.66E-05	+	2.84E-05	+	8.83E-10	NC	=	NC	+	NC	+	NC
Methylene chloride	6.20E-10	=	6.20E-10	+	NC	+	1.10E-15	1.45E-04	=	1.45E-04	+	NC	+	5.11E-10
Naphthalene	1.51E-10	=	NC	+	NC	+	1.51E-10	1.76E-03	=	1.76E-03	+	NC	+	4.15E-06
Phenanthrene	NC	=	NC	+	NC	+	NC	1.02E-03	=	3.74E-04	+	6.42E-04	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	1.76E-02	=	6.46E-03	+	1.11E-02	+	NC
Xylenes (Total)	NC	=	NC	+	NC	+	NC	8.00E-07	=	8.00E-07	+	NC	+	5.66E-10
Total CR	**9.57E-04**	=	**3.52E-04**	+	**6.05E-04**	+	**2.01E-08**	**Total HI**	**6.90E-02**	=	**5.06E-02**	+	**1.84E-02**	+	**1.25E-05**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 66
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Onsite Indoor Worker: Inhalation of Air – Carcinogenic Effects
EA8
Vertellus

$$EC = \frac{C_{air} \times ET \times EF \times EDt}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{air} mg/m^3	×	ET hours/day	×	EF days/year	×	ED_t year	)	÷	(	AT_c hours	)
Benzene	4.15E-04	=	(	5.09E-03	×	8	×	250	×	25	)	÷	(	613,200	)
Ethylbenzene	6.15E-05	=	(	7.54E-04	×	8	×	250	×	25	)	÷	(	613,200	)
Naphthalene	1.61E-04	=	(	1.97E-03	×	8	×	250	×	25	)	÷	(	613,200	)
Xylenes (Total)	2.28E-04	=	(	2.80E-03	×	8	×	250	×	25	)	÷	(	613,200	)

Notes:
AT_c – Averaging Time for Carcinogens
C_{air} – Air Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
mg/m^3 – milligrams per cubic meters

Table 67
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Onsite Indoor Worker: Inhalation of Air– Carcinogenic Effects
EA8
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	**Inh - Risk**	**=**	**(**	**EC**	**×**	**Unit risk**	**×**	**CF**	**)**
Units	**unitless**			**mg/m^3**		**m^3/ug**		**ug/mg**	
Benzene	3.24E-06	=	(	4.15E-04	×	7.80E-06	×	1000	)
Ethylbenzene	1.54E-07	=	(	6.15E-05	×	2.50E-06	×	1000	)
Naphthalene	5.46E-06	=	(	1.61E-04	×	3.40E-05	×	1000	)
Xylenes (Total)	NC	=	(	2.28E-04	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – cubic meters per microgram
mg/m^3 – milligrams per cubic meters
ug/mg – microgram per milligram

Table 68
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Onsite Indoor Worker: Inhalation of Air– Noncarcinogenic Effects
EA8
Vertellus

$$EC = \frac{C_{air} \times ET \times EF \times EDt}{AT_n}$$

Equation Units	EC mg/m^3	=	(	C_{air} mg/m^3	×	ET hours/day	×	EF days/year	×	ED_t year	)	÷	(	AT_n hours	)
Benzene	1.16E-03	=	(	5.09E-03	×	8	×	250	×	25	)	÷	(	219,000	)
Ethylbenzene	1.72E-04	=	(	7.54E-04	×	8	×	250	×	25	)	÷	(	219,000	)
Naphthalene	4.50E-04	=	(	1.97E-03	×	8	×	250	×	25	)	÷	(	219,000	)
Xylenes (Total)	6.39E-04	=	(	2.80E-03	×	8	×	250	×	25	)	÷	(	219,000	)

Notes:

AT_n – Averaging Time for Noncarcinogens

C_{air} – Air Concentration

EC – Exposure Concentration

ED – Exposure Duration

EF – Exposure Frequency

ET – Exposure Time

mg/m^3 – milligrams per cubic meters

Table 69
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Onsite Indoor Worker: Inhalation of Air – Noncarcinogenic Effects
EA8
Vertellus

Inh - HQ = EC/RfC

Equation	**Inh - HQ**	**=**	**(**	**EC**	**÷**	**RfC**	**)**
Units	**unitless**			**mg/m^3**		**mg/m^3**	
Benzene	3.87E-02	=	(	1.16E-03	÷	3.00E-02	)
Ethylbenzene	1.72E-04	=	(	1.72E-04	÷	1.00E+00	)
Naphthalene	1.50E-01	=	(	4.50E-04	÷	3.00E-03	)
Xylenes (Total)	6.39E-03	=	(	6.39E-04	÷	1.00E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
RfC – Inhalation Reference Concentration

Table 70
Hypothetical Onsite Indoor Worker Risk Summary
Reasonable Maximum Exposure
EA8
Vertellus

	Carcinogenic Risk				Noncarcinogenic Hazard		
Equation	CR	=	Inhalation		HI	=	Inhalation
Units	unitless		unitless		unitless		unitless
Benzene	3.24E-06	=	3.24E-06		3.87E-02	=	3.87E-02
Ethylbenzene	1.54E-07	=	1.54E-07		1.72E-04	=	1.72E-04
Naphthalene	5.46E-06	=	5.46E-06		1.50E-01	=	1.50E-01
Xylenes (Total)	NC	=	NC		6.39E-03	=	6.39E-03
Total CR	**8.85E-06**	=	**9E-06**	**Total HI**	**1.95E-01**	=	**2E-01**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 71
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2,4-Dimethylphenol	NC	=	(	3.05E+00	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	3.30E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	3.15E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	3.20E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzene	3.83E-08	=	(	3.02E+01	×	5.50E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzenethiol	NC	=	(	1.50E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	3.58E-06	=	(	2.12E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	4.73E-05	=	(	2.81E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	4.51E-06	=	(	2.68E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.29E-07	=	(	1.36E+02	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	1.70E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chloroform	2.31E-10	=	(	3.23E-01	×	3.10E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	4.19E-08	=	(	2.49E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	2.39E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	4.68E-06	=	(	2.78E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.90E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Ethylbenzene	6.49E-10	=	(	2.56E+00	×	1.10E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	4.97E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.40E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.82E-06	=	(	1.67E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Methylene bromide	NC	=	(	1.00E+00	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Methylene chloride	1.61E-10	=	(	3.49E+00	×	2.00E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	9.56E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	8.07E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.84E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Resorcinol	NC	=	(	1.50E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	1.38E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 72
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	2.47E-04	=	(	3.05E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-02	)
2-Methylnaphthalene	1.33E-01	=	(	3.30E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	2.54E-03	=	(	3.15E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Acenaphthylene	2.58E-04	=	(	3.20E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	4.88E-03	=	(	3.02E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzenethiol	2.42E-03	=	(	1.50E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.12E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.81E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.68E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.36E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chloroform	5.21E-05	=	(	3.23E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Chrysene	NC	=	(	2.49E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Cyanide, Total	7.72E-04	=	(	2.39E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	2.78E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	1.17E-01	=	(	2.90E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Ethylbenzene	4.13E-05	=	(	2.56E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	8.02E-03	=	(	4.97E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	9.70E-04	=	(	2.40E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.67E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Methylene bromide	1.61E-04	=	(	1.00E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Methylene chloride	9.38E-04	=	(	3.49E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-03	)
Naphthalene	2.57E-03	=	(	9.56E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	4.34E-03	=	(	8.07E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	2.60E-03	=	(	4.84E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Resorcinol	1.21E-05	=	(	1.50E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E+00	)
Xylenes (Total)	1.11E-04	=	(	1.38E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 73
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	3.05E+00	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	3.30E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	3.15E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Acenaphthylene	0.00E+00	= (	3.20E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzene	NC	= (	3.02E+01	×	5.50E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzenethiol	NC	= (	1.50E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzo(a)anthracene	1.39E-06	= (	2.12E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.85E-05	= (	2.81E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.76E-06	= (	2.68E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	8.92E-08	= (	1.36E+02	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	0.00E+00	= (	1.70E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Chloroform	NC	= (	3.23E-01	×	3.10E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	1.63E-08	= (	2.49E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	2.39E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	1.82E-06	= (	2.78E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	2.90E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	2.56E+00	×	1.10E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	4.97E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	2.40E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.10E-06	= (	1.67E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Methylene bromide	NC	= (	1.00E+00	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Methylene chloride	NC	= (	3.49E+00	×	2.00E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	9.56E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	0.00E+00	= (	8.07E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	4.84E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Resorcinol	0.00E+00	= (	1.50E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
Xylenes (Total)	NC	= (	1.38E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 74
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2,4-Dimethylphenol	7.40E-05	=	(	3.05E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	3.30E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	9.91E-04	=	(	3.15E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Acenaphthylene	1.01E-04	=	(	3.20E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	NC	=	(	3.02E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzenethiol	NC	=	(	1.50E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.12E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.81E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.68E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.36E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	1.70E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chloroform	NC	=	(	3.23E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Chrysene	NC	=	(	2.49E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Cyanide, Total	NC	=	(	2.39E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	2.78E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	2.90E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Ethylbenzene	NC	=	(	2.56E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	3.13E-03	=	(	4.97E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	3.78E-04	=	(	2.40E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.67E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Methylene bromide	NC	=	(	1.00E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Methylene chloride	NC	=	(	3.49E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-03	)
Naphthalene	NC	=	(	9.56E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	1.69E-03	=	(	8.07E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	1.02E-03	=	(	4.84E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Resorcinol	3.63E-06	=	(	1.50E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	2.00E+00	)
Xylenes (Total)	NC	=	(	1.38E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	2.00E-01	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events

kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 75
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
2,4-Dimethylphenol	4.98E-09	=	(	3.05E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
2-Methylnaphthalene	5.38E-07	=	(	3.30E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthene	5.13E-07	=	(	3.15E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthylene	5.22E-08	=	(	3.20E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzene	4.93E-08	=	(	3.02E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzenethiol	2.45E-08	=	(	1.50E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)anthracene	3.46E-07	=	(	2.12E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	4.58E-07	=	(	2.81E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	4.37E-07	=	(	2.68E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	2.21E-07	=	(	1.36E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Carbazole	2.77E-08	=	(	1.70E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chloroform	5.26E-10	=	(	3.23E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chrysene	4.06E-07	=	(	2.49E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Cyanide, Total	3.90E-08	=	(	2.39E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	4.53E-08	=	(	2.78E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenzofuran	4.73E-07	=	(	2.90E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Ethylbenzene	4.17E-09	=	(	2.56E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluoranthene	8.10E-07	=	(	4.97E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluorene	3.92E-07	=	(	2.40E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	2.73E-07	=	(	1.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Methylene bromide	1.63E-09	=	(	1.00E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Methylene chloride	5.68E-09	=	(	3.49E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Naphthalene	1.56E-06	=	(	9.56E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Phenanthrene	1.32E-06	=	(	8.07E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Pyrene	7.89E-07	=	(	4.84E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Resorcinol	2.45E-08	=	(	1.50E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Xylenes (Total)	2.24E-08	=	(	1.38E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 76
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
2,4-Dimethylphenol	NC	=	(	4.98E-09	×		×	1000	)
2-Methylnaphthalene	NC	=	(	5.38E-07	×		×	1000	)
Acenaphthene	NC	=	(	5.13E-07	×		×	1000	)
Acenaphthylene	NC	=	(	5.22E-08	×		×	1000	)
Benzene	3.84E-10	=	(	4.93E-08	×	7.80E-06	×	1000	)
Benzenethiol	NC	=	(	2.45E-08	×		×	1000	)
Benzo(a)anthracene	3.81E-08	=	(	3.46E-07	×	1.10E-04	×	1000	)
Benzo(a)pyrene	5.04E-07	=	(	4.58E-07	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	4.81E-08	=	(	4.37E-07	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	2.44E-08	=	(	2.21E-07	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	2.77E-08	×		×	1000	)
Chloroform	1.21E-11	=	(	5.26E-10	×	2.30E-05	×	1000	)
Chrysene	4.47E-09	=	(	4.06E-07	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	3.90E-08	×		×	1000	)
Dibenz(a,h)anthracene	5.44E-08	=	(	4.53E-08	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	4.73E-07	×		×	1000	)
Ethylbenzene	1.04E-11	=	(	4.17E-09	×	2.50E-06	×	1000	)
Fluoranthene	NC	=	(	8.10E-07	×		×	1000	)
Fluorene	NC	=	(	3.92E-07	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.00E-08	=	(	2.73E-07	×	1.10E-04	×	1000	)
Methylene bromide	NC	=	(	1.63E-09	×		×	1000	)
Methylene chloride	5.68E-14	=	(	5.68E-09	×	1.00E-08	×	1000	)
Naphthalene	5.30E-08	=	(	1.56E-06	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	1.32E-06	×		×	1000	)
Pyrene	NC	=	(	7.89E-07	×		×	1000	)
Resorcinol	NC	=	(	2.45E-08	×		×	1000	)
Xylenes (Total)	NC	=	(	2.24E-08	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 77
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Nonarcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_{nc}}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m^3/kg	]	)	÷	(	AT_{nc} hours	)
2,4-Dimethylphenol	3.49E-07	=	(	3.05E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
2-Methylnaphthalene	3.77E-05	=	(	3.30E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthene	3.59E-05	=	(	3.15E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthylene	3.65E-06	=	(	3.20E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzene	3.45E-06	=	(	3.02E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzenethiol	1.71E-06	=	(	1.50E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)anthracene	2.42E-05	=	(	2.12E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	3.21E-05	=	(	2.81E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	3.06E-05	=	(	2.68E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	1.55E-05	=	(	1.36E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Carbazole	1.94E-06	=	(	1.70E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chloroform	3.68E-08	=	(	3.23E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chrysene	2.84E-05	=	(	2.49E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Cyanide, Total	2.73E-06	=	(	2.39E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	3.17E-06	=	(	2.78E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenzofuran	3.31E-05	=	(	2.90E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Ethylbenzene	2.92E-07	=	(	2.56E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluoranthene	5.67E-05	=	(	4.97E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluorene	2.74E-05	=	(	2.40E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	1.91E-05	=	(	1.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Methylene bromide	1.14E-07	=	(	1.00E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Methylene chloride	3.98E-07	=	(	3.49E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Naphthalene	1.09E-04	=	(	9.56E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Phenanthrene	9.21E-05	=	(	8.07E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Pyrene	5.52E-05	=	(	4.84E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Resorcinol	1.71E-06	=	(	1.50E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Xylenes (Total)	1.57E-06	=	(	1.38E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 78
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Combined Surface and Subsurface Soil
EA3
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
2,4-Dimethylphenol	NC	=	(	3.49E-07	÷		)
2-Methylnaphthalene	NC	=	(	3.77E-05	÷		)
Acenaphthene	NC	=	(	3.59E-05	÷		)
Acenaphthylene	NC	=	(	3.65E-06	÷		)
Benzene	1.15E-04	=	(	3.45E-06	÷	3.00E-02	)
Benzenethiol	NC	=	(	1.71E-06	÷		)
Benzo(a)anthracene	NC	=	(	2.42E-05	÷		)
Benzo(a)pyrene	NC	=	(	3.21E-05	÷		)
Benzo(b)fluoranthene	NC	=	(	3.06E-05	÷		)
Benzo(k)fluoranthene	NC	=	(	1.55E-05	÷		)
Carbazole	NC	=	(	1.94E-06	÷		)
Chloroform	3.76E-07	=	(	3.68E-08	÷	9.80E-02	)
Chrysene	NC	=	(	2.84E-05	÷		)
Cyanide, Total	3.41E-03	=	(	2.73E-06	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	3.17E-06	÷		)
Dibenzofuran	NC	=	(	3.31E-05	÷		)
Ethylbenzene	2.92E-07	=	(	2.92E-07	÷	1.00E+00	)
Fluoranthene	NC	=	(	5.67E-05	÷		)
Fluorene	NC	=	(	2.74E-05	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.91E-05	÷		)
Methylene bromide	2.85E-05	=	(	1.14E-07	÷	4.00E-03	)
Methylene chloride	6.63E-07	=	(	3.98E-07	÷	6.00E-01	)
Naphthalene	3.64E-02	=	(	1.09E-04	÷	3.00E-03	)
Phenanthrene	NC	=	(	9.21E-05	÷		)
Pyrene	NC	=	(	5.52E-05	÷		)
Resorcinol	NC	=	(	1.71E-06	÷		)
Xylenes (Total)	1.57E-05	=	(	1.57E-06	÷	1.00E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 79
Construction Worker Risk Summary
Reasonable Maximum Exposure
Combined Surface and Subsurface Soil
EA3
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	3.20E-04	=	2.47E-04	+	7.40E-05	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	1.33E-01	=	1.33E-01	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	3.53E-03	=	2.54E-03	+	9.91E-04	+	NC
Acenaphthylene	NC	=	NC	+	0.00E+00	+	NC	3.59E-04	=	2.58E-04	+	1.01E-04	+	NC
Benzene	3.87E-08	=	3.83E-08	+	NC	+	3.84E-10	4.99E-03	=	4.88E-03	+	NC	+	1.15E-04
Benzenethiol	NC	=	NC	+	NC	+	NC	2.42E-03	=	2.42E-03	+	NC	+	NC
Benzo(a)anthracene	5.01E-06	=	3.58E-06	+	1.39E-06	+	3.81E-08	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	6.63E-05	=	4.73E-05	+	1.85E-05	+	5.04E-07	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	6.32E-06	=	4.51E-06	+	1.76E-06	+	4.81E-08	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	3.42E-07	=	2.29E-07	+	8.92E-08	+	2.44E-08	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	0.00E+00	+	NC	NC	=	NC	+	NC	+	NC
Chloroform	2.43E-10	=	2.31E-10	+	NC	+	1.21E-11	5.25E-05	=	5.21E-05	+	NC	+	3.76E-07
Chrysene	6.27E-08	=	4.19E-08	+	1.63E-08	+	4.47E-09	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	4.18E-03	=	7.72E-04	+	NC	+	3.41E-03
Dibenz(a,h)anthracene	6.55E-06	=	4.68E-06	+	1.82E-06	+	5.44E-08	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	1.17E-01	=	1.17E-01	+	NC	+	NC
Ethylbenzene	6.59E-10	=	6.49E-10	+	NC	+	1.04E-11	4.16E-05	=	4.13E-05	+	NC	+	2.92E-07
Fluoranthene	NC	=	NC	+	NC	+	NC	1.12E-02	=	8.02E-03	+	3.13E-03	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	1.35E-03	=	9.70E-04	+	3.78E-04	+	NC
Indeno(1,2,3-c,d)pyrene	3.95E-06	=	2.82E-06	+	1.10E-06	+	3.00E-08	NC	=	NC	+	NC	+	NC
Methylene bromide	NC	=	NC	+	NC	+	NC	1.90E-04	=	1.61E-04	+	NC	+	2.85E-05
Methylene chloride	1.61E-10	=	1.61E-10	+	NC	+	5.68E-14	9.38E-04	=	9.38E-04	+	NC	+	6.63E-07
Naphthalene	5.30E-08	=	NC	+	NC	+	5.30E-08	3.90E-02	=	2.57E-03	+	NC	+	3.64E-02
Phenanthrene	NC	=	NC	+	0.00E+00	+	NC	6.03E-03	=	4.34E-03	+	1.69E-03	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	3.62E-03	=	2.60E-03	+	1.02E-03	+	NC
Resorcinol	NC	=	NC	+	0.00E+00	+	NC	1.57E-05	=	1.21E-05	+	3.63E-06	+	NC
Xylenes (Total)	NC	=	NC	+	NC	+	NC	1.27E-04	=	1.11E-04	+	NC	+	1.57E-05
Total CR	**8.86E-05**	=	**6.32E-05**	+	**2.46E-05**	+	**7.57E-07**	**Total HI**	**3.29E-01**	=	**2.81E-01**	+	**7.38E-03**	+	**4.00E-02**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 80
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	1.400E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
3&4-Methylphenol	NC	=	(	9.37E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	6.67E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzene	1.21E-08	=	(	9.57E+00	×	5.50E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	3.47E-05	=	(	2.063E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	9.09E-06	=	(	5.40E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	8.93E-07	=	(	5.30E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	4.42E-08	=	(	2.63E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	3.48E-07	=	(	2.065E+03	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	8.80E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.32E-06	=	(	7.87E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	1.000E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	7.17E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.45E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	4.26E-07	=	(	2.53E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	3.665E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	6.08E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Resorcinol	NC	=	(	2.02E+00	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 81
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	5.65E-01	=	(	1.400E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
3&4-Methylphenol	3.03E-03	=	(	9.37E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	5.38E-03	=	(	6.67E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	1.54E-03	=	(	9.57E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.063E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	5.40E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	5.30E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	2.63E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.065E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Cyanide, Total	2.84E-03	=	(	8.80E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	7.87E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	4.04E-01	=	(	1.000E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	1.16E-02	=	(	7.17E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	1.80E-03	=	(	4.45E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.53E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	9.86E-03	=	(	3.665E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	3.27E-03	=	(	6.08E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Resorcinol	1.63E-06	=	(	2.02E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E+00	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 82
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days	
2-Methylnaphthalene	NC	=	(	1.400E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
3&4-Methylphenol	NC	=	(	9.37E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	6.67E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzene	NC	=	(	9.57E+00	×	5.50E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Benzo(a)anthracene	1.35E-05	=	(	2.063E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.55E-06	=	(	5.40E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.48E-07	=	(	5.30E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.72E-08	=	(	2.63E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Chrysene	1.36E-07	=	(	2.065E+03	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	8.80E+01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	5.16E-07	=	(	7.87E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	1.000E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	7.17E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.45E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.66E-07	=	(	2.53E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	3.665E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	6.08E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Resorcinol	NC	=	(	2.02E+00	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	25,550	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 83
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2-Methylnaphthalene	NC	=	(	1.400E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
3&4-Methylphenol	9.08E-04	=	(	9.37E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	2.10E-03	=	(	6.67E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	NC	=	(	9.57E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.063E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	5.40E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	5.30E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	2.63E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.065E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Cyanide, Total	NC	=	(	8.80E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	7.87E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	1.000E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	4.52E-03	=	(	7.17E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	7.01E-04	=	(	4.45E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.53E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	3.665E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	1.28E-03	=	(	6.08E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Resorcinol	4.88E-07	=	(	2.02E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	2.00E+00	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 84
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_c hours	)
2-Methylnaphthalene	2.28E-06	=	(	1.400E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
3&4-Methylphenol	1.53E-07	=	(	9.37E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthene	1.09E-06	=	(	6.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzene	1.56E-08	=	(	9.57E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)anthracene	3.36E-06	=	(	2.063E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	8.80E-08	=	(	5.40E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	8.65E-08	=	(	5.30E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	4.28E-08	=	(	2.63E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chrysene	3.37E-06	=	(	2.065E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Cyanide, Total	1.44E-07	=	(	8.80E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	1.28E-08	=	(	7.87E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenzofuran	1.63E-06	=	(	1.000E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluoranthene	1.17E-06	=	(	7.17E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluorene	7.26E-07	=	(	4.45E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	4.12E-08	=	(	2.53E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Naphthalene	5.98E-06	=	(	3.665E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Pyrene	9.92E-07	=	(	6.08E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Resorcinol	3.29E-09	=	(	2.02E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 85
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Subsurface Soil
EA4
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
2-Methylnaphthalene	NC	=	(	2.28E-06	×		×	1000	)
3&4-Methylphenol	NC	=	(	1.53E-07	×		×	1000	)
Acenaphthene	NC	=	(	1.09E-06	×		×	1000	)
Benzene	1.22E-10	=	(	1.56E-08	×	7.80E-06	×	1000	)
Benzo(a)anthracene	3.70E-07	=	(	3.36E-06	×	1.10E-04	×	1000	)
Benzo(a)pyrene	9.69E-08	=	(	8.80E-08	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	9.51E-09	=	(	8.65E-08	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.71E-09	=	(	4.28E-08	×	1.10E-04	×	1000	)
Chrysene	3.70E-08	=	(	3.37E-06	×	1.10E-05	×	1000	)
Cyanide, Total	NC	=	(	1.44E-07	×		×	1000	)
Dibenz(a,h)anthracene	1.54E-08	=	(	1.28E-08	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.63E-06	×		×	1000	)
Fluoranthene	NC	=	(	1.17E-06	×		×	1000	)
Fluorene	NC	=	(	7.26E-07	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	4.53E-09	=	(	4.12E-08	×	1.10E-04	×	1000	)
Naphthalene	2.03E-07	=	(	5.98E-06	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	9.92E-07	×		×	1000	)
Resorcinol	NC	=	(	3.29E-09	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 86
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Subsurface Soil
EA4
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_{nc}}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_{nc} hours	)
2-Methylnaphthalene	1.60E-04	=	(	1.400E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
3&4-Methylphenol	1.07E-05	=	(	9.37E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthene	7.61E-05	=	(	6.67E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzene	1.09E-06	=	(	9.57E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)anthracene	2.36E-04	=	(	2.063E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	6.16E-06	=	(	5.40E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	6.05E-06	=	(	5.30E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	3.00E-06	=	(	2.63E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chrysene	2.36E-04	=	(	2.065E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Cyanide, Total	1.00E-05	=	(	8.80E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	8.98E-07	=	(	7.87E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenzofuran	1.14E-04	=	(	1.000E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluoranthene	8.19E-05	=	(	7.17E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluorene	5.08E-05	=	(	4.45E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	2.89E-06	=	(	2.53E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Naphthalene	4.18E-04	=	(	3.665E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Pyrene	6.95E-05	=	(	6.08E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Resorcinol	2.30E-07	=	(	2.02E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 87
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Subsurface Soil
EA4
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2-Methylnaphthalene	NC	=	(	1.60E-04	÷		)
3&4-Methylphenol	1.78E-05	=	(	1.07E-05	÷	6.00E-01	)
Acenaphthene	NC	=	(	7.61E-05	÷		)
Benzene	3.64E-05	=	(	1.09E-06	÷	3.00E-02	)
Benzo(a)anthracene	NC	=	(	2.36E-04	÷		)
Benzo(a)pyrene	NC	=	(	6.16E-06	÷		)
Benzo(b)fluoranthene	NC	=	(	6.05E-06	÷		)
Benzo(k)fluoranthene	NC	=	(	3.00E-06	÷		)
Chrysene	NC	=	(	2.36E-04	÷		)
Cyanide, Total	1.26E-02	=	(	1.00E-05	÷	8.00E-04	)
Dibenz(a,h)anthracene	NC	=	(	8.98E-07	÷		)
Dibenzofuran	NC	=	(	1.14E-04	÷		)
Fluoranthene	NC	=	(	8.19E-05	÷		)
Fluorene	NC	=	(	5.08E-05	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.89E-06	÷		)
Naphthalene	1.39E-01	=	(	4.18E-04	÷	3.00E-03	)
Pyrene	NC	=	(	6.95E-05	÷		)
Resorcinol	NC	=	(	2.30E-07	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 88
Construction Worker Risk Summary
Reasonable Maximum Exposure
Subsurface Soil
EA4
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	5.65E-01	=	5.65E-01	+	NC	+	NC
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	3.95E-03	=	3.03E-03	+	9.08E-04	+	1.78E-05
Acenaphthene	NC	=	NC	+	NC	+	NC	7.48E-03	=	5.38E-03	+	2.10E-03	+	NC
Benzene	1.23E-08	=	1.21E-08	+	NC	+	1.22E-10	1.58E-03	=	1.54E-03	+	NC	+	3.64E-05
Benzo(a)anthracene	4.87E-05	=	3.47E-05	+	1.35E-05	+	3.70E-07	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.27E-05	=	9.09E-06	+	3.55E-06	+	9.69E-08	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.25E-06	=	8.93E-07	+	3.48E-07	+	9.51E-09	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	6.62E-08	=	4.42E-08	+	1.72E-08	+	4.71E-09	NC	=	NC	+	NC	+	NC
Chrysene	5.20E-07	=	3.48E-07	+	1.36E-07	+	3.70E-08	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	1.54E-02	=	2.84E-03	+	NC	+	1.26E-02
Dibenz(a,h)anthracene	1.86E-06	=	1.32E-06	+	5.16E-07	+	1.54E-08	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	4.04E-01	=	4.04E-01	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC	1.61E-02	=	1.16E-02	+	4.52E-03	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	2.50E-03	=	1.80E-03	+	7.01E-04	+	NC
Indeno(1,2,3-c,d)pyrene	5.96E-07	=	4.26E-07	+	1.66E-07	+	4.53E-09	NC	=	NC	+	NC	+	NC
Naphthalene	2.03E-07	=	NC	+	NC	+	2.03E-07	1.49E-01	=	9.86E-03	+	NC	+	1.39E-01
Pyrene	NC	=	NC	+	NC	+	NC	4.55E-03	=	3.27E-03	+	1.28E-03	+	NC
Resorcinol	NC	=	NC	+	NC	+	NC	2.11E-06	=	1.63E-06	+	4.88E-07	+	NC
Total CR	**6.59E-05**	=	**4.69E-05**	+	**1.83E-05**	+	**7.42E-07**	**Total HI**	**1.17E+00**	=	**1.01E+00**	+	**9.50E-03**	+	**1.52E-01**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 89
Calculation of EC: Reasonable Maximum Exposure
Future Offsite Indoor Worker: Inhalation of Air – Carcinogenic Effects
EA5
Vertellus

$$EC = \frac{C_{air} \times ET \times EF \times EDt}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{air} mg/m^3	×	ET hours/day	×	EF days/year	×	ED_t year	)	÷	(	AT_c hours	)
Benzene	2.06E-05	=	(	2.53E-04	×	8	×	250	×	25	)	÷	(	613,200	)
Ethylbenzene	2.19E-06	=	(	2.68E-05	×	8	×	250	×	25	)	÷	(	613,200	)
Naphthalene	2.62E-04	=	(	3.21E-03	×	8	×	250	×	25	)	÷	(	613,200	)

Notes:
AT_c – Averaging Time for Carcinogens
C_{air} – Air Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
mg/m^3 – milligrams per cubic meters

Table 90
Risk Calculations: Reasonable Maximum Exposure
Future Offsite Indoor Worker: Inhalation of Air– Carcinogenic Effects
EA5
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzene	1.61E-07	=	(	2.06E-05	×	7.80E-06	×	1000	)
Ethylbenzene	5.46E-09	=	(	2.19E-06	×	2.50E-06	×	1000	)
Naphthalene	8.90E-06	=	(	2.62E-04	×	3.40E-05	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – cubic meters per microgram
mg/m^3 – milligrams per cubic meters
ug/mg – microgram per milligram

Table 91
Calculation of EC: Reasonable Maximum Exposure
Future Offsite Indoor Worker: Inhalation of Air– Noncarcinogenic Effects
EA5
Vertellus

$$EC = \frac{C_{air} \times ET \times EF \times EDt}{AT_n}$$

Equation Units	EC mg/m^3	=	(	C_{air} mg/m^3	×	ET hours/day	×	EF days/year	×	ED_t year	)	÷	(	AT_n hours	)
Benzene	5.78E-05	=	(	2.53E-04	×	8	×	250	×	25	)	÷	(	219,000	)
Ethylbenzene	6.12E-06	=	(	2.68E-05	×	8	×	250	×	25	)	÷	(	219,000	)
Naphthalene	7.33E-04	=	(	3.21E-03	×	8	×	250	×	25	)	÷	(	219,000	)

Notes:

AT_n – Averaging Time for Noncarcinogens

C_{air} – Air Concentration

EC – Exposure Concentration

ED – Exposure Duration

EF – Exposure Frequency

ET – Exposure Time

mg/m^3 – milligrams per cubic meters

Table 92
Risk Calculations: Reasonable Maximum Exposure
Future Offsite Indoor Worker: Inhalation of Air – Noncarcinogenic Effects
EA5
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzene	1.93E-03	=	(	5.78E-05	÷	3.00E-02	)
Ethylbenzene	6.12E-06	=	(	6.12E-06	÷	1.00E+00	)
Naphthalene	2.44E-01	=	(	7.33E-04	÷	3.00E-03	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
RfC – Inhalation Reference Concentration

Table 93
Future Offsite Indoor Worker Risk Summary
Reasonable Maximum Exposure
EA5
Vertellus

	Carcinogenic Risk				Noncarcinogenic Hazard		
Equation	CR	=	Inhalation		HI	=	Inhalation
Units	unitless		unitless		unitless		unitless
Benzene	1.61E-07	=	1.61E-07		1.93E-03	=	1.93E-03
Ethylbenzene	5.46E-09	=	5.46E-09		6.12E-06	=	6.12E-06
Naphthalene	8.90E-06	=	8.90E-06		2.44E-01	=	2.44E-01
Total CR	**9.07E-06**	=	**1.6E-07**	**Total HI**	**2.46E-01**	=	**1.9E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 94
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
3&4-Methylphenol	NC	=	(	1.32E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	1.960E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	1.26E-05	=	(	7.47E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.87E-05	=	(	1.11E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	2.32E-06	=	(	1.38E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	8.41E-08	=	(	4.99E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	1.42E-07	=	(	8.44E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.37E-07	=	(	8.17E-01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	4.170E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	9.87E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	8.01E-07	=	(	4.76E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.470E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	7.810E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.470E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 95
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
3&4-Methylphenol	4.26E-03	=	(	1.32E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	1.58E-02	=	(	1.960E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Benzo(a)anthracene	NC	=	(	7.47E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.11E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	1.38E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	4.99E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	8.44E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	8.17E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Fluoranthene	6.73E-02	=	(	4.170E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	3.98E-03	=	(	9.87E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.76E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	3.96E-03	=	(	1.470E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	4.20E-02	=	(	7.810E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	2.41E-02	=	(	4.470E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 96
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
3&4-Methylphenol	NC	= (	1.32E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	1.960E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	4.91E-06	= (	7.47E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	7.29E-06	= (	1.11E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	9.03E-07	= (	1.38E+02	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	3.28E-08	= (	4.99E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Chrysene	5.54E-08	= (	8.44E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	5.36E-08	= (	8.17E-01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	4.170E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	9.87E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	3.12E-07	= (	4.76E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	1.470E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	7.810E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	4.470E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 97
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
3&4-Methylphenol	1.28E-03	=	(	1.32E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	5.00E-02	)
Acenaphthene	6.17E-03	=	(	1.960E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Benzo(a)anthracene	NC	=	(	7.47E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.11E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	1.38E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	4.99E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	8.44E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	8.17E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Fluoranthene	2.63E-02	=	(	4.170E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	1.55E-03	=	(	9.87E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.76E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	1.470E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	1.64E-02	=	(	7.810E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	9.38E-03	=	(	4.470E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 98
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_c hours	)
3&4-Methylphenol	2.15E-07	=	(	1.32E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Acenaphthene	3.20E-06	=	(	1.960E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)anthracene	1.22E-06	=	(	7.47E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	1.81E-07	=	(	1.11E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	2.24E-07	=	(	1.38E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	8.14E-08	=	(	4.99E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chrysene	1.38E-06	=	(	8.44E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	1.33E-09	=	(	8.17E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluoranthene	6.80E-06	=	(	4.170E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Fluorene	1.61E-06	=	(	9.87E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	7.76E-08	=	(	4.76E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Naphthalene	2.40E-06	=	(	1.470E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Phenanthrene	1.27E-05	=	(	7.810E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Pyrene	7.29E-06	=	(	4.470E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 99
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Subsurface Soil
EA5
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
3&4-Methylphenol	NC	=	(	2.15E-07	×		×	1000	)
Acenaphthene	NC	=	(	3.20E-06	×		×	1000	)
Benzo(a)anthracene	1.34E-07	=	(	1.22E-06	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.99E-07	=	(	1.81E-07	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.47E-08	=	(	2.24E-07	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	8.96E-09	=	(	8.14E-08	×	1.10E-04	×	1000	)
Chrysene	1.51E-08	=	(	1.38E-06	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.60E-09	=	(	1.33E-09	×	1.20E-03	×	1000	)
Fluoranthene	NC	=	(	6.80E-06	×		×	1000	)
Fluorene	NC	=	(	1.61E-06	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	8.53E-09	=	(	7.76E-08	×	1.10E-04	×	1000	)
Naphthalene	8.15E-08	=	(	2.40E-06	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	1.27E-05	×		×	1000	)
Pyrene	NC	=	(	7.29E-06	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 100
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Subsurface Soil
EA5
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{Atnc}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
3&4-Methylphenol	1.51E-05	=	(	1.32E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Acenaphthene	2.24E-04	=	(	1.960E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)anthracene	8.53E-05	=	(	7.47E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	1.27E-05	=	(	1.11E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	1.57E-05	=	(	1.38E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	5.70E-06	=	(	4.99E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chrysene	9.63E-05	=	(	8.44E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	9.32E-08	=	(	8.17E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluoranthene	4.76E-04	=	(	4.170E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Fluorene	1.13E-04	=	(	9.87E+02	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	5.43E-06	=	(	4.76E+01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Naphthalene	1.68E-04	=	(	1.470E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Phenanthrene	8.92E-04	=	(	7.810E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Pyrene	5.10E-04	=	(	4.470E+03	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 101
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Subsurface Soil
EA5
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
3&4-Methylphenol	2.51E-05	=	(	1.51E-05	÷	6.00E-01	)
Acenaphthene	NC	=	(	2.24E-04	÷		)
Benzo(a)anthracene	NC	=	(	8.53E-05	÷		)
Benzo(a)pyrene	NC	=	(	1.27E-05	÷		)
Benzo(b)fluoranthene	NC	=	(	1.57E-05	÷		)
Benzo(k)fluoranthene	NC	=	(	5.70E-06	÷		)
Chrysene	NC	=	(	9.63E-05	÷		)
Dibenz(a,h)anthracene	NC	=	(	9.32E-08	÷		)
Fluoranthene	NC	=	(	4.76E-04	÷		)
Fluorene	NC	=	(	1.13E-04	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	5.43E-06	÷		)
Naphthalene	5.59E-02	=	(	1.68E-04	÷	3.00E-03	)
Phenanthrene	NC	=	(	8.92E-04	÷		)
Pyrene	NC	=	(	5.10E-04	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 102
Construction Worker Risk Summary
Reasonable Maximum Exposure
Subsurface Soil
EA5
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	5.56E-03	=	4.26E-03	+	1.28E-03	+	2.51E-05
Acenaphthene	NC	=	NC	+	NC	+	NC	2.20E-02	=	1.58E-02	+	6.17E-03	+	NC
Benzo(a)anthracene	1.76E-05	=	1.26E-05	+	4.91E-06	+	1.34E-07	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	2.62E-05	=	1.87E-05	+	7.29E-06	+	1.99E-07	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	3.24E-06	=	2.32E-06	+	9.03E-07	+	2.47E-08	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	1.26E-07	=	8.41E-08	+	3.28E-08	+	8.96E-09	NC	=	NC	+	NC	+	NC
Chrysene	2.13E-07	=	1.42E-07	+	5.54E-08	+	1.51E-08	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	1.93E-07	=	1.37E-07	+	5.36E-08	+	1.60E-09	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC	9.36E-02	=	6.73E-02	+	2.63E-02	+	NC
Fluorene	NC	=	NC	+	NC	+	NC	5.54E-03	=	3.98E-03	+	1.55E-03	+	NC
Indeno(1,2,3-c,d)pyrene	1.12E-06	=	8.01E-07	+	3.12E-07	+	8.53E-09	NC	=	NC	+	NC	+	NC
Naphthalene	8.15E-08	=	NC	+	NC	+	8.15E-08	5.99E-02	=	3.96E-03	+	NC	+	5.59E-02
Phenanthrene	NC	=	NC	+	NC	+	NC	5.84E-02	=	4.20E-02	+	1.64E-02	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	3.34E-02	=	2.41E-02	+	9.38E-03	+	NC
Total CR	**4.88E-05**	=	**3.48E-05**	+	**1.36E-05**	+	**4.74E-07**	**Total HI**	**2.78E-01**	=	**1.61E-01**	+	**6.10E-02**	+	**5.60E-02**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 103
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Carcinogenic Effects
Groundwater
EA5
Vertellus

$$\text{Ing-Risk} = \frac{C_{water} \times SF_o \times ET \times EF \times ED \times GWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{water}	×	SF_o	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		hours/day		days/year		years		L/hour				kg		days	
2,4-Dimethylphenol	NC	=	(	1.90E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	5.20E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylphenol	NC	=	(	1.50E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
3&4-Methylphenol	NC	=	(	1.30E+01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	6.10E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acenaphthylene	NC	=	(	6.50E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Anthracene	NC	=	(	1.70E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzene	3.94E-10	=	(	5.70E-02	×	5.5E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	9.00E-11	=	(	9.80E-04	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.74E-10	=	(	1.90E-04	×	7.3E+00	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.21E-11	=	(	3.50E-04	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.56E-13	=	(	1.70E-05	×	7.3E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Chrysene	5.88E-13	=	(	6.40E-04	×	7.3E-03	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	3.80E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.01E-11	=	(	1.10E-05	×	7.3E+00	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.30E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Ethylbenzene	8.30E-12	=	(	6.00E-03	×	1.1E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.10E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	7.80E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	2.10E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Phenol	NC	=	(	2.60E+01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	1.30E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	3.47E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate

Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 104
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA5
Vertellus

$$\text{Ing - HQ} = \frac{C_{water} \times ET \times EF \times ED \times GWIR}{BW \times AT_n \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_n	×	RfD_o	)
Units	unitless			mg/L		hours/day		days/year		years		L/hour				kg		days		mg/kg-day	
2,4-Dimethylphenol	3.35E-04	=	(	1.90E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
2-Methylnaphthalene	1.14E-03	=	(	5.20E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
2-Methylphenol	2.64E-04	=	(	1.50E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
3&4-Methylphenol	2.29E-03	=	(	1.30E+01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Acenaphthene	2.69E-05	=	(	6.10E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)
Acenaphthylene	2.86E-06	=	(	6.50E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)
Anthracene	4.99E-06	=	(	1.70E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Benzene	5.02E-05	=	(	5.70E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	9.80E-04	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.90E-04	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	3.50E-04	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.70E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	6.40E-04	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Cyanide, Total	6.69E-05	=	(	3.80E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Dibenzofuran	5.06E-04	=	(	2.30E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
Ethylbenzene	5.28E-07	=	(	6.00E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-01	)
Fluorene	4.62E-06	=	(	2.10E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-01	)
Naphthalene	1.14E-04	=	(	7.80E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	6.0E-01	)
Phenanthrene	6.16E-06	=	(	2.10E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Phenol	7.63E-04	=	(	2.60E+01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Pyrene	3.82E-07	=	(	1.30E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Xylenes (Total)	1.53E-06	=	(	3.47E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)

Notes:

AT_n – Averaging Time for Noncarcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
L/hour – liters per hour
mg/kg-day – milligram per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 105
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Carcinogenic Effects
Groundwater
EA5
Vertellus

$$\text{Derm - Risk} = \frac{C_{water} \times SF_{abs} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{water}	×	SF_{abs}	×	ET	×	EF	×	ED	×	SA	×	PC	)	÷	(	CF	×	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		hours/day		days/year		years		cm²		cm/hour				cm³/L		kg		days	
2,4-Dimethylphenol	NC	=	(	1.90E+00	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	5.20E-01	×		×	1	x	45	×	1	×	3,300	×	9.17E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
2-Methylphenol	NC	=	(	1.50E+00	×		×	1	x	45	×	1	×	3,300	×	7.70E-03	)	÷	(	1.00E+03	×	70	×	25,550	)
3&4-Methylphenol	NC	=	(	1.30E+01	×		×	1	x	45	×	1	×	3,300	×	7.80E-03	)	÷	(	1.00E+03	×	70	×	25,550	)
Acenaphthene	NC	=	(	6.10E-01	×		×	1	x	45	×	1	×	3,300	×	8.60E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Acenaphthylene	NC	=	(	6.50E-02	×		×	1	x	45	×	1	×	3,300	×	9.11E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Anthracene	NC	=	(	1.70E-01	×		×	1	x	45	×	1	×	3,300	×	1.42E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Benzene	3.90E-09	=	(	5.70E-02	×	5.5E-02	×	1	x	45	×	1	×	3,300	×	1.50E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Benzo(a)anthracene	2.79E-08	=	(	9.80E-04	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Benzo(a)pyrene	8.06E-08	=	(	1.90E-04	×	7.3E+00	×	1	x	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Benzo(b)fluoranthene	1.49E-08	=	(	3.50E-04	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Benzo(k)fluoranthene	7.12E-11	=	(	1.70E-05	×	7.3E-02	×	1	x	45	×	1	×	3,300	×	6.91E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Chrysene	1.82E-10	=	(	6.40E-04	×	7.3E-03	×	1	x	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Cyanide, Total	NC	=	(	3.80E-01	×		×	1	x	45	×	1	×	3,300	×	1.00E-03	)	÷	(	1.00E+03	×	70	×	25,550	)
Dibenz(a,h)anthracene	1.00E-08	=	(	1.10E-05	×	7.3E+00	×	1	x	45	×	1	×	3,300	×	1.50E+00	)	÷	(	1.00E+03	×	70	×	25,550	)
Dibenzofuran	NC	=	(	2.30E-01	×		×	1	x	45	×	1	×	3,300	×	9.75E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Ethylbenzene	2.69E-10	=	(	6.00E-03	×	1.1E-02	×	1	x	45	×	1	×	3,300	×	4.90E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Fluorene	NC	=	(	2.10E-01	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Naphthalene	NC	=	(	7.80E+00	×		×	1	x	45	×	1	×	3,300	×	4.70E-02	)	÷	(	1.00E+03	×	70	×	25,550	)
Phenanthrene	NC	=	(	2.10E-01	×		×	1	x	45	×	1	×	3,300	×	1.40E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Phenol	NC	=	(	2.60E+01	×		×	1	x	45	×	1	×	3,300	×	4.30E-03	)	÷	(	1.00E+03	×	70	×	25,550	)
Pyrene	NC	=	(	1.30E-02	×		×	1	x	45	×	1	×	3,300	×	2.01E-01	)	÷	(	1.00E+03	×	70	×	25,550	)
Xylenes (Total)	NC	=	(	3.47E-02	×		×	1	x	45	×	1	×	3,300	×	5.00E-02	)	÷	(	1.00E+03	×	70	×	25,550	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 106
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA5
Vertellus

$$\text{Derm - HQ} = \frac{C_{water} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	SA	×	PC	)	÷	(	CF	×	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		hours/day		days/year		years		cm²		cm/hour				cm³/L		kg		days		mg/kg-day	
2,4-Dimethylphenol	2.43E-02	=	(	1.90E+00	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
2-Methylnaphthalene	6.93E-02	=	(	5.20E-01	×	1	×	45	×	1	×	3,300	×	9.17E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
2-Methylphenol	1.34E-03	=	(	1.50E+00	×	1	×	45	×	1	×	3,300	×	7.70E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
3&4-Methylphenol	1.18E-02	=	(	1.30E+01	×	1	×	45	×	1	×	3,300	×	7.80E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Acenaphthene	1.52E-03	=	(	6.10E-01	×	1	×	45	×	1	×	3,300	×	8.60E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)
Acenaphthylene	1.72E-04	=	(	6.50E-02	×	1	×	45	×	1	×	3,300	×	9.11E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)
Anthracene	4.68E-04	=	(	1.70E-01	×	1	×	45	×	1	×	3,300	×	1.42E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Benzene	4.97E-04	=	(	5.70E-02	×	1	×	45	×	1	×	3,300	×	1.50E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	9.80E-04	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.90E-04	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	3.50E-04	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.70E-05	×	1	×	45	×	1	×	3,300	×	6.91E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Chrysene	NC	=	(	6.40E-04	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Cyanide, Total	4.42E-05	=	(	3.80E-01	×	1	×	45	×	1	×	3,300	×	1.00E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	3,300	×	1.50E+00	)	÷	(	1.00E+03	×	70	×	365	×		)
Dibenzofuran	3.26E-02	=	(	2.30E-01	×	1	×	45	×	1	×	3,300	×	9.75E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
Ethylbenzene	1.71E-05	=	(	6.00E-03	×	1	×	45	×	1	×	3,300	×	4.90E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-01	)
Fluorene	3.36E-04	=	(	2.10E-01	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-01	)
Naphthalene	3.55E-03	=	(	7.80E+00	×	1	×	45	×	1	×	3,300	×	4.70E-02	)	÷	(	1.00E+03	×	70	×	365	×	6.0E-01	)
Phenanthrene	5.70E-04	=	(	2.10E-01	×	1	×	45	×	1	×	3,300	×	1.40E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Phenol	2.17E-03	=	(	2.60E+01	×	1	×	45	×	1	×	3,300	×	4.30E-03	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Pyrene	5.06E-05	=	(	1.30E-02	×	1	×	45	×	1	×	3,300	×	2.01E-01	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Xylenes (Total)	5.04E-05	=	(	3.47E-02	×	1	×	45	×	1	×	3,300	×	5.00E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SA – Skin Surface Area

Table 107
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA5
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_c}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_c hours	)
2,4-Dimethylphenol	NC	=	(	1.90E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
2-Methylnaphthalene	8.79E-07	=	(	5.20E-01	×	1	×	45	×	1	×	2.30E-02	]	)	÷	(	613,200	)
2-Methylphenol	NC	=	(	1.50E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
3&4-Methylphenol	NC	=	(	1.30E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Acenaphthene	NC	=	(	6.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Acenaphthylene	NC	=	(	6.50E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Anthracene	NC	=	(	1.70E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzene	1.37E-07	=	(	5.70E-02	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	613,200	)
Benzo(a)anthracene	NC	=	(	9.80E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(a)pyrene	NC	=	(	1.90E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	NC	=	(	3.50E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	NC	=	(	1.70E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Chrysene	NC	=	(	6.40E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Cyanide, Total	NC	=	(	3.80E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Dibenzofuran	NC	=	(	2.30E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Ethylbenzene	1.27E-08	=	(	6.00E-03	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	613,200	)
Fluorene	NC	=	(	2.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Naphthalene	1.36E-05	=	(	7.80E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	613,200	)
Phenanthrene	NC	=	(	2.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Phenol	NC	=	(	2.60E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Pyrene	NC	=	(	1.30E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Xylenes (Total)	8.13E-08	=	(	3.47E-02	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m^3 – liters per cubic meter
mg/L – milligrams per liter
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 108
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA5
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	NC	×		×	1000	)
2-Methylnaphthalene	NC	=	(	8.79E-07	×		×	1000	)
2-Methylphenol	NC	=	(	NC	×		×	1000	)
3&4-Methylphenol	NC	=	(	NC	×		×	1000	)
Acenaphthene	NC	=	(	NC	×		×	1000	)
Acenaphthylene	NC	=	(	NC	×		×	1000	)
Anthracene	NC	=	(	NC	×		×	1000	)
Benzene	1.07E-09	=	(	1.37E-07	×	7.8E-06	×	1000	)
Benzo(a)anthracene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(a)pyrene	NC	=	(	NC	×	1.1E-03	×	1000	)
Benzo(b)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(k)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Chrysene	NC	=	(	NC	×	1.1E-05	×	1000	)
Cyanide, Total	NC	=	(	NC	×		×	1000	)
Dibenz(a,h)anthracene	NC	=	(	NC	×	1.2E-03	×	1000	)
Dibenzofuran	NC	=	(	NC	×		×	1000	)
Ethylbenzene	3.18E-11	=	(	1.27E-08	×	2.5E-06	×	1000	)
Fluorene	NC	=	(	NC	×		×	1000	)
Naphthalene	4.61E-07	=	(	1.36E-05	×	3.4E-05	×	1000	)
Phenanthrene	NC	=	(	NC	×		×	1000	)
Phenol	NC	=	(	NC	×		×	1000	)
Pyrene	NC	=	(	NC	×		×	1000	)
Xylenes (Total)	NC	=	(	8.13E-08	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 109
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA5
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_n}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_n hours	)
2,4-Dimethylphenol	NC	=	(	1.90E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
2-Methylnaphthalene	6.15E-05	=	(	5.20E-01	×	1	×	45	×	1	×	2.30E-02	]	)	÷	(	8,760	)
2-Methylphenol	NC	=	(	1.50E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
3&4-Methylphenol	NC	=	(	1.30E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Acenaphthene	NC	=	(	6.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Acenaphthylene	NC	=	(	6.50E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Anthracene	NC	=	(	1.70E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzene	9.61E-06	=	(	5.70E-02	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	8,760	)
Benzo(a)anthracene	NC	=	(	9.80E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(a)pyrene	NC	=	(	1.90E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	NC	=	(	3.50E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	NC	=	(	1.70E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Chrysene	NC	=	(	6.40E-04	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Cyanide, Total	NC	=	(	3.80E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Dibenzofuran	NC	=	(	2.30E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Ethylbenzene	8.90E-07	=	(	6.00E-03	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	8,760	)
Fluorene	NC	=	(	2.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Naphthalene	9.50E-04	=	(	7.80E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	8,760	)
Phenanthrene	NC	=	(	2.10E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Phenol	NC	=	(	2.60E+01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Pyrene	NC	=	(	1.30E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Xylenes (Total)	5.69E-06	=	(	3.47E-02	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	8,760	)

Notes:

AT_n – Averaging Time for Noncarcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m^3 – liters per cubic meter
mg/L – milligrams per liter
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 110
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA5
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2,4-Dimethylphenol	NC	=	(	NC	÷		)
2-Methylnaphthalene	NC	=	(	6.15E-05	÷		)
2-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
3&4-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
Acenaphthene	NC	=	(	NC	÷		)
Acenaphthylene	NC	=	(	NC	÷		)
Anthracene	NC	=	(	NC	÷		)
Benzene	3.20E-04	=	(	9.61E-06	÷	3.0E-02	)
Benzo(a)anthracene	NC	=	(	NC	÷		)
Benzo(a)pyrene	NC	=	(	NC	÷		)
Benzo(b)fluoranthene	NC	=	(	NC	÷		)
Benzo(k)fluoranthene	NC	=	(	NC	÷		)
Chrysene	NC	=	(	NC	÷		)
Cyanide, Total	NC	=	(	NC	÷	8.0E-04	)
Dibenz(a,h)anthracene	NC	=	(	NC			)
Dibenzofuran	NC	=	(	NC			)
Ethylbenzene	8.90E-07	=	(	8.90E-07		1.0E+00	)
Fluorene	NC	=	(				)
Naphthalene	3.17E-01	=	(	9.50E-04		3.0E-03	)
Phenanthrene	NC	=	(	NC			)
Phenol	NC	=	(	NC		2.0E-01	)
Pyrene	NC	=	(	NC			)
Xylenes (Total)	5.69E-05	=	(	5.69E-06		1.0E-01	)

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EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 111
Hypothetical Future Construction Worker: Summary
Reasonable Maximum Exposure
Groundwater
EA5
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	2.46E-02	=	3.35E-04	+	2.43E-02	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	7.04E-02	=	1.14E-03	+	6.93E-02	+	NC
2-Methylphenol	NC	=	NC	+	NC	+	NC	1.61E-03	=	2.64E-04	+	1.34E-03	+	NC
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	1.41E-02	=	2.29E-03	+	1.18E-02	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	1.55E-03	=	2.69E-05	+	1.52E-03	+	NC
Acenaphthylene	NC	=	NC	+	NC	+	NC	1.75E-04	=	2.86E-06	+	1.72E-04	+	NC
Anthracene	NC	=	NC	+	NC	+	NC	4.73E-04	=	4.99E-06	+	4.68E-04	+	NC
Benzene	5.37E-09	=	3.94E-10	+	3.90E-09	+	1.07E-09	8.67E-04	=	5.02E-05	+	4.97E-04	+	3.20E-04
Benzo(a)anthracene	2.80E-08	=	9.00E-11	+	2.79E-08	+	NC	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	8.08E-08	=	1.74E-10	+	8.06E-08	+	NC	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.49E-08	=	3.21E-11	+	1.49E-08	+	NC	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	7.14E-11	=	1.56E-13	+	7.12E-11	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	1.83E-10	=	5.88E-13	+	1.82E-10	+	NC	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	1.11E-04	=	6.69E-05	+	4.42E-05	+	NC
Dibenz(a,h)anthracene	1.00E-08	=	1.01E-11	+	1.00E-08	+	NC	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	3.31E-02	=	5.06E-04	+	3.26E-02	+	NC
Ethylbenzene	3.09E-10	=	8.30E-12	+	2.69E-10	+	3.18E-11	1.85E-05	=	5.28E-07	+	1.71E-05	+	8.90E-07
Fluorene	NC	=	NC	+	NC	+	NC	3.40E-04	=	4.62E-06	+	3.36E-04	+	NC
Naphthalene	4.61E-07	=	NC	+	NC	+	4.61E-07	3.20E-01	=	1.14E-04	+	3.55E-03	+	3.17E-01
Phenanthrene	NC	=	NC	+	NC	+	NC	5.76E-04	=	6.16E-06	+	5.70E-04	+	NC
Phenol	NC	=	NC	+	NC	+	NC	2.93E-03	=	7.63E-04	+	2.17E-03	+	NC
Pyrene	NC	=	NC	+	NC	+	NC	5.10E-05	=	3.82E-07	+	5.06E-05	+	NC
Xylenes (Total)	NC	=	NC	+	NC	+	NC	1.09E-04	=	1.53E-06	+	5.04E-05	+	5.69E-05
Total CR	**6.01E-07**	=	**7E-10**	+	**1E-07**	+	**5E-07**	**Total HI**	**4.71E-01**	=	**6E-03**	+	**1E-01**	+	**3E-01**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 112
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	8.20E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Acenaphthene	NC	=	(	5.50E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)anthracene	1.55E-05	=	(	2.400E+03	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	1.42E-04	=	(	2.200E+03	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	1.61E-05	=	(	2.500E+03	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(g,h,i)perylene	0.00E+00	=	(	1.100E+03	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	6.45E-07	=	(	1.000E+03	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	0.00E+00	=	(	6.50E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	1.61E-07	=	(	2.500E+03	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	2.39E-05	=	(	3.70E+02	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenzofuran	NC	=	(	2.00E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluoranthene	NC	=	(	5.300E+03	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluorene	NC	=	(	4.70E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.09E-06	=	(	1.100E+03	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	4.50E+02	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Phenanthrene	0.00E+00	=	(	4.400E+03	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	4.800E+03	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 113
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	1.06E-03	=	(	8.20E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	4.72E-04	=	(	5.50E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(g,h,i)perylene	1.89E-03	=	(	1.100E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenzofuran	1.03E-02	=	(	2.00E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-03	)
Fluoranthene	6.83E-03	=	(	5.300E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	6.05E-04	=	(	4.70E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	1.16E-03	=	(	4.50E+02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	7.56E-04	=	(	4.400E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	8.24E-03	=	(	4.800E+03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 114
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2-Methylnaphthalene	NC	= (	8.20E+01	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Acenaphthene	NC	= (	5.50E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)anthracene	3.62E-05	= (	2.400E+03	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	3.32E-04	= (	2.200E+03	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	3.77E-05	= (	2.500E+03	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(g,h,i)perylene	NC	= (	1.100E+03	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	1.51E-06	= (	1.000E+03	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	6.50E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	3.77E-07	= (	2.500E+03	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	5.59E-05	= (	3.70E+02	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenzofuran	NC	= (	2.00E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Fluoranthene	NC	= (	5.300E+03	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Fluorene	NC	= (	4.70E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.66E-05	= (	1.100E+03	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Naphthalene	NC	= (	4.50E+02	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Phenanthrene	NC	= (	4.400E+03	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Pyrene	NC	= (	4.800E+03	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 115
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2-Methylnaphthalene	NC	=	(	8.20E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	4.00E-03	)
Acenaphthene	1.11E-03	=	(	5.50E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(g,h,i)perylene	4.42E-03	=	(	1.100E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenzofuran	NC	=	(	2.00E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-03	)
Fluoranthene	1.60E-02	=	(	5.300E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Fluorene	1.42E-03	=	(	4.70E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	NC	=	(	4.50E+02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-02	)
Phenanthrene	1.77E-03	=	(	4.400E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-01	)
Pyrene	1.93E-02	=	(	4.800E+03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 116
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	2.53E-10	=	(	8.20E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	1.70E-09	=	(	5.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	7.40E-09	=	(	2.400E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	6.78E-09	=	(	2.200E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	7.71E-09	=	(	2.500E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(g,h,i)perylene	3.39E-09	=	(	1.100E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	3.08E-09	=	(	1.000E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	2.00E-09	=	(	6.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	7.71E-09	=	(	2.500E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.14E-09	=	(	3.70E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	6.17E-10	=	(	2.00E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	1.63E-08	=	(	5.300E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	1.45E-09	=	(	4.70E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	3.39E-09	=	(	1.100E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	1.39E-09	=	(	4.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	1.36E-08	=	(	4.400E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.48E-08	=	(	4.800E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 117
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2-Methylnaphthalene	NC	=	(	2.53E-10	×		×	1000	)
Acenaphthene	NC	=	(	1.70E-09	×		×	1000	)
Benzo(a)anthracene	8.14E-10	=	(	7.40E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	7.46E-09	=	(	6.78E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	8.48E-10	=	(	7.71E-09	×	1.10E-04	×	1000	)
Benzo(g,h,i)perylene	NC	=	(	3.39E-09	×		×	1000	)
Benzo(k)fluoranthene	3.39E-10	=	(	3.08E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	2.00E-09	×		×	1000	)
Chrysene	8.48E-11	=	(	7.71E-09	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.37E-09	=	(	1.14E-09	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	6.17E-10	×		×	1000	)
Fluoranthene	NC	=	(	1.63E-08	×		×	1000	)
Fluorene	NC	=	(	1.45E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.73E-10	=	(	3.39E-09	×	1.10E-04	×	1000	)
Naphthalene	4.72E-11	=	(	1.39E-09	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	1.36E-08	×		×	1000	)
Pyrene	NC	=	(	1.48E-08	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 118
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
2-Methylnaphthalene	1.48E-09	=	(	8.20E+01	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Acenaphthene	9.89E-09	=	(	5.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)anthracene	4.32E-08	=	(	2.400E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	3.96E-08	=	(	2.200E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	4.50E-08	=	(	2.500E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(g,h,i)perylene	1.98E-08	=	(	1.100E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	1.80E-08	=	(	1.000E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	1.17E-08	=	(	6.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	4.50E-08	=	(	2.500E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	6.66E-09	=	(	3.70E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenzofuran	3.60E-09	=	(	2.00E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Fluoranthene	9.53E-08	=	(	5.300E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Fluorene	8.45E-09	=	(	4.70E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	1.98E-08	=	(	1.100E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Naphthalene	8.09E-09	=	(	4.50E+02	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Phenanthrene	7.91E-08	=	(	4.400E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Pyrene	8.63E-08	=	(	4.800E+03	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 119
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
2-Methylnaphthalene	NC	=	(	1.48E-09	÷		)
Acenaphthene	NC	=	(	9.89E-09	÷		)
Benzo(a)anthracene	NC	=	(	4.32E-08	÷		)
Benzo(a)pyrene	NC	=	(	3.96E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	4.50E-08	÷		)
Benzo(g,h,i)perylene	NC	=	(	1.98E-08	÷		)
Benzo(k)fluoranthene	NC	=	(	1.80E-08	÷		)
Carbazole	NC	=	(	1.17E-08	÷		)
Chrysene	NC	=	(	4.50E-08	÷		)
Dibenz(a,h)anthracene	NC	=	(	6.66E-09	÷		)
Dibenzofuran	NC	=	(	3.60E-09	÷		)
Fluoranthene	NC	=	(	9.53E-08	÷		)
Fluorene	NC	=	(	8.45E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.98E-08	÷		)
Naphthalene	2.70E-06	=	(	8.09E-09	÷	3.00E-03	)
Phenanthrene	NC	=	(	7.91E-08	÷		)
Pyrene	NC	=	(	8.63E-08	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 120
Child Trespasser: Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA6
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC
Benzo(a)anthracene	5.17E-05	=	1.55E-05	+	3.62E-05	+	8.14E-10
Benzo(a)pyrene	4.74E-04	=	1.42E-04	+	3.32E-04	+	7.46E-09
Benzo(b)fluoranthene	5.39E-05	=	1.61E-05	+	3.77E-05	+	8.48E-10
Benzo(g,h,i)perylene	NC	=	0.00E+00	+	NC	+	NC
Benzo(k)fluoranthene	2.15E-06	=	6.45E-07	+	1.51E-06	+	3.39E-10
Carbazole	NC	=	0.00E+00	+	NC	+	NC
Chrysene	5.39E-07	=	1.61E-07	+	3.77E-07	+	8.48E-11
Dibenz(a,h)anthracene	7.97E-05	=	2.39E-05	+	5.59E-05	+	1.37E-09
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Fluorene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	2.37E-05	=	7.09E-06	+	1.66E-05	+	3.73E-10
Naphthalene	4.72E-11	=	NC	+	NC	+	4.72E-11
Phenanthrene	NC	=	0.00E+00	+	NC	+	NC
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**6.86E-04**	=	**2.05E-04**	+	**4.80E-04**	+	**1.13E-08**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
2-Methylnaphthalene	1.06E-03	=	1.06E-03	+	NC	+	NC
Acenaphthene	1.58E-03	=	4.72E-04	+	1.11E-03	+	NC
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(g,h,i)perylene	6.31E-03	=	1.89E-03	+	4.42E-03	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	1.03E-02	=	1.03E-02	+	NC	+	NC
Fluoranthene	2.28E-02	=	6.83E-03	+	1.60E-02	+	NC
Fluorene	2.02E-03	=	6.05E-04	+	1.42E-03	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.16E-03	=	1.16E-03	+	NC	+	2.70E-06
Phenanthrene	2.52E-03	=	7.56E-04	+	1.77E-03	+	NC
Pyrene	2.75E-02	=	8.24E-03	+	1.93E-02	+	NC
Soil HI	**7.53E-02**	=	**3.13E-02**	+	**4.40E-02**	+	**2.70E-06**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 121
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	8.20E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	5.50E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	2.94E-05	=	(	2.400E+03	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.69E-04	=	(	2.200E+03	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.06E-05	=	(	2.500E+03	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(g,h,i)perylene	NC	=	(	1.100E+03	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.22E-06	=	(	1.000E+03	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	6.50E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	3.06E-07	=	(	2.500E+03	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	4.53E-05	=	(	3.70E+02	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.00E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	5.300E+03	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.70E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.35E-05	=	(	1.100E+03	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	4.50E+02	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	4.400E+03	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.800E+03	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 122
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	9.63E-04	=	(	8.20E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	4.31E-04	=	(	5.50E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(g,h,i)perylene	1.72E-03	=	(	1.100E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenzofuran	9.39E-03	=	(	2.00E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	6.22E-03	=	(	5.300E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	5.52E-04	=	(	4.70E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Naphthalene	1.06E-03	=	(	4.50E+02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	6.89E-04	=	(	4.400E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	7.51E-03	=	(	4.800E+03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 123
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2-Methylnaphthalene	NC	= (	8.20E+01	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	5.50E+02	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	1.26E-05	= (	2.400E+03	×	7.30E-01	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.16E-04	= (	2.200E+03	×	7.30E+00	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.31E-05	= (	2.500E+03	×	7.30E-01	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(g,h,i)perylene	NC	= (	1.100E+03	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	5.25E-07	= (	1.000E+03	×	7.30E-02	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	6.50E+02	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	1.31E-07	= (	2.500E+03	×	7.30E-03	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	1.94E-05	= (	3.70E+02	×	7.30E+00	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	2.00E+02	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	5.300E+03	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	4.70E+02	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.78E-06	= (	1.100E+03	×	7.30E-01	×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	4.50E+02	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	4.400E+03	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	4.800E+03	×		×	1.00E-06	×	12	×	25		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 124
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation Units	Derm - HQ unitless	=	(	C_{soil} mg/kg	×	CF kg/mg	×	EF days/year	×	ED years	×	EV events/day	×	SA cm²	×	SSAF mg/cm²-event	×	ABS_d unitless	)	÷	(	BW kg	×	AT_{nc} days	×	RfD_{abs} mg/kg-day	)
2-Methylnaphthalene	NC	=	(	8.20E+01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	1.85E-04	=	(	5.50E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(g,h,i)perylene	7.39E-04	=	(	1.100E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	2.00E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	2.67E-03	=	(	5.300E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	2.37E-04	=	(	4.70E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	4.50E+02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	2.96E-04	=	(	4.400E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	3.22E-03	=	(	4.800E+03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 125
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times Edt}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED_t	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	2.43E-10	=	(	8.20E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	1.63E-09	=	(	5.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	7.12E-09	=	(	2.400E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	6.52E-09	=	(	2.200E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	7.41E-09	=	(	2.500E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(g,h,i)perylene	3.26E-09	=	(	1.100E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	2.97E-09	=	(	1.000E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.93E-09	=	(	6.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	7.41E-09	=	(	2.500E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.10E-09	=	(	3.70E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	5.93E-10	=	(	2.00E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	1.57E-08	=	(	5.300E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	1.39E-09	=	(	4.70E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	3.26E-09	=	(	1.100E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	1.33E-09	=	(	4.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	1.30E-08	=	(	4.400E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.42E-08	=	(	4.800E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 126
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2-Methylnaphthalene	NC	=	(	2.43E-10	×		×	1000	)
Acenaphthene	NC	=	(	1.63E-09	×		×	1000	)
Benzo(a)anthracene	7.83E-10	=	(	7.12E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	7.18E-09	=	(	6.52E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	8.15E-10	=	(	7.41E-09	×	1.10E-04	×	1000	)
Benzo(g,h,i)perylene	NC	=	(	3.26E-09	×		×	1000	)
Benzo(k)fluoranthene	3.26E-10	=	(	2.97E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.93E-09	×		×	1000	)
Chrysene	8.15E-11	=	(	7.41E-09	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.32E-09	=	(	1.10E-09	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	5.93E-10	×		×	1000	)
Fluoranthene	NC	=	(	1.57E-08	×		×	1000	)
Fluorene	NC	=	(	1.39E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.59E-10	=	(	3.26E-09	×	1.10E-04	×	1000	)
Naphthalene	4.54E-11	=	(	1.33E-09	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	1.30E-08	×		×	1000	)
Pyrene	NC	=	(	1.42E-08	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 127
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times Edt}{VF/PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED_t	]	)	÷	(	PEF/VF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	6.81E-10	=	(	8.20E+01	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthene	4.57E-09	=	(	5.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)anthracene	1.99E-08	=	(	2.400E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	1.83E-08	=	(	2.200E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	2.08E-08	=	(	2.500E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(g,h,i)perylene	9.13E-09	=	(	1.100E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	8.30E-09	=	(	1.000E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	5.40E-09	=	(	6.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	2.08E-08	=	(	2.500E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	3.07E-09	=	(	3.70E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	1.66E-09	=	(	2.00E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	4.40E-08	=	(	5.300E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluorene	3.90E-09	=	(	4.70E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	9.13E-09	=	(	1.100E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	3.74E-09	=	(	4.50E+02	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Phenanthrene	3.65E-08	=	(	4.400E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	3.99E-08	=	(	4.800E+03	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 128
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2-Methylnaphthalene	NC	=	(	6.81E-10	÷		)
Acenaphthene	NC	=	(	4.57E-09	÷		)
Benzo(a)anthracene	NC	=	(	1.99E-08	÷		)
Benzo(a)pyrene	NC	=	(	1.83E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	2.08E-08	÷		)
Benzo(g,h,i)perylene	NC	=	(	9.13E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	8.30E-09	÷		)
Carbazole	NC	=	(	5.40E-09	÷		)
Chrysene	NC	=	(	2.08E-08	÷		)
Dibenz(a,h)anthracene	NC	=	(	3.07E-09	÷		)
Dibenzofuran	NC	=	(	1.66E-09	÷		)
Fluoranthene	NC	=	(	4.40E-08	÷		)
Fluorene	NC	=	(	3.90E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	9.13E-09	÷		)
Naphthalene	1.25E-06	=	(	3.74E-09	÷	3.00E-03	)
Phenanthrene	NC	=	(	3.65E-08	÷		)
Pyrene	NC	=	(	3.99E-08	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 129
Maintenance Worker: Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA6
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC
Benzo(a)anthracene	4.20E-05	=	2.94E-05	+	1.26E-05	+	7.83E-10
Benzo(a)pyrene	3.85E-04	=	2.69E-04	+	1.16E-04	+	7.18E-09
Benzo(b)fluoranthene	4.37E-05	=	3.06E-05	+	1.31E-05	+	8.15E-10
Benzo(g,h,i)perylene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	1.75E-06	=	1.22E-06	+	5.25E-07	+	3.26E-10
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	4.38E-07	=	3.06E-07	+	1.31E-07	+	8.15E-11
Dibenz(a,h)anthracene	6.47E-05	=	4.53E-05	+	1.94E-05	+	1.32E-09
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Fluorene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.92E-05	=	1.35E-05	+	5.78E-06	+	3.59E-10
Naphthalene	4.54E-11	=	NC	+	NC	+	4.54E-11
Phenanthrene	NC	=	NC	+	NC	+	NC
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**5.57E-04**	=	**3.90E-04**	+	**1.67E-04**	+	**1.09E-08**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
2-Methylnaphthalene	9.63E-04	=	9.63E-04	+	NC	+	NC
Acenaphthene	6.15E-04	=	4.31E-04	+	1.85E-04	+	NC
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(g,h,i)perylene	2.46E-03	=	1.72E-03	+	7.39E-04	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	9.39E-03	=	9.39E-03	+	NC	+	NC
Fluoranthene	8.89E-03	=	6.22E-03	+	2.67E-03	+	NC
Fluorene	7.89E-04	=	5.52E-04	+	2.37E-04	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.06E-03	=	1.06E-03	+	NC	+	1.25E-06
Phenanthrene	9.84E-04	=	6.89E-04	+	2.96E-04	+	NC
Pyrene	1.07E-02	=	7.51E-03	+	3.22E-03	+	NC
Total HI	**3.59E-02**	=	**2.85E-02**	+	**7.35E-03**	+	**1.25E-06**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 130
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	8.20E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	5.50E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	3.06E-04	=	(	2.400E+03	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.81E-03	=	(	2.200E+03	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.19E-04	=	(	2.500E+03	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(g,h,i)perylene	NC	=	(	1.100E+03	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.28E-05	=	(	1.000E+03	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	6.50E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	3.19E-06	=	(	2.500E+03	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	4.72E-04	=	(	3.70E+02	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.00E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	5.300E+03	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.70E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.40E-04	=	(	1.100E+03	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	4.50E+02	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	4.400E+03	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.800E+03	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 131
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	1.00E-02	=	(	8.20E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	4.48E-03	=	(	5.50E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(g,h,i)perylene	1.79E-02	=	(	1.100E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenzofuran	9.78E-02	=	(	2.00E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	6.48E-02	=	(	5.300E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	5.75E-03	=	(	4.70E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Naphthalene	1.10E-02	=	(	4.50E+02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	7.18E-03	=	(	4.400E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	7.83E-02	=	(	4.800E+03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 132
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days	
2-Methylnaphthalene	NC	=	(	8.20E+01	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	5.50E+02	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	5.25E-04	=	(	2.400E+03	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	4.82E-03	=	(	2.200E+03	×	7.30E+00		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	5.47E-04	=	(	2.500E+03	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(g,h,i)perylene	NC	=	(	1.100E+03	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.19E-05	=	(	1.000E+03	×	7.30E-02		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	6.50E+02	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	25,550	)
Chrysene	5.47E-06	=	(	2.500E+03	×	7.30E-03		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	8.10E-04	=	(	3.70E+02	×	7.30E+00		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.00E+02	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	5.300E+03	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.70E+02	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.41E-04	=	(	1.100E+03	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	4.50E+02	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	4.400E+03	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.800E+03	×			1.00E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 133
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2-Methylnaphthalene	NC	=	(	8.20E+01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×	4.00E-03	)
Acenaphthene	7.70E-03	=	(	5.50E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	6.00E-02	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(g,h,i)perylene	3.08E-02	=	(	1.100E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	2.00E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	1.11E-01	=	(	5.300E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Fluorene	9.86E-03	=	(	4.70E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	4.50E+02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Phenanthrene	1.23E-02	=	(	4.400E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-01	)
Pyrene	1.34E-01	=	(	4.800E+03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 134
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	5.07E-09	=	(	8.20E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Acenaphthene	3.40E-08	=	(	5.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)anthracene	1.48E-07	=	(	2.400E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.36E-07	=	(	2.200E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	1.54E-07	=	(	2.500E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(g,h,i)perylene	6.79E-08	=	(	1.100E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	6.18E-08	=	(	1.000E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	4.02E-08	=	(	6.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	1.54E-07	=	(	2.500E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	2.29E-08	=	(	3.70E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.24E-08	=	(	2.00E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	3.27E-07	=	(	5.300E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluorene	2.90E-08	=	(	4.70E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	6.79E-08	=	(	1.100E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.78E-08	=	(	4.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Phenanthrene	2.72E-07	=	(	4.400E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	2.97E-07	=	(	4.800E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC - Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 135
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2-Methylnaphthalene	NC	=	(	5.07E-09	×		×	1.00E+03	)
Acenaphthene	NC	=	(	3.40E-08	×		×	1.00E+03	)
Benzo(a)anthracene	1.63E-08	=	(	1.48E-07	×	1.10E-04	×	1.00E+03	)
Benzo(a)pyrene	1.49E-07	=	(	1.36E-07	×	1.10E-03	×	1.00E+03	)
Benzo(b)fluoranthene	1.70E-08	=	(	1.54E-07	×	1.10E-04	×	1.00E+03	)
Benzo(g,h,i)perylene	NC	=	(	6.79E-08	×		×	1.00E+03	)
Benzo(k)fluoranthene	6.79E-09	=	(	6.18E-08	×	1.10E-04	×	1.00E+03	)
Carbazole	NC	=	(	4.02E-08	×		×	1.00E+03	)
Chrysene	1.70E-09	=	(	1.54E-07	×	1.10E-05	×	1.00E+03	)
Dibenz(a,h)anthracene	2.74E-08	=	(	2.29E-08	×	1.20E-03	×	1.00E+03	)
Dibenzofuran	NC	=	(	1.24E-08	×		×	1.00E+03	)
Fluoranthene	NC	=	(	3.27E-07	×		×	1.00E+03	)
Fluorene	NC	=	(	2.90E-08	×		×	1.00E+03	)
Indeno(1,2,3-c,d)pyrene	7.47E-09	=	(	6.79E-08	×	1.10E-04	×	1.00E+03	)
Naphthalene	9.45E-10	=	(	2.78E-08	×	3.40E-05	×	1.00E+03	)
Phenanthrene	NC	=	(	2.72E-07	×		×	1.00E+03	)
Pyrene	NC	=	(	2.97E-07	×		×	1.00E+03	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 136
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	1.42E-08	=	(	8.20E+01	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Acenaphthene	9.51E-08	=	(	5.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)anthracene	4.15E-07	=	(	2.400E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	3.81E-07	=	(	2.200E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	4.32E-07	=	(	2.500E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(g,h,i)perylene	1.90E-07	=	(	1.100E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	1.73E-07	=	(	1.000E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	1.12E-07	=	(	6.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	4.32E-07	=	(	2.500E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	6.40E-08	=	(	3.70E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	3.46E-08	=	(	2.00E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	9.17E-07	=	(	5.300E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluorene	8.13E-08	=	(	4.70E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	1.90E-07	=	(	1.100E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	7.78E-08	=	(	4.50E+02	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Phenanthrene	7.61E-07	=	(	4.400E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	8.30E-07	=	(	4.800E+03	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC - Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 137
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2-Methylnaphthalene	NC	=	(	1.42E-08	÷		)
Acenaphthene	NC	=	(	9.51E-08	÷		)
Benzo(a)anthracene	NC	=	(	4.15E-07	÷		)
Benzo(a)pyrene	NC	=	(	3.81E-07	÷		)
Benzo(b)fluoranthene	NC	=	(	4.32E-07	÷		)
Benzo(g,h,i)perylene	NC	=	(	1.90E-07	÷		)
Benzo(k)fluoranthene	NC	=	(	1.73E-07	÷		)
Carbazole	NC	=	(	1.12E-07	÷		)
Chrysene	NC	=	(	4.32E-07	÷		)
Dibenz(a,h)anthracene	NC	=	(	6.40E-08	÷		)
Dibenzofuran	NC	=	(	3.46E-08	÷		)
Fluoranthene	NC	=	(	9.17E-07	÷		)
Fluorene	NC	=	(	8.13E-08	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.90E-07	÷		)
Naphthalene	2.59E-05	=	(	7.78E-08	÷	3.00E-03	)
Phenanthrene	NC	=	(	7.61E-07	÷		)
Pyrene	NC	=	(	8.30E-07	÷		)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 138
Indoor Worker: Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA6
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC
Benzo(a)anthracene	8.31E-04	=	3.06E-04	+	5.25E-04	+	1.63E-08
Benzo(a)pyrene	7.62E-03	=	2.81E-03	+	4.82E-03	+	1.49E-07
Benzo(b)fluoranthene	8.66E-04	=	3.19E-04	+	5.47E-04	+	1.70E-08
Benzo(g,h,i)perylene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	3.46E-05	=	1.28E-05	+	2.19E-05	+	6.79E-09
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	8.66E-06	=	3.19E-06	+	5.47E-06	+	1.70E-09
Dibenz(a,h)anthracene	1.28E-03	=	4.72E-04	+	8.10E-04	+	2.74E-08
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Fluorene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	3.81E-04	=	1.40E-04	+	2.41E-04	+	7.47E-09
Naphthalene	9.45E-10	=	NC	+	NC	+	9.45E-10
Phenanthrene	NC	=	NC	+	NC	+	NC
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**1.10E-02**	=	**4.06E-03**	+	**6.97E-03**	+	**2.27E-07**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
2-Methylnaphthalene	1.00E-02	=	1.00E-02	+	NC	+	NC
Acenaphthene	1.22E-02	=	4.48E-03	+	7.70E-03	+	NC
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(g,h,i)perylene	4.87E-02	=	1.79E-02	+	3.08E-02	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	9.78E-02	=	9.78E-02	+	NC	+	NC
Fluoranthene	1.76E-01	=	6.48E-02	+	1.11E-01	+	NC
Fluorene	1.56E-02	=	5.75E-03	+	9.86E-03	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.10E-02	=	1.10E-02	+	NC	+	2.59E-05
Phenanthrene	1.95E-02	=	7.18E-03	+	1.23E-02	+	NC
Pyrene	2.13E-01	=	7.83E-02	+	1.34E-01	+	NC
Total HI	**6.04E-01**	=	**2.97E-01**	+	**3.06E-01**	+	**2.59E-05**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 139
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2-Methylnaphthalene	NC	=	(	8.20E+01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	5.50E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	4.04E-05	=	(	2.400E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.70E-04	=	(	2.200E+03	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	4.21E-05	=	(	2.500E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(g,h,i)perylene	NC	=	(	1.100E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.68E-06	=	(	1.000E+03	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	6.50E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	4.21E-07	=	(	2.500E+03	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	6.23E-05	=	(	3.70E+02	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.00E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	5.300E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	4.70E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.85E-05	=	(	1.100E+03	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	4.50E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	4.400E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	4.800E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 140
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2-Methylnaphthalene	3.31E-02	=	(	8.20E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	4.44E-03	=	(	5.50E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(g,h,i)perylene	5.92E-02	=	(	1.100E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	8.07E-02	=	(	2.00E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	8.56E-02	=	(	5.300E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	1.90E-03	=	(	4.70E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	1.21E-03	=	(	4.50E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	2.37E-02	=	(	4.400E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	2.58E-02	=	(	4.800E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 141
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2-Methylnaphthalene	NC	= (	8.20E+01	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	5.50E+02	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)anthracene	1.58E-05	= (	2.400E+03	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.44E-04	= (	2.200E+03	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.64E-05	= (	2.500E+03	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(g,h,i)perylene	NC	= (	1.100E+03	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	6.57E-07	= (	1.000E+03	×	7.30E-02		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	6.50E+02	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	1.64E-07	= (	2.500E+03	×	7.30E-03		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	2.43E-05	= (	3.70E+02	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	2.00E+02	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	5.300E+03	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	4.70E+02	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.22E-06	= (	1.100E+03	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	4.50E+02	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	4.400E+03	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	4.800E+03	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 142
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
EA6
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2-Methylnaphthalene	NC	=	(	8.20E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	1.73E-03	=	(	5.50E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Benzo(a)anthracene	NC	=	(	2.400E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.200E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.500E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(g,h,i)perylene	2.31E-02	=	(	1.100E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-02	)
Benzo(k)fluoranthene	NC	=	(	1.000E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	6.50E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.500E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	3.70E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	2.00E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	3.34E-02	=	(	5.300E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	7.40E-04	=	(	4.70E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.100E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	4.50E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	9.23E-03	=	(	4.400E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	1.01E-02	=	(	4.800E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 143
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	1.34E-07	=	(	8.20E+01	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Acenaphthene	8.97E-07	=	(	5.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)anthracene	3.91E-06	=	(	2.400E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)pyrene	3.59E-06	=	(	2.200E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(b)fluoranthene	4.08E-06	=	(	2.500E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(g,h,i)perylene	1.79E-06	=	(	1.100E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(k)fluoranthene	1.63E-06	=	(	1.000E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Carbazole	1.06E-06	=	(	6.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Chrysene	4.08E-06	=	(	2.500E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenz(a,h)anthracene	6.03E-07	=	(	3.70E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenzofuran	3.26E-07	=	(	2.00E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Fluoranthene	8.64E-06	=	(	5.300E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Fluorene	7.66E-07	=	(	4.70E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.79E-06	=	(	1.100E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Naphthalene	7.34E-07	=	(	4.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Phenanthrene	7.18E-06	=	(	4.400E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Pyrene	7.83E-06	=	(	4.800E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 144
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
2-Methylnaphthalene	NC	=	(	1.34E-07	×		×	1000	)
Acenaphthene	NC	=	(	8.97E-07	×		×	1000	)
Benzo(a)anthracene	4.31E-07	=	(	3.91E-06	×	1.10E-04	×	1000	)
Benzo(a)pyrene	3.95E-06	=	(	3.59E-06	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	4.48E-07	=	(	4.08E-06	×	1.10E-04	×	1000	)
Benzo(g,h,i)perylene	NC	=	(	1.79E-06	×		×	1000	)
Benzo(k)fluoranthene	1.79E-07	=	(	1.63E-06	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.06E-06	×		×	1000	)
Chrysene	4.48E-08	=	(	4.08E-06	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	7.24E-07	=	(	6.03E-07	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	3.26E-07	×		×	1000	)
Fluoranthene	NC	=	(	8.64E-06	×		×	1000	)
Fluorene	NC	=	(	7.66E-07	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.97E-07	=	(	1.79E-06	×	1.10E-04	×	1000	)
Naphthalene	2.50E-08	=	(	7.34E-07	×	3.40E-05	×	1000	)
Phenanthrene	NC	=	(	7.18E-06	×		×	1000	)
Pyrene	NC	=	(	7.83E-06	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 145
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_{nc}}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
2-Methylnaphthalene	9.36E-06	=	(	8.20E+01	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Acenaphthene	6.28E-05	=	(	5.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)anthracene	2.74E-04	=	(	2.400E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)pyrene	2.51E-04	=	(	2.200E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(b)fluoranthene	2.85E-04	=	(	2.500E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(g,h,i)perylene	1.26E-04	=	(	1.100E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(k)fluoranthene	1.14E-04	=	(	1.000E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Carbazole	7.42E-05	=	(	6.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Chrysene	2.85E-04	=	(	2.500E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenz(a,h)anthracene	4.22E-05	=	(	3.70E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenzofuran	2.28E-05	=	(	2.00E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Fluoranthene	6.05E-04	=	(	5.300E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Fluorene	5.37E-05	=	(	4.70E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Indeno(1,2,3-c,d)pyrene	1.26E-04	=	(	1.100E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Naphthalene	5.14E-05	=	(	4.50E+02	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Phenanthrene	5.02E-04	=	(	4.400E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Pyrene	5.48E-04	=	(	4.800E+03	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 146
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
EA6
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
2-Methylnaphthalene	NC	=	(	9.36E-06	÷		)
Acenaphthene	NC	=	(	6.28E-05	÷		)
Benzo(a)anthracene	NC	=	(	2.74E-04	÷		)
Benzo(a)pyrene	NC	=	(	2.51E-04	÷		)
Benzo(b)fluoranthene	NC	=	(	2.85E-04	÷		)
Benzo(g,h,i)perylene	NC	=	(	1.26E-04	÷		)
Benzo(k)fluoranthene	NC	=	(	1.14E-04	÷		)
Carbazole	NC	=	(	7.42E-05	÷		)
Chrysene	NC	=	(	2.85E-04	÷		)
Dibenz(a,h)anthracene	NC	=	(	4.22E-05	÷		)
Dibenzofuran	NC	=	(	2.28E-05	÷		)
Fluoranthene	NC	=	(	6.05E-04	÷		)
Fluorene	NC	=	(	5.37E-05	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.26E-04	÷		)
Naphthalene	1.71E-02	=	(	5.14E-05	÷	3.00E-03	)
Phenanthrene	NC	=	(	5.02E-04	÷		)
Pyrene	NC	=	(	5.48E-04	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 147
Construction Worker Worker: Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA6
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC
Benzo(a)anthracene	5.66E-05	=	4.04E-05	+	1.58E-05	+	4.31E-07
Benzo(a)pyrene	5.19E-04	=	3.70E-04	+	1.44E-04	+	3.95E-06
Benzo(b)fluoranthene	5.90E-05	=	4.21E-05	+	1.64E-05	+	4.48E-07
Benzo(g,h,i)perylene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	2.52E-06	=	1.68E-06	+	6.57E-07	+	1.79E-07
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	6.30E-07	=	4.21E-07	+	1.64E-07	+	4.48E-08
Dibenz(a,h)anthracene	8.73E-05	=	6.23E-05	+	2.43E-05	+	7.24E-07
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Fluorene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	2.59E-05	=	1.85E-05	+	7.22E-06	+	1.97E-07
Naphthalene	2.50E-08	=	NC	+	NC	+	2.50E-08
Phenanthrene	NC	=	NC	+	NC	+	NC
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**7.51E-04**	=	**5.36E-04**	+	**2.09E-04**	+	**6.00E-06**

	Noncarcinogenic Hazard						
Equation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
2-Methylnaphthalene	3.31E-02	=	3.31E-02	+	NC	+	NC
Acenaphthene	6.17E-03	=	4.44E-03	+	1.73E-03	+	NC
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(g,h,i)perylene	8.23E-02	=	5.92E-02	+	2.31E-02	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	8.07E-02	=	8.07E-02	+	NC	+	NC
Fluoranthene	1.19E-01	=	8.56E-02	+	3.34E-02	+	NC
Fluorene	2.64E-03	=	1.90E-03	+	7.40E-04	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.83E-02	=	1.21E-03	+	NC	+	1.71E-02
Phenanthrene	3.29E-02	=	2.37E-02	+	9.23E-03	+	NC
Pyrene	3.59E-02	=	2.58E-02	+	1.01E-02	+	NC
Total HI	**4.11E-01**	=	**3.16E-01**	+	**7.82E-02**	+	**1.71E-02**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 148
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
Benzo(a)anthracene	4.34E-08	=	(	6.73E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	5.00E-07	=	(	7.75E+00	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	5.56E-08	=	(	8.62E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	2.63E-09	=	(	4.08E+00	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	NC	=	(	8.69E-01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	5.67E-10	=	(	8.79E+00	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	9.75E-08	=	(	1.51E+00	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	3.15E-08	=	(	4.88E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	1.26E+01	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 149
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	3.23E-05	=	(	1.26E+01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 150
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact with Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.02E-07	=	(6.73E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	1.17E-06	=	(7.75E+00	×	7.30E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	1.30E-07	=	(8.62E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	6.15E-09	=	(4.08E+00	×	7.30E-02	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	=	(8.69E-01	×		×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	1.33E-09	=	(8.79E+00	×	7.30E-03	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	2.28E-07	=	(1.51E+00	×	7.30E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.37E-08	=	(4.88E+00	×	7.30E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Naphthalene	NC	=	(1.26E+01	×		×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 151
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	7.57E-05	=	(	1.26E+01	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	2.00E-02	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 152
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_c hours	)
Benzo(a)anthracene	2.07E-11	=	(	6.73E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(a)pyrene	2.39E-11	=	(	7.75E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	2.66E-11	=	(	8.62E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	1.26E-11	=	(	4.08E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Carbazole	2.68E-12	=	(	8.69E-01	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Chrysene	2.71E-11	=	(	8.79E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	4.66E-12	=	(	1.51E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	1.51E-11	=	(	4.88E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Naphthalene	3.87E-11	=	(	1.26E+01	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 153
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzo(a)anthracene	2.28E-12	=	(	2.07E-11	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.63E-11	=	(	2.39E-11	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.92E-12	=	(	2.66E-11	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.38E-12	=	(	1.26E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	2.68E-12	×		×	1000	)
Chrysene	2.98E-13	=	(	2.71E-11	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	5.60E-12	=	(	4.66E-12	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	1.66E-12	=	(	1.51E-11	×	1.10E-04	×	1000	)
Naphthalene	1.32E-12	=	(	3.87E-11	×	3.40E-05	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 154
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{ATnc}$$

Equation Units	EC mg/m^3	=	(	C_{soil} mg/kg	×	ET hours/day	×	EF days/year	×	ED year	×	[	1	/	PEF m³/kg	]	)	÷	(	AT_{nc} hours	)
Benzo(a)anthracene	1.21E-10	=	(	6.73E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Benzo(a)pyrene	1.39E-10	=	(	7.75E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Benzo(b)fluoranthene	1.55E-10	=	(	8.62E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Benzo(k)fluoranthene	7.33E-11	=	(	4.08E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Carbazole	1.56E-11	=	(	8.69E-01	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Chrysene	1.58E-10	=	(	8.79E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Dibenz(a,h)anthracene	2.72E-11	=	(	1.51E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Indeno(1,2,3-c,d)pyrene	8.79E-11	=	(	4.88E+00	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)
Naphthalene	2.26E-10	=	(	1.26E+01	×	4	×	52	×	12	×	[	1	/	1.32E+09	]	)	÷	(	105,120	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor
Page 1 of 1

Table 155
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - HQ = EC/RfC

Equation	**Inh - HQ**	**=**	**(**	**EC**	**÷**	**RfC**	**)**
Units	**unitless**			**mg/m^3**		**mg/m^3**	
Benzo(a)anthracene	NC	=	(	1.21E-10	÷		)
Benzo(a)pyrene	NC	=	(	1.39E-10	÷		)
Benzo(b)fluoranthene	NC	=	(	1.55E-10	÷		)
Benzo(k)fluoranthene	NC	=	(	7.33E-11	÷		)
Carbazole	NC	=	(	1.56E-11	÷		)
Chrysene	NC	=	(	1.58E-10	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.72E-11	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	8.79E-11	÷		)
Naphthalene	7.53E-08	=	(	2.26E-10	÷	3.00E-03	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 156
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA7
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.45E-07	=	4.34E-08	+	1.02E-07	+	2.28E-12	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.67E-06	=	5.00E-07	+	1.17E-06	+	2.63E-11	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.86E-07	=	5.56E-08	+	1.30E-07	+	2.92E-12	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	8.78E-09	=	2.63E-09	+	6.15E-09	+	1.38E-12	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	1.89E-09	=	5.67E-10	+	1.33E-09	+	2.98E-13	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	3.26E-07	=	9.75E-08	+	2.28E-07	+	5.60E-12	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.05E-07	=	3.15E-08	+	7.37E-08	+	1.66E-12	NC	=	NC	+	NC	+	NC
Naphthalene	1.32E-12	=	NC	+	NC	+	1.32E-12	1.08E-04	=	3.23E-05	+	7.57E-05	+	7.53E-08
Total CR	**2.44E-06**	=	**7.31E-07**	+	**1.71E-06**	+	**4.17E-11**	**Soil HI**	**1.08E-04**	=	**3.23E-05**	+	**7.57E-05**	+	**7.53E-08**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 157
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	8.24E-08	=	(	6.73E+00	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	9.49E-07	=	(	7.75E+00	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.06E-07	=	(	8.62E+00	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	4.99E-09	=	(	4.08E+00	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	8.69E-01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	1.08E-09	=	(	8.79E+00	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.85E-07	=	(	1.51E+00	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.98E-08	=	(	4.88E+00	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.26E+01	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 158
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Naphthalene	2.95E-05	=	(	1.26E+01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 159
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	3.53E-08	=	(6.73E+00	×	7.30E-01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.07E-07	=	(7.75E+00	×	7.30E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	4.53E-08	=	(8.62E+00	×	7.30E-01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.14E-09	=	(4.08E+00	×	7.30E-02	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	=	(8.69E-01	×		×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	4.62E-10	=	(8.79E+00	×	7.30E-03	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	7.94E-08	=	(1.51E+00	×	7.30E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.57E-08	=	(4.88E+00	×	7.30E-01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	=	(1.26E+01	×		×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 160
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	1.26E+01	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 161
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
Benzo(a)anthracene	1.99E-11	=	(	6.73E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(a)pyrene	2.30E-11	=	(	7.75E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	2.56E-11	=	(	8.62E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	1.21E-11	=	(	4.08E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Carbazole	2.58E-12	=	(	8.69E-01	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Chrysene	2.61E-11	=	(	8.79E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	4.48E-12	=	(	1.51E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	1.45E-11	=	(	4.88E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Naphthalene	3.72E-11	=	(	1.26E+01	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 162
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m3/ug	×	CF ug/mg	)
Benzo(a)anthracene	2.19E-12	=	(	1.99E-11	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.53E-11	=	(	2.30E-11	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.81E-12	=	(	2.56E-11	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.33E-12	=	(	1.21E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	2.58E-12	×		×	1000	)
Chrysene	2.87E-13	=	(	2.61E-11	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	5.38E-12	=	(	4.48E-12	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	1.59E-12	=	(	1.45E-11	×	1.10E-04	×	1000	)
Naphthalene	1.27E-12	=	(	3.72E-11	×	3.40E-05	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 163
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{Atnc}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					days	
Benzo(a)anthracene	5.58E-11	=	(	6.73E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(a)pyrene	6.44E-11	=	(	7.75E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(b)fluoranthene	7.15E-11	=	(	8.62E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(k)fluoranthene	3.38E-11	=	(	4.08E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Carbazole	7.22E-12	=	(	8.69E-01	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Chrysene	7.30E-11	=	(	8.79E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Dibenz(a,h)anthracene	1.26E-11	=	(	1.51E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Indeno(1,2,3-c,d)pyrene	4.05E-11	=	(	4.88E+00	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Naphthalene	1.04E-10	=	(	1.26E+01	×	8	×	12	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 164
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	5.58E-11	÷		)
Benzo(a)pyrene	NC	=	(	6.44E-11	÷		)
Benzo(b)fluoranthene	NC	=	(	7.15E-11	÷		)
Benzo(k)fluoranthene	NC	=	(	3.38E-11	÷		)
Carbazole	NC	=	(	7.22E-12	÷		)
Chrysene	NC	=	(	7.30E-11	÷		)
Dibenz(a,h)anthracene	NC	=	(	1.26E-11	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.05E-11	÷		)
Naphthalene	3.47E-08	=	(	1.04E-10	÷	3.00E-03	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 165
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA7
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.18E-07	=	8.24E-08	+	3.53E-08	+	2.19E-12	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.36E-06	=	9.49E-07	+	4.07E-07	+	2.53E-11	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.51E-07	=	1.06E-07	+	4.53E-08	+	2.81E-12	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	7.13E-09	=	4.99E-09	+	2.14E-09	+	1.33E-12	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	1.54E-09	=	1.08E-09	+	4.62E-10	+	2.87E-13	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	2.65E-07	=	1.85E-07	+	7.94E-08	+	5.38E-12	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	8.55E-08	=	5.98E-08	+	2.57E-08	+	1.59E-12	NC	=	NC	+	NC	+	NC
Naphthalene	1.27E-12	=	NC	+	NC	+	1.27E-12	2.95E-05	=	2.95E-05	+	NC	+	3.47E-08
Total CR	**1.98E-06**	=	**1.39E-06**	+	**5.96E-07**	+	**4.01E-11**	**Total HI**	**2.95E-05**	=	**2.95E-05**	+	**0.00E+00**	+	**3.47E-08**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 166
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	8.58E-07	=	(	6.73E+00	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	9.89E-06	=	(	7.75E+00	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.10E-06	=	(	8.62E+00	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	5.20E-08	=	(	4.08E+00	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	8.69E-01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	1.12E-08	=	(	8.79E+00	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.93E-06	=	(	1.51E+00	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	6.23E-07	=	(	4.88E+00	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.26E+01	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 167
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Naphthalene	3.07E-04	=	(	1.26E+01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 168
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.47E-06	= (	6.73E+00	×	7.30E-01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.70E-05	= (	7.75E+00	×	7.30E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.89E-06	= (	8.62E+00	×	7.30E-01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	8.92E-08	= (	4.08E+00	×	7.30E-02	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	8.69E-01	×		×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		) ÷ (	70	×	25,550	)
Chrysene	1.92E-08	= (	8.79E+00	×	7.30E-03	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	3.31E-06	= (	1.51E+00	×	7.30E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.07E-06	= (	4.88E+00	×	7.30E-01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	1.26E+01	×		×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 169
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Surface Soil
EA7
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	6.73E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	7.75E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	8.62E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	4.08E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	8.69E-01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	8.79E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	1.51E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.88E+00	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	1.26E+01	×	1E-06	×	250	×	25		1	×	3300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 170
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
Benzo(a)anthracene	4.16E-10	=	(	6.73E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(a)pyrene	4.79E-10	=	(	7.75E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	5.32E-10	=	(	8.62E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	2.52E-10	=	(	4.08E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Carbazole	5.37E-11	=	(	8.69E-01	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Chrysene	5.43E-10	=	(	8.79E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	9.34E-11	=	(	1.51E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	3.02E-10	=	(	4.88E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)
Naphthalene	7.76E-10	=	(	1.26E+01	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 171
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	4.57E-11	=	(	4.16E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	5.27E-10	=	(	4.79E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	5.86E-11	=	(	5.32E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	2.77E-11	=	(	2.52E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	5.37E-11	×		×	1000	)
Chrysene	5.97E-12	=	(	5.43E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.12E-10	=	(	9.34E-11	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	3.32E-11	=	(	3.02E-10	×	1.10E-04	×	1000	)
Naphthalene	2.64E-11	=	(	7.76E-10	×	3.40E-05	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 172
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{Atnc}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					days	
Benzo(a)anthracene	1.16E-09	=	(	6.73E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(a)pyrene	1.34E-09	=	(	7.75E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(b)fluoranthene	1.49E-09	=	(	8.62E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Benzo(k)fluoranthene	7.05E-10	=	(	4.08E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Carbazole	1.50E-10	=	(	8.69E-01	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Chrysene	1.52E-09	=	(	8.79E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Dibenz(a,h)anthracene	2.62E-10	=	(	1.51E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Indeno(1,2,3-c,d)pyrene	8.45E-10	=	(	4.88E+00	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)
Naphthalene	2.17E-09	=	(	1.26E+01	×	8	×	250	×	25	×	[	1	/	1.32E+09	]	)	÷	(	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 173
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Surface Soil
EA7
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.16E-09	÷		)
Benzo(a)pyrene	NC	=	(	1.34E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	1.49E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	7.05E-10	÷		)
Carbazole	NC	=	(	1.50E-10	÷		)
Chrysene	NC	=	(	1.52E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.62E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	8.45E-10	÷		)
Naphthalene	7.24E-07	=	(	2.17E-09	÷	3.00E-03	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 174
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
EA7
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	2.33E-06	=	8.58E-07	+	1.47E-06	+	4.57E-11	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	2.69E-05	=	9.89E-06	+	1.70E-05	+	5.27E-10	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	2.99E-06	=	1.10E-06	+	1.89E-06	+	5.86E-11	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	1.41E-07	=	5.20E-08	+	8.92E-08	+	2.77E-11	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	3.05E-08	=	1.12E-08	+	1.92E-08	+	5.97E-12	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	5.24E-06	=	1.93E-06	+	3.31E-06	+	1.12E-10	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.69E-06	=	6.23E-07	+	1.07E-06	+	3.32E-11	NC	=	NC	+	NC	+	NC
Naphthalene	2.64E-11	=	NC	+	NC	+	2.64E-11	3.08E-04	=	3.07E-04	+	NC	+	7.24E-07
Total CR	**3.93E-05**	=	**1.45E-05**	+	**2.48E-05**	+	**8.36E-10**	**Total HI**	**3.08E-04**	=	**3.07E-04**	+	**0.00E+00**	+	**7.24E-07**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 175
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.33E-07	=	(	7.92E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.36E-06	=	(	8.08E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.46E-07	=	(	8.70E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	6.44E-09	=	(	3.82E+00	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	5.98E-01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	1.55E-09	=	(	9.23E+00	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	2.39E-07	=	(	1.42E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.90E-08	=	(	4.69E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	6.80E+00	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 176
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Noncarcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	7.92E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	8.08E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	8.70E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	3.82E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	5.98E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	9.23E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	1.42E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.69E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	1.83E-05	=	(	6.80E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 177
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Carcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	5.20E-08	= (	7.92E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	5.31E-07	= (	8.08E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	5.71E-08	= (	8.70E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.51E-09	= (	3.82E+00	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	5.98E-01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	6.06E-10	= (	9.23E+00	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	9.33E-08	= (	1.42E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	3.08E-08	= (	4.69E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	6.80E+00	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)

Notes:
ABSd - Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 178
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact with Soil Pathway – Non-carcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	7.92E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	8.08E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	8.70E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	3.82E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	5.98E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	9.23E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	1.42E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.69E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	6.80E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 179
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Subsurface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_c	)
Units	mg/m³			mg/kg		hours/day		days/year		year					m³/kg					hours	
Benzo(a)anthracene	1.29E-08	=	(	7.92E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	1.32E-08	=	(	8.08E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	1.42E-08	=	(	8.70E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	6.23E-09	=	(	3.82E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Carbazole	9.75E-10	=	(	5.98E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Chrysene	1.50E-08	=	(	9.23E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	2.32E-09	=	(	1.42E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	7.65E-09	=	(	4.69E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)
Naphthalene	1.11E-08	=	(	6.80E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m³ – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 180
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway– Carcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	1.42E-09	=	(	1.29E-08	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.45E-08	=	(	1.32E-08	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.56E-09	=	(	1.42E-08	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	6.86E-10	=	(	6.23E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	9.75E-10	×		×	1000	)
Chrysene	1.66E-10	=	(	1.50E-08	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	2.78E-09	=	(	2.32E-09	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	8.42E-10	=	(	7.65E-09	×	1.10E-04	×	1000	)
Naphthalene	3.77E-10	=	(	1.11E-08	×	3.40E-05	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 181
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Subsurface Soil
EA7
Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_{nc}}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
Benzo(a)anthracene	9.04E-07	=	(	7.92E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	9.23E-07	=	(	8.08E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	9.93E-07	=	(	8.70E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	4.36E-07	=	(	3.82E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Carbazole	6.83E-08	=	(	5.98E-01	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Chrysene	1.05E-06	=	(	9.23E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	1.62E-07	=	(	1.42E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	5.36E-07	=	(	4.69E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)
Naphthalene	7.76E-07	=	(	6.80E+00	×	8	×	125	×	1.0	×	[	1	/	1.00E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 182
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation of Soil-derived Chemicals Pathway – Noncarcinogenic Effects
Combined Surface and Subsurface Soil
EA7
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	9.04E-07	÷		)
Benzo(a)pyrene	NC	=	(	9.23E-07	÷		)
Benzo(b)fluoranthene	NC	=	(	9.93E-07	÷		)
Benzo(k)fluoranthene	NC	=	(	4.36E-07	÷		)
Carbazole	NC	=	(	6.83E-08	÷		)
Chrysene	NC	=	(	1.05E-06	÷		)
Dibenz(a,h)anthracene	NC	=	(	1.62E-07	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	5.36E-07	÷		)
Naphthalene	2.59E-04	=	(	7.76E-07	÷	3.00E-03	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 183
Construction Worker Risk Summary
Reasonable Maximum Exposure
Combined Surface and Subsurface Soil
EA7
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.87E-07	=	1.33E-07	+	5.20E-08	+	1.42E-09	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.91E-06	=	1.36E-06	+	5.31E-07	+	1.45E-08	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	2.05E-07	=	1.46E-07	+	5.71E-08	+	1.56E-09	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	9.63E-09	=	6.44E-09	+	2.51E-09	+	6.86E-10	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	2.32E-09	=	1.55E-09	+	6.06E-10	+	1.66E-10	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	3.35E-07	=	2.39E-07	+	9.33E-08	+	2.78E-09	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.11E-07	=	7.90E-08	+	3.08E-08	+	8.42E-10	NC	=	NC	+	NC	+	NC
Naphthalene	3.77E-10	=	NC	+	NC	+	3.77E-10	2.77E-04	=	1.83E-05	+	NC	+	2.59E-04
Total CR	**2.76E-06**	=	**1.97E-06**	+	**7.67E-07**	+	**2.23E-08**	**Total HI**	**2.77E-04**	=	**1.83E-05**	+	**0.00E+00**	+ **2.59E-04**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 184
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
E9
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	5.72E-08	=	(	3.40E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	6.90E-07	=	(	4.10E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	7.91E-08	=	(	4.70E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.69E-09	=	(	1.60E+00	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.23E-07	=	(	7.30E-01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	4.71E-08	=	(	2.80E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 185
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
E9
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	3.40E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	4.10E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	4.70E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.60E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.80E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 186
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
E9
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event	
Benzo(a)anthracene	2.23E-08	= (	3.40E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×
Benzo(a)pyrene	2.69E-07	= (	4.10E+00	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×
Benzo(b)fluoranthene	3.09E-08	= (	4.70E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×
Benzo(k)fluoranthene	1.05E-09	= (	1.60E+00	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×
Dibenz(a,h)anthracene	4.79E-08	= (	7.30E-01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×
Indeno(1,2,3-c,d)pyrene	1.84E-08	= (	2.80E+00	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 186
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
E9
Vertellus

ABSd	)	÷	(	BW	×	AT_c	)
unitless				kg		days	
1.30E-01	)	÷	(	70	×	25,550	)
1.30E-01	)	÷	(	70	×	25,550	)
1.30E-01	)	÷	(	70	×	25,550	)
1.30E-01	)	÷	(	70	×	25,550	)
1.30E-01	)	÷	(	70	×	25,550	)
1.30E-01	)	÷	(	70	×	25,550	)

Table 187
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
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Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless			
Benzo(a)anthracene	NC	=	(	3.40E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(
Benzo(a)pyrene	NC	=	(	4.10E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(
Benzo(b)fluoranthene	NC	=	(	4.70E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(
Benzo(k)fluoranthene	NC	=	(	1.60E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(
Dibenz(a,h)anthracene	NC	=	(	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.80E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(

Notes:

ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 187
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
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Vertellus

BW kg	×	AT_{nc} days	×	RfD_{abs} mg/kg-day	)
70	×	365	×		)
70	×	365	×		)
70	×	365	×		)
70	×	365	×		)
70	×	365	×		)
70	×	365	×		)

Table 188
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
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$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_c}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
Benzo(a)anthracene	5.54E-09	=	(	3.40E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)
Benzo(a)pyrene	6.69E-09	=	(	4.10E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	7.66E-09	=	(	4.70E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	2.61E-09	=	(	1.60E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)
Dibenz(a,h)anthracene	1.19E-09	=	(	7.30E-01	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)
Indeno(1,2,3-c,d)pyrene	4.57E-09	=	(	2.80E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 189
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
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Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzo(a)anthracene	6.10E-10	=	(	5.54E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	7.35E-09	=	(	6.69E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	8.43E-10	=	(	7.66E-09	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	2.87E-10	=	(	2.61E-09	×	1.10E-04	×	1000	)
Dibenz(a,h)anthracene	1.43E-09	=	(	1.19E-09	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	5.02E-10	=	(	4.57E-09	×	1.10E-04	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 190
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
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Vertellus

$$EC = \frac{C_{soil} \times ET \times EF \times ED \times (1/PEF)}{AT_{nc}}$$

Equation	EC	=	(	C_{soil}	×	ET	×	EF	×	ED	×	[	1	/	PEF	]	)	÷	(	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg					hours	
Benzo(a)anthracene	3.88E-07	=	(	3.40E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)
Benzo(a)pyrene	4.68E-07	=	(	4.10E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	5.37E-07	=	(	4.70E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	1.83E-07	=	(	1.60E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)
Dibenz(a,h)anthracene	8.33E-08	=	(	7.30E-01	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)
Indeno(1,2,3-c,d)pyrene	3.20E-07	=	(	2.80E+00	×	8	×	125	×	1.0	×	[	1	/	1.0E+06	]	)	÷	(	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 191
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
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Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	3.88E-07	÷		)
Benzo(a)pyrene	NC	=	(	4.68E-07	÷		)
Benzo(b)fluoranthene	NC	=	(	5.37E-07	÷		)
Benzo(k)fluoranthene	NC	=	(	1.83E-07	÷		)
Dibenz(a,h)anthracene	NC	=	(	8.33E-08	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.20E-07	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 192
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion of Soil Pathway – Carcinogenic Effects
Subsurface Soil
E9
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	8.02E-08	=	5.72E-08	+	2.23E-08	+	6.10E-10	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	9.67E-07	=	6.90E-07	+	2.69E-07	+	7.35E-09	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	1.11E-07	=	7.91E-08	+	3.09E-08	+	8.43E-10	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	4.03E-09	=	2.69E-09	+	1.05E-09	+	2.87E-10	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	1.72E-07	=	1.23E-07	+	4.79E-08	+	1.43E-09	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	6.60E-08	=	4.71E-08	+	1.84E-08	+	5.02E-10	NC	=	NC	+	NC	+	NC
Total CR	**1.40E-06**	=	**9.99E-07**	+	**3.90E-07**	+	**1.10E-08**	**Total HI**	**NC**	=	**NC**	+	**NC**	+	**Nc**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 198
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Carcinogenic Effects
Groundwater
EA10
Vertellus

$$\text{Ing-Risk} = \frac{C_{water} \times SF_o \times ET \times EF \times ED \times GWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{water}	×	SF_o	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		hours/day		days/year		years		L/hour				kg		days	
2,4-Dimethylphenol	NC	=	(	4.80E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	6.80E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
2-Methylphenol	NC	=	(	1.55E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
3&4-Methylphenol	NC	=	(	1.66E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	1.20E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzene	6.59E-10	=	(	9.53E-02	×	5.5E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzenethiol	NC	=	(	7.00E-03	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	3.21E-12	=	(	3.50E-05	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.38E-11	=	(	1.50E-05	×	7.3E+00	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.65E-12	=	(	1.80E-05	×	7.3E-01	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.01E-13	=	(	1.10E-05	×	7.3E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Chrysene	2.94E-14	=	(	3.20E-05	×	7.3E-03	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	8.50E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	2.40E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Ethylbenzene	9.70E-11	=	(	7.01E-02	×	1.1E-02	×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.30E-02	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	2.20E+00	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Phenol	NC	=	(	4.80E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Toluene	NC	=	(	1.11E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)
Xylenes (Total)	NC	=	(	1.30E-01	×		×	1	x	45	×	1	×	0.005	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate
Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 199
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Incidental Ingestion of Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA10
Vertellus

$$\text{Ing - HQ} = \frac{C_{water} \times ET \times EF \times ED \times GWIR}{BW \times AT_n \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	GWIR	)	÷	(	BW	×	AT_n	×	RfD_o	)
Units	unitless			mg/L		hours/day		days/year		years		L/hour				kg		days		mg/kg-day	
2,4-Dimethylphenol	8.45E-04	=	(	4.80E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
2-Methylnaphthalene	1.50E-04	=	(	6.80E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
2-Methylphenol	2.73E-04	=	(	1.55E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
3&4-Methylphenol	2.92E-04	=	(	1.66E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Acenaphthene	5.28E-06	=	(	1.20E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)
Benzene	8.39E-05	=	(	9.53E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-02	)
Benzenethiol	6.16E-06	=	(	7.00E-03	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	3.50E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.50E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	1.80E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	3.20E-05	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×		)
Cyanide, Total	1.50E-05	=	(	8.50E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	5.0E-02	)
Dibenzofuran	5.28E-05	=	(	2.40E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-03	)
Ethylbenzene	6.17E-06	=	(	7.01E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	1.0E-01	)
Fluorene	5.06E-07	=	(	2.30E-02	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	4.0E-01	)
Naphthalene	3.23E-05	=	(	2.20E+00	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	6.0E-01	)
Phenol	1.41E-05	=	(	4.80E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	3.0E-01	)
Toluene	1.22E-05	=	(	1.11E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	8.0E-02	)
Xylenes (Total)	5.72E-06	=	(	1.30E-01	×	1	×	45	×	1	×	0.005	)	÷	(	70	×	365	×	2.0E-01	)

Notes:

AT_n – Averaging Time for Noncarcinogens
BW – Body Weight
C_{water} – Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
GWIR – Groundwater Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
L/hour – liters per hour
mg/kg-day – milligram per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 200
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Carcinogenic Effects
Groundwater
EA10
Vertellus

$$\text{Derm - Risk} = \frac{C_{water} \times SF_{abs} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{water}	×	SF_{abs}	×	ET	×	EF	×	ED	×	SA	×	PC	) ÷ (	CF	×	BW	×	AT_c	)
Units	unitless		mg/L		kg-day/mg		hours/day		days/year		years		cm²		cm/hour		cm³/L		kg		days	
2,4-Dimethylphenol	NC	= (	4.80E+00	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
2-Methylnaphthalene	NC	= (	6.80E-02	×		×	1	x	45	×	1	×	3,300	×	9.17E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
2-Methylphenol	NC	= (	1.55E+00	×		×	1	x	45	×	1	×	3,300	×	7.70E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
3&4-Methylphenol	NC	= (	1.66E+00	×		×	1	x	45	×	1	×	3,300	×	7.80E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Acenaphthene	NC	= (	1.20E-01	×		×	1	x	45	×	1	×	3,300	×	8.60E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzene	6.53E-09	= (	9.53E-02	×	5.5E-02	×	1	x	45	×	1	×	3,300	×	1.50E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzenethiol	NC	= (	7.00E-03	×		×	1	x	45	×	1	×	3,300	×	1.78E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(a)anthracene	9.97E-10	= (	3.50E-05	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	4.70E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(a)pyrene	6.36E-09	= (	1.50E-05	×	7.3E+00	×	1	x	45	×	1	×	3,300	×	7.00E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(b)fluoranthene	7.64E-10	= (	1.80E-05	×	7.3E-01	×	1	x	45	×	1	×	3,300	×	7.00E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Benzo(k)fluoranthene	4.61E-11	= (	1.10E-05	×	7.3E-02	×	1	x	45	×	1	×	3,300	×	6.91E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Chrysene	9.12E-12	= (	3.20E-05	×	7.3E-03	×	1	x	45	×	1	×	3,300	×	4.70E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Cyanide, Total	NC	= (	8.50E-02	×		×	1	x	45	×	1	×	3,300	×	1.00E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Dibenzofuran	NC	= (	2.40E-02	×		×	1	x	45	×	1	×	3,300	×	9.75E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Ethylbenzene	3.14E-09	= (	7.01E-02	×	1.1E-02	×	1	x	45	×	1	×	3,300	×	4.90E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Fluorene	NC	= (	2.30E-02	×		×	1	x	45	×	1	×	3,300	×	1.10E-01	) ÷ (	1.00E+03	×	70	×	25,550	)
Naphthalene	NC	= (	2.20E+00	×		×	1	x	45	×	1	×	3,300	×	4.70E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Phenol	NC	= (	4.80E-01	×		×	1	x	45	×	1	×	3,300	×	4.30E-03	) ÷ (	1.00E+03	×	70	×	25,550	)
Toluene	NC	= (	1.11E-01	×		×	1	x	45	×	1	×	3,300	×	3.10E-02	) ÷ (	1.00E+03	×	70	×	25,550	)
Xylenes (Total)	NC	= (	1.30E-01	×		×	1	x	45	×	1	×	3,300	×	5.00E-02	) ÷ (	1.00E+03	×	70	×	25,550	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 201
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Dermal Contact with Groundwater Pathway – Noncarcinogenic Effects
Groundwater
EA10
Vertellus

$$\text{Derm - HQ} = \frac{C_{water} \times ET \times EF \times ED \times SA \times PC}{CF \times BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{water}	×	ET	×	EF	×	ED	×	SA	×	PC	)	÷	(	CF	×	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		hours/day		days/year		years		cm²		cm/hour				cm³/L		kg		days		mg/kg-day	
2,4-Dimethylphenol	6.14E-02	=	(	4.80E+00	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
2-Methylnaphthalene	9.06E-03	=	(	6.80E-02	×	1	×	45	×	1	×	3,300	×	9.17E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
2-Methylphenol	1.39E-03	=	(	1.55E+00	×	1	×	45	×	1	×	3,300	×	7.70E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
3&4-Methylphenol	1.51E-03	=	(	1.66E+00	×	1	×	45	×	1	×	3,300	×	7.80E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Acenaphthene	3.00E-04	=	(	1.20E-01	×	1	×	45	×	1	×	3,300	×	8.60E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)
Benzene	8.31E-04	=	(	9.53E-02	×	1	×	45	×	1	×	3,300	×	1.50E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-02	)
Benzenethiol	7.24E-05	=	(	7.00E-03	×	1	×	45	×	1	×	3,300	×	1.78E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-02	)
Benzo(a)anthracene	NC	=	(	3.50E-05	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	1.50E-05	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	1.80E-05	×	1	×	45	×	1	×	3,300	×	7.00E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	3,300	×	6.91E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Chrysene	NC	=	(	3.20E-05	×	1	×	45	×	1	×	3,300	×	4.70E-01	)	÷	(	1.00E+03	×	70	×	365	×		)
Cyanide, Total	9.88E-06	=	(	8.50E-02	×	1	×	45	×	1	×	3,300	×	1.00E-03	)	÷	(	1.00E+03	×	70	×	365	×	5.0E-02	)
Dibenzofuran	3.40E-03	=	(	2.40E-02	×	1	×	45	×	1	×	3,300	×	9.75E-02	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-03	)
Ethylbenzene	2.00E-04	=	(	7.01E-02	×	1	×	45	×	1	×	3,300	×	4.90E-02	)	÷	(	1.00E+03	×	70	×	365	×	1.0E-01	)
Fluorene	3.68E-05	=	(	2.30E-02	×	1	×	45	×	1	×	3,300	×	1.10E-01	)	÷	(	1.00E+03	×	70	×	365	×	4.0E-01	)
Naphthalene	1.00E-03	=	(	2.20E+00	×	1	×	45	×	1	×	3,300	×	4.70E-02	)	÷	(	1.00E+03	×	70	×	365	×	6.0E-01	)
Phenol	4.00E-05	=	(	4.80E-01	×	1	×	45	×	1	×	3,300	×	4.30E-03	)	÷	(	1.00E+03	×	70	×	365	×	3.0E-01	)
Toluene	2.50E-04	=	(	1.11E-01	×	1	×	45	×	1	×	3,300	×	3.10E-02	)	÷	(	1.00E+03	×	70	×	365	×	8.0E-02	)
Xylenes (Total)	1.89E-04	=	(	1.30E-01	×	1	×	45	×	1	×	3,300	×	5.00E-02	)	÷	(	1.00E+03	×	70	×	365	×	2.0E-01	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
cm^3/L – cubed centimeters per liter
C_{water} – Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SA – Skin Surface Area

Table 202
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA10
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_c}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_c hours	)
2,4-Dimethylphenol	NC	=	(	4.80E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
2-Methylnaphthalene	NC	=	(	6.80E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
2-Methylphenol	NC	=	(	1.55E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
3&4-Methylphenol	NC	=	(	1.66E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Acenaphthene	NC	=	(	1.20E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzene	2.30E-07	=	(	9.53E-02	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	613,200	)
Benzenethiol	NC	=	(	7.00E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Benzo(a)anthracene	NC	=	(	3.50E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(a)pyrene	NC	=	(	1.50E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(b)fluoranthene	NC	=	(	1.80E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Benzo(k)fluoranthene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Chrysene	NC	=	(	3.20E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Cyanide, Total	NC	=	(	8.50E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Dibenzofuran	NC	=	(	2.40E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Ethylbenzene	1.49E-07	=	(	7.01E-02	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	613,200	)
Fluorene	NC	=	(	2.30E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	613,200	)
Naphthalene	3.83E-06	=	(	2.20E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	613,200	)
Phenol	NC	=	(	4.80E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	613,200	)
Toluene	2.49E-07	=	(	1.11E-01	×	1	×	45	×	1	×	3.05E-02	]	)	÷	(	613,200	)
Xylenes (Total)	3.05E-07	=	(	1.30E-01	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	613,200	)

Notes:
AT_c – Averaging Time for Carcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m³ – liters per cubic meter
mg/L – milligrams per liter
mg/m³ – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 203
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway– Carcinogenic Effects
Groundwater
EA10
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
2,4-Dimethylphenol	NC	=	(	NC	×		×	1000	)
2-Methylnaphthalene	NC	=	(	NC	×		×	1000	)
2-Methylphenol	NC	=	(	NC	×		×	1000	)
3&4-Methylphenol	NC	=	(	NC	×		×	1000	)
Acenaphthene	NC	=	(	NC	×		×	1000	)
Benzene	1.79E-09	=	(	2.30E-07	×	7.8E-06	×	1000	)
Benzenethiol	NC	=	(	NC	×		×	1000	)
Benzo(a)anthracene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(a)pyrene	NC	=	(	NC	×	1.1E-03	×	1000	)
Benzo(b)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Benzo(k)fluoranthene	NC	=	(	NC	×	1.1E-04	×	1000	)
Chrysene	NC	=	(	NC	×	1.1E-05	×	1000	)
Cyanide, Total	NC	=	(	NC	×		×	1000	)
Dibenzofuran	NC	=	(	NC	×		×	1000	)
Ethylbenzene	3.71E-10	=	(	1.49E-07	×	2.5E-06	×	1000	)
Fluorene	NC	=	(	NC	×		×	1000	)
Naphthalene	1.30E-07	=	(	3.83E-06	×	3.4E-05	×	1000	)
Phenol	NC	=	(	NC	×		×	1000	)
Toluene	NC	=	(	2.49E-07	×		×	1000	)
Xylenes (Total)	NC	=	(	3.05E-07	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 204
Calculation of EC: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA10
Vertellus

$$EC = \frac{C_{water} \times ET \times EF \times ED \times VF}{AT_n}$$

Equation Units	EC mg/m³	=	(	C_{water} mg/L	×	ET hours/day	×	EF days/year	×	ED year	×	VF L/m³	]	)	÷	(	AT_n hours	)
2,4-Dimethylphenol	NC	=	(	4.80E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
2-Methylnaphthalene	NC	=	(	6.80E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
2-Methylphenol	NC	=	(	1.55E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
3&4-Methylphenol	NC	=	(	1.66E+00	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Acenaphthene	NC	=	(	1.20E-01	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzene	1.61E-05	=	(	9.53E-02	×	1	×	45	×	1	×	3.28E-02	]	)	÷	(	8,760	)
Benzenethiol	NC	=	(	7.00E-03	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Benzo(a)anthracene	NC	=	(	3.50E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(a)pyrene	NC	=	(	1.50E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(b)fluoranthene	NC	=	(	1.80E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Benzo(k)fluoranthene	NC	=	(	1.10E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Chrysene	NC	=	(	3.20E-05	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Cyanide, Total	NC	=	(	8.50E-02	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Dibenzofuran	NC	=	(	2.40E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Ethylbenzene	1.04E-05	=	(	7.01E-02	×	1	×	45	×	1	×	2.89E-02	]	)	÷	(	8,760	)
Fluorene	NC	=	(	2.30E-02	×	1	×	45	×	1	×	NTV	]	)	÷	(	8,760	)
Naphthalene	2.68E-04	=	(	2.20E+00	×	1	×	45	×	1	×	2.37E-02	]	)	÷	(	8,760	)
Phenol	NC	=	(	4.80E-01	×	1	×	45	×	1	×	NV	]	)	÷	(	8,760	)
Toluene	1.74E-05	=	(	1.11E-01	×	1	×	45	×	1	×	3.05E-02	]	)	÷	(	8,760	)
Xylenes (Total)	2.13E-05	=	(	1.30E-01	×	1	×	45	×	1	×	3.19E-02	]	)	÷	(	8,760	)

Notes:

AT_n – Averaging Time for Noncarcinogens
C_{water} – Water Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
L/m³ – liters per cubic meter
mg/L – milligrams per liter
mg/m³ – milligrams per cubic meters
NC – Not Calculated
NTV – Chemical is volatile, but does not have inhalation toxicity values
NV – Chemical is not volatile
VF – Volatilization Factor

Table 205
Risk Calculations: Reasonable Maximum Exposure
Hypothetical Future Construction Worker: Inhalation of Groundwater-derived Chemicals Pathway – Noncarcinogenic Effects
Groundwater
EA10
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
2,4-Dimethylphenol	NC	=	(	NC	÷		)
2-Methylnaphthalene	NC	=	(	NC	÷		)
2-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
3&4-Methylphenol	NC	=	(	NC	÷	6.0E-01	)
Acenaphthene	NC	=	(	NC	÷		)
Benzene	5.36E-04	=	(	1.61E-05	÷	3.0E-02	)
Benzenethiol	NC	=	(	NC	÷		)
Benzo(a)anthracene	NC	=	(	NC	÷		)
Benzo(a)pyrene	NC	=	(	NC	÷		)
Benzo(b)fluoranthene	NC	=	(	NC	÷		)
Benzo(k)fluoranthene	NC	=	(	NC	÷		)
Chrysene	NC	=	(	NC	÷		)
Cyanide, Total	NC	=	(	NC	÷	8.0E-04	)
Dibenzofuran	NC	=	(	NC	÷		)
Ethylbenzene	1.04E-05	=	(	1.04E-05	÷	1.0E+00	)
Fluorene	NC	=	(	NC	÷		)
Naphthalene	8.93E-02	=	(	2.68E-04	÷	3.0E-03	)
Phenol	NC	=	(	NC	÷	2.0E-01	)
Toluene	3.48E-06	=	(	1.74E-05	÷	5.0E+00	)
Xylenes (Total)	2.13E-04	=	(	2.13E-05	÷	1.0E-01	)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 206
Hypothetical Future Construction Worker: Summary
Reasonable Maximum Exposure
Groundwater
EA10
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	+	NC	6.22E-02	=	8.45E-04	+	6.14E-02	+	NC
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	9.21E-03	=	1.50E-04	+	9.06E-03	+	NC
2-Methylphenol	NC	=	NC	+	NC	+	NC	1.66E-03	=	2.73E-04	+	1.39E-03	+	NC
3&4-Methylphenol	NC	=	NC	+	NC	+	NC	1.80E-03	=	2.92E-04	+	1.51E-03	+	NC
Acenaphthene	NC	=	NC	+	NC	+	NC	3.05E-04	=	5.28E-06	+	3.00E-04	+	NC
Benzene	8.98E-09	=	6.59E-10	+	6.53E-09	+	1.79E-09	1.45E-03	=	8.39E-05	+	8.31E-04	+	5.36E-04
Benzenethiol	NC	=	NC	+	NC	+	NC	7.86E-05	=	6.16E-06	+	7.24E-05	+	NC
Benzo(a)anthracene	1.00E-09	=	3.21E-12	+	9.97E-10	+	NC	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	6.38E-09	=	1.38E-11	+	6.36E-09	+	NC	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	7.65E-10	=	1.65E-12	+	7.64E-10	+	NC	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	4.62E-11	=	1.01E-13	+	4.61E-11	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	9.15E-12	=	2.94E-14	+	9.12E-12	+	NC	NC	=	NC	+	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	+	NC	2.49E-05	=	1.50E-05	+	9.88E-06	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	3.45E-03	=	5.28E-05	+	3.40E-03	+	NC
Ethylbenzene	3.61E-09	=	9.70E-11	+	3.14E-09	+	3.71E-10	2.16E-04	=	6.17E-06	+	2.00E-04	+	1.04E-05
Fluorene	NC	=	NC	+	NC	+	NC	3.73E-05	=	5.06E-07	+	3.68E-05	+	NC
Naphthalene	1.30E-07	=	NC	+	NC	+	1.30E-07	9.03E-02	=	3.23E-05	+	1.00E-03	+	8.93E-02
Phenol	NC	=	NC	+	NC	+	NC	5.41E-05	=	1.41E-05	+	4.00E-05	+	NC
Toluene	NC	=	NC	+	NC	+	NC	2.66E-04	=	1.22E-05	+	2.50E-04	+	3.48E-06
Xylenes (Total)	NC	=	NC	+	NC	+	NC	4.08E-04	=	5.72E-06	+	1.89E-04	+	2.13E-04
Total CR	**1.51E-07**	=	**8E-10**	+	**2E-08**	+	**1E-07**	**Total HI**	**1.72E-01**	=	**2E-03**	+	**8E-02**	+ **9E-02**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 207
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
Benzo(a)anthracene	1.42E-07	=	(	22.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	1.68E-06	=	(	26	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	1.81E-07	=	(	28.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	8.38E-09	=	(	13	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	NC	=	(	2.6	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	1.68E-09	=	(	26.0	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	3.16E-07	=	(	4.9	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	9.67E-08	=	(	15	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF - Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 208
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 209
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	3.32E-07	= (	22.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	3.92E-06	= (	26	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	4.23E-07	= (	28.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	1.96E-08	= (	13	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	2.6	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	3.92E-09	= (	26.0	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	7.40E-07	= (	4.9	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.26E-07	= (	15	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event - milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 210
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 211
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation
Pathway– Carcinogenic Effects
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	6.78E-11	=	(	22.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	8.02E-11	=	(	26	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	8.63E-11	=	(	28.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	4.01E-11	=	(	13	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	8.02E-12	=	(	2.6	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	8.02E-11	=	(	26.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.51E-11	=	(	4.9	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	4.63E-11	=	(	15	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 212
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzo(a)anthracene	7.46E-12	=	(	6.78E-11	×	1.10E-04	×	1000	)
Benzo(a)pyrene	8.82E-11	=	(	8.02E-11	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	9.50E-12	=	(	8.63E-11	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.41E-12	=	(	4.01E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	8.02E-12	×		×	1000	)
Chrysene	8.82E-13	=	(	8.02E-11	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.81E-11	=	(	1.51E-11	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	5.09E-12	=	(	4.63E-11	×	1.10E-04	×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 213
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times Edt}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED_t year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
Benzo(a)anthracene	3.96E-10	=	(	22.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	4.68E-10	=	(	26	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	5.04E-10	=	(	28.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	2.34E-10	=	(	13	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	4.68E-11	=	(	2.6	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	4.68E-10	=	(	26.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	8.81E-11	=	(	4.9	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	2.70E-10	=	(	15	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor
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Table 214
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	3.96E-10	÷		)
Benzo(a)pyrene	NC	=	(	4.68E-10	÷		)
Benzo(b)fluoranthene	NC	=	(	5.04E-10	÷		)
Benzo(k)fluoranthene	NC	=	(	2.34E-10	÷		)
Carbazole	NC	=	(	4.68E-11	÷		)
Chrysene	NC	=	(	4.68E-10	÷		)
Dibenz(a,h)anthracene	NC	=	(	8.81E-11	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.70E-10	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 215
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-18
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	4.74E-07	=	1.42E-07	+	3.32E-07	+	7.46E-12
Benzo(a)pyrene	5.60E-06	=	1.68E-06	+	3.92E-06	+	8.82E-11
Benzo(b)fluoranthene	6.03E-07	=	1.81E-07	+	4.23E-07	+	9.50E-12
Benzo(k)fluoranthene	2.80E-08	=	8.38E-09	+	1.96E-08	+	4.41E-12
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	5.60E-09	=	1.68E-09	+	3.92E-09	+	8.82E-13
Dibenz(a,h)anthracene	1.06E-06	=	3.16E-07	+	7.40E-07	+	1.81E-11
Indeno(1,2,3-c,d)pyrene	3.23E-07	=	9.67E-08	+	2.26E-07	+	5.09E-12
Total CR	**8.09E-06**	=	**2.42E-06**	+	**5.67E-06**	+	**1.34E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Total HI	**NC**	=	**NC**	+	**NC**	+	**NC**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 216
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	2.69E-07	=	(	22.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.18E-06	=	(	26	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.43E-07	=	(	28.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.59E-08	=	(	13	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	2.6	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	3.18E-09	=	(	26.0	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	6.00E-07	=	(	4.9	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.84E-07	=	(	15	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 217
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 218
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.16E-07	= (	22.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.37E-06	= (	26	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.47E-07	= (	28.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	6.83E-09	= (	13	×	7.30E-02		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	2.6	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	1.37E-09	= (	26.0	×	7.30E-03		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	2.57E-07	= (	4.9	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.88E-08	= (	15	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 219
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 220
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	6.52E-11	=	(	22.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	7.71E-11	=	(	26	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	8.30E-11	=	(	28.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	3.85E-11	=	(	13	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	7.71E-12	=	(	2.6	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	7.71E-11	=	(	26.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.45E-11	=	(	4.9	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	4.45E-11	=	(	15	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 221
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	7.18E-12	=	(	6.52E-11	×	1.10E-04	×	1000	)
Benzo(a)pyrene	8.48E-11	=	(	7.71E-11	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	9.13E-12	=	(	8.30E-11	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.24E-12	=	(	3.85E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	7.71E-12	×		×	1000	)
Chrysene	8.48E-13	=	(	7.71E-11	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.74E-11	=	(	1.45E-11	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	4.89E-12	=	(	4.45E-11	×	1.10E-04	×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 222
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.83E-10	=	(	22.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	2.16E-10	=	(	26	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	2.32E-10	=	(	28.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	1.08E-10	=	(	13	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	2.16E-11	=	(	2.6	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	2.16E-10	=	(	26.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	4.07E-11	=	(	4.9	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	1.25E-10	=	(	15	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor
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Table 223
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.83E-10	÷		)
Benzo(a)pyrene	NC	=	(	2.16E-10	÷		)
Benzo(b)fluoranthene	NC	=	(	2.32E-10	÷		)
Benzo(k)fluoranthene	NC	=	(	1.08E-10	÷		)
Carbazole	NC	=	(	2.16E-11	÷		)
Chrysene	NC	=	(	2.16E-10	÷		)
Dibenz(a,h)anthracene	NC	=	(	4.07E-11	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.25E-10	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 224
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-18
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	3.85E-07	=	2.69E-07	+	1.16E-07	+	7.18E-12
Benzo(a)pyrene	4.55E-06	=	3.18E-06	+	1.37E-06	+	8.48E-11
Benzo(b)fluoranthene	4.90E-07	=	3.43E-07	+	1.47E-07	+	9.13E-12
Benzo(k)fluoranthene	2.28E-08	=	1.59E-08	+	6.83E-09	+	4.24E-12
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	4.55E-09	=	3.18E-09	+	1.37E-09	+	8.48E-13
Dibenz(a,h)anthracene	8.57E-07	=	6.00E-07	+	2.57E-07	+	1.74E-11
Indeno(1,2,3-c,d)pyrene	2.62E-07	=	1.84E-07	+	7.88E-08	+	4.89E-12
Total CR	**6.57E-06**	=	**4.60E-06**	+	**1.97E-06**	+	**1.29E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Total HI	**NC**	=	**NC**	+	**NC**	+	**NC**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 225
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	2.81E-06	=	(	22.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.32E-05	=	(	26	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.57E-06	=	(	28.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.66E-07	=	(	13	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	2.6	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	3.32E-08	=	(	26.0	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	6.25E-06	=	(	4.9	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.91E-06	=	(	15	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 226
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 227
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	4.82E-06	= (	22.0	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	5.69E-05	= (	26	×	7.30E+00		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	6.13E-06	= (	28.0	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.85E-07	= (	13	×	7.30E-02		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	2.6	×			1.00E-06	×	250	×	25		1	×	3,300		0.2	×		) ÷ (	70	×	25,550	)
Chrysene	5.69E-08	= (	26.0	×	7.30E-03		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	1.07E-05	= (	4.9	×	7.30E+00		1.00E-06	×	250	×	25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	3.28E-06	= (	15	×	7.30E-01		1.00E-06	×	250	×	25		1	×	3300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per millilgram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 228
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	250	×	25	×	1	×	3300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 229
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.36E-09	=	(	22.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.61E-09	=	(	26	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	1.73E-09	=	(	28.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	8.03E-10	=	(	13	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.61E-10	=	(	2.6	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	1.61E-09	=	(	26.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	3.03E-10	=	(	4.9	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	9.27E-10	=	(	15	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 230
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzo(a)anthracene	1.49E-10	=	(	1.36E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.77E-09	=	(	1.61E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.90E-10	=	(	1.73E-09	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	8.83E-11	=	(	8.03E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.61E-10	×		×	1000	)
Chrysene	1.77E-11	=	(	1.61E-09	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	3.63E-10	=	(	3.03E-10	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	1.02E-10	=	(	9.27E-10	×	1.10E-04	×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 231
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	3.81E-09	=	(	22.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	4.50E-09	=	(	26	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	4.84E-09	=	(	28.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	2.25E-09	=	(	13	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	4.50E-10	=	(	2.6	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	4.50E-09	=	(	26.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	8.48E-10	=	(	4.9	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	2.59E-09	=	(	15	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 232
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzo(a)anthracene	NC	=	(	3.81E-09	÷		)
Benzo(a)pyrene	NC	=	(	4.50E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	4.84E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	2.25E-09	÷		)
Carbazole	NC	=	(	4.50E-10	÷		)
Chrysene	NC	=	(	4.50E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	8.48E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.59E-09	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 233
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-18
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	7.62E-06	=	2.81E-06	+	4.82E-06	+	1.49E-10
Benzo(a)pyrene	9.01E-05	=	3.32E-05	+	5.69E-05	+	1.77E-09
Benzo(b)fluoranthene	9.70E-06	=	3.57E-06	+	6.13E-06	+	1.90E-10
Benzo(k)fluoranthene	4.50E-07	=	1.66E-07	+	2.85E-07	+	8.83E-11
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	9.01E-08	=	3.32E-08	+	5.69E-08	+	1.77E-11
Dibenz(a,h)anthracene	1.70E-05	=	6.25E-06	+	1.07E-05	+	3.63E-10
Indeno(1,2,3-c,d)pyrene	5.20E-06	=	1.91E-06	+	3.28E-06	+	1.02E-10
Total CR	**1.30E-04**	=	**4.79E-05**	+	**8.22E-05**	+	**2.68E-09**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Total HI	**NC**	=	**NC**	+	**NC**	+	**NC**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 234
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times Atc}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	3.70E-07	=	(	22.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	4.38E-06	=	(	26	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	4.71E-07	=	(	28.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.19E-08	=	(	13	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	2.6	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	4.38E-09	=	(	26.0	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	8.25E-07	=	(	4.9	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.53E-07	=	(	15	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 235
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)

Notes:
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 236
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days	
Benzo(a)anthracene	1.44E-07	=	(	22.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.71E-06	=	(	26	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.84E-07	=	(	28.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	8.54E-09	=	(	13	×	7.30E-02		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	2.6	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Chrysene	1.71E-09	=	(	26.0	×	7.30E-03		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	3.22E-07	=	(	4.9	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	9.85E-08	=	(	15	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 237
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	22.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	26	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	28.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	13	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	2.6	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	26.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	4.9	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	15	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 238
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	3.59E-08	=	(	22.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)pyrene	4.24E-08	=	(	26	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(b)fluoranthene	4.57E-08	=	(	28.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(k)fluoranthene	2.12E-08	=	(	13	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Carbazole	4.24E-09	=	(	2.6	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Chrysene	4.24E-08	=	(	26.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenz(a,h)anthracene	7.99E-09	=	(	4.9	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Indeno(1,2,3-c,d)pyrene	2.45E-08	=	(	15	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 239
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	3.95E-09	=	(	3.59E-08	×	1.10E-04	×	1000	)
Benzo(a)pyrene	4.66E-08	=	(	4.24E-08	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	5.02E-09	=	(	4.57E-08	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	2.33E-09	=	(	2.12E-08	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	4.24E-09	×		×	1000	)
Chrysene	4.66E-10	=	(	4.24E-08	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	9.59E-09	=	(	7.99E-09	×	1.20E-03	×	1000	)
Indeno(1,2,3-c,d)pyrene	2.69E-09	=	(	2.45E-08	×	1.10E-04	×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 240
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	2.51E-06	=	(	22.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)pyrene	2.97E-06	=	(	26	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(b)fluoranthene	3.20E-06	=	(	28.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(k)fluoranthene	1.48E-06	=	(	13	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Carbazole	2.97E-07	=	(	2.6	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Chrysene	2.97E-06	=	(	26.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenz(a,h)anthracene	5.59E-07	=	(	4.9	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Indeno(1,2,3-c,d)pyrene	1.71E-06	=	(	15	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 241
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-18
Vertellus

Inh - HQ = EC/RfC

Equation	**Inh - HQ**	**=**	**(**	**EC**	**÷**	**RfC**	**)**
Units	**unitless**			**mg/m^3**		**mg/m^3**	
Benzo(a)anthracene	NC	=	(	2.51E-06	÷		)
Benzo(a)pyrene	NC	=	(	2.97E-06	÷		)
Benzo(b)fluoranthene	NC	=	(	3.20E-06	÷		)
Benzo(k)fluoranthene	NC	=	(	1.48E-06	÷		)
Carbazole	NC	=	(	2.97E-07	÷		)
Chrysene	NC	=	(	2.97E-06	÷		)
Dibenz(a,h)anthracene	NC	=	(	5.59E-07	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.71E-06	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 242
Construction Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-18
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	5.19E-07	=	3.70E-07	+	1.44E-07	+	3.95E-09
Benzo(a)pyrene	6.13E-06	=	4.38E-06	+	1.71E-06	+	4.66E-08
Benzo(b)fluoranthene	6.60E-07	=	4.71E-07	+	1.84E-07	+	5.02E-09
Benzo(k)fluoranthene	3.28E-08	=	2.19E-08	+	8.54E-09	+	2.33E-09
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	6.55E-09	=	4.38E-09	+	1.71E-09	+	4.66E-10
Dibenz(a,h)anthracene	1.16E-06	=	8.25E-07	+	3.22E-07	+	9.59E-09
Indeno(1,2,3-c,d)pyrene	3.54E-07	=	2.53E-07	+	9.85E-08	+	2.69E-09
Total CR	**8.86E-06**	=	**6.32E-06**	+	**2.47E-06**	+	**7.07E-08**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Total HI	**NC**	=	**NC**	+	**NC**	+	**NC**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 243
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
Benzo(a)anthracene	5.74E-07	=	(	89.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	5.16E-06	=	(	80	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	6.45E-07	=	(	100.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	2.77E-08	=	(	43	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	0.00E+00	=	(	30.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	6.45E-09	=	(	100.0	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	9.67E-07	=	(	15.0	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenzofuran	NC	=	(	20	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.90E-07	=	(	45	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	44.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	190.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 244
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenzofuran	1.03E-03	=	(	20	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	1.13E-04	=	(	44.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
Pyrene	3.26E-04	=	(	190.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
Page 1 of 1
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 245
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.34E-06	= (	89.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	1.21E-05	= (	80	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	1.51E-06	= (	100.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	6.49E-08	= (	43	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	30.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	1.51E-08	= (	100.0	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	2.26E-06	= (	15.0	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenzofuran	NC	= (	20	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	6.79E-07	= (	45	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Naphthalene	NC	= (	44.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Pyrene	NC	= (	190.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 246
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation Units	Derm - HQ unitless	=	(	C_{soil} mg/kg	×	CF kg/mg	×	EF days/year	×	ED years	×	EV events/day	×	SA cm²	×	SSAF mg/cm²-event	×	ABS_d unitless	)	÷	(	BW kg	×	AT_{nc} days	×	RfD_{abs} mg/kg-day	)
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenzofuran	NC	=	(	20	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	NC	=	(	44.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-02	)
Pyrene	7.64E-04	=	(	190.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 247
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	(	AT$_c$ hours	)
Benzo(a)anthracene	2.74E-10	=	(	89.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	2.47E-10	=	(	80	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	3.08E-10	=	(	100.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	1.33E-10	=	(	43	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	9.25E-11	=	(	30.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	3.08E-10	=	(	100.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	4.63E-11	=	(	15.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	6.17E-11	=	(	20	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.39E-10	=	(	45	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	1.36E-10	=	(	44.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	5.86E-10	=	(	190.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 248
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	3.02E-11	=	(	2.74E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.71E-10	=	(	2.47E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	3.39E-11	=	(	3.08E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.46E-11	=	(	1.33E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	9.25E-11	×		×	1000	)
Chrysene	3.39E-12	=	(	3.08E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	5.55E-11	=	(	4.63E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	6.17E-11	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.53E-11	=	(	1.39E-10	×	1.10E-04	×	1000	)
Naphthalene	4.61E-12	=	(	1.36E-10	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	5.86E-10	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 249
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
Benzo(a)anthracene	1.60E-09	=	(	89.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	1.44E-09	=	(	80	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	1.80E-09	=	(	100.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	7.73E-10	=	(	43	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	5.40E-10	=	(	30.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	1.80E-09	=	(	100.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	2.70E-10	=	(	15.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenzofuran	3.60E-10	=	(	20	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	8.09E-10	=	(	45	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Naphthalene	7.91E-10	=	(	44.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Pyrene	3.42E-09	=	(	190.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 250
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.60E-09	÷		)
Benzo(a)pyrene	NC	=	(	1.44E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	1.80E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	7.73E-10	÷		)
Carbazole	NC	=	(	5.40E-10	÷		)
Chrysene	NC	=	(	1.80E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.70E-10	÷		)
Dibenzofuran	NC	=	(	3.60E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	8.09E-10	÷		)
Naphthalene	2.64E-07	=	(	7.91E-10	÷	3.00E-03	)
Pyrene	NC	=	(	3.42E-09	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 251
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-19
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.92E-06	=	5.74E-07	+	1.34E-06	+	3.02E-11
Benzo(a)pyrene	1.72E-05	=	5.16E-06	+	1.21E-05	+	2.71E-10
Benzo(b)fluoranthene	2.15E-06	=	6.45E-07	+	1.51E-06	+	3.39E-11
Benzo(k)fluoranthene	9.27E-08	=	2.77E-08	+	6.49E-08	+	1.46E-11
Carbazole	NC	=	0.00E+00	+	NC	+	NC
Chrysene	2.15E-08	=	6.45E-09	+	1.51E-08	+	3.39E-12
Dibenz(a,h)anthracene	3.23E-06	=	9.67E-07	+	2.26E-06	+	5.55E-11
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	9.69E-07	=	2.90E-07	+	6.79E-07	+	1.53E-11
Naphthalene	4.61E-12	=	NC	+	NC	+	4.61E-12
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**2.56E-05**	=	**7.67E-06**	+	**1.80E-05**	+	**4.29E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	1.03E-03	=	1.03E-03	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.14E-04	=	1.13E-04	+	NC	+	2.64E-07
Pyrene	1.09E-03	=	3.26E-04	+	7.64E-04	+	NC
Total HI	**2.23E-03**	=	**1.47E-03**	+	**7.64E-04**	+	**2.64E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 252
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.09E-06	=	(	89.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	9.80E-06	=	(	80	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.22E-06	=	(	100.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	5.27E-08	=	(	43	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	1.22E-08	=	(	100.0	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.84E-06	=	(	15.0	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	20	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.51E-07	=	(	45	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	44.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	190.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 253
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenzofuran	9.39E-04	=	(	20	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Naphthalene	1.03E-04	=	(	44.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	2.97E-04	=	(	190.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 254
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	4.68E-07	= (	89.0	×	7.30E-01	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.20E-06	= (	80	×	7.30E+00	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	5.25E-07	= (	100.0	×	7.30E-01	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.26E-08	= (	43	×	7.30E-02	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	30.0	×		×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	5.25E-09	= (	100.0	×	7.30E-03	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	7.88E-07	= (	15.0	×	7.30E+00	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	20	×		×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.36E-07	= (	45	×	7.30E-01	×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	44.0	×		×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Pyrene	NC	= (	190.0	×		×	1.00E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 255
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	20	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	44.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	1.28E-04	=	(	190.0	×	1E-06	×	12	×	25.0		1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 256
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	(	AT$_c$ hours	)
Benzo(a)anthracene	2.64E-10	=	(	89.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	2.37E-10	=	(	80	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	2.97E-10	=	(	100.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	1.27E-10	=	(	43	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	8.90E-11	=	(	30.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	2.97E-10	=	(	100.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	4.45E-11	=	(	15.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	5.93E-11	=	(	20	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.33E-10	=	(	45	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	1.30E-10	=	(	44.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	5.63E-10	=	(	190.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 257
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	2.90E-11	=	(	2.64E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.61E-10	=	(	2.37E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	3.26E-11	=	(	2.97E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.40E-11	=	(	1.27E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	8.90E-11	×		×	1000	)
Chrysene	3.26E-12	=	(	2.97E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	5.34E-11	=	(	4.45E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	5.93E-11	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.47E-11	=	(	1.33E-10	×	1.10E-04	×	1000	)
Naphthalene	4.44E-12	=	(	1.30E-10	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	5.63E-10	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 258
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	7.39E-10	=	(	89.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	6.64E-10	=	(	80	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	8.30E-10	=	(	100.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	3.57E-10	=	(	43	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	2.49E-10	=	(	30.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	8.30E-10	=	(	100.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	1.25E-10	=	(	15.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	1.66E-10	=	(	20	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	3.74E-10	=	(	45	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	3.65E-10	=	(	44.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	1.58E-09	=	(	190.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 259
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzo(a)anthracene	NC	=	(	7.39E-10	÷		)
Benzo(a)pyrene	NC	=	(	6.64E-10	÷		)
Benzo(b)fluoranthene	NC	=	(	8.30E-10	÷		)
Benzo(k)fluoranthene	NC	=	(	3.57E-10	÷		)
Carbazole	NC	=	(	2.49E-10	÷		)
Chrysene	NC	=	(	8.30E-10	÷		)
Dibenz(a,h)anthracene	NC	=	(	1.25E-10	÷		)
Dibenzofuran	NC	=	(	1.66E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.74E-10	÷		)
Naphthalene	1.22E-07	=	(	3.65E-10	÷	3.00E-03	)
Pyrene	NC	=	(	1.58E-09	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 260
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-19
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.56E-06	=	1.09E-06	+	4.68E-07	+	2.90E-11
Benzo(a)pyrene	1.40E-05	=	9.80E-06	+	4.20E-06	+	2.61E-10
Benzo(b)fluoranthene	1.75E-06	=	1.22E-06	+	5.25E-07	+	3.26E-11
Benzo(k)fluoranthene	7.53E-08	=	5.27E-08	+	2.26E-08	+	1.40E-11
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	1.75E-08	=	1.22E-08	+	5.25E-09	+	3.26E-12
Dibenz(a,h)anthracene	2.62E-06	=	1.84E-06	+	7.88E-07	+	5.34E-11
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	7.87E-07	=	5.51E-07	+	2.36E-07	+	1.47E-11
Naphthalene	4.44E-12	=	NC	+	NC	+	4.44E-12
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**2.08E-05**	=	**1.46E-05**	+	**6.25E-06**	+	**4.12E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	9.39E-04	=	9.39E-04	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.03E-04	=	1.03E-04	+	NC	+	1.22E-07
Pyrene	4.25E-04	=	2.97E-04	+	1.28E-04	+	NC
Total HI	**1.47E-03**	=	**1.34E-03**	+	**1.28E-04**	+	**1.22E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 261
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.14E-05	=	(	89.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.02E-04	=	(	80	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.28E-05	=	(	100.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	5.48E-07	=	(	43	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	1.28E-07	=	(	100.0	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.91E-05	=	(	15.0	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	20	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.74E-06	=	(	45	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	44.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	190.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 262
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenzofuran	9.78E-03	=	(	20	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Naphthalene	1.08E-03	=	(	44.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	3.10E-03	=	(	190.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 263
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.95E-05	= (	89.0	×	7.30E-01		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.75E-04	= (	80	×	7.30E+00		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	2.19E-05	= (	100.0	×	7.30E-01		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	9.41E-07	= (	43	×	7.30E-02		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	30.0	×			1.00E-06	×	250		25		1	×	3,300		0.2	×		) ÷ (	70	×	25,550	)
Chrysene	2.19E-07	= (	100.0	×	7.30E-03		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	3.28E-05	= (	15.0	×	7.30E+00		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	20	×			1.00E-06	×	250		25		1	×	3,300		0.2	×		) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	9.85E-06	= (	45	×	7.30E-01		1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	44.0	×			1.00E-06	×	250		25		1	×	3,300		0.2	×		) ÷ (	70	×	25,550	)
Pyrene	NC	= (	190.0	×			1.00E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 264
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	250		25		1	×	3,300		0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	20	×	1E-06	×	250		25		1	×	3,300		0.2	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	44.0	×	1E-06	×	250		25		1	×	3,300		0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	5.32E-03	=	(	190.0	×	1E-06	×	250		25		1	×	3,300		0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 265
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	5.50E-09	=	(	89.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	4.94E-09	=	(	80	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	6.18E-09	=	(	100.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	2.66E-09	=	(	43	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.85E-09	=	(	30.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	6.18E-09	=	(	100.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	9.27E-10	=	(	15.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.24E-09	=	(	20	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	2.78E-09	=	(	45	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.72E-09	=	(	44.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.17E-08	=	(	190.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 266
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	6.05E-10	=	(	5.50E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	5.44E-09	=	(	4.94E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	6.79E-10	=	(	6.18E-09	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	2.92E-10	=	(	2.66E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.85E-09	×		×	1000	)
Chrysene	6.79E-11	=	(	6.18E-09	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.11E-09	=	(	9.27E-10	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.24E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.06E-10	=	(	2.78E-09	×	1.10E-04	×	1000	)
Naphthalene	9.24E-11	=	(	2.72E-09	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	1.17E-08	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 267
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.54E-08	=	(	89.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	1.38E-08	=	(	80	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	1.73E-08	=	(	100.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	7.44E-09	=	(	43	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	5.19E-09	=	(	30.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	1.73E-08	=	(	100.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	2.59E-09	=	(	15.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	3.46E-09	=	(	20	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	7.78E-09	=	(	45	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	7.61E-09	=	(	44.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	3.29E-08	=	(	190.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 268
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.54E-08	÷		)
Benzo(a)pyrene	NC	=	(	1.38E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	1.73E-08	÷		)
Benzo(k)fluoranthene	NC	=	(	7.44E-09	÷		)
Carbazole	NC	=	(	5.19E-09	÷		)
Chrysene	NC	=	(	1.73E-08	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.59E-09	÷		)
Dibenzofuran	NC	=	(	3.46E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	7.78E-09	÷		)
Naphthalene	2.54E-06	=	(	7.61E-09	÷	3.00E-03	)
Pyrene	NC	=	(	3.29E-08	÷		)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 269
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-19
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	3.08E-05	=	1.14E-05	+	1.95E-05	+	6.05E-10
Benzo(a)pyrene	2.77E-04	=	1.02E-04	+	1.75E-04	+	5.44E-09
Benzo(b)fluoranthene	3.46E-05	=	1.28E-05	+	2.19E-05	+	6.79E-10
Benzo(k)fluoranthene	1.49E-06	=	5.48E-07	+	9.41E-07	+	2.92E-10
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	3.46E-07	=	1.28E-07	+	2.19E-07	+	6.79E-11
Dibenz(a,h)anthracene	5.20E-05	=	1.91E-05	+	3.28E-05	+	1.11E-09
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.56E-05	=	5.74E-06	+	9.85E-06	+	3.06E-10
Naphthalene	9.24E-11	=	NC	+	NC	+	9.24E-11
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**4.12E-04**	=	**1.52E-04**	+	**2.60E-04**	+	**8.59E-09**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	9.78E-03	=	9.78E-03	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.08E-03	=	1.08E-03	+	NC	+	2.54E-06
Pyrene	8.42E-03	=	3.10E-03	+	5.32E-03	+	NC
Total HI	**1.93E-02**	=	**1.40E-02**	+	**5.32E-03**	+	**2.54E-06**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 270
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.50E-06	=	(	89.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.35E-05	=	(	80	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.68E-06	=	(	100.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	7.24E-08	=	(	43	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	1.68E-08	=	(	100.0	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	2.53E-06	=	(	15.0	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	20	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.58E-07	=	(	45	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	44.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	190.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF - Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 271
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	8.07E-03	=	(	20	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	1.18E-04	=	(	44.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	1.02E-03	=	(	190.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day - milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 272
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days	
Benzo(a)anthracene	5.84E-07	=	(	89.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	5.25E-06	=	(	80	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	6.57E-07	=	(	100.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.82E-08	=	(	43	×	7.30E-02		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Chrysene	6.57E-09	=	(	100.0	×	7.30E-03		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	9.85E-07	=	(	15.0	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	20	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.95E-07	=	(	45	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	44.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	190.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 273
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	89.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	80	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	100.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	43	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	100.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	15.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	20	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	45	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	44.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	3.99E-04	=	(	190.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 274
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.45E-07	=	(	89.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)pyrene	1.30E-07	=	(	80	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(b)fluoranthene	1.63E-07	=	(	100.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(k)fluoranthene	7.01E-08	=	(	43	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Carbazole	4.89E-08	=	(	30.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Chrysene	1.63E-07	=	(	100.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenz(a,h)anthracene	2.45E-08	=	(	15.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenzofuran	3.26E-08	=	(	20	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Indeno(1,2,3-c,d)pyrene	7.34E-08	=	(	45	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Naphthalene	7.18E-08	=	(	44.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Pyrene	3.10E-07	=	(	190.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 275
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	1.60E-08	=	(	1.45E-07	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.44E-07	=	(	1.30E-07	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.79E-08	=	(	1.63E-07	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	7.71E-09	=	(	7.01E-08	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	4.89E-08	×		×	1000	)
Chrysene	1.79E-09	=	(	1.63E-07	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	2.94E-08	=	(	2.45E-08	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	3.26E-08	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	8.07E-09	=	(	7.34E-08	×	1.10E-04	×	1000	)
Naphthalene	2.44E-09	=	(	7.18E-08	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	3.10E-07	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 276
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_{nc}}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_{nc} hours	)
Benzo(a)anthracene	1.02E-05	=	(	89.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)pyrene	9.13E-06	=	(	80	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(b)fluoranthene	1.14E-05	=	(	100.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(k)fluoranthene	4.91E-06	=	(	43	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Carbazole	3.42E-06	=	(	30.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Chrysene	1.14E-05	=	(	100.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenz(a,h)anthracene	1.71E-06	=	(	15.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenzofuran	2.28E-06	=	(	20	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Indeno(1,2,3-c,d)pyrene	5.14E-06	=	(	45	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Naphthalene	5.02E-06	=	(	44.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Pyrene	2.17E-05	=	(	190.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 277
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– NonCarcinogenic Effects
Surface Soil
Hotspot 2-SF-2-19
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzo(a)anthracene	NC	=	(	1.02E-05	÷		)
Benzo(a)pyrene	NC	=	(	9.13E-06	÷		)
Benzo(b)fluoranthene	NC	=	(	1.14E-05	÷		)
Benzo(k)fluoranthene	NC	=	(	4.91E-06	÷		)
Carbazole	NC	=	(	3.42E-06	÷		)
Chrysene	NC	=	(	1.14E-05	÷		)
Dibenz(a,h)anthracene	NC	=	(	1.71E-06	÷		)
Dibenzofuran	NC	=	(	2.28E-06	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	5.14E-06	÷		)
Naphthalene	1.67E-03	=	(	5.02E-06	÷	3.00E-03	)
Pyrene	NC	=	(	2.17E-05	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 278
Construction Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-2-19
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	2.10E-06	=	1.50E-06	+	5.84E-07	+	1.60E-08	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	1.89E-05	=	1.35E-05	+	5.25E-06	+	1.44E-07	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	2.36E-06	=	1.68E-06	+	6.57E-07	+	1.79E-08	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	1.08E-07	=	7.24E-08	+	2.82E-08	+	7.71E-09	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	2.52E-08	=	1.68E-08	+	6.57E-09	+	1.79E-09	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	3.54E-06	=	2.53E-06	+	9.85E-07	+	2.94E-08	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	8.07E-03	=	8.07E-03	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.06E-06	=	7.58E-07	+	2.95E-07	+	8.07E-09	NC	=	NC	+	NC	+	NC
Naphthalene	2.44E-09	=	NC	+	NC	+	2.44E-09	1.79E-03	=	1.18E-04	+	NC	+	1.67E-03
Pyrene	NC	=	NC	+	NC	+	NC	1.42E-03	=	1.02E-03	+	3.99E-04	+	NC
Total CR	**2.81E-05**	=	**2.00E-05**	+	**7.81E-06**	+	**2.27E-07**	**1.13E-02**	=	**9.21E-03**	+	**3.99E-04**	+	**1.67E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 279
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
Benzo(a)anthracene	5.09E-07	=	(	79.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	4.06E-06	=	(	63	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	4.71E-07	=	(	73.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	1.74E-08	=	(	27	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	5.16E-09	=	(	80.0	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	7.74E-07	=	(	12.0	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenzofuran	NC	=	(	45	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.51E-07	=	(	39	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	220.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
2-Methylnaphthalene	NC	=	(	49.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 280
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenzofuran	2.32E-03	=	(	45	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	5.67E-04	=	(	220.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
2-Methylnaphthalene	6.31E-04	=	(	49.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-03	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 281
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.19E-06	= (	79.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	9.51E-06	= (	63	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	1.10E-06	= (	73.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	4.08E-08	= (	27	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	30.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	1.21E-08	= (	80.0	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	1.81E-06	= (	12.0	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenzofuran	NC	= (	45	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.89E-07	= (	39	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Naphthalene	NC	= (	220.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
2-Methylnaphthalene	NC	= (	49.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 282
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenzofuran	NC	=	(	45	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	NC	=	(	220.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	49.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	4.00E-03	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 283
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	2.44E-10	=	(	79.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.94E-10	=	(	63	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	2.25E-10	=	(	73.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	8.33E-11	=	(	27	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	9.25E-11	=	(	30.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	2.47E-10	=	(	80.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	3.70E-11	=	(	12.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.39E-10	=	(	45	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.20E-10	=	(	39	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	6.78E-10	=	(	220.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	1.51E-10	=	(	49.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 284
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	2.68E-11	=	(	2.44E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.14E-10	=	(	1.94E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.48E-11	=	(	2.25E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	9.16E-12	=	(	8.33E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	9.25E-11	×		×	1000	)
Chrysene	2.71E-12	=	(	2.47E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	4.44E-11	=	(	3.70E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.39E-10	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.32E-11	=	(	1.20E-10	×	1.10E-04	×	1000	)
Naphthalene	2.31E-11	=	(	6.78E-10	×	3.40E-05	×	1000	)
2-Methylnaphthalene	NC	=	(	1.51E-10	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 285
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.42E-09	=	(	79.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	1.13E-09	=	(	63	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	1.31E-09	=	(	73.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	4.86E-10	=	(	27	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	5.40E-10	=	(	30.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	1.44E-09	=	(	80.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	2.16E-10	=	(	12.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenzofuran	8.09E-10	=	(	45	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	7.02E-10	=	(	39	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Naphthalene	3.96E-09	=	(	220.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
2-Methylnaphthalene	8.81E-10	=	(	49.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 286
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.42E-09	÷		)
Benzo(a)pyrene	NC	=	(	1.13E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	1.31E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	4.86E-10	÷		)
Carbazole	NC	=	(	5.40E-10	÷		)
Chrysene	NC	=	(	1.44E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.16E-10	÷		)
Dibenzofuran	NC	=	(	8.09E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	7.02E-10	÷		)
Naphthalene	1.32E-06	=	(	3.96E-09	÷	3.00E-03	)
2-Methylnaphthalene	NC	=	(	8.81E-10	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 287
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-3-36
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.70E-06	=	5.09E-07	+	1.19E-06	+	2.68E-11
Benzo(a)pyrene	1.36E-05	=	4.06E-06	+	9.51E-06	+	2.14E-10
Benzo(b)fluoranthene	1.57E-06	=	4.71E-07	+	1.10E-06	+	2.48E-11
Benzo(k)fluoranthene	5.82E-08	=	1.74E-08	+	4.08E-08	+	9.16E-12
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	1.72E-08	=	5.16E-09	+	1.21E-08	+	2.71E-12
Dibenz(a,h)anthracene	2.59E-06	=	7.74E-07	+	1.81E-06	+	4.44E-11
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	8.40E-07	=	2.51E-07	+	5.89E-07	+	1.32E-11
Naphthalene	2.31E-11	=	NC	+	NC	+	2.31E-11
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Total CR	**2.03E-05**	=	**6.09E-06**	+	**1.43E-05**	+	**3.58E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	2.32E-03	=	2.32E-03	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	5.68E-04	=	5.67E-04	+	NC	+	1.32E-06
2-Methylnaphthalene	6.31E-04	=	6.31E-04	+	NC	+	NC
Total HI	**3.52E-03**	=	**3.52E-03**	+	**NC**	+	**1.32E-06**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 288
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	9.67E-07	=	(	79.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	7.71E-06	=	(	63	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	8.94E-07	=	(	73.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	3.31E-08	=	(	27	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	9.80E-09	=	(	80.0	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.47E-06	=	(	12.0	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	45	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	4.78E-07	=	(	39	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	220.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	49.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 289
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenzofuran	2.11E-03	=	(	45	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Naphthalene	5.17E-04	=	(	220.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	5.75E-04	=	(	49.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-03	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 290
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	4.15E-07	= (	79.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	3.31E-06	= (	63	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	3.83E-07	= (	73.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	1.42E-08	= (	27	×	7.30E-02		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	30.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	4.20E-09	= (	80.0	×	7.30E-03		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	6.30E-07	= (	12.0	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	45	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.05E-07	= (	39	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	220.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	49.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 291
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	45	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	220.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	49.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	4.00E-03	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 292
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	2.34E-10	=	(	79.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.87E-10	=	(	63	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	2.16E-10	=	(	73.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	8.01E-11	=	(	27	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	8.90E-11	=	(	30.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	2.37E-10	=	(	80.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	3.56E-11	=	(	12.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.33E-10	=	(	45	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.16E-10	=	(	39	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	6.52E-10	=	(	220.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	1.45E-10	=	(	49.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 293
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	2.58E-11	=	(	2.34E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	2.05E-10	=	(	1.87E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.38E-11	=	(	2.16E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	8.81E-12	=	(	8.01E-11	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	8.90E-11	×		×	1000	)
Chrysene	2.61E-12	=	(	2.37E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	4.27E-11	=	(	3.56E-11	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.33E-10	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.27E-11	=	(	1.16E-10	×	1.10E-04	×	1000	)
Naphthalene	2.22E-11	=	(	6.52E-10	×	3.40E-05	×	1000	)
2-Methylnaphthalene	NC	=	(	1.45E-10	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 294
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
Benzo(a)anthracene	6.56E-10	=	(	79.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	5.23E-10	=	(	63	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	6.06E-10	=	(	73.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	2.24E-10	=	(	27	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	2.49E-10	=	(	30.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	6.64E-10	=	(	80.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	9.96E-11	=	(	12.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	3.74E-10	=	(	45	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	3.24E-10	=	(	39	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	1.83E-09	=	(	220.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
2-Methylnaphthalene	4.07E-10	=	(	49.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 295
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	6.56E-10	÷		)
Benzo(a)pyrene	NC	=	(	5.23E-10	÷		)
Benzo(b)fluoranthene	NC	=	(	6.06E-10	÷		)
Benzo(k)fluoranthene	NC	=	(	2.24E-10	÷		)
Carbazole	NC	=	(	2.49E-10	÷		)
Chrysene	NC	=	(	6.64E-10	÷		)
Dibenz(a,h)anthracene	NC	=	(	9.96E-11	÷		)
Dibenzofuran	NC	=	(	3.74E-10	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	3.24E-10	÷		)
Naphthalene	6.09E-07	=	(	1.83E-09	÷	3.00E-03	)
2-Methylnaphthalene	NC	=	(	4.07E-10	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 296
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-3-36
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.38E-06	=	9.67E-07	+	4.15E-07	+	2.58E-11
Benzo(a)pyrene	1.10E-05	=	7.71E-06	+	3.31E-06	+	2.05E-10
Benzo(b)fluoranthene	1.28E-06	=	8.94E-07	+	3.83E-07	+	2.38E-11
Benzo(k)fluoranthene	4.73E-08	=	3.31E-08	+	1.42E-08	+	8.81E-12
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	1.40E-08	=	9.80E-09	+	4.20E-09	+	2.61E-12
Dibenz(a,h)anthracene	2.10E-06	=	1.47E-06	+	6.30E-07	+	4.27E-11
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	6.82E-07	=	4.78E-07	+	2.05E-07	+	1.27E-11
Naphthalene	2.22E-11	=	NC	+	NC	+	2.22E-11
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Total CR	**1.65E-05**	=	**1.16E-05**	+	**4.96E-06**	+	**3.44E-10**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	2.11E-03	=	2.11E-03	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	5.17E-04	=	5.17E-04	+	NC	+	6.09E-07
2-Methylnaphthalene	5.75E-04	=	5.75E-04	+	NC	+	NC
Total HI	**3.21E-03**	=	**3.21E-03**	+	**NC**	+	**6.09E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 297
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.01E-05	=	(	79.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	8.04E-05	=	(	63	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	9.31E-06	=	(	73.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	3.44E-07	=	(	27	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	1.02E-07	=	(	80.0	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.53E-05	=	(	12.0	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	45	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	4.97E-06	=	(	39	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	220.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	49.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 298
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenzofuran	2.20E-02	=	(	45	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Naphthalene	5.38E-03	=	(	220.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	5.99E-03	=	(	49.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-03	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 299
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.73E-05	= (	79.0	×	7.30E-01	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.38E-04	= (	63	×	7.30E+00	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.60E-05	= (	73.0	×	7.30E-01	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	5.91E-07	= (	27	×	7.30E-02	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	30.0	×		×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Chrysene	1.75E-07	= (	80.0	×	7.30E-03	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	2.63E-05	= (	12.0	×	7.30E+00	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	45	×		×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	8.54E-06	= (	39	×	7.30E-01	×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	220.0	×		×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	49.0	×		×	1.00E-06	×	250		25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 300
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	45	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	220.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	49.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	4.00E-03	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 301
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	4.88E-09	=	(	79.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	3.89E-09	=	(	63	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	4.51E-09	=	(	73.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	1.67E-09	=	(	27	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.85E-09	=	(	30.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	4.94E-09	=	(	80.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	7.41E-10	=	(	12.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	2.78E-09	=	(	45	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	2.41E-09	=	(	39	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	1.36E-08	=	(	220.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
2-Methylnaphthalene	3.03E-09	=	(	49.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 302
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	5.37E-10	=	(	4.88E-09	×	1.10E-04	×	1000	)
Benzo(a)pyrene	4.28E-09	=	(	3.89E-09	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	4.96E-10	=	(	4.51E-09	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.83E-10	=	(	1.67E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.85E-09	×		×	1000	)
Chrysene	5.44E-11	=	(	4.94E-09	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	8.90E-10	=	(	7.41E-10	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	2.78E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	2.65E-10	=	(	2.41E-09	×	1.10E-04	×	1000	)
Naphthalene	4.62E-10	=	(	1.36E-08	×	3.40E-05	×	1000	)
2-Methylnaphthalene	NC	=	(	3.03E-09	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 303
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_n hours	)
Benzo(a)anthracene	1.37E-08	=	(	79.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	1.09E-08	=	(	63	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	1.26E-08	=	(	73.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	4.67E-09	=	(	27	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	5.19E-09	=	(	30.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	1.38E-08	=	(	80.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	2.08E-09	=	(	12.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	7.78E-09	=	(	45	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	6.75E-09	=	(	39	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	3.81E-08	=	(	220.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
2-Methylnaphthalene	8.48E-09	=	(	49.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 304
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	1.37E-08	÷		)
Benzo(a)pyrene	NC	=	(	1.09E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	1.26E-08	÷		)
Benzo(k)fluoranthene	NC	=	(	4.67E-09	÷		)
Carbazole	NC	=	(	5.19E-09	÷		)
Chrysene	NC	=	(	1.38E-08	÷		)
Dibenz(a,h)anthracene	NC	=	(	2.08E-09	÷		)
Dibenzofuran	NC	=	(	7.78E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	6.75E-09	÷		)
Naphthalene	1.27E-05	=	(	3.81E-08	÷	3.00E-03	)
2-Methylnaphthalene	NC	=	(	8.48E-09	÷		)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 305
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-3-36
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	2.74E-05	=	1.01E-05	+	1.73E-05	+	5.37E-10	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	2.18E-04	=	8.04E-05	+	1.38E-04	+	4.28E-09	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	2.53E-05	=	9.31E-06	+	1.60E-05	+	4.96E-10	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	9.36E-07	=	3.44E-07	+	5.91E-07	+	1.83E-10	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	2.77E-07	=	1.02E-07	+	1.75E-07	+	5.44E-11	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	4.16E-05	=	1.53E-05	+	2.63E-05	+	8.90E-10	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	2.20E-02	=	2.20E-02	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	1.35E-05	=	4.97E-06	+	8.54E-06	+	2.65E-10	NC	=	NC	+	NC	+	NC
Naphthalene	4.62E-10	=	NC	+	NC	+	4.62E-10	5.39E-03	=	5.38E-03	+	NC	+	1.27E-05
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC	5.99E-03	=	5.99E-03	+	NC	+	NC
Total CR	**3.27E-04**	=	**1.20E-04**	+	**2.07E-04**	+	**7.17E-09**	**Total HI**	**3.34E-02**	=	**3.34E-02**	+	**0.00E+00**	+	**1.27E-05**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 306
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	1.33E-06	=	(	79.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.06E-05	=	(	63	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	1.23E-06	=	(	73.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	4.55E-08	=	(	27	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	30.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	1.35E-08	=	(	80.0	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	2.02E-06	=	(	12.0	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	45	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	6.57E-07	=	(	39	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	220.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	49.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 307
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	1.82E-02	=	(	45	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	5.92E-04	=	(	220.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
2-Methylnaphthalene	1.98E-02	=	(	49.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 308
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	5.19E-07	= (	79.0	×	7.30E-01	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.14E-06	= (	63	×	7.30E+00	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	4.79E-07	= (	73.0	×	7.30E-01	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	1.77E-08	= (	27	×	7.30E-02	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	30.0	×		×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	5.25E-09	= (	80.0	×	7.30E-03	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	7.88E-07	= (	12.0	×	7.30E+00	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	45	×		×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.56E-07	= (	39	×	7.30E-01	×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	220.0	×		×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	49.0	×		×	1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per millligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 309
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	79.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	63	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	73.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	27	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	30.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	80.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	12.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	45	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	39	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	220.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
2-Methylnaphthalene	NC	=	(	49.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 310
Calculation of EC: Reasonable Maximum Exposure
Construction Workers: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.29E-07	=	(	79.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)pyrene	1.03E-07	=	(	63	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(b)fluoranthene	1.19E-07	=	(	73.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(k)fluoranthene	4.40E-08	=	(	27	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Carbazole	4.89E-08	=	(	30.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Chrysene	1.30E-07	=	(	80.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenz(a,h)anthracene	1.96E-08	=	(	12.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenzofuran	7.34E-08	=	(	45	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Indeno(1,2,3-c,d)pyrene	6.36E-08	=	(	39	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Naphthalene	3.59E-07	=	(	220.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
2-Methylnaphthalene	7.99E-08	=	(	49.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 311
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation Units	Inh - Risk unitless	=	(	EC mg/m^3	×	Unit risk m^3/ug	×	CF ug/mg	)
Benzo(a)anthracene	1.42E-08	=	(	1.29E-07	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.13E-07	=	(	1.03E-07	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.31E-08	=	(	1.19E-07	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	4.84E-09	=	(	4.40E-08	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	4.89E-08	×		×	1000	)
Chrysene	1.44E-09	=	(	1.30E-07	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	2.35E-08	=	(	1.96E-08	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	7.34E-08	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	7.00E-09	=	(	6.36E-08	×	1.10E-04	×	1000	)
Naphthalene	1.22E-08	=	(	3.59E-07	×	3.40E-05	×	1000	)
2-Methylnaphthalene	NC	=	(	7.99E-08	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 312
Calculation of EC: Reasonable Maximum Exposure
Construction Workers: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_{nc}}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_{nc}	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	9.02E-06	=	(	79.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)pyrene	7.19E-06	=	(	63	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(b)fluoranthene	8.33E-06	=	(	73.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(k)fluoranthene	3.08E-06	=	(	27	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Carbazole	3.42E-06	=	(	30.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Chrysene	9.13E-06	=	(	80.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenz(a,h)anthracene	1.37E-06	=	(	12.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenzofuran	5.14E-06	=	(	45	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Indeno(1,2,3-c,d)pyrene	4.45E-06	=	(	39	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Naphthalene	2.51E-05	=	(	220.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
2-Methylnaphthalene	5.59E-06	=	(	49.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 313
Risk Calculations: Reasonable Maximum Exposure
Construction Workers: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-3-36
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	9.02E-06	÷		)
Benzo(a)pyrene	NC	=	(	7.19E-06	÷		)
Benzo(b)fluoranthene	NC	=	(	8.33E-06	÷		)
Benzo(k)fluoranthene	NC	=	(	3.08E-06	÷		)
Carbazole	NC	=	(	3.42E-06	÷		)
Chrysene	NC	=	(	9.13E-06	÷		)
Dibenz(a,h)anthracene	NC	=	(	1.37E-06	÷		)
Dibenzofuran	NC	=	(	5.14E-06	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	4.45E-06	÷		)
Naphthalene	8.37E-03	=	(	2.51E-05	÷	3.00E-03	)
2-Methylnaphthalene	NC	=	(	5.59E-06	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 314
Construction Workers Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-3-36
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	1.86E-06	=	1.33E-06	+	5.19E-07	+	1.42E-08
Benzo(a)pyrene	1.49E-05	=	1.06E-05	+	4.14E-06	+	1.13E-07
Benzo(b)fluoranthene	1.72E-06	=	1.23E-06	+	4.79E-07	+	1.31E-08
Benzo(k)fluoranthene	6.80E-08	=	4.55E-08	+	1.77E-08	+	4.84E-09
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	2.02E-08	=	1.35E-08	+	5.25E-09	+	1.44E-09
Dibenz(a,h)anthracene	2.83E-06	=	2.02E-06	+	7.88E-07	+	2.35E-08
Dibenzofuran	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	9.20E-07	=	6.57E-07	+	2.56E-07	+	7.00E-09
Naphthalene	1.22E-08	=	NC	+	NC	+	1.22E-08
2-Methylnaphthalene	NC	=	NC	+	NC	+	NC
Total CR	**2.23E-05**	=	**1.59E-05**	+	**6.20E-06**	+	**1.89E-07**

	Noncarcinogenic Hazard						
Equation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	1.82E-02	=	1.82E-02	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	8.96E-03	=	5.92E-04	+	NC	+	8.37E-03
2-Methylnaphthalene	1.98E-02	=	1.98E-02	+	NC	+	NC
Total HI	**4.69E-02**	=	**3.85E-02**	+	**NC**	+	**8.37E-03**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 315
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		unitless		mg/day				kg		days	
Benzo(a)anthracene	1.61E-06	=	(	250.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(a)pyrene	1.29E-05	=	(	200	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(b)fluoranthene	2.00E-06	=	(	310.0	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Benzo(k)fluoranthene	6.45E-08	=	(	100	×	7.30E-02	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Carbazole	0.00E+00	=	(	24.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Chrysene	2.00E-08	=	(	310.0	×	7.30E-03	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenz(a,h)anthracene	2.51E-06	=	(	39.0	×	7.30E+00	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Dibenzofuran	NC	=	(	40	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Fluoranthene	NC	=	(	580	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.09E-07	=	(	110	×	7.30E-01	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Naphthalene	NC	=	(	81.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)
Pyrene	NC	=	(	470.0	×		×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 316
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times ETf \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	ETf	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		unitless		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Dibenzofuran	2.06E-03	=	(	40	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	1.00E-03	)
Fluoranthene	7.47E-04	=	(	580	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×		)
Naphthalene	2.09E-04	=	(	81.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	2.00E-02	)
Pyrene	8.07E-04	=	(	470.0	×	1E-06	×	52	×	12	×	0.17	×	100	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
ETf – Exposure Time Fraction
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram-day
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 317
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	3.77E-06	= (	250.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(a)pyrene	3.02E-05	= (	200	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(b)fluoranthene	4.68E-06	= (	310.0	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Benzo(k)fluoranthene	1.51E-07	= (	100	×	7.30E-02		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Carbazole	NC	= (	24.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Chrysene	4.68E-08	= (	310.0	×	7.30E-03		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenz(a,h)anthracene	5.89E-06	= (	39.0	×	7.30E+00		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Dibenzofuran	NC	= (	40	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Fluoranthene	NC	= (	580	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.66E-06	= (	110	×	7.30E-01		1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)
Naphthalene	NC	= (	81.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		) ÷ (	47	×	25,550	)
Pyrene	NC	= (	470.0	×			1.00E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	) ÷ (	47	×	25,550	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg - milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 318
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Dibenzofuran	NC	=	(	40	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	1.00E-03	)
Fluoranthene	1.75E-03	=	(	580	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×		)
Naphthalene	NC	=	(	81.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×		)	÷	(	47	×	4,380	×	2.00E-02	)
Pyrene	1.89E-03	=	(	470.0	×	1E-06	×	52	×	12	×	1	×	4,373	×	0.07	×	1.30E-01	)	÷	(	47	×	4,380	×	3.00E-02	)

Notes:
ABSd – Dermal absorption fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milogram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 319
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	7.71E-10	=	(	250.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	6.17E-10	=	(	200	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	9.56E-10	=	(	310.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	3.08E-10	=	(	100	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	7.40E-11	=	(	24.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	9.56E-10	=	(	310.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.20E-10	=	(	39.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.23E-10	=	(	40	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	1.79E-09	=	(	580	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	3.39E-10	=	(	110	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.50E-10	=	(	81.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.45E-09	=	(	470.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 320
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	8.48E-11	=	(	7.71E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	6.78E-10	=	(	6.17E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.05E-10	=	(	9.56E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	3.39E-11	=	(	3.08E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	7.40E-11	×		×	1000	)
Chrysene	1.05E-11	=	(	9.56E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.44E-10	=	(	1.20E-10	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.23E-10	×		×	1000	)
Fluoranthene	NC	=	(	1.79E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.73E-11	=	(	3.39E-10	×	1.10E-04	×	1000	)
Naphthalene	8.49E-12	=	(	2.50E-10	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	1.45E-09	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 321
Calculation of EC: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	4.50E-09	=	(	250.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(a)pyrene	3.60E-09	=	(	200	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(b)fluoranthene	5.58E-09	=	(	310.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Benzo(k)fluoranthene	1.80E-09	=	(	100	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Carbazole	4.32E-10	=	(	24.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Chrysene	5.58E-09	=	(	310.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenz(a,h)anthracene	7.02E-10	=	(	39.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Dibenzofuran	7.20E-10	=	(	40	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Fluoranthene	1.04E-08	=	(	580	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Indeno(1,2,3-c,d)pyrene	1.98E-09	=	(	110	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Naphthalene	1.46E-09	=	(	81.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)
Pyrene	8.45E-09	=	(	470.0	×	4	×	52	×	12	]	)	÷	(	1.32E+09	x	105,120	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 322
Risk Calculations: Reasonable Maximum Exposure
Child Trespasser: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	4.50E-09	÷		)
Benzo(a)pyrene	NC	=	(	3.60E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	5.58E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	1.80E-09	÷		)
Carbazole	NC	=	(	4.32E-10	÷		)
Chrysene	NC	=	(	5.58E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	7.02E-10	÷		)
Dibenzofuran	NC	=	(	7.20E-10	÷		)
Fluoranthene	NC	=	(	1.04E-08	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.98E-09	÷		)
Naphthalene	4.86E-07	=	(	1.46E-09	÷	3.00E-03	)
Pyrene	NC	=	(	8.45E-09	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 323
Child Trespasser Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-4-23
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	5.39E-06	=	1.61E-06	+	3.77E-06	+	8.48E-11
Benzo(a)pyrene	4.31E-05	=	1.29E-05	+	3.02E-05	+	6.78E-10
Benzo(b)fluoranthene	6.68E-06	=	2.00E-06	+	4.68E-06	+	1.05E-10
Benzo(k)fluoranthene	2.15E-07	=	6.45E-08	+	1.51E-07	+	3.39E-11
Carbazole	NC	=	0.00E+00	+	NC	+	NC
Chrysene	6.68E-08	=	2.00E-08	+	4.68E-08	+	1.05E-11
Dibenz(a,h)anthracene	8.40E-06	=	2.51E-06	+	5.89E-06	+	1.44E-10
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	2.37E-06	=	7.09E-07	+	1.66E-06	+	3.73E-11
Naphthalene	8.49E-12	=	NC	+	NC	+	8.49E-12
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**6.62E-05**	=	**1.98E-05**	+	**4.64E-05**	+	**1.10E-09**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	2.06E-03	=	2.06E-03	+	NC	+	NC
Fluoranthene	2.50E-03	=	7.47E-04	+	1.75E-03	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	2.09E-04	=	2.09E-04	+	NC	+	4.86E-07
Pyrene	2.70E-03	=	8.07E-04	+	1.89E-03	+	NC
Total HI	**7.46E-03**	=	**3.82E-03**	+	**3.64E-03**	+	**4.86E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 324
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	3.06E-06	=	(	250.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.45E-05	=	(	200	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.80E-06	=	(	310.0	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.22E-07	=	(	100	×	7.30E-02	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	24.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Chrysene	3.80E-08	=	(	310.0	×	7.30E-03	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	4.78E-06	=	(	39.0	×	7.30E+00	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	40	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	580	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.35E-06	=	(	110	×	7.30E-01	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	81.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	470.0	×		×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 325
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Dibenzofuran	1.88E-03	=	(	40	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	6.81E-04	=	(	580	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×		)
Naphthalene	1.90E-04	=	(	81.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	7.36E-04	=	(	470.0	×	1E-06	×	12	×	25.0	×	100	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 326
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.31E-06	= (	250.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.05E-05	= (	200	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	1.63E-06	= (	310.0	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	5.25E-08	= (	100	×	7.30E-02		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	24.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Chrysene	1.63E-08	= (	310.0	×	7.30E-03		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	2.05E-06	= (	39.0	×	7.30E+00		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	40	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	580	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.78E-07	= (	110	×	7.30E-01		1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	81.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×		) ÷ (	70	×	25,550	)
Pyrene	NC	= (	470.0	×			1.00E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 327
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	40	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	2.92E-04	=	(	580	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	81.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	3.16E-04	=	(	470.0	×	1E-06	×	12	×	25	×	1	×	3300	×	0.1	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 328
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	7.41E-10	=	(	250.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	5.93E-10	=	(	200	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	9.19E-10	=	(	310.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	2.97E-10	=	(	100	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	7.12E-11	=	(	24.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	9.19E-10	=	(	310.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	1.16E-10	=	(	39.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	1.19E-10	=	(	40	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	1.72E-09	=	(	580	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	3.26E-10	=	(	110	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	2.40E-10	=	(	81.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	1.39E-09	=	(	470.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 329
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	**Inh - Risk**	**=**	**(**	**EC**	**×**	**Unit risk**	**×**	**CF**	**)**
Units	**unitless**			**mg/m^3**		**m^3/ug**		**ug/mg**	
Benzo(a)anthracene	8.15E-11	=	(	7.41E-10	×	1.10E-04	×	1000	)
Benzo(a)pyrene	6.52E-10	=	(	5.93E-10	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	1.01E-10	=	(	9.19E-10	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	3.26E-11	=	(	2.97E-10	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	7.12E-11	×		×	1000	)
Chrysene	1.01E-11	=	(	9.19E-10	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	1.39E-10	=	(	1.16E-10	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	1.19E-10	×		×	1000	)
Fluoranthene	NC	=	(	1.72E-09	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	3.59E-11	=	(	3.26E-10	×	1.10E-04	×	1000	)
Naphthalene	8.17E-12	=	(	2.40E-10	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	1.39E-09	×		×	1000	)

Notes:
CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 330
Calculation of EC: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	2.08E-09	=	(	250.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	1.66E-09	=	(	200	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	2.57E-09	=	(	310.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	8.30E-10	=	(	100	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	1.99E-10	=	(	24.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	2.57E-09	=	(	310.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	3.24E-10	=	(	39.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	3.32E-10	=	(	40	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	4.82E-09	=	(	580	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	9.13E-10	=	(	110	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	6.72E-10	=	(	81.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	3.90E-09	=	(	470.0	×	8	×	12	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 331
Risk Calculations: Reasonable Maximum Exposure
Maintenance Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzo(a)anthracene	NC	=	(	2.08E-09	÷		)
Benzo(a)pyrene	NC	=	(	1.66E-09	÷		)
Benzo(b)fluoranthene	NC	=	(	2.57E-09	÷		)
Benzo(k)fluoranthene	NC	=	(	8.30E-10	÷		)
Carbazole	NC	=	(	1.99E-10	÷		)
Chrysene	NC	=	(	2.57E-09	÷		)
Dibenz(a,h)anthracene	NC	=	(	3.24E-10	÷		)
Dibenzofuran	NC	=	(	3.32E-10	÷		)
Fluoranthene	NC	=	(	4.82E-09	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	9.13E-10	÷		)
Naphthalene	2.24E-07	=	(	6.72E-10	÷	3.00E-03	)
Pyrene	NC	=	(	3.90E-09	÷		)

Notes:
EC – Exposure Concentration
Inh - HQ – Inhalation Hazard Quotient
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
RfC – Inhalation Reference Concentration

Table 332
Maintenance Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-4-23
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	4.37E-06	=	3.06E-06	+	1.31E-06	+	8.15E-11	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	3.50E-05	=	2.45E-05	+	1.05E-05	+	6.52E-10	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	5.42E-06	=	3.80E-06	+	1.63E-06	+	1.01E-10	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	1.75E-07	=	1.22E-07	+	5.25E-08	+	3.26E-11	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	5.43E-08	=	3.80E-08	+	1.63E-08	+	1.01E-11	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	6.82E-06	=	4.78E-06	+	2.05E-06	+	1.39E-10	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	1.88E-03	=	1.88E-03	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC	9.73E-04	=	6.81E-04	+	2.92E-04	+	NC
Indeno(1,2,3-c,d)pyrene	1.92E-06	=	1.35E-06	+	5.78E-07	+	3.59E-11	NC	=	NC	+	NC	+	NC
Naphthalene	8.17E-12	=	NC	+	NC	+	8.17E-12	1.90E-04	=	1.90E-04	+	NC	+	2.24E-07
Pyrene	NC	=	NC	+	NC	+	NC	1.05E-03	=	7.36E-04	+	3.16E-04	+	NC
Total CR	**5.38E-05**	=	**3.76E-05**	+	**1.61E-05**	+	**1.06E-09**	**Total HI**	**4.09E-03**	=	**3.49E-03**	+	**6.08E-04**	+	**2.24E-07**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 333
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	3.19E-05	=	(	250.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.55E-04	=	(	200	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	3.95E-05	=	(	310.0	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.28E-06	=	(	100	×	7.30E-02	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	24.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Chrysene	3.95E-07	=	(	310.0	×	7.30E-03	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	4.97E-05	=	(	39.0	×	7.30E+00	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	40	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	580	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.40E-05	=	(	110	×	7.30E-01	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	81.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	470.0	×		×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 334
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Dibenzofuran	1.96E-02	=	(	40	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	7.09E-03	=	(	580	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×		)
Naphthalene	1.98E-03	=	(	81.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	7.66E-03	=	(	470.0	×	1E-06	×	250	×	25	×	50	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 335
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	5.47E-05	= (	250.0	×	7.30E-01		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	4.38E-04	= (	200	×	7.30E+00		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	6.79E-05	= (	310.0	×	7.30E-01		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	2.19E-06	= (	100	×	7.30E-02		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	24.0	×			1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Chrysene	6.79E-07	= (	310.0	×	7.30E-03		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	8.54E-05	= (	39.0	×	7.30E+00		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	40	×			1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	580	×			1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	2.41E-05	= (	110	×	7.30E-01		1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	81.0	×			1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		) ÷ (	70	×	25,550	)
Pyrene	NC	= (	470.0	×			1.00E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 336
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Dibenzofuran	NC	=	(	40	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	1.00E-03	)
Fluoranthene	1.22E-02	=	(	580	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	4.00E-02	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×		)
Naphthalene	NC	=	(	81.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×		)	÷	(	70	×	9,125	×	2.00E-02	)
Pyrene	1.32E-02	=	(	470.0	×	1E-06	×	250	×	25	×	1	×	3,300	×	0.2	×	1.30E-01	)	÷	(	70	×	9,125	×	3.00E-02	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 337
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	1.54E-08	=	(	250.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(a)pyrene	1.24E-08	=	(	200	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(b)fluoranthene	1.91E-08	=	(	310.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Benzo(k)fluoranthene	6.18E-09	=	(	100	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Carbazole	1.48E-09	=	(	24.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Chrysene	1.91E-08	=	(	310.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenz(a,h)anthracene	2.41E-09	=	(	39.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Dibenzofuran	2.47E-09	=	(	40	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Fluoranthene	3.58E-08	=	(	580	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Indeno(1,2,3-c,d)pyrene	6.79E-09	=	(	110	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Naphthalene	5.00E-09	=	(	81.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)
Pyrene	2.90E-08	=	(	470.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	613,200	)

Notes:

AT_c – Averaging Time for Carcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 338
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	1.70E-09	=	(	1.54E-08	×	1.10E-04	×	1000	)
Benzo(a)pyrene	1.36E-08	=	(	1.24E-08	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	2.11E-09	=	(	1.91E-08	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	6.79E-10	=	(	6.18E-09	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	1.48E-09	×		×	1000	)
Chrysene	2.11E-10	=	(	1.91E-08	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	2.89E-09	=	(	2.41E-09	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	2.47E-09	×		×	1000	)
Fluoranthene	NC	=	(	3.58E-08	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	7.47E-10	=	(	6.79E-09	×	1.10E-04	×	1000	)
Naphthalene	1.70E-10	=	(	5.00E-09	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	2.90E-08	×		×	1000	)

Notes:

CF – Conversion Factor

EC – Exposure Concentration

Inh - Risk – Inhalation Risk

m^3/ug – meters cubed per microgram

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

ug/mg – microgram per milligram

Table 339
Calculation of EC: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_n}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	]	AT_n	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	4.32E-08	=	(	250.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(a)pyrene	3.46E-08	=	(	200	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(b)fluoranthene	5.36E-08	=	(	310.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Benzo(k)fluoranthene	1.73E-08	=	(	100	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Carbazole	4.15E-09	=	(	24.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Chrysene	5.36E-08	=	(	310.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenz(a,h)anthracene	6.75E-09	=	(	39.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Dibenzofuran	6.92E-09	=	(	40	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Fluoranthene	1.00E-07	=	(	580	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Indeno(1,2,3-c,d)pyrene	1.90E-08	=	(	110	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Naphthalene	1.40E-08	=	(	81.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)
Pyrene	8.13E-08	=	(	470.0	×	8	×	250	×	25	]	)	÷	(	1.32E+09	x	219,000	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 340
Risk Calculations: Reasonable Maximum Exposure
Indoor Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - HQ = EC/RfC

Equation Units	Inh - HQ unitless	=	(	EC mg/m^3	÷	RfC mg/m^3	)
Benzo(a)anthracene	NC	=	(	4.32E-08	÷		)
Benzo(a)pyrene	NC	=	(	3.46E-08	÷		)
Benzo(b)fluoranthene	NC	=	(	5.36E-08	÷		)
Benzo(k)fluoranthene	NC	=	(	1.73E-08	÷		)
Carbazole	NC	=	(	4.15E-09	÷		)
Chrysene	NC	=	(	5.36E-08	÷		)
Dibenz(a,h)anthracene	NC	=	(	6.75E-09	÷		)
Dibenzofuran	NC	=	(	6.92E-09	÷		)
Fluoranthene	NC	=	(	1.00E-07	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.90E-08	÷		)
Naphthalene	4.67E-06	=	(	1.40E-08	÷	3.00E-03	)
Pyrene	NC	=	(	8.13E-08	÷		)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 341
Indoor Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-4-23
Vertellus

	Carcinogenic Risk						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless
Benzo(a)anthracene	8.66E-05	=	3.19E-05	+	5.47E-05	+	1.70E-09
Benzo(a)pyrene	6.93E-04	=	2.55E-04	+	4.38E-04	+	1.36E-08
Benzo(b)fluoranthene	1.07E-04	=	3.95E-05	+	6.79E-05	+	2.11E-09
Benzo(k)fluoranthene	3.46E-06	=	1.28E-06	+	2.19E-06	+	6.79E-10
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	1.07E-06	=	3.95E-07	+	6.79E-07	+	2.11E-10
Dibenz(a,h)anthracene	1.35E-04	=	4.97E-05	+	8.54E-05	+	2.89E-09
Dibenzofuran	NC	=	NC	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC
Indeno(1,2,3-c,d)pyrene	3.81E-05	=	1.40E-05	+	2.41E-05	+	7.47E-10
Naphthalene	1.70E-10	=	NC	+	NC	+	1.70E-10
Pyrene	NC	=	NC	+	NC	+	NC
Total CR	**1.06E-03**	=	**3.92E-04**	+	**6.73E-04**	+	**2.21E-08**

	Noncarcinogenic Hazard						
	HI	=	Ingestion	+	Dermal	+	Inhalation
	unitless		unitless		unitless		unitless
Benzo(a)anthracene	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC
Chrysene	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	NC	=	NC	+	NC	+	NC
Dibenzofuran	1.96E-02	=	1.96E-02	+	NC	+	NC
Fluoranthene	1.93E-02	=	7.09E-03	+	1.22E-02	+	NC
Indeno(1,2,3-c,d)pyrene	NC	=	NC	+	NC	+	NC
Naphthalene	1.99E-03	=	1.98E-03	+	NC	+	4.67E-06
Pyrene	2.08E-02	=	7.66E-03	+	1.32E-02	+	NC
Total HI	**6.16E-02**	=	**3.63E-02**	+	**2.53E-02**	+	**4.67E-06**

Notes:

CR – Cancer Risk

HI – Hazard Index

NC – Not Calculated

Table 342
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing-Risk} = \frac{C_{soil} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{soil}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
Benzo(a)anthracene	4.21E-06	=	(	250.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	3.37E-05	=	(	200	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	5.22E-06	=	(	310.0	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	1.68E-07	=	(	100	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Carbazole	NC	=	(	24.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	5.22E-08	=	(	310.0	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	6.57E-06	=	(	39.0	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenzofuran	NC	=	(	40	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	580	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.85E-06	=	(	110	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	81.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	470.0	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Soil Ingestion Rate

Table 343
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Ing - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Dibenzofuran	1.61E-02	=	(	40	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	9.36E-03	=	(	580	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	2.18E-04	=	(	81.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	2.53E-03	=	(	470.0	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{soil} – Soil Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Soil Ingestion Rate

Table 344
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - Risk} = \frac{C_{soil} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{soil}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
Benzo(a)anthracene	1.64E-06	= (	250.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	1.31E-05	= (	200	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	2.04E-06	= (	310.0	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	6.57E-08	= (	100	×	7.30E-02		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Carbazole	NC	= (	24.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Chrysene	2.04E-08	= (	310.0	×	7.30E-03		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	2.56E-06	= (	39.0	×	7.30E+00		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Dibenzofuran	NC	= (	40	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	580	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	7.22E-07	= (	110	×	7.30E-01		1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	81.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Pyrene	NC	= (	470.0	×			1.00E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 345
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$\text{Derm - HQ} = \frac{C_{soil} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{soil}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
Benzo(a)anthracene	NC	=	(	250.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	200	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	310.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	100	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Carbazole	NC	=	(	24.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	310.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenz(a,h)anthracene	NC	=	(	39.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Dibenzofuran	NC	=	(	40	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Fluoranthene	3.65E-03	=	(	580	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	110	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	81.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Pyrene	9.86E-04	=	(	470.0	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)

Notes:
ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{soil} – Soil Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 346
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation
Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_c}$$

Equation	EC	=	(	Csoil	×	ET	×	EF	×	ED	]	)	÷	(	PEF	(	AT_c	)
Units	mg/m^3			mg/kg		hours/day		days/year		year					m^3/kg		hours	
Benzo(a)anthracene	4.08E-07	=	(	250.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(a)pyrene	3.26E-07	=	(	200	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(b)fluoranthene	5.06E-07	=	(	310.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Benzo(k)fluoranthene	1.63E-07	=	(	100	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Carbazole	3.91E-08	=	(	24.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Chrysene	5.06E-07	=	(	310.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenz(a,h)anthracene	6.36E-08	=	(	39.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Dibenzofuran	6.52E-08	=	(	40	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Fluoranthene	9.46E-07	=	(	580	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Indeno(1,2,3-c,d)pyrene	1.79E-07	=	(	110	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Naphthalene	1.32E-07	=	(	81.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)
Pyrene	7.66E-07	=	(	470.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	613,200	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m^3/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 347
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Carcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - Risk = EC × Unit Risk × CF

Equation	Inh - Risk	=	(	EC	×	Unit risk	×	CF	)
Units	unitless			mg/m^3		m^3/ug		ug/mg	
Benzo(a)anthracene	4.48E-08	=	(	4.08E-07	×	1.10E-04	×	1000	)
Benzo(a)pyrene	3.59E-07	=	(	3.26E-07	×	1.10E-03	×	1000	)
Benzo(b)fluoranthene	5.56E-08	=	(	5.06E-07	×	1.10E-04	×	1000	)
Benzo(k)fluoranthene	1.79E-08	=	(	1.63E-07	×	1.10E-04	×	1000	)
Carbazole	NC	=	(	3.91E-08	×		×	1000	)
Chrysene	5.56E-09	=	(	5.06E-07	×	1.10E-05	×	1000	)
Dibenz(a,h)anthracene	7.63E-08	=	(	6.36E-08	×	1.20E-03	×	1000	)
Dibenzofuran	NC	=	(	6.52E-08	×		×	1000	)
Fluoranthene	NC	=	(	9.46E-07	×		×	1000	)
Indeno(1,2,3-c,d)pyrene	1.97E-08	=	(	1.79E-07	×	1.10E-04	×	1000	)
Naphthalene	4.49E-09	=	(	1.32E-07	×	3.40E-05	×	1000	)
Pyrene	NC	=	(	7.66E-07	×		×	1000	)

Notes:

CF – Conversion Factor
EC – Exposure Concentration
Inh - Risk – Inhalation Risk
m^3/ug – meters cubed per microgram
mg/m^3 – milligrams per cubic meters
NC – Not Calculated
ug/mg – microgram per milligram

Table 348
Calculation of EC: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway– Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

$$EC = \frac{Csoil \times ET \times EF \times ED}{PEF \times AT_{nc}}$$

Equation Units	EC mg/m^3	=	(	Csoil mg/kg	×	ET hours/day	×	EF days/year	×	ED year	]	)	÷	(	PEF m^3/kg	]	AT_{nc} hours	)
Benzo(a)anthracene	2.85E-05	=	(	250.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(a)pyrene	2.28E-05	=	(	200	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(b)fluoranthene	3.54E-05	=	(	310.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Benzo(k)fluoranthene	1.14E-05	=	(	100	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Carbazole	2.74E-06	=	(	24.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Chrysene	3.54E-05	=	(	310.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenz(a,h)anthracene	4.45E-06	=	(	39.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Dibenzofuran	4.57E-06	=	(	40	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Fluoranthene	6.62E-05	=	(	580	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Indeno(1,2,3-c,d)pyrene	1.26E-05	=	(	110	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Naphthalene	9.25E-06	=	(	81.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)
Pyrene	5.37E-05	=	(	470.0	×	8	×	125	×	1.0	]	)	÷	(	1.00E+06	x	8,760	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
C_{soil} – Soil Concentration
EC – Exposure Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
m³/kg – cubic meters per kilogram
mg/kg – milligrams per kilogram
mg/m^3 – milligrams per cubic meters
PEF – Particulate Emission Factor

Table 349
Risk Calculations: Reasonable Maximum Exposure
Construction Worker: Inhalation Pathway – Noncarcinogenic Effects
Surface Soil
Hotspot 2-SF-4-23
Vertellus

Inh - HQ = EC/RfC

Equation	Inh - HQ	=	(	EC	÷	RfC	)
Units	unitless			mg/m^3		mg/m^3	
Benzo(a)anthracene	NC	=	(	2.85E-05	÷		)
Benzo(a)pyrene	NC	=	(	2.28E-05	÷		)
Benzo(b)fluoranthene	NC	=	(	3.54E-05	÷		)
Benzo(k)fluoranthene	NC	=	(	1.14E-05	÷		)
Carbazole	NC	=	(	2.74E-06	÷		)
Chrysene	NC	=	(	3.54E-05	÷		)
Dibenz(a,h)anthracene	NC	=	(	4.45E-06	÷		)
Dibenzofuran	NC	=	(	4.57E-06	÷		)
Fluoranthene	NC	=	(	6.62E-05	÷		)
Indeno(1,2,3-c,d)pyrene	NC	=	(	1.26E-05	÷		)
Naphthalene	3.08E-03	=	(	9.25E-06	÷	3.00E-03	)
Pyrene	NC	=	(	5.37E-05	÷		)

Notes:

EC – Exposure Concentration

Inh - HQ – Inhalation Hazard Quotient

mg/m^3 – milligrams per cubic meters

NC – Not Calculated

RfC – Inhalation Reference Concentration

Table 350
Construction Worker Risk Summary
Reasonable Maximum Exposure
Surface Soil
Hotspot 2-SF-4-23
Vertellus

	Carcinogenic Risk							Noncarcinogenic Hazard						
Equation	CR	=	Ingestion	+	Dermal	+	Inhalation	HI	=	Ingestion	+	Dermal	+	Inhalation
Units	unitless		unitless		unitless		unitless	unitless		unitless		unitless		unitless
Benzo(a)anthracene	5.90E-06	=	4.21E-06	+	1.64E-06	+	4.48E-08	NC	=	NC	+	NC	+	NC
Benzo(a)pyrene	4.72E-05	=	3.37E-05	+	1.31E-05	+	3.59E-07	NC	=	NC	+	NC	+	NC
Benzo(b)fluoranthene	7.31E-06	=	5.22E-06	+	2.04E-06	+	5.56E-08	NC	=	NC	+	NC	+	NC
Benzo(k)fluoranthene	2.52E-07	=	1.68E-07	+	6.57E-08	+	1.79E-08	NC	=	NC	+	NC	+	NC
Carbazole	NC	=	NC	+	NC	+	NC	NC	=	NC	+	NC	+	NC
Chrysene	7.81E-08	=	5.22E-08	+	2.04E-08	+	5.56E-09	NC	=	NC	+	NC	+	NC
Dibenz(a,h)anthracene	9.20E-06	=	6.57E-06	+	2.56E-06	+	7.63E-08	NC	=	NC	+	NC	+	NC
Dibenzofuran	NC	=	NC	+	NC	+	NC	1.61E-02	=	1.61E-02	+	NC	+	NC
Fluoranthene	NC	=	NC	+	NC	+	NC	1.30E-02	=	9.36E-03	+	3.65E-03	+	NC
Indeno(1,2,3-c,d)pyrene	2.59E-06	=	1.85E-06	+	7.22E-07	+	1.97E-08	NC	=	NC	+	NC	+	NC
Naphthalene	4.49E-09	=	NC	+	NC	+	4.49E-09	3.30E-03	=	2.18E-04	+	NC	+	3.08E-03
Pyrene	NC	=	NC	+	NC	+	NC	3.52E-03	=	2.53E-03	+	9.86E-04	+	NC
Total CR	**7.25E-05**	=	**5.17E-05**	+	**2.02E-05**	+	**5.83E-07**	**Total HI**	**3.60E-02**	=	**2.83E-02**	+	**4.64E-03**	+	**3.08E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 351
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Incidental Ingestion of Sediments Pathway – Carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sed} \times SF_o \times CF \times EF \times ED \times SIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sed}	×	SF_o	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/kg		kg-day/mg		kg/mg		days/year		years		mg/day				kg		days	
2,4-Dimethylphenol	NC	=	(	6.03E-01	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
2-Methylnaphthalene	NC	=	(	7.70E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Acenaphthene	NC	=	(	1.137E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzene	3.36E-09	=	(	2.65E+00	×	5.50E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzenethiol	NC	=	(	4.70E-02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	1.62E-06	=	(	9.63E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	1.01E-05	=	(	6.01E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	9.91E-07	=	(	5.89E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	8.23E-08	=	(	4.89E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Chrysene	1.69E-08	=	(	1.01E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	1.22E+00	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Dibenz(a,h)anthracene	1.72E-06	=	(	1.02E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Ethylbenzene	4.22E-09	=	(	1.66E+01	×	1.10E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluoranthene	NC	=	(	3.49E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Fluorene	NC	=	(	2.35E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	4.34E-07	=	(	2.58E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.728E+03	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Phenanthrene	NC	=	(	6.38E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)
Pyrene	NC	=	(	3.00E+02	×		×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - Risk – Ingestion Risk
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
SF_o – Oral Slope Factor
SIR – Sediment Ingestion Rate

Table 352
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Incidental Ingestion of Sediments Pathway – Noncarcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sed} \times CF \times EF \times ED \times SIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sed}	×	CF	×	EF	×	ED	×	SIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/kg		kg/mg		days/year		years		mg/day				kg		days		mg/kg-day	
2,4-Dimethylphenol	4.87E-05	=	(	6.03E-01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-02	)
2-Methylnaphthalene	3.11E-01	=	(	7.70E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	9.17E-03	=	(	1.137E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	4.27E-04	=	(	2.65E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzenethiol	7.59E-06	=	(	4.70E-02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	9.63E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	6.01E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	5.89E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	4.89E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	1.01E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Cyanide, Total	3.95E-05	=	(	1.22E+00	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.02E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Ethylbenzene	2.69E-04	=	(	1.66E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	5.63E-03	=	(	3.49E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	9.50E-04	=	(	2.35E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.58E+01	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×		)
Naphthalene	4.65E-03	=	(	1.728E+03	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	3.43E-03	=	(	6.38E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	1.61E-03	=	(	3.00E+02	×	1E-06	×	125	×	1.0	×	330	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
C_{sed} – Sediment Concentration
ED – Exposure Duration
EF – Exposure Frequency
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/day – milligrams/day
mg/kg – milligrams per kilogram
NC – Not Calculated
RfD_o – Oral Reference Dose
SIR – Sediment Ingestion Rate

Table 353
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Dermal Contact with Sediments Pathway – Carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Derm - Risk} = \frac{C_{sed} \times SF_{abs} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_c}$$

Equation	Derm - Risk	= (	C_{sed}	×	SF_{abs}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABSd	) ÷ (	BW	×	AT_c	)
Units	unitless		mg/kg		kg-day/mg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless		kg		days	
2,4-Dimethylphenol	NC	= (	6.03E-01	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	) ÷ (	70	×	25,550	)
2-Methylnaphthalene	NC	= (	7.70E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Acenaphthene	NC	= (	1.137E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzene	NC	= (	2.65E+00	×	5.50E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzenethiol	NC	= (	4.70E-02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Benzo(a)anthracene	6.33E-07	= (	9.63E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(a)pyrene	3.94E-06	= (	6.01E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(b)fluoranthene	3.87E-07	= (	5.89E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Benzo(k)fluoranthene	3.21E-08	= (	4.89E+01	×	7.30E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Chrysene	6.60E-09	= (	1.01E+02	×	7.30E-03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Cyanide, Total	NC	= (	1.22E+00	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Dibenz(a,h)anthracene	6.72E-07	= (	1.02E+01	×	7.30E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Ethylbenzene	NC	= (	1.66E+01	×	1.10E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Fluoranthene	NC	= (	3.49E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Fluorene	NC	= (	2.35E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	1.69E-07	= (	2.58E+01	×	7.30E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Naphthalene	NC	= (	1.728E+03	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		) ÷ (	70	×	25,550	)
Phenanthrene	NC	= (	6.38E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)
Pyrene	NC	= (	3.00E+02	×		×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	) ÷ (	70	×	25,550	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
kg-day/mg – kilogram-day per milligram
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor
SSAF – Soil-to-Skin Adherence Factor

Table 354
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Dermal Contact with Sediments Pathway – Non-carcinogenic Effects
Surface and Subsurface Sediments
EA1
Vertellus

$$\text{Derm - HQ} = \frac{C_{sed} \times CF \times EF \times ED \times EV \times SA \times SSAF \times ABS_d}{BW \times AT_{nc} \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{sed}	×	CF	×	EF	×	ED	×	EV	×	SA	×	SSAF	×	ABS_d	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/kg		kg/mg		days/year		years		events/day		cm²		mg/cm²-event		unitless				kg		days		mg/kg-day	
2,4-Dimethylphenol	1.46E-05	=	(	6.03E-01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.00E-01	)	÷	(	70	×	365	×	2.00E-02	)
2-Methylnaphthalene	NC	=	(	7.70E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	4.00E-03	)
Acenaphthene	3.58E-03	=	(	1.137E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	2.00E-01	)
Benzene	NC	=	(	2.65E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzenethiol	NC	=	(	4.70E-02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	9.63E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	6.01E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	5.89E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	4.89E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	1.01E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Cyanide, Total	NC	=	(	1.22E+00	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	5.00E-02	)
Dibenz(a,h)anthracene	NC	=	(	1.02E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Ethylbenzene	NC	=	(	1.66E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	1.00E-01	)
Fluoranthene	2.20E-03	=	(	3.49E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	1.00E-01	)
Fluorene	3.70E-04	=	(	2.35E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	4.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.58E+01	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×		)
Naphthalene	NC	=	(	1.728E+03	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×		)	÷	(	70	×	365	×	6.00E-01	)
Phenanthrene	1.34E-03	=	(	6.38E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)
Pyrene	6.29E-04	=	(	3.00E+02	×	1E-06	×	125	×	1.0	×	1	×	3,300	×	0.3	×	1.30E-01	)	÷	(	70	×	365	×	3.00E-01	)

Notes:

ABSd – Dermal Absorption Fraction
ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm^2 – centimeters squared
C_{sed} – Sediment Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
EV – Events
kg – kilogram
kg/mg – kilograms per milligram
mg/kg-day – milligrams per kilogram-day
mg/cm^2-event – milligrams per square centimeter-event
mg/kg – milligrams per kilogram
NC – Not Calculated
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose
SSAF – Soil-to-Skin Adherence Factor

Table 355
Construction Worker Scenario 2 Risk Summary
Reasonable Maximum Exposure
Surface and Subsurface Sediments
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
2,4-Dimethylphenol	NC	=	NC	+	NC	6.32E-05	=	4.87E-05	+	1.46E-05
2-Methylnaphthalene	NC	=	NC	+	NC	3.11E-01	=	3.11E-01	+	NC
Acenaphthene	NC	=	NC	+	NC	1.28E-02	=	9.17E-03	+	3.58E-03
Benzene	3.36E-09	=	3.36E-09	+	NC	4.27E-04	=	4.27E-04	+	NC
Benzenethiol	NC	=	NC	+	NC	7.59E-06	=	7.59E-06	+	NC
Benzo(a)anthracene	2.25E-06	=	1.62E-06	+	6.33E-07	NC	=	NC	+	NC
Benzo(a)pyrene	1.41E-05	=	1.01E-05	+	3.94E-06	NC	=	NC	+	NC
Benzo(b)fluoranthene	1.38E-06	=	9.91E-07	+	3.87E-07	NC	=	NC	+	NC
Benzo(k)fluoranthene	1.14E-07	=	8.23E-08	+	3.21E-08	NC	=	NC	+	NC
Chrysene	2.35E-08	=	1.69E-08	+	6.60E-09	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	3.95E-05	=	3.95E-05	+	NC
Dibenz(a,h)anthracene	2.39E-06	=	1.72E-06	+	6.72E-07	NC	=	NC	+	NC
Ethylbenzene	4.22E-09	=	4.22E-09	+	NC	2.69E-04	=	2.69E-04	+	NC
Fluoranthene	NC	=	NC	+	NC	7.83E-03	=	5.63E-03	+	2.20E-03
Fluorene	NC	=	NC	+	NC	1.32E-03	=	9.50E-04	+	3.70E-04
Indeno(1,2,3-c,d)pyrene	6.03E-07	=	4.34E-07	+	1.69E-07	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	4.65E-03	=	4.65E-03	+	NC
Phenanthrene	NC	=	NC	+	NC	4.77E-03	=	3.43E-03	+	1.34E-03
Pyrene	NC	=	NC	+	NC	2.24E-03	=	1.61E-03	+	6.29E-04
Total CR	**2.08E-05**	=	**1.50E-05**	+	**5.84E-06**	**Total HI**	**3.45E-01**	=	**3.37E-01**	+	**8.13E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated

Table 356
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Incidental Ingestion Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing-Risk} = \frac{C_{sw} \times SF_o \times EF \times ED \times ET \times SWIR}{BW \times AT_c}$$

Equation	Ing - Risk	=	(	C_{sw}	×	SF_o	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		days/year		years		hours/day		L/hour				kg		days	
3&4-Methylphenol	NC	=	(	3.74E-01	×		×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzene	3.42E-10	=	(	1.78E-02	×	5.50E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(a)anthracene	5.10E-12	=	(	2.00E-05	×	7.30E-01	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(a)pyrene	6.25E-11	=	(	2.45E-05	×	7.30E+00	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	6.45E-12	=	(	2.53E-05	×	7.30E-01	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	
Benzo(k)fluoranthene	4.54E-13	=	(	1.78E-05	×	7.30E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)
Chrysene	6.45E-14	=	(	2.53E-05	×	7.30E-03	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	1.13E-02	×		×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)
Ethylbenzene	3.84E-12	=	(	1.00E-03	×	1.10E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	5.10E-12	=	(	2.00E-05	×	7.30E-01	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	
Naphthalene	NC	=	(	1.20E-02	×		×	125	×	1	×	1	×	0.005	)	÷	(	70	×	25,550	)

Notes:

AT_c – Averaging Time for Carcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - Risk – Ingestion Risk
kg – kilogram
kg-day/mg – kilogram-day per milligram
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
SF_o – Oral Slope Factor

Table 357
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Incidental Ingestion Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Ing - HQ} = \frac{C_{sw} \times EF \times ED \times ET \times SWIR}{BW \times AT_{nc} \times RfD_o}$$

Equation	Ing - HQ	=	(	C_{sw}	×	EF	×	ED	×	ET	×	SWIR	)	÷	(	BW	×	AT_{nc}	×	RfD_o	)
Units	unitless			mg/L		days/year		years		hours/day		L/hour				kg		days		mg/kg-day	
3&4-Methylphenol	1.83E-04	=	(	3.74E-01	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×	5.00E-02	)
Benzene	4.35E-05	=	(	1.78E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.53E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Cyanide, Total	5.52E-06	=	(	1.13E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×	5.00E-02	)
Ethylbenzene	2.45E-07	=	(	1.00E-03	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×		)
Naphthalene	4.88E-07	=	(	1.20E-02	×	125	×	1	×	1	×	0.005	)	÷	(	70	×	365	×	6.00E-01	)

Notes:

AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
C_{sw} – Surface Water Concentration
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
SWIR – Surface Water Ingestion Rate
Ing - HQ – Ingestion Hazard Quotient
kg – kilogram
mg/kg-day – milligrams per kilogram-day
L/hour – liters per hour
mg/L – milligrams per liter
NC – Not Calculated
RfD_o – Oral Reference Dose

Table 358
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Dermal Contact Pathway – Carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - Risk} = \frac{C_{sw} \times SFabs \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times AT_c}$$

Equation	Derm - Risk	=	(	C_{sw}	×	SF_{abs}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	)	÷	(	BW	×	AT_c	)
Units	unitless			mg/L		kg-day/mg		L/cm^3		days/year		years		hours/day		cm^2		cm/hour				kg		days	
3&4-Methylphenol	NC	=	(	3.74E-01	×			1.00E-03	×	125	×	1	×	1	×	3,300	×	7.80E-03	)	÷	(	70	×	25,550	)
Benzene	3.39E-09	=	(	1.78E-02	×	5.50E-02		1.00E-03	×	125	×	1	×	1	×	3,300	×	1.50E-02	)	÷	(	70	×	25,550	)
Benzo(a)anthracene	1.58E-09	=	(	2.00E-05	×	7.30E-01		1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	25,550	)
Benzo(a)pyrene	2.89E-08	=	(	2.45E-05	×	7.30E+00		1.00E-03	×	125	×	1	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	25,550	)
Benzo(b)fluoranthene	2.98E-09	=	(	2.53E-05	×	7.30E-01		1.00E-03	×	125	×	1	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	25,550	)
Benzo(k)fluoranthene	2.07E-10	=	(	1.78E-05	×	7.30E-02		1.00E-03	×	125	×	1	×	1	×	3,300	×	6.91E-01	)	÷	(	70	×	25,550	)
Chrysene	2.00E-11	=	(	2.53E-05	×	7.30E-03		1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	25,550	)
Cyanide, Total	NC	=	(	1.13E-02	×			1.00E-03	×	125	×	1	×	1	×	3,300	×	1.00E-03	)	÷	(	70	×	25,550	)
Ethylbenzene	1.24E-10	=	(	1.00E-03	×	1.10E-02		1.00E-03	×	125	×	1	×	1	×	3,300	×	4.90E-02	)	÷	(	70	×	25,550	)
Indeno(1,2,3-c,d)pyrene	3.37E-09	=	(	2.00E-05	×	7.30E-01		1.00E-03	×	125	×	1	×	1	×	3,300	×	1.00E+00	)	÷	(	70	×	25,550	)
Naphthalene	NC	=	(	1.20E-02	×			1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-02	)	÷	(	70	×	25,550	)

Notes:
ABS_{gi} – Gastrointestinal Absorption Factor
AT_c – Averaging Time for Carcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - Risk – Dermal Risk
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
kg-day/mg – kilogram-day per milligram
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
SF_{abs} – Dermal Slope Factor ($SF_o \div ABS_{gi}$)
SF_o – Oral Slope Factor

Table 359
Risk Calculations: Reasonable Maximum Exposure
Construction Worker Scenario 2: Dermal Contact Pathway – Non-carcinogenic Effects
Surface Water
EA1
Vertellus

$$\text{Derm - HQ} = \frac{C_{sw} \times CF \times EF \times ED \times ET \times SA \times PC}{BW \times Atc \times RfD_{abs}}$$

Equation	Derm - HQ	=	(	C_{sw}	×	CF	×	EF	×	ED	×	ET	×	SA	×	PC	)	÷	(	BW	×	AT_{nc}	×	RfD_{abs}	)
Units	unitless			mg/L		L/cm^3		days/year		years		hours/day		cm^2		cm/hour				kg		days		mg/kg-day	
3&4-Methylphenol	9.41E-04	=	(	3.74E-01	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	7.80E-03	)	÷	(	70	×	365	×	5.00E-02	)
Benzene	4.31E-04	=	(	1.78E-02	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	1.50E-02	)	÷	(	70	×	365	×	1.00E-02	)
Benzo(a)anthracene	NC	=	(	2.00E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	365	×		)
Benzo(a)pyrene	NC	=	(	2.45E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	365	×		)
Benzo(b)fluoranthene	NC	=	(	2.53E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	7.00E-01	)	÷	(	70	×	365	×		)
Benzo(k)fluoranthene	NC	=	(	1.78E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	6.91E-01	)	÷	(	70	×	365	×		)
Chrysene	NC	=	(	2.53E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-01	)	÷	(	70	×	365	×		)
Cyanide, Total	3.65E-06	=	(	1.13E-02	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	1.00E-03	)	÷	(	70	×	365	×	5.00E-02	)
Ethylbenzene	7.91E-06	=	(	1.00E-03	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	4.90E-02	)	÷	(	70	×	365	×	1.00E-01	)
Indeno(1,2,3-c,d)pyrene	NC	=	(	2.00E-05	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	1.00E+00	)	÷	(	70	×	365	×		)
Naphthalene	1.51E-05	=	(	1.20E-02	×	1.00E-03	×	125	×	1	×	1	×	3,300	×	4.70E-02	)	÷	(	70	×	365	×	6.00E-01	)

Notes:

ABS_{gi} – Gastrointestinal Absorption Factor
AT_{nc} – Averaging Time for Noncarcinogens
BW – Body Weight
CF – Conversion Factor
cm/hour – centimeters per hour
cm^2 – centimeters squared
L/cm^3 – liters per cubic centimeters
C_{sw} – Surface Water Concentration
Derm - HQ – Dermal Hazard Quotient
ED – Exposure Duration
EF – Exposure Frequency
ET – Exposure Time
kg – kilogram
mg/kg-day – milligrams per kilogram-day
mg/L – milligrams per liter
NC – Not Calculated
PC – Permeability constant
SA – Skin Surface Area
RfD_{abs} – Dermal Reference Dose ($RfD_o \times ABS_{gi}$)
RfD_o – Oral Reference Dose

Table 360
Construction Worker Scenario 2 Risk Summary
Reasonable Maximum Exposure
Surface Water
EA1
Vertellus

	Carcinogenic Risk					Noncarcinogenic Hazard				
Equation	CR	=	Ingestion	+	Dermal	HI	=	Ingestion	+	Dermal
Units	unitless		unitless		unitless	unitless		unitless		unitless
3&4-Methylphenol	NC	=	NC	+	NC	1.12E-03	=	1.83E-04	+	9.41E-04
Benzene	3.73E-09	=	3.42E-10	+	3.39E-09	4.75E-04	=	4.35E-05	+	4.31E-04
Benzo(a)anthracene	1.59E-09	=	5.10E-12	+	1.58E-09	NC	=	NC	+	NC
Benzo(a)pyrene	2.89E-08	=	6.25E-11	+	2.89E-08	NC	=	NC	+	NC
Benzo(b)fluoranthene	2.99E-09	=	6.45E-12	+	2.98E-09	NC	=	NC	+	NC
Benzo(k)fluoranthene	2.08E-10	=	4.54E-13	+	2.07E-10	NC	=	NC	+	NC
Chrysene	2.01E-11	=	6.45E-14	+	2.00E-11	NC	=	NC	+	NC
Cyanide, Total	NC	=	NC	+	NC	9.17E-06	=	5.52E-06	+	3.65E-06
Ethylbenzene	1.28E-10	=	3.84E-12	+	1.24E-10	8.16E-06	=	2.45E-07	+	7.91E-06
Indeno(1,2,3-c,d)pyrene	3.37E-09	=	5.10E-12	+	3.37E-09	NC	=	NC	+	NC
Naphthalene	NC	=	NC	+	NC	1.56E-05	=	4.88E-07	+	1.51E-05
Total CR	**4.10E-08**	=	**4.26E-10**	+	**4.05E-08**	**Total HI**	**1.63E-03**	=	**2.33E-04**	+	**1.40E-03**

Notes:
CR – Cancer Risk
HI – Hazard Index
NC – Not Calculated