

APPENDIX K

Risk Assessment Calculations

CARCINOGENS

Soil Ingestion

$$CDI = CS \text{ (mg/kg)} \times 10^{-6} \text{ (kg/mg)} \times SIR \text{ (mg/day)} \times 1/BW \text{ (kg)} \times (\# \text{ days}/365 \text{ days}) \times (\# \text{ years}/70 \text{ years})$$

Dermal Contact with Soils

$$CDI = CS \text{ (mg/kg)} \times 10^{-6} \text{ (kg/mg)} \times AF \text{ (mg/cm}^2\text{)} \times SA \text{ (cm}^2\text{)} \times ABS/BW \times (\# \text{ days}/365 \text{ days}) \times (\# \text{ years}/70 \text{ years})$$

Inhalation of Resuspended Soil Particulates

1. When using air fate and transport modeling:

$$CDI = CA \text{ (mg/m}^3\text{)} \times IR \text{ (m}^3\text{/days)} \times ET \text{ (hours/day)} \times (\# \text{ days}/365 \text{ days}) \times (\# \text{ yrs}/70 \text{ yrs}) \times 1/BW \text{ (kg)}$$

2. When using the soil concentration and a particulate emission factor obtained from monitoring:

$$CDI = CS \text{ (mg/kg)} \times IR \text{ (m}^3\text{/hour)} \times ET \text{ (hours/day)} \times (\# \text{ days}/365 \text{ days}) \times (\# \text{ yrs}/70 \text{ yrs}) \times 1/BW \text{ (kg)} \times 1/PEF \text{ (m}^3\text{/kg)}$$

Groundwater Ingestion

$$CDI = CW \text{ (mg/L)} \times GIR \text{ (L/day)} \times 1/BW \text{ (kg)} \times (\# \text{ days}/365 \text{ days}) \times (\# \text{ yrs}/70 \text{ yrs})$$

NONCARCINOGENS

Chronic daily intakes (CDIs) for noncarcinogens are calculated in the same manner as that used for carcinogens (above) with one exception: intakes are not averaged over a 70 year lifetime. That is, the last term in the equation (# years/70 years) is excluded because noncarcinogenic effects that could be associated with exposures to COCs could manifest during the exposure period, whereas carcinogenic effects could manifest during and after the exposure has ended.

DEFINITIONS

COC	Contaminant of concern
CDI	Chronic daily intake (mg/kg/day)
CS	COC concentration in soil (mg/kg)
CW	COC concentration in groundwater (mg/L)
10^{-6}	Unit correction factor (kg/mg)
SIR	Soil ingestion rate (mg/day)
BW	Body weight (kg)
AF	Soil adherence factor (mg/cm ²)
SA	Skin surface area exposed (cm ²)
ABS	Dermal absorption rate (unitless)
PM ₁₀	Mean annual concentration of respirable particulates (<10um in diameter)
IR	Inhalation rate (m ³ /hour)
ET	Exposure time (hours/day)
PEF	Particulate emissions factor (m ³ /kg)
GIR	Groundwater ingestion rate (L/day)

NOTE:

Soil and air EPCs used to calculate CDIs are listed in Table 5.1-6. Table 5.1-8 summarizes human exposure parameters used as input to the above equations.

Table K.1-2 Oral Cancer Parameters for Group 2 SWMU COCs

Chemical	Ingestion Cancer Slope Factor (mg/kg/day) ⁻¹	Weight-of-Evidence Classification	Type of Cancer (Species)	Source
<u>Volatiles</u>				
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA			
2,4,6-Trinitrotoluene	3.0E-02	C	Bladder	(2)
Bromodichloromethane	6.2E-02	B2	Kidney, large intestine, liver (mice, rat)	(1)
Chloroform	6.1E-03	B2	Several tumor types (mice, rat)	(1)
Methylene Chloride	7.5E-03	B2	Hepatocellular, bronchiolar, salivary gland, leukemia (mice, rat)	(1)
Methylphosphonic acid (MPA)	NA			
Pentaerythritol tetranitrite	NA			
Toluene	NA	D	NA	(2)
Trichloroethene	1.1E-02	C-B2	NA	(2)
Trichlorofluoromethane	NA			
<u>Semivolatiles</u>				
Di-n-butylphthalate	NA	D		(1)
<u>Inorganics</u>				
Aluminum	NA	D		(M1)
Antimony	NA			
Arsenic *	1.75E+00	A	Lung, skin (human)	(1)

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Table K.1-2 Oral Cancer Parameters for Group 2 SWMU COCs

Chemical	Ingestion Cancer Slope Factor (mg/kg/day) ⁻¹	Weight-of-Evidence Classification	Type of Cancer (Species)	Source
Barium	NA			
Beryllium	4.3E+00	B2	Osteosarcoma (rabbit)	(1)
Cadmium	NA	B1	Lung, tumors (human, rat, mice)	(1)
Chromium (III)	NA			
Chromium (VI)	NA	A	Lung (human)	(1)
Copper	NA	D		(1)
Lead	NA	B2	Kidney (mice, rat)	(1)
Mercury	NA	D		(1)
Nickel **	NA	A	Lung and nasal (human), tumors (rat)	(1)
Silver	NA	D		(1)
Thallium ***	NA	D		(1)
Vanadium	NA			
Zinc	NA	D		(1)

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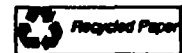


Table K.1-2 Oral Cancer Parameters for Group 2 SWMU COCs

Chemical	Ingestion Cancer Slope Factor (mg/kg/day) ¹	Weight-of-Evidence Classification	Type of Cancer (Species)	Source
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COC Contaminant of Concern
 NA Not Available

Consistent with EPA Guidance (1992), the oral cancer slope factors are used for the dermal contact risk calculations, as well as for the soil and groundwater ingestion scenarios.

* For adults only. Derived from the drinking water unit risk of 5E-5. Assumed 70 kg body weight and water consumption of 2 liters/day.

** From the IRIS file for nickel subsulfide.

*** From the IRIS file for thallium sulfate.

(1) Integrated Risk Information System (EPA 1994).

(2) Superfund Health Risk Technical Support Center (EPA 1993).

(M1) EPA (1992d)

A Human carcinogen

B1 Probable human carcinogen, limited human data are available

B2 Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans

C Possible human carcinogen

D Not classifiable as to human carcinogenicity

E Evidence of noncarcinogenicity for humans

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Table K.1-3 Inhalation Cancer Parameters for Group 2 SWMU COCs

Chemical	Inhalation Unit Risk ($\mu\text{g}/\text{m}^3$) ¹	Weight-of-Evidence Classification	Type of Cancer (Species)	Source
Volatiles				
Chloroform	2.3E-02	B2	Several tumor types (mice, rat)	(1)
Ethylbenzene	NA			
Methylene chloride	4.7E-07	B2	Hepatocellular, bronchiolar, salivary gland, leukemia (rat, mice)	(1)
Tetrachloroethene	5.8E-07	C-B2	NA	(2)
Toluene	NA	D		
Trichloroethene	1.76E-06	C-B2	NA	
Xylenes	NA			

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- COC Contaminant of Concern
- NA Not Available
- (1) Integrated Risk Information System (EPA 1994)
- (2) Superfund Health Risk Technical Support Center (EPA 1993)

- A Human carcinogen
- B1 Probable human carcinogen, limited human data are available
- B2 Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans
- C Possible human carcinogen
- D Not classifiable as to human carcinogenicity
- E Evidence of noncarcinogenicity for humans



Table K.1-4 Oral Reference Doses for Group 2 SWMU COCs

Chemical	Ingestion Reference Dose (mg/kg/day)	RfD Confidence Level	Critical Effects	Uncertainty Factor	Modifying Factor	Source
<u>Volatiles</u>						
1,1,2-Trichloro-1,2,2-Trifluoroethane	3E+01	Low	Psychomotor impairment	10	1	(1)
2,4,6-Trinitrotoluene	5E-04	Medium	Liver effects	1,000	1	(1)
Bromodichloromethane	2E-02	Medium	Renal cytomegaly	1,000	1	(1)
Chloroform	1E-02	Medium	Fatty cyst formation in liver	1,000	1	(1)
Methylene Chloride	6E-02	Medium	Liver toxicity	100	1	(1)
Methylphosphonic acid (MPA)	NA					
Pentaerythritol tetranitrite	NA					
Toluene	2E-01	Medium	Changes in liver, kidney weights	1,000	1	(1)
Trichloroethene	NA					
Trichlorofluoromethane	3E-01	Medium	Survival and histopathology	1,000	1	(1)
<u>Semivolatiles</u>						
Di-n-Butylphthalate	1E-01	Low	Increased mortality	1,000	1	(1)

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Table K.1-4 Oral Reference Doses for Group 2 SWMU COCs

Chemical	Ingestion Reference Dose (mg/kg/day)	RfD Confidence Level	Critical Effects	Uncertainty Factor	Modifying Factor	Source
<u>Inorganics</u>						
Aluminum	1E+00	Medium	Decreased body weight	100		(M1)
Antimony	4E-04	Low	Reduced life span, disturbances in blood glucose, and cholesterol metabolism	1,000	1	(1)
Arsenic	3E-04	Medium	Hyperpigmentation, keratosis and possible vascular complications	3	1	(1)
Barium	7E-02	Medium	Increased blood pressure	3	1	(1)
Beryllium	5E-03	Low	No adverse effects	100	1	(1)
Cadmium (in food)	1E-03	High	Significant proteinuria	10	1	(1)
Chromium (III)	1E+00	Low	No effects observed	100	10	(1)
Chromium (VI)	5E-03	Low	No effects reported	500	1	(1)
Copper *	3.71E-02	NA	Gastrointestinal system irritation	NA	NA	(2)
Lead	NA					
Mercury	3E-04	NA	Kidney effects	1,000		(2)
Nickel	2E-02	Medium	Decreased body and organ weights	300	1	(1)
Silver	5E-03	Low	Argyria	3	1	(1)
Thallium **	0.00008	Low	No adverse effects	3,000	1	(1)
Vanadium	7E-03	NA	None observed	100		(2)

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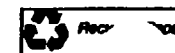


Table K.1-4 Oral Reference Doses for Group 2 SWMU COCs

Chemical	Ingestion Reference Dose (mg/kg/day)	RfD Confidence Level	Critical Effects	Uncertainty Factor	Modifying Factor	Source
Zinc	3E-01	Medium	47% decrease in erythrocyte, superoxide dismutase (ESOD)	3	1	(1)

COC Contaminant of Concern
 NA Not Available
 mg/kg/day milligrams per kilogram per day

Consistent with EPA Guidance (1992), the oral RfDs are used for the dermal contact risk characterizations, as well as for the soil and groundwater ingestion scenarios.
 * For adults only. Derived from the drinking water standard of 1.3 mg/L. Assumed 70 kg body weight and water consumption of 2 L/day.
 ** From the IRIS file for thallium sulfate.
 (1) Integrated Risk Information System (EPA 1994).
 (2) Health Effects Assessment Summary Tables (EPA 1993).
 (M1) EPA (1992d).

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Table K.1-5 Inhalation Reference Concentrations for Group 2 SWMU COCs

Chemical	Inhalation Reference Concentration (mg/m ³)	RFC Confidence Level	Critical Effects	Uncertainty Factors	Modifying Factor	Source
<u>Volatiles</u>						
Chloroform	NA					
Ethylbenzene	1E+00	Low	Developmental toxicity	300	1	(1)
Methylene chloride	3E+00	NA	Liver toxicity	100		(2)
Tetrachloroethene	NA					
Toluene	4E-01	Medium	Neurological effects	300	1	(1)
Trichloroethene	NA					
Xylenes	NA					

COC Contaminant of Concern

NA Not Available

(1) Integrated Risk Information System (EPA 1994).

(2) Health Effects Assessment Summary Tables (EPA 1993).

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Appendix Table K.2-1 Soil Risk-Based Screening Levels (RBSLs) Developed for Residential Use Pathways: Carcinogenic Effects Page 1 of 1

<p>Equation: $RBSL(met) = \frac{TR \cdot BW_a \cdot AT \cdot 365 \text{ days/yr}}{EF \cdot ED \cdot [(IRSa \cdot SFo \cdot 1.0E-6 \text{ kg/mg}) + (IRa \cdot SFi \cdot 1/PEF)]}$</p> <p>$RBSL(svoc) = \frac{TR \cdot BW_a \cdot AT \cdot 365 \text{ days/yr}}{EF \cdot ED \cdot [(2 \cdot IRSa \cdot SFo \cdot 1.0E-6 \text{ kg/mg}) + (IRa \cdot SFi \cdot 1/PEF)]}$</p> <p>$RBSL(vol) = \frac{TR \cdot BW_a \cdot AT \cdot 365 \text{ days/yr}}{EF \cdot ED \cdot [(IRSa \cdot SFo \cdot 1.0E-6 \text{ kg/mg}) + (IRa \cdot SFi \cdot 1/VF)]}$</p>	<p>Where:</p> <p>RBSL = Risk Reference Level (mg/kg)</p> <p>TR = Target cancer risk (unitless)</p> <p>BW_a = Body weight, adult (kg)</p> <p>AT = Averaging time (years of life)</p> <p>EF = Exposure frequency (days/year)</p> <p>ED = Exposure duration (years)</p> <p>SFo = Slope factor, oral (1/(mg/kg-day))</p> <p>SFi = Slope factor, inhalation (1/(mg/kg-day))</p> <p>IRSa = Soil ingestion rate – lifetime resident (mg/day)</p> <p>IRa = Inhalation rate, adult (cu.m/day)</p> <p>PEF = Particulate emission factor (cu.m/kg)</p> <p>VF = Volatilization factor (cu.m/kg)</p>	<p>Value</p> <p>1.00E-06</p> <p>70</p> <p>70</p> <p>350</p> <p>30</p> <p>chem-sp</p> <p>chem-sp</p> <p>100</p> <p>20</p> <p>8.62E+08</p> <p>chem-sp</p>
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Chemicals of Concern	(Chem Class)	SFo	SFi	RBSL (ug/g)
Antimony	(met)			
Arsenic	(met)	1.75E+00	1.51E+01	9.71E-01
Cadmium	(met)		6.30E+00	1.17E+03
Chromium	(met)		4.20E+01	1.75E+02
Copper	(met)			
Di-n-butylphthalate	(svoc)			
Lead	(met)			
Mercury	(met)			
Nickel	(met)		1.68E+00	4.37E+03
Silver	(met)			
Toluene	(vol)			
Trichlorofluoromethane	(vol)			
Vanadium	(met)			
Zinc	(met)			
1,1,2-Trichloro-1,2,2-fluoroethane	(vol)			
2,4,6-Trinitrotoluene	(vol)	3.00E-02		5.68E+01

Equation: $RBSL (met) = \frac{THQ \cdot RfDo \cdot BWc \cdot ED \cdot 365 \text{ days/yr}}{(EF \cdot ED \cdot IRSc \cdot 1.0E-6 \text{ kg/mg})}$
 (See Note /a)

$RBSL (svoc) = \frac{THQ \cdot RfDo \cdot BWc \cdot ED \cdot 365 \text{ days/yr}}{(EF \cdot ED \cdot 2IRSc \cdot 1.0E-6 \text{ kg/mg})}$
 (See Note /a)

$RBSL (vol) = \frac{THQ \cdot BWa \cdot ED \cdot 365 \text{ days/yr}}{EF \cdot ED \cdot [(1/RfDo \cdot 1.0E-6 \text{ kg/mg} \cdot IRSa) + (1/RfDi \cdot IRa \cdot 1/VF)]}$
 (See Note /b)

Where:	Value
RBSL = Risk Reference Level (mg/kg)	
THQ = Target hazard quotient (unitless)	1
BWc = Body weight, child (kg)	15
BWa = Body weight, adult (kg)	70
AT = Averaging time (years of life)	70
EF = Exposure frequency (days/year)	350
ED = Exposure duration (years)	30, 6
RfDo = Reference dose, oral (mg/kg-day)	chem-sp
RfDi = Reference dose, inhalation (mg/kg-day)	chem-sp
IRSa = Soil ingestion rate -- lifetime resident (mg/day)	100
IRSc = Soil ingestion rate -- child resident (mg/day)	200
IRa = Inhalation rate, adult (cu.m/day)	20
PEF = Particulate emission factor (cu.m/kg)	8.62E+08
VF = Volatilization factor (cu.m/kg)	chem-sp

Note:
 /a/ The child exposure duration value of 6 years represents a subchronic exposure, for which a subchronic RfDo would be most applicable. In this case, however, a subchronic RfDo value was used, leading to a more conservative RBSL.
 /b/ The RRL equation for volatile compounds listed above was used only for those constituents with inhalation RfDs. Otherwise, the RRL was calculated using the same equation as that indicated above for metals [RRL(met)].
 /c/ The exposure duration for adults is assumed to be 30 years, and for children is assumed to be 6 years (ages 1 through 6).

Chemicals of Concern		RfDo	RfDi	RBSL (ug/g)	VF
Antimony	(met)	4.00E-04		3.13E+01	
Arsenic	(met)	3.00E-04		2.35E+01	
Cadmium	(met)	1.00E-03		7.82E+01	
Chromium (VI)	(met)	5.00E-03		3.91E+02	
Copper	(met)	3.71E-02		2.90E+03	
Di-n-butylphthalate	(svoc)	1.00E-01		3.91E+03	
Lead	(met)				
Mercury	(met)	3.00E-04	8.57E-05	2.35E+01	
Nickel	(met)	2.00E-02		1.56E+03	
Silver	(met)	5.00E-03		3.91E+02	
Toluene	(vol)	2.00E-01	1.14E-01	1.23E+04	32,256
Trichlorofluoromethane	(vol)	3.00E-01		2.35E+04	
Vanadium	(met)	7.00E-03		5.48E+02	
Zinc	(met)	3.00E-01		2.35E+04	
1,1,2-Trichloro-1,2,2-fluoroethane	(vol)	3.00E+01		2.35E+06	
2,4,6-Trinitrotoluene	(vol)	5.00E-04		3.91E+01	

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Equation: $RBSL(vol) = \frac{TR * BW_a * AT * 365 \text{ days/yr} * 1000 \text{ ug/mg}}{EF * ED * [(IR_w * SF_o) + (K * IR_a * SF_i)]}$

$RBSL(other) = \frac{TR * BW_a * AT * 365 \text{ days/yr} * 1000 \text{ ug/mg}}{EF * ED * IR_w * SF_o}$

Where:	Value
RBSL = Risk Reference Level (ug/l)	
TR = Target cancer risk (unitless)	1.00E-06
BW _a = Body weight, adult (kg)	70
AT = Averaging time (years of life)	70
EF = Exposure frequency (days/year)	350
ED = Exposure duration (years)	30
SF _o = Slope factor, oral (1/(mg/kg-day))	chem-sp
SF _i = Slope factor, inhalation (1/(mg/kg-day))	chem-sp
IR _w = Drinking water ingestion (L/day)	2
IR _a = Inhalation rate, adult (cu.m/day)	20
K = Volatilization factor for water (L/m ³)	0.5

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Chemicals of Concern	SF _o	SF _i	RBSL (ug/l)	RBSL (ug/l) -- ingestion only
Aluminum				
Antimony				
Arsenic	1.75E+00	1.51E+01	4.87E-02	4.87E-02
Barium				
Beryllium	4.30E+00	8.40E+00	1.98E-02	1.98E-02
Bromodichloromethane (vol)	6.20E-02		1.37E+00	1.37E+00
Chloroform (vol)	6.10E-03	8.05E-02	2.08E-01	1.40E+01
Chromium		4.20E+01		
Copper				
Lead				
Mercury				
Methylene chloride (vol)	7.50E-03	1.65E-03	5.42E+00	1.14E+01
Nickel		1.68E+00		
Thallium				
Trichloroethene (vol)	1.10E-02	6.16E-03	2.04E+00	7.74E+00
Vanadium				

Equation: $RBSL(vol) = \frac{THQ * BW_a * ED * 365 \text{ days/yr} * 1000 \text{ ug/mg}}{ED * EF * [(IR_w / RfDo) + (K * IR_a / RfDi)]}$

$RBSL(other) = \frac{THQ * BW_a * ED * 365 \text{ days/yr} * 1000 \text{ ug/mg}}{ED * EF * (IR_w / RfDo)}$

Where:

RBSL = Risk Reference Level (ug/l)	Value
THQ = Target hazard quotient (unitless)	1
BW _a = Body weight, adult (kg)	70
AT = Averaging time (years of life)	70
EF = Exposure frequency (days/year)	350
ED = Exposure duration (years)	30
RfDo = Reference dose, oral (mg/kg-day)	chem-sp
RfDi = Reference dose, inhalation (mg/kg-day)	chem-sp
IR _w = Drinking water ingestion (L/day)	2
IR _a = Inhalation rate, adult (cu.m/day)	20
K = Volatilization factor for water (L/m ³)	0.5

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Chemicals of Concern	RfDo	RfDi	RBSL (ug/l)
Aluminum	1.00E+00		3.65E+04
Antimony	4.00E-04		1.46E+01
Arsenic	3.00E-04		1.10E+01
Barium	7.00E-02		2.56E+03
Beryllium	5.00E-03		1.83E+02
Bromodichloromethane (vol)	2.00E-02		7.30E+02
Chloroform (vol)	1.00E-02		3.65E+02
Chromium	5.00E-03		1.83E+02
Copper	3.71E-02		1.35E+03
Lead			
Mercury	3.00E-04		1.10E+01
Methylene chloride (vol)	6.00E-02	8.57E-01	1.62E+03
Nickel	2.00E-02		7.30E+02
Thallium	8.00E-05		2.92E+00
Trichloroethene (vol)			
Vanadium	7.00E-03		2.56E+02

Appendix Table K.2-5 Comparison of Soil Residential RBSLs to TEAD-S Group 2 SWMU Soil Background Concentrations

Contaminant of Concern	Soil Background				Soil Background			
	Carcinogenic RBSL (mg/kg)	Levels (ug/g)	Associated Cancer Risk	(% Cont.)	Noncarcinogenic RBSL (ug/g)	Levels (ug/g)	Associated HQ	(% Cont.)
Antimony		11.9			31.3	11.9	3.8E-01	0.16
Arsenic	0.97	40.0	4.1E-05	0.99	23.5	40.0	1.7E+00	0.72
Cadmium	1,170	0.98	8.4E-10	<0.01	78.2	0.98	1.3E-02	<0.01
Chromium	175	48.5	2.8E-07	<0.01	391	48.5	1.2E-01	0.05
Copper		27.6			2,902	27.6	9.5E-03	<0.01
Di-n-butylphthalate		ND			3,911	ND		
Lead		35.0				35.0		
Mercury		0.143			23.5	0.143	6.1E-03	<0.01
Nickel	4,370	27.9	6.4E-09	<0.01	1,564	27.9	1.8E-02	<0.01
Silver		0.435			391.1	0.435	1.1E-03	<0.01
Toluene		ND			280	ND		
Trichlorofluoromethane		ND			410	ND		
Vanadium		62.6			547.5	62.6	1.1E-01	0.05
Zinc		144			23,464	144	6.1E-03	<0.01
1,1,2-Trichloro-1,2,2-fluoroethane		ND			410	ND		
2,4,6-Trinitrotoluene	56.78	ND			39.1	ND		
Total Cancer Risk:			4.1E-05	Total Hazard Index (HI):			2.4E+00	

Note:

Bolded COCs/values reflect exceedances of either a 1.0E-06 cancer risk and/or a hazard quotient (HQ) of 1.0.

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Appendix Table K.2-6 Comparison of Groundwater Residential RBSLs to TEAD-S Groundwater Background Concentrations

Contaminant of Concern	GW Background				GW Background			
	Carcinogenic RBSL (ug/l)	Levels (ug/l)	Associated Cancer Risk	(% Cont.)	Noncarcinogenic RBSL (ug/l)	Levels (ug/l)	Associated HQ	(% Cont.)
Aluminum		14,200			36,500	14,200	3.9E-01	0.06
Antimony		4.54			14.6	4.54	3.1E-01	0.05
Arsenic	0.05	35.5	7.3E-04	0.95	11	35.5	3.2E+00	0.47
Barium		200			2,560	200	7.8E-02	0.01
Beryllium	0.02	0.805	4.1E-05	0.05	183	0.805	4.4E-03	<0.01
Bromodichloromethane	1.37	ND			730	ND		
Chloroform	0.21	ND			365	ND		
Chromium		35.5			183	35.5	1.9E-01	0.03
Copper		47.7			1,350	47.7	3.5E-02	<0.01
Lead		57.7				57.7		
Mercury		< 0.243			11	< 0.243	2.2E-02	<0.01
Methylene chloride	5.42	ND			1,620	ND		
Nickel		45.1			730	45.1	6.2E-02	<0.01
Thallium		< 7.0			2.92	< 7.0	2.4E+00	0.35
Trichloroethene	2.04	ND				ND		
Vanadium		27.1			256	27.1	1.1E-01	0.02
Total Cancer Risk:			7.7E-04		Total Hazard Index (HI):			6.8E+00

Note:

Bolded COCs/values reflect exceedances of either a 1.0E-06 cancer risk and/or a hazard quotient (HQ) of 1.0.

K - 16

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
 Exposure Location: SWMU 3 Interior

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk
Arsenic	0.00E+00	1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00
Cadmium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	0.00E+00	0.00E+00
Chromium (VI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	0.00E+00	0.00E+00
Nickel	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E+00	0.00E+00	0.00E+00
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation:	0.0E+00	0.0E+00

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient
Antimony	0.00E+00	4.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium	0.00E+00	1.00E-03	0.00E+00	0.00E+00	1.43E-04	0.00E+00	0.00E+00
Chromium (Total)	0.00E+00	9.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	0.00E+00	3.71E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Lead	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00
Mercury	0.00E+00	3.00E-04	0.00E+00	0.00E+00	8.57E-05	0.00E+00	0.00E+00
Nickel	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Silver	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium	0.00E+00	7.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zinc	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation:	0.0E+00	0.0E+00

Exposure Scenario: Current Use
Exposed Population: Environmental Management Staff
Exposure Pathway: Dermal Contact with Surface Soil
Exposure Location: SWMU 3: Evaluation of Site-Wide COCs

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.2-5
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations

Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal Contact CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day) ⁻¹	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	#DIV/0!
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	0.0E+00	0.0E+00	#DIV/0!
Chromium (VI)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	0.0E+00	0.0E+00	#DIV/0!
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	0.0E+00	0.0E+00	#DIV/0!
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	#DIV/0!
Total Dermal Contact Cancer Risk:											0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	#DIV/0!
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	#DIV/0!
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	#DIV/0!
Chromium (Total)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	#DIV/0!
Copper	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.71E-02	0.0E+00	#DIV/0!
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	#DIV/0!
Lead	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	#DIV/0!
Mercury	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	#DIV/0!
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	#DIV/0!
Silver	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	#DIV/0!
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	#DIV/0!
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	#DIV/0!
Vanadium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	#DIV/0!
Zinc	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	#DIV/0!
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	#DIV/0!
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	#DIV/0!
Dermal Contact Hazard Index:											0.0E+00	

K-18

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 3: Evaluation of Site-Wide COCs

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.2-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*ED)/(BW*AT)
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day) ⁻¹	Soil Ingestion Cancer Risk	% Cont.
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	#DIV/0!
Cadmium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	#DIV/0!
Chromium (VI)	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	#DIV/0!
Nickel	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	#DIV/0!
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	#DIV/0!
Total Soil Ingestion Cancer Risk:										0.0E+00	

Non-Cancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	#DIV/0!
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	#DIV/0!
Cadmium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	#DIV/0!
Chromium (Total)	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	#DIV/0!
Copper	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.71E-02	0.0E+00	#DIV/0!
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	#DIV/0!
Lead	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	#DIV/0!
Mercury	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	#DIV/0!
Nickel	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	#DIV/0!
Silver	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	#DIV/0!
Toluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	#DIV/0!
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	#DIV/0!
Vanadium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	#DIV/0!
Zinc	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	#DIV/0!
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	#DIV/0!
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	#DIV/0!
Soil Ingestion Hazard Index:										0.0E+00	

K-19

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 3

Exposure Pathway Variables		
CA (Air Concentration)	=	See Table 5.2-5
IR (Inhalation Rate)	=	2.5 m3/hour
ET (Exposure Time)	=	4 hours/day
EF (Exposure Frequency)	=	4 days/year
ED (Exposure Duration)	=	25 years
BW (Body Weight)	=	70 kg
AT (Averaging Time, Carcinogenic Effects)	=	25550 days
AT (Noncarcinogenic Effects)	=	9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00
Cadmium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00
Chromium (VI)	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00
Nickel	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00
Total Soil Inhalation Cancer Risk:										0.0E+00

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient
Antimony	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Cadmium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00
Chromium (Total)	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Copper	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Lead	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA
Mercury	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00
Nickel	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Silver	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Vanadium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Zinc	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00		

Soil Inhalation Hazard Index: 0.0E+00

SWMU 3

Contaminant

Antimony
 Arsenic
 Cadmium
 Chromium (Total)
 Copper
 Di-n-butylphthalate
 Lead
 Mercury
 Nickel
 Silver
 Toluene
 Trichlorofluoromethane
 Vanadium
 Zinc
 1,1,2-Trichloro-1,2,2-fluoroethane
 2,4,6-Trinitrotoluene

RME Soil
 Concentration
 (mg/kg)

<u>Contaminant</u>	Air Concentration (mg/m3)	<u>Conversion Factor (m3/kg soil)</u>
Antimony	0.00E+00	8.62E+08
Arsenic	0.00E+00	
Cadmium	0.00E+00	
Chromium (Total)	0.00E+00	
Copper	0.00E+00	
Di-n-butylphthalate	0.00E+00	
Lead	0.00E+00	
Mercury	0.00E+00	
Nickel	0.00E+00	
Silver	0.00E+00	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	0.00E+00	
Zinc	0.00E+00	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

K-21

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of SWMU 3 Volatile Contaminants
 Exposure Location: SWMU 3

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.2-5
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Chloroform	5.50E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	3.08E-06	8.05E-02	2.5E-07	95.8%
Methylene chloride	1.15E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	6.43E-07	1.65E-03	1.1E-09	0.4%
Tetrachloroethene	4.34E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	2.43E-06	2.03E-03	4.9E-09	1.9%
Trichloroethene	1.39E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	7.77E-07	6.16E-03	4.8E-09	1.9%
Total VOC Soil Inhalation Cancer Risk:										2.6E-07	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Chloroform	5.50E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	8.61E-06			0.0%
Ethyl Benzene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00	2.86E-01	0.0E+00	0.0%
Methylene chloride	1.15E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	1.80E-06	8.57E-01	2.1E-06	100.0%
Tetrachloroethene	4.34E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	6.79E-06			0.0%
Toluene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00	1.14E-01	0.0E+00	0.0%
Trichloroethene	1.39E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	2.18E-06			0.0%
Xylenes		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Soil Inhalation Hazard Index:										2.1E-06	

Exposure Scenario: Current Use
 Exposed Population: Site Security Personnel
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 3 Perimeter

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.2-5
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 0.5 hours/day
EF (Exposure Frequency)	= 250 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25,550 days
AT (Noncarcinogenic Effects)	= 9,125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk
Arsenic		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00
Cadmium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00
Chromium (VI)		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00
Nickel		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00
2,4,6-Trinitrotoluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00
Total Soil Inhalation Cancer Risk:										0.0E+00

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient
Antimony		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Arsenic		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Cadmium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00
Chromium (Total)		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Copper		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Di-n-butylphthalate		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Lead		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA
Mercury		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00
Nickel		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Silver		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Toluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00
Trichlorofluoromethane		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Vanadium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Zinc		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
1,1,2-Trichloro-1,2,2-fluoroethane		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
2,4,6-Trinitrotoluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Soil Inhalation Hazard Index:										0.0E+00

K-23

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
 Exposure Location: SWMU 3 Trench 1&2 Locations

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic		1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00	0.0%
Cadmium		0.00E+00	0.00E+00	0.00E+00	6.30E+00	0.00E+00	0.00E+00	
Chromium (VI)	1.17E+01	0.00E+00	0.00E+00	0.00E+00	4.20E+01	3.19E-10	3.19E-10	100.0%
Nickel		0.00E+00	0.00E+00	0.00E+00	1.68E+00	0.00E+00	0.00E+00	
2,4,6-Trinitrotoluene		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Pathway-Specific Totals--		Ingestion: 0.0E+00	0.0E+00	0.0E+00	Inhalation: 3.2E-10	3.2E-10	3.2E-10	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	0.00E+00	4.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	0.00E+00	1.00E-03	0.00E+00	0.00E+00	1.43E-04	0.00E+00	0.00E+00	0.0%
Chromium (Total)	1.17E+02	9.00E-01	2.04E-06	8.34E-08	0.00E+00	0.00E+00	2.12E-06	2.9%
Copper	6.12E+01	3.71E-02	2.58E-05	1.06E-06	0.00E+00	0.00E+00	2.69E-05	36.6%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA		
Mercury	0.00E+00	3.00E-04	0.00E+00	0.00E+00	8.57E-05	0.00E+00	0.00E+00	0.0%
Nickel	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Silver	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Vanadium	0.00E+00	7.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Zinc	8.20E+02	3.00E-01	4.28E-05	1.75E-06	0.00E+00	0.00E+00	4.45E-05	60.6%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion: 7.1E-05	7.1E-05	2.9E-06	Inhalation: 0.0E+00	0.0E+00	7.4E-05	

*The oral RfD for chromium (9.0E-01 mg/kg/day) is weighted as follows: 90% trivalent fraction (RfD=1.0 mg/kg/day) and 10% hexavalent fraction (RfD=0.005 mg/kg/day). Page E of this worksheet provides the rationale for this approach.

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 3: Trench (1&2) Locations
 (Location-Specific COCs)

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.2-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*ED)/(BW*AT)
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk
Arsenic		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00
Cadmium		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00
Chromium (VI)	1.17E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	6.54E-08		0.0E+00
Nickel		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00
2,4,6-Trinitrotoluene		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00
Total Soil Ingestion Cancer Risk:										0.0E+00

Inorganic Hazard Index Calculations

Contaminant	Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	0.0%
Chromium (Total)	1.17E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.83E-06	9.00E-01	2.0E-06	2.9%
Copper	6.12E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	9.58E-07	3.71E-02	2.6E-05	36.6%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	0.00E+00										
Mercury	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Nickel	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Silver	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	8.20E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.28E-05	3.00E-01	4.3E-05	60.6%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										7.1E-05	

K-25

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 3: Trench (1&2) Locations
 (Location-Specific COCs)

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.2-5
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations
Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal Contact CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)-1	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	#DIV/0!
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	0.0E+00	0.0E+00	#DIV/0!
Chromium (VI)	1.17E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	2.7E-09	0.0E+00	0.0E+00	#DIV/0!
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	0.0E+00	0.0E+00	#DIV/0!
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	#DIV/0!
Total Dermal Contact Cancer Risk:											0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	0.0%
Chromium (Total)	1.17E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	7.51E-08	9.00E-01	8.3E-08	2.9%
Copper	6.12E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.93E-08	3.71E-02	1.1E-06	36.6%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	0.00E+00											
Mercury	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Silver	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	8.20E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.26E-07	3.00E-01	1.8E-06	60.6%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											2.9E-06	

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil Contaminants
 Exposure Location: SWMU 3: Trench (1&2) Locations
 (Location-Specific COCs)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.2-5
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)-	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00	0.0%
Chromium (VI)	1.36E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	7.60E-12	4.20E+01	3.2E-10	100.0%
Nickel		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										3.2E-10	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00	#DIV/0!
Chromium (Total)	1.36E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.12E-10			
Copper	7.10E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.11E-10			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA	NA
Mercury	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00	#DIV/0!
Nickel	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Silver	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	#DIV/0!
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	9.51E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.49E-09			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										0.0E+00	

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SWMU 3: Location-Specific <u>Contaminant</u>	RME Soil Concentration (mg/kg)
Antimony	
Arsenic	
Cadmium	
Chromium (Total)	117
Copper	61.2
Di-n-butylphthalate	
Lead	
Mercury	
Nickel	
Silver	
Toluene	
Trichlorofluoromethane	
Vanadium	
Zinc	820
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.

<u>Contaminant</u>	Air Concentration (mg/m3)	<u>Conversion Factor (m3/kg soil)</u>
Antimony	0.00E+00	8.62E+08
Arsenic	0.00E+00	
Cadmium	0.00E+00	
Chromium (Total)	1.36E-07	
Copper	7.10E-08	
Di-n-butylphthalate	0.00E+00	
Lead	0.00E+00	
Mercury	0.00E+00	
Nickel	0.00E+00	
Silver	0.00E+00	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	0.00E+00	
Zinc	9.51E-07	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

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Joint Source: SWMU 3 Trench 1 and 2 Locations

Exposure Scenario: Current Use
 Exposed Population: Site Security Personnel
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 3 Perimeter

Exposure Pathway Variables

CA (Air Concentration)	=	See Table 5.2-5
IR (Inhalation Rate)	=	2.5 m ³ /hour
ET (Exposure Time)	=	0.5 hours/day
EF (Exposure Frequency)	=	250 days/year
ED (Exposure Duration)	=	25 years
BW (Body Weight)	=	70 kg
AT (Averaging Time, Carcinogenic Effects)	=	25,550 days
AT (Noncarcinogenic Effects)	=	9,125 days

Intake and Risk Calculation Equations

CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
 Cancer Risk = CDI * Inhalation SF
 Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day) ⁻¹	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00	0.0%
Chromium (VI)	1.36E-08	2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	5.94E-11	4.20E+01	2.5E-09	100.0%
Nickel		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										2.5E-09	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient
Antimony		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Arsenic		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Cadmium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00
Chromium (Total)	1.36E-07	2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.66E-09		
Copper	7.10E-08	2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	8.68E-10		
Di-n-butylphthalate		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Lead		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA
Mercury		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00
Nickel		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Silver		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Toluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00
Trichlorofluoromethane		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Vanadium		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Zinc	9.51E-07	2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.16E-08		
1,1,2-Trichloro-1,2,2-fluoroethane		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
2,4,6-Trinitrotoluene		2.50E+00	5.00E-01	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00		
Soil Inhalation Hazard Index:										0.0E+00

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Appendix Table K.4-1 SWMU 5 Current Use Worker Exposure Scenario: Risk Calculation
Documentation for the Former Pond Subarea Evaluation

Exposure Scenario: Current Use
Exposed Population: Environmental Management Staff
Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
Exposure Location: SWMU 5 Former Pond Area (see Table 5.3-5)

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic		1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00	0.0%
Cadmium	1.94E+01	0.00E+00	0.00E+00	0.00E+00	6.30E+00	7.93E-11	7.93E-11	0.3%
Chromium (VI)	9.59E+01	0.00E+00	0.00E+00	0.00E+00	1.65E-03	1.31E-09	1.31E-09	4.7%
Nickel	8.05E+01	0.00E+00	0.00E+00	0.00E+00	4.20E+01	2.61E-08	2.61E-08	94.4%
2,4,6-Trinitrotoluene		3.00E-02	0.00E+00	0.00E+00	1.68E+00	8.77E-11	8.77E-11	0.3%
Methylene chloride		0.00E+00	0.00E+00	0.00E+00	1.65E-03	7.90E-11	7.90E-11	0.3%
Pathway-Specific Totals--		Ingestion: 0.0E+00	0.0E+00	0.0E+00	Inhalation: 2.8E-08	2.8E-08	2.8E-08	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	2.20E+01	4.00E-04	8.59E-04	3.52E-05	0.00E+00	0.00E+00	8.94E-04	50.0%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	1.94E+01	1.00E-03	3.04E-04	1.25E-05	1.43E-04	2.46E-07	3.16E-04	17.7%
Chromium (Total)	9.59E+02	9.00E-01	1.67E-05	6.84E-07	0.00E+00	0.00E+00	1.74E-05	1.0%
Copper	1.48E+02	3.71E-02	6.26E-05	2.57E-06	0.00E+00	0.00E+00	6.52E-05	3.6%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	7.42E+02	0.00E+00	0.00E+00	0.00E+00	NA	NA		
Mercury	2.64E-01	3.00E-04	1.38E-05	5.65E-07	8.57E-05	5.59E-09	1.43E-05	0.8%
Nickel	8.05E+01	2.00E-02	6.30E-05	2.58E-06	0.00E+00	0.00E+00	6.56E-05	3.7%
Silver	6.60E+01	5.00E-03	2.07E-04	8.47E-06	0.00E+00	0.00E+00	2.15E-04	12.0%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Vanadium	2.57E+01	7.00E-03	5.75E-05	2.36E-06	0.00E+00	0.00E+00	5.99E-05	3.4%
Zinc	2.57E+03	3.00E-01	1.34E-04	5.49E-06	0.00E+00	0.00E+00	1.39E-04	7.8%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion: 1.7E-03	1.7E-03	7.0E-05	Inhalation: 2.5E-07	2.5E-07	1.8E-03	

*The oral RfD for chromium (9.0E-01 mg/kg/day) is weighted as follows: 90% trivalent fraction (RfD=1.0 mg/kg/day) and 10% hexavalent fraction (RfD=0.005 mg/kg/day). Page E of this worksheet provides the rationale for this approach.

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 5 Former Pond Area (see Table 5.3-5)

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.3-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time)	=
Carcinogenic Effects	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
$CDI (mg/kg/day) = (CS \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day) ⁻¹	Soil Ingestion Cancer Risk	% Cont.
Arsenic		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	
Cadmium	1.94E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.08E-07		0.0E+00	
Chromium (VI)	9.59E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	5.36E-07		0.0E+00	
Nickel	8.05E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	4.50E-07		0.0E+00	
2,4,6-Trinitrotoluene		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	
Total Soil Ingestion Cancer Risk:										0.0E+00	

Soil Ingestion Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	2.20E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.44E-07	4.00E-04	8.6E-04	50.0%
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	1.94E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.04E-07	1.00E-03	3.0E-04	17.7%
Chromium (Total)	9.59E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.50E-05	9.00E-01	1.7E-05	1.0%
Copper	1.48E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.32E-06	3.71E-02	6.3E-05	3.6%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	7.42E+02										
Mercury	2.64E-01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.13E-09	3.00E-04	1.4E-05	0.8%
Nickel	8.05E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.26E-06	2.00E-02	6.3E-05	3.7%
Silver	6.60E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.03E-06	5.00E-03	2.1E-04	12.0%
Toluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	2.57E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.03E-07	7.00E-03	5.8E-05	3.4%
Zinc	2.57E+03	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.02E-05	3.00E-01	1.3E-04	7.8%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										1.7E-03	

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 5 Former Pond Area (see Table 5.3-5)

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.3-5
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001, orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations
Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal Contact CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Conc (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day) ⁻¹	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.00E+00	
Cadmium	1.94E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	4.4E-09		0.00E+00	
Chromium (VI)	9.59E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	2.2E-08		0.00E+00	
Nickel	8.05E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.8E-08		0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.00E+00	
Total Dermal Contact Cancer Risk:											0.00E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Conc (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	2.20E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.41E-08	4.00E-04	3.5E-05	50.0%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.00E+00	0.0%
Cadmium	1.94E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.25E-08	1.00E-03	1.2E-05	17.7%
Chromium (Total)	9.59E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	6.15E-07	9.00E-01	6.8E-07	1.0%
Copper	1.48E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	9.53E-08	3.71E-02	2.6E-06	3.6%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.00E+00	0.0%
Lead	7.42E+02											
Mercury	2.64E-01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.69E-10	3.00E-04	5.6E-07	0.8%
Nickel	8.05E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.17E-08	2.00E-02	2.6E-06	3.7%
Silver	6.60E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.24E-08	5.00E-03	8.5E-06	12.0%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.00E+00	0.0%
Vanadium	2.57E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.65E-08	7.00E-03	2.4E-06	3.4%
Zinc	2.57E+03	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.65E-06	3.00E-01	5.5E-06	7.8%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.00E+00	0.0%
Dermal Contact Hazard Index:											7.0E-05	

Appendix Table K.4-1c SWMU 5 Worker Exposure Scenario: Inhalation Risk Calculation
 Documentation for Former Pond Subarea Evaluation

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 5 Former Pond Area (see Table 5.3-5)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.3-5
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25,550 days
AT (Noncarcinogenic Effects)	= 9,125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	2.25E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.26E-11	6.30E+00	7.9E-11	0.3%
Methylene chloride	1.56E-03	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	7.94E-07	1.65E-03	1.3E-09	4.8%
Chromium (VI)	1.11E-06	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	6.21E-10	4.20E+01	2.6E-08	94.6%
Nickel	9.34E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	5.22E-11	1.68E+00	8.8E-11	0.3%
2,4,6-Trinitrotoluene		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										2.8E-08	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	2.55E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.99E-11			
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	2.25E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.52E-11	1.43E-04	2.5E-07	97.8%
Chromium (Total)	1.11E-06	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.74E-09			
Copper	1.72E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.70E-10			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	8.61E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.35E-09	NA	NA	NA
Mercury	3.06E-10	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.79E-13	8.57E-05	5.6E-09	2.2%
Nickel	9.34E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.46E-10			
Silver	7.65E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.20E-10			
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	2.98E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.67E-11			
Zinc	2.98E-06	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.66E-09			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										2.5E-07	

Appendix Table K.4-1d Exposure Point Concentrations (EPCs) Used for SWMU 5 Current Use
 Worker Exposure Scenario--Former Pond Subarea Evaluation

SWMU 5	Soil Exposure Point Concentration (EPC) (mg/kg)
<u>Contaminant</u>	
Antimony	21.95
Arsenic	
Cadmium	19.4
Chromium (Total)	958.9
Copper	148.4
Di-n-butylphthalate	
Lead	741.8
Mercury	0.264
Nickel	80.47
Silver	65.98
Toluene	
Trichlorofluoromethane	
Vanadium	25.73
Zinc	2567
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.

<u>Contaminant</u>	Modeled Air Concentration (mg/m ³)	<u>Conversion Factor (m³/kg soil)</u>
Antimony	2.55E-08	8.62E+08
Arsenic	0.00E+00	
Cadmium	2.25E-08	
Chromium (Total)	1.11E-06	
Copper	1.72E-07	
Di-n-butylphthalate	0.00E+00	
Lead	8.61E-07	
Mercury	3.06E-10	
Nickel	9.34E-08	
Silver	7.65E-08	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	2.98E-08	
Zinc	2.98E-06	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

Exposure Scenario: Current Use
 Exposed Population: Demilitarization Area Worker
 Exposure Pathway: Inhalation of COCs in Pond Area Surface Soils
 Exposure Location: Southeast of SWMU (downwind)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.3-5
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 8 hours/day
EF (Exposure Frequency)	= 150 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	2.25E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	2.56E+04	9.44E-10	6.30E+00	5.9E-09	2.9%
Chromium (VI)	1.11E-07	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	2.56E+04	4.65E-09	4.20E+01	2.0E-07	94.0%
Nickel	9.34E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	2.56E+04	3.92E-09	1.68E+00	6.6E-09	3.2%
2,4,6-Trinitrotoluene		2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										2.1E-07	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Vanadium	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	2.55E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	2.99E-09			
Cadmium	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00	0.0%
Chromium (Total)	2.25E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	2.64E-09			
Copper	1.11E-06	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	1.31E-07			
Di-n-butylphthalate	1.72E-07	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	2.02E-08			
Lead	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA	0.0%
Mercury	8.61E-07	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	1.01E-07	8.57E-05	1.2E-03	100.0%
Nickel	3.06E-10	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	3.60E-11			
Silver	9.34E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	1.10E-08			
Toluene	7.65E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	8.99E-09	4.00E-01	2.2E-08	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	2.98E-08	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	3.50E-09			
1,1,2-Trichloro-1,2,2-flu	2.98E-06	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	3.50E-07			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	8.00E+00	1.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										1.2E-03	

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Appendix Table K.4-3 SWMU 5 Current Use Worker Exposure Scenario: Risk Calculation
Documentation for the Ditch/SS Sample Location Subarea Evaluation

Exposure Scenario: Current Use
Exposed Population: Environmental Management Staff
Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
Exposure Location: SWMU 5 Ditch/SS Subarea (see Table 5.3-5)

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic	0.00E+00	1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00	0.0%
Cadmium	1.42E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	6.02E-12	6.02E-12	0.4%
Chromium (VI)	2.95E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	8.03E-11	8.03E-11	5.2%
Nickel	1.43E+01	0.00E+00	0.00E+00	0.00E+00	1.68E+00	1.55E-11	1.55E-11	1.0%
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Methylene chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03	1.44E-09	1.44E-09	93.4%
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation:	1.5E-09	1.5E-09	

Noncancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	3.57E+00	4.00E-04	1.40E-04	5.73E-06	0.00E+00	0.00E+00	1.45E-04	54.8%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	1.47E+00	1.00E-03	2.30E-05	9.44E-07	1.43E-04	1.87E-08	2.40E-05	9.0%
Chromium (Total)	2.95E+01	9.00E-01	5.12E-07	2.10E-08	0.00E+00	0.00E+00	5.33E-07	0.2%
Copper	2.59E+01	3.71E-02	1.09E-05	4.48E-07	0.00E+00	0.00E+00	1.14E-05	4.3%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	5.09E+01	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.0%
Mercury	7.50E-02	3.00E-04	3.91E-06	1.60E-07	8.57E-05	1.59E-09	4.08E-06	1.5%
Nickel	1.43E+01	2.00E-02	1.12E-05	4.57E-07	0.00E+00	0.00E+00	1.16E-05	4.4%
Silver	2.95E-01	5.00E-03	9.24E-07	3.79E-08	0.00E+00	0.00E+00	9.62E-07	0.4%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Vanadium	2.16E+01	7.00E-03	4.83E-05	1.98E-06	0.00E+00	0.00E+00	5.03E-05	18.9%
Zinc	3.18E+02	3.00E-01	1.66E-05	6.81E-07	0.00E+00	0.00E+00	1.73E-05	6.5%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway Specific Totals--		Ingestion:	2.6E-04	1.0E-05	Inhalation:	2.0E-08	2.7E-04	

*The oral RfD for chromium (9.0E-01 mg/kg/day) is weighted as follows: 90% trivalent fraction (RfD=1.0 mg/kg/day) and 10% hexavalent fraction (RfD=0.005 mg/kg/day). Page E of this worksheet provides the rationale for this approach.

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 5 Ditch/SS Subarea (see Table 5.3-5)

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.3-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
$CDI (mg/kg/day) = (CS \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	% Cont.
Arsenic		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	
Cadmium	1.42E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	7.94E-09		0.0E+00	
Chromium (VI)	2.95E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.65E-08		0.0E+00	
Nickel	1.43E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	8.00E-08		0.0E+00	
2,4,6-Trinitrotoluene		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	
Total Soil Ingestion Cancer Risk:										0.0E+00	

Non-Cancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	3.57E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.59E-08	4.00E-04	1.4E-04	54.8%
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	1.47E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.30E-08	1.00E-03	2.3E-05	9.0%
Chromium (Total)	2.95E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.61E-07	9.00E-01	5.1E-07	0.2%
Copper	2.59E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.05E-07	3.71E-02	1.1E-05	4.3%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	5.09E+01										
Mercury	7.50E-02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.17E-09	3.00E-04	3.9E-06	1.5%
Nickel	1.43E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.23E-07	2.00E-02	1.1E-05	4.4%
Silver	2.95E-01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.62E-09	5.00E-03	9.2E-07	0.4%
Toluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	2.16E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.38E-07	7.00E-03	4.8E-05	18.9%
Zinc	3.18E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.98E-06	3.00E-01	1.7E-05	6.5%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										2.6E-04	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 5 Ditch/SS Subarea (see Table 5.3-5)

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.3-5
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations
Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal Contact CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	
Cadmium	1.42E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	3.3E-10		0.0E+00	
Chromium (VI)	2.95E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	6.8E-10		0.0E+00	
Nickel	1.43E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	3.3E-09		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	
Total Dermal Contact Cancer Risk:											0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	3.57E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.29E-09	4.00E-04	5.7E-06	54.8%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	1.47E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	9.44E-10	1.00E-03	9.4E-07	9.0%
Chromium (Total)	2.95E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.89E-08	9.00E-01	2.1E-08	0.2%
Copper	2.59E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.66E-08	3.71E-02	4.5E-07	4.3%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	5.09E+01											
Mercury	7.50E-02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.81E-11	3.00E-04	1.6E-07	1.5%
Nickel	1.43E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	9.15E-09	2.00E-02	4.6E-07	4.4%
Silver	2.95E-01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.89E-10	5.00E-03	3.8E-08	0.4%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	2.16E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.39E-08	7.00E-03	2.0E-06	18.9%
Zinc	3.18E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.04E-07	3.00E-01	6.8E-07	6.5%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											1.0E-05	

Appendix Table K.4-3c SWMU 5 Worker Exposure Scenario: Inhalation Risk Calculation
 Documentation for Ditch/SS Sample Location Subarea Evaluation

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 5 Ditch/SS Subarea (see Table 5.3-5)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.3-5
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	1.71E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	9.56E-13	6.30E+00	6.0E-12	0.4%
Chromium (VI)	3.42E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.91E-12	4.20E+01	8.0E-11	5.2%
Nickel	1.65E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	9.23E-12	1.68E+00	1.5E-11	1.0%
2,4,6-Trinitrotoluene		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Methylene chloride	1.56E-03	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	8.72E-07	1.65E-03	1.4E-09	93.4%
Total Soil Inhalation Cancer Risk:										1.5E-09	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	4.14E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	6.48E-12			
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	1.71E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.67E-12	1.43E-04	1.9E-08	92.2%
Chromium (Total)	3.42E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.35E-11			
Copper	3.00E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.70E-11			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	5.90E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	9.24E-11	NA	NA	0.0%
Mercury	8.70E-11	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.36E-13	8.57E-05	1.6E-09	7.8%
Nickel	1.65E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.59E-11			
Silver	3.42E-10	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.36E-13			
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	2.51E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.92E-11			
Zinc	3.69E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.78E-10			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										2.0E-08	

Appendix Table K.4-3d Exposure Point Concentrations (EPCs) Used for SWMU 5 Current Use
 Worker Exposure Scenario--Ditch/SS Subarea Evaluation

SWMU 5: Ditch/SS Subarea	Soil Exposure Point Concentration (EPC) (mg/kg)
Antimony	3.57
Arsenic	
Cadmium	1.47
Chromium (Total)	29.46
Copper	25.89
Di-n-butylphthalate	
Lead	50.88
Mercury	0.075
Nickel	14.25
Silver	0.295
Toluene	
Trichlorofluoromethane	
Vanadium	21.61
Zinc	318.26
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.

Contaminant	Modeled Air Concentration (mg/m³)	Conversion Factor (m³/kg soil)
Antimony	4.14E-09	8.62E+08
Arsenic	0.00E+00	
Cadmium	1.71E-09	
Chromium (Total)	3.42E-08	
Copper	3.00E-08	
Di-n-butylphthalate	0.00E+00	
Lead	5.90E-08	
Mercury	8.70E-11	
Nickel	1.65E-08	
Silver	3.42E-10	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	2.51E-08	
Zinc	3.69E-07	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

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Appendix Table K.4-4 SWMU 5 Current Use Worker Exposure Scenario: Risk Calculation
Documentation for Remaining Sample Locations

Exposure Scenario: Current Use
Exposed Population: Environmental Management Staff
Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
Exposure Location: SWMU 5: Remaining Sample Locations (see Table 5.3-5)

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic	0.00E+00	1.75E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	1.09E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	4.44E-12	4.44E-12	0.3%
Chromium (VI)	3.47E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	9.46E-11	9.46E-11	6.1%
Nickel	1.61E+01	0.00E+00	0.00E+00	0.00E+00	1.68E+00	1.76E-11	1.76E-11	1.1%
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Methylene chloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03	1.4E-09	1.44E-09	92.5%
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation:	1.6E-09	1.6E-09	

Noncancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	3.57E+00	4.00E-04	1.40E-04	5.73E-06	0.00E+00	0.00E+00	1.45E-04	50.4%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	1.09E+00	1.00E-03	1.71E-05	7.09E-07	1.43E-04	1.38E-08	1.78E-05	6.2%
Chromium (Total)	3.47E+01	9.00E-01	6.04E-07	2.48E-08	0.00E+00	0.00E+00	6.29E-07	0.2%
Copper	3.19E+01	3.71E-02	1.35E-05	5.52E-07	0.00E+00	0.00E+00	1.40E-05	4.8%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	1.30E+02	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	--
Mercury	2.70E-01	3.00E-04	1.41E-05	5.78E-07	8.57E-05	5.72E-09	1.47E-05	5.1%
Nickel	1.61E+01	2.00E-02	1.26E-05	5.16E-07	0.00E+00	0.00E+00	1.31E-05	4.5%
Silver	2.95E-01	5.00E-03	9.24E-07	3.79E-08	0.00E+00	0.00E+00	9.62E-07	0.3%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Vanadium	3.12E+01	7.00E-03	6.98E-05	2.86E-06	0.00E+00	0.00E+00	7.27E-05	25.2%
Zinc	1.76E+02	3.00E-01	9.16E-06	3.75E-07	0.00E+00	0.00E+00	9.53E-06	3.3%
1,1,2-Trichloro-1,2,2-fluoroet	8.00E-03	3.00E+01	4.17E-12	1.71E-11	0.00E+00	0.00E+00	2.13E-11	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion:	2.8E-04	1.1E-05	Inhalation:	2.0E-08	2.9E-04	

*The oral RfD for chromium (9.0E-01 mg/kg/day) is weighted as follows: 90% trivalent fraction (RfD=1.0 mg/kg/day) and 10% hexavalent fraction (RfD=0.005 mg/kg/day). Page E of this worksheet provides the rationale for this approach.

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Appendix Table K.4-4a SWMU 5 Worker Exposure Scenario: Soil Ingestion Risk Calculation Documentation for Remaining Sample Locations

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 5: Remaining Sample Locations (see Table 5.3)

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.3-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*EDY)/(BW*AT)
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	% Cont.
Arsenic		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	
Cadmium	1.09E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	6.09E-09		0.0E+00	
Chromium (VI)	3.47E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.94E-08		0.0E+00	
Nickel	1.61E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	9.00E-08		0.0E+00	
2,4,6-Trinitrotoluene		1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	
Total Soil Ingestion Cancer Risk:										0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	3.57E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.59E-08	4.00E-04	1.4E-04	50.4%
Arsenic	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	1.09E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.71E-08	1.00E-03	1.7E-05	6.2%
Chromium (Total)	3.47E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.44E-07	9.00E-01	6.0E-07	0.2%
Copper	3.19E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.99E-07	3.71E-02	1.3E-05	4.8%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	1.30E+02										
Mercury	2.70E-01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.23E-09	3.00E-04	1.4E-05	5.1%
Nickel	1.61E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.52E-07	2.00E-02	1.3E-05	4.5%
Silver	2.95E-01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.62E-09	5.00E-03	9.2E-07	0.3%
Toluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	3.12E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.89E-07	7.00E-03	7.0E-05	25.2%
Zinc	1.76E+02	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.75E-06	3.00E-01	9.2E-06	3.3%
1,1,2-Trichloro-1,2,2-fluor	8.00E-03	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.25E-10	3.00E+01	4.2E-12	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										2.8E-04	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 5: Remaining Sample Locations (see Table 5.3-5)

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.3-5
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations

Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
 Cancer Risk = Dermal Contact CDI * SF
 Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	
Cadmium	1.09E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	2.5E-10		0.0E+00	
Chromium (VI)	3.47E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	8.0E-10		0.0E+00	
Nickel	1.61E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	3.7E-09		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	
Total Dermal Contact Cancer Risk:											0.0E+00	

Cancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	3.57E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.29E-09	4.00E-04	5.7E-06	50.4%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	1.09E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	7.00E-10	1.00E-03	7.0E-07	6.2%
Chromium (Total)	3.47E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.23E-08	9.00E-01	2.5E-08	0.2%
Copper	3.19E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.05E-08	3.71E-02	5.5E-07	4.8%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	1.30E+02											
Mercury	2.70E-01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.73E-10	3.00E-04	5.8E-07	5.1%
Nickel	1.61E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.03E-08	2.00E-02	5.2E-07	4.5%
Silver	2.95E-01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.89E-10	5.00E-03	3.8E-08	0.3%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	3.12E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.00E-08	7.00E-03	2.9E-06	25.2%
Zinc	1.76E+02	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.13E-07	3.00E-01	3.8E-07	3.3%
1,1,2-Trichloro-1,2,2-flu	8.00E-03	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.14E-10	3.00E+01	1.7E-11	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											1.1E-05	

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Appendix Table K.4-4c SWMU 5 Worker Exposure Scenario: Inhalation Risk Calculation
Documentation for Remaining Sample Locations

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 5: Remaining Sample Locations

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.3-5
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic											
Cadmium	1.26E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	7.05E-13	6.30E+00	4.4E-12	0.3%
Chromium (VI)	4.03E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	2.25E-12	4.20E+01	9.5E-11	6.1%
Nickel	1.87E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	1.05E-11	1.68E+00	1.8E-11	1.1%
2,4,6-Trinitrotoluene		2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	0.00E+00	0.0E+00	0.0%
Methylene chloride	1.56E-03	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	8.72E-07	1.65E-03	1.4E-09	92.5%
Total Soil Inhalation Cancer Risk:										1.6E-09	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	4.14E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	6.48E-12			
Arsenic	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	1.26E-09	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.98E-12	1.43E-04	1.4E-08	70.8%
Chromium (Total)	4.03E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	6.31E-11			
Copper	3.70E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.79E-11			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	1.51E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.37E-10	NA	NA	
Mercury	3.13E-10	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.90E-13	8.57E-05	5.7E-09	29.2%
Nickel	1.87E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.92E-11			
Silver	3.42E-10	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.36E-13			
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	3.62E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.67E-11			
Zinc	2.04E-07	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	3.19E-10			
1,1,2-Trichloro-1,2,2-flu	9.28E-12	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.45E-14			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										2.0E-08	

Appendix Table K.4-4d Exposure Point Concentrations (EPCs) Used for SWMU 5 Current Use
 Worker Exposure Scenario--Evaluation of Remaining Sample Locations

SWMU 5: Remaining Locations	Soil Exposure Point Concentration (EPC)	
Contaminant	(mg/kg)	
Antimony	3.57	
Arsenic		
Cadmium	1.09	
Chromium (Total)	34.74	<i>Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.</i>
Copper	31.88	
Di-n-butylphthalate		
Lead	130.44	
Mercury	0.27	
Nickel	16.08	
Silver	0.295	
Toluene		
Trichlorofluoromethane		
Vanadium	31.23	
Zinc	175.5	
1,1,2-Trichloro-1,2,2-fluoroethane	0.008	
2,4,6-Trinitrotoluene		

Contaminant	Modeled Air Concentration (mg/m3)	Conversion Factor (m3/kg soil)
Antimony	4.14E-09	8.62E+08
Arsenic	0.00E+00	
Cadmium	1.26E-09	
Chromium (Total)	4.03E-08	
Copper	3.70E-08	
Di-n-butylphthalate	0.00E+00	
Lead	1.51E-07	
Mercury	3.13E-10	
Nickel	1.87E-08	
Silver	3.42E-10	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	3.62E-08	
Zinc	2.04E-07	
1,1,2-Trichloro-1,2,2-fluoroethane	9.28E-12	
2,4,6-Trinitrotoluene	0.00E+00	

Appendix Table K.4-5 SWMU 5 Worker Exposure Scenario: Inhalation Risks Associated with Volatile Air COCs (Methylene Chloride only)

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of SWMU 5 VOC Air COCs
 Exposure Location: SWMU 5 (Methylene chloride only)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.3-5
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Facto (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Chloroform		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	8.05E-02	0.0E+00	0.0%
Methylene chloride	1.56E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	8.72E-07	1.65E-03	1.4E-09	100.0%
Tetrachloroethene		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	2.03E-03	0.0E+00	0.0%
Trichloroethene		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	6.16E-03	0.0E+00	0.0%
Total VOC Soil Inhalation Cancer Risk:										1.4E-09	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Chloroform		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Ethyl Benzene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00	2.86E-01	0.0E+00	0.0%
Methylene chloride	1.56E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	2.44E-06	8.57E-01	2.8E-06	100.0%
Tetrachloroethene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Toluene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00	1.14E-01	0.0E+00	0.0%
Trichloroethene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Xylenes		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Soil Inhalation Hazard Index:										2.8E-06	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
 Exposure Location: SWMU 8 Interior

Cancer Risk Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic	0.00E+00	1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00	
Cadmium	3.74E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	1.91E-12	1.91E-12	
Chromium (VI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	0.00E+00	0.00E+00	
Nickel	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E+00	0.00E+00	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation:	1.9E-12	1.9E-12	

Noncancer Hazard Index Calculations

Contaminant	RME Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	0.00E+00	4.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	3.74E+00	1.00E-03	2.93E-05	1.20E-06	1.43E-04	5.94E-09	3.05E-05	31.0%
Chromium (Total)	0.00E+00	9.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Copper	1.55E+02	3.71E-02	3.26E-05	1.34E-06	0.00E+00	0.00E+00	3.39E-05	34.5%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	9.89E+01	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	0.0%
Mercury	1.38E-01	3.00E-04	3.60E-06	1.48E-07	8.57E-05	3.66E-10	3.75E-06	3.8%
Nickel	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Silver	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	5.00E-03	3.00E-01	1.30E-10	5.35E-10	0.00E+00	0.00E+00	6.65E-10	0.0%
Vanadium	0.00E+00	7.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Zinc	1.11E+03	3.00E-01	2.89E-05	1.18E-06	0.00E+00	0.00E+00	3.01E-05	30.6%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion:	9.4E-05	3.9E-06	Inhalation:	6.3E-09	9.8E-05	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 8: Evaluation of Site-Wide COCs

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.4-4)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 2 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
$CDI (mg/kg/day) = (CS \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day) ⁻¹	Soil Ingestion Cancer Risk	% Cont.
Arsenic	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	
Cadmium	3.74E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	1.05E-08		0.0E+00	
Chromium (VI)	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	
Nickel	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	
Total Soil Ingestion Cancer Risk:										0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	3.74E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.93E-08	1.00E-03	2.9E-05	31.0%
Chromium (Total)	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	0.0%
Copper	1.55E+02	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.21E-06	3.71E-02	3.3E-05	34.5%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	9.89E+01										
Mercury	1.38E-01	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.08E-09	3.00E-04	3.6E-06	3.8%
Nickel	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Silver	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	5.00E-03	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	3.91E-11	3.00E-01	1.3E-10	0.0%
Vanadium	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	1.11E+03	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	8.67E-06	3.00E-01	2.9E-05	30.6%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										9.4E-05	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 8: Evaluation of Site-Wide COCs

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.4-4
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	2 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations
Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal Contact CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	
Cadmium	3.74E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	4.3E-10		0.0E+00	
Chromium (VI)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00		0.0E+00	
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	
Total Dermal Contact Cancer Risk:											0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	3.74E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.20E-09	1.00E-03	1.2E-06	31.0%
Chromium (Total)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	0.0%
Copper	1.55E+02	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	4.96E-08	3.71E-02	1.3E-06	34.5%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	9.89E+01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	4.43E-11	3.00E-04	1.5E-07	3.8%
Mercury	1.38E-01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Silver	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	5.00E-03	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.60E-10	3.00E-01	5.3E-10	0.0%
Vanadium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	1.11E+03	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	3.55E-07	3.00E-01	1.2E-06	30.6%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											3.9E-06	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 8

Exposure Pathway Variables		
CA (Air Concentration)	=	See Table 5.4-4
IR (Inhalation Rate)	=	2.5 m3/hour
ET (Exposure Time)	=	1 hour/day
EF (Exposure Frequency)	=	2 days/year
ED (Exposure Duration)	=	25 years
BW (Body Weight)	=	70 kg
AT (Averaging Time, Carcinogenic Effects)	=	25550 days
AT (Noncarcinogenic Effects)	=	9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	% Cont.
Arsenic	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	4.34E-09	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	3.03E-13	6.30E+00	1.9E-12	100.0%
Chromium (VI)	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00	0.0%
Nickel	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										1.9E-12	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	4.34E-09	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	8.49E-13	1.43E-04	5.9E-09	94.2%
Chromium (Total)	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Copper	1.79E-07	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	3.51E-11			
Di-n-butylphthalate	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	1.15E-07	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.25E-11	NA	NA	
Mercury	1.60E-10	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	3.13E-14	8.57E-05	3.7E-10	5.8%
Nickel	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Silver	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	5.80E-12	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.14E-15			
Vanadium	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	1.28E-06	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.51E-10			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										6.3E-09	

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Appendix Table K.5-1d Exposure Point Concentrations (EPCs) Used for SWMU 8 Current Use Worker
 Exposure Scenario--Site-Wide COCs Page 5 of 5

SWMU 8: Site-Wide EPCs	RME Soil Concentration (mg/kg)
<u>Contaminant</u>	
Antimony	
Arsenic	
Cadmium	3.74
Chromium (Total)	
Copper	154.5
Di-n-butylphthalate	
Lead	98.9
Mercury	0.138
Nickel	
Silver	
Toluene	
Trichlorofluoromethane	0.005
Vanadium	
Zinc	1107
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

<u>Contaminant</u>	<u>Air Concentration (mg/m3)</u>	<u>Conversion Factor (m3/kg soil)</u>
Antimony	0.00E+00	8.62E+08
Arsenic	0.00E+00	
Cadmium	4.34E-09	
Chromium (Total)	0.00E+00	
Copper	1.79E-07	
Di-n-butylphthalate	0.00E+00	
Lead	1.15E-07	
Mercury	1.60E-10	
Nickel	0.00E+00	
Silver	0.00E+00	
Toluene	0.00E+00	
Trichlorofluoromethane	5.80E-12	
Vanadium	0.00E+00	
Zinc	1.28E-06	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

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Appendix Table K.5-2: Inhalation Risks Associated with Off-Site Dispersion of SWMU 8 Soils:
Worst-Case Screening Level Analysis Of Site-Wide COCs

Exposure Scenario: Current Use
 Exposed Population: (On-Post) SWMU 31 Workers
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 31 Former Demilitarization Area

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.4-4
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 250 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations

CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
 Cancer Risk = CDI * Inhalation SF
 Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day) ⁻¹	Inhalation Cancer Risk	% Cont.
Arsenic	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	4.34E-09	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	1.52E-10	6.30E+00	9.6E-10	100.0%
Chromium (VI)	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00	0.0%
Nickel	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										9.6E-10	

Noncancer Hazard Index Calculations

Contaminant	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	4.34E-09	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	4.25E-10	1.43E-04	3.0E-06	94.2%
Chromium (Total)	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Copper	1.79E-07	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.75E-08			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	1.15E-07	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.12E-08	NA	NA	0.0%
Mercury	1.60E-10	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.57E-11	8.57E-05	1.8E-07	5.8%
Nickel	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Silver	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	5.80E-12	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	5.68E-13			
Vanadium	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	1.28E-06	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	1.26E-07			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										3.2E-06	

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Appendix Table K.5-3 SWMU 8 Current Use Worker Exposure Scenario: Risk Calculation
Documentation for Location-Specific Evaluation

Exposure Scenario: Current Use
Exposed Population: Environmental Management Staff
Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
Exposure Location: SWMU 8: West Trench and Drop Tower Locations

Cancer Risk Calculations

Contaminant	Soil EPC (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic	0.00E+00	1.75E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	0.00E+00	0.0%
Cadmium	6.43E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	3.28E-12	3.28E-12	8.9%
Chromium (VI)	7.58E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	2.58E-11	2.58E-11	69.8%
Nickel	5.79E+01	0.00E+00	0.00E+00	0.00E+00	1.68E+00	7.89E-12	7.89E-12	21.3%
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion:	0.0E+00	0.0E+00	Inhalation	3.7E-11	3.7E-11	

Noncancer Hazard Index Calculations

Contaminant	Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	0.00E+00	4.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Arsenic	0.00E+00	3.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Cadmium	6.43E+00	1.00E-03	5.03E-05	2.06E-06	1.43E-04	1.02E-08	5.24E-05	18.0%
Chromium (Total)	7.58E+01	9.00E-01	6.59E-07	2.70E-08	0.00E+00	0.00E+00	6.86E-07	0.2%
Copper	5.57E+02	3.71E-02	1.18E-04	4.82E-06	0.00E+00	0.00E+00	1.22E-04	41.9%
Di-n-butylphthalate	0.00E+00	1.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Lead	7.30E+01	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.0%
Mercury	5.91E-01	3.00E-04	1.54E-05	6.32E-07	8.57E-05	1.57E-09	1.61E-05	5.5%
Nickel	5.79E+01	2.00E-02	2.27E-05	9.29E-07	0.00E+00	0.00E+00	2.36E-05	8.1%
Silver	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Toluene	0.00E+00	2.00E-01	0.00E+00	0.00E+00	4.00E-01	0.00E+00	0.00E+00	0.0%
Trichlorofluoromethane	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Vanadium	0.00E+00	7.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Zinc	2.82E+03	3.00E-01	7.36E-05	3.02E-06	0.00E+00	0.00E+00	7.66E-05	26.3%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion:	2.8E-04	1.1E-05	Inhalation:	1.2E-08	2.9E-04	

*The oral RfD for chromium (9.0E-01 mg/kg/day) is weighted as follows: 90% trivalent fraction (RfD=1.0 mg/kg/day) and 10% hexavalent fraction (RfD=0.005 mg/kg/day). Page E of this worksheet provides the rationale for this approach.

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 8: West Trench and Drop Tower Locations
 (Location-Specific COCs)

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.4-4)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 2 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*ED)/(BW*AT)
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	% Cont.
Arsenic	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.75E+00	0.0E+00	
Cadmium	6.43E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	1.80E-08		0.0E+00	
Chromium (VI)	7.58E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	2.12E-08		0.0E+00	
Nickel	5.79E+01	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	1.62E-07		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	
Total Soil Ingestion Cancer Risk:										0.0E+00	

Noncancer Hazard Index Calculations

Contaminant	Soil EPC (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	6.43E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	5.03E-08	1.00E-03	5.0E-05	18.0%
Chromium (Total)	7.58E+01	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	5.93E-07	9.00E-01	6.6E-07	0.2%
Copper	5.57E+02	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	4.36E-06	3.71E-02	1.2E-04	41.9%
Di-n-butylphthalate	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	7.30E+01										
Mercury	5.91E-01	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	4.63E-09	3.00E-04	1.5E-05	5.5%
Nickel	5.79E+01	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	4.53E-07	2.00E-02	2.3E-05	8.1%
Silver	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	2.82E+03	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.21E-05	3.00E-01	7.4E-05	26.3%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										2.8E-04	

K-54

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 8: West Trench and Drop Tower Locations
 (Location-Specific COCs)

Exposure Pathway Variables	
CS (Chemical Concentration) =	See Table 5.4-4
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	2 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations
 Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
 Cancer Risk = Dermal Contact CDI * SF
 Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)	Dermal Cancer Risk	% Cont.
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	1.75E+00	0.0E+00	
Cadmium	6.43E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	7.4E-10		0.0E+00	
Chromium (VI)	7.58E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	8.7E-10		0.0E+00	
Nickel	5.79E+01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	2.56E+04	6.6E-09		0.0E+00	
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	
Total Dermal Contact Cancer Risk:											0.0E+00	

Cancer Hazard Index Calculations

Contaminant	Soil EPC (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Cadmium	6.43E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.06E-09	1.00E-03	2.1E-06	18.0%
Chromium (Total)	7.58E+01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	2.43E-08	9.00E-01	2.7E-08	0.2%
Copper	5.57E+02	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.79E-07	3.71E-02	4.8E-06	41.9%
Di-n-butylphthalate	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-01	0.0E+00	0.0%
Lead	7.30E+01											
Mercury	5.91E-01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.90E-10	3.00E-04	6.3E-07	5.5%
Nickel	5.79E+01	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.86E-08	2.00E-02	9.3E-07	8.1%
Silver	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
Vanadium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	2.82E+03	4.10E+03	1.00E+00	1.00E-03	2.00E+00	2.50E+01	7.00E+01	9.13E+03	9.05E-07	3.00E-01	3.0E-06	26.3%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											1.1E-05	

K-55

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 8: West Trench and Drop Tower Locati
 (Location-Specific COCs)

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.4-4
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 1 hour/day
EF (Exposure Frequency)	= 2 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic		2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	7.46E-09	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	5.21E-13	6.30E+00	3.3E-12	8.9%
Chromium (VI)	8.79E-09	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	6.14E-13	4.20E+01	2.6E-11	69.8%
Nickel	6.72E-08	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	4.70E-12	1.68E+00	7.9E-12	21.3%
2,4,6-Trinitrotoluene		2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										3.7E-11	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	7.46E-09	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.46E-12	1.43E-04	1.0E-08	86.7%
Chromium (Total)	8.79E-08	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.72E-11			
Copper	6.46E-07	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.26E-10			
Di-n-butylphthalate	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	8.47E-08	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.66E-11	NA	NA	0.0%
Mercury	6.86E-10	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.34E-13	8.57E-05	1.6E-09	13.3%
Nickel	6.72E-08	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	1.31E-11			
Silver	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	3.27E-06	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	6.40E-10			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	1.00E+00	2.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										1.2E-08	

SWMU 8: Location-Specific	Soil EPC (mg/kg)
<u>Contaminant</u>	
Antimony	
Arsenic	
Cadmium	6.43
Chromium (Total)	75.8
Copper	557
Di-n-butylphthalate	
Lead	73
Mercury	0.591
Nickel	57.9
Silver	
Toluene	
Trichlorofluoromethane	
Vanadium	
Zinc	2820
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.

<u>Contaminant</u>	Modeled Air EPC (mg/m3)	<u>Conversion Factor (m3/kg soil)</u>
Antimony	0.00E+00	8.62E+08
Arsenic	0.00E+00	
Cadmium	7.46E-09	
Chromium (Total)	8.79E-08	
Copper	6.46E-07	
Di-n-butylphthalate	0.00E+00	
Lead	8.47E-08	
Mercury	6.86E-10	
Nickel	6.72E-08	
Silver	0.00E+00	
Toluene	0.00E+00	
Trichlorofluoromethane	0.00E+00	
Vanadium	0.00E+00	
Zinc	3.27E-06	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

Appendix Table K.5-4: Inhalation Risks Associated with Off-Site Dispersion of SWMU 8 Soils:
Worst-Case Screening Level Analysis Of Location-Specific COC Concentrations

Point Source: SWMU 8 West Trench and Drop Tower Locations

Exposure Scenario: Current Use
Exposed Population: (On-Post) SWMU 31 Workers
Exposure Pathway: Inhalation of Surface Soil COCs
Exposure Location: SWMU 31 Former Demilitarization Area

Exposure Pathway Variables		
CA (Air Concentration)	=	See Table 5.4-4
IR (Inhalation Rate)	=	2.5 m ³ /hour
ET (Exposure Time)	=	4 hours/day
EF (Exposure Frequency)	=	250 days/year
ED (Exposure Duration)	=	25 years
BW (Body Weight)	=	70 kg
AT (Averaging Time, Carcinogenic Effects)	=	25550 days
AT (Noncarcinogenic Effects)	=	9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day) ⁻¹	Inhalation Cancer Risk	% Cont.
Arsenic	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.51E+01	0.0E+00	0.0%
Cadmium	7.46E-09	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	2.61E-10	6.30E+00	1.6E-09	8.9%
Chromium (VI)	8.79E-09	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	3.07E-10	4.20E+01	1.3E-08	69.8%
Nickel	6.72E-08	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	2.35E-09	1.68E+00	3.9E-09	21.3%
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										1.8E-08	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Cadmium	7.46E-09	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	7.30E-10	1.43E-04	5.1E-06	86.7%
Chromium (Total)	8.79E-08	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	8.60E-09			
Copper	6.46E-07	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	6.32E-08			
Di-n-butylphthalate	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Lead	8.47E-08	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	8.29E-09	NA	NA	0.0%
Mercury	6.86E-10	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	6.71E-11	8.57E-05	7.8E-07	13.3%
Nickel	6.72E-08	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	6.57E-09			
Silver	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	0.0%
Trichlorofluoromethane	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Vanadium	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	3.27E-06	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	3.20E-07			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										5.9E-06	

K-58

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
 Exposure Location: Within SWMU 9

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% Cont.
Arsenic	1.15E+01	1.75E+00	1.13E-07	4.61E-09	1.51E+01	1.12E-10	1.17E-07	100%
Cadmium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E+00	0.00E+00	0.00E+00	0%
Chromium (VI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E+01	0.00E+00	0.00E+00	0%
Nickel	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E+00	0.00E+00	0.00E+00	0%
2,4,6-Trinitrotoluene	0.00E+00	3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0%
Pathway-Specific Totals--		Ingestion:	1.1E-07	4.6E-09	Inhalation	0.0E+00	1.2E-07	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% Cont.
Antimony	0.00E+00	4.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Arsenic	1.15E+01	3.00E-04	6.00E-04	2.46E-05	0.00E+00	0.00E+00	6.25E-04	94.5%
Cadmium	0.00E+00	1.00E-03	0.00E+00	0.00E+00	1.43E-04	0.00E+00	0.00E+00	0.0%
Chromium (Total)	0.00E+00	9.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Copper	3.28E+01	3.71E-02	1.38E-05	5.67E-07	0.00E+00	0.00E+00	1.44E-05	2.2%
Di-n-butylphthalate	2.77E+01	1.00E-01	4.34E-06	1.78E-05	0.00E+00	0.00E+00	2.21E-05	3.3%
Lead	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	0.0%
Mercury	0.00E+00	3.00E-04	0.00E+00	0.00E+00	8.57E-05	0.00E+00	0.00E+00	0.0%
Nickel	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Silver	0.00E+00	5.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Toluene	3.80E-01	2.00E-01	2.97E-08	1.22E-07	4.00E-01	0.00E+00	1.52E-07	0.0%
Trichlorofluoromethane	1.00E-03	3.00E-01	5.22E-11	2.14E-10	0.00E+00	0.00E+00	2.66E-10	0.0%
Vanadium	0.00E+00	7.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Zinc	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
1,1,2-Trichloro-1,2,2-fluoro	0.00E+00	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%
Pathway-Specific Totals--		Ingestion:	6.2E-04	4.3E-05	Inhalation:	0.0E+00	6.6E-04	

K-59

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Soil Ingestion
 Exposure Location: SWMU 9

Exposure Pathway Variables	
CS (Chemical Concentration)	= Surface Soil upper 95% UCL (Table 5.5-5)
IR (Soil Ingestion Rate)	= 100.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (unitless)
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarc Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*ED)/(BW*AT)
Cancer Risk = CDI * SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	% Cont.
Arsenic	1.15E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	6.43E-08	1.75E+00	1.1E-07	100.0%
Cadmium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Chromium (VI)	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Nickel	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	3.00E-02	0.0E+00	0.0%
Total Soil Ingestion Cancer Risk:										1.1E-07	

Noncancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Antimony	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	1.15E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.80E-07	3.00E-04	6.0E-04	97.1%
Cadmium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	0.0%
Chromium (Total)	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	0.0%
Copper	3.28E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.14E-07	3.71E-02	1.4E-05	2.2%
Di-n-butylphthalate	2.77E+01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	4.34E-07	1.00E-01	4.3E-06	0.7%
Lead	0.00E+00										
Mercury	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Nickel	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Silver	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	3.80E-01	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.95E-09	2.00E-01	3.0E-08	0.0%
Trichlorofluoromethane	1.00E-03	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.57E-11	3.00E-01	5.2E-11	0.0%
Vanadium	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
1,1,2-Trichloro-1,2,2-fluor	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	1.00E+02	1.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Soil Ingestion Hazard Index:										6.2E-04	

K-60

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Dermal Contact with Surface Soil
 Exposure Location: SWMU 9

Exposure Pathway Variables	
CS (Chemical Concentration) =	Surface Soil upper 95% UCL (Table
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	metals-0.001; orgs-0.1
EF (Exposure Frequency) =	4 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25550 days
AT (Noncarcinogenic Effects) =	9125 days

Intake and Risk Calculation Equations	
Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)	
Cancer Risk = Dermal Contact CDI * SF	
Hazard Quotient = CDI/RfD	

Cancer Risk Calculations

Contaminant	RME Soil Concentration (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) SF (mg/kg/day)-1	Dermal Cancer Risk	% Cont.
Arsenic	1.15E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	2.6E-09	1.75E+00	4.6E-09	100.0%
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00		0.0E+00	0.0%
Chromium (VI)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00		0.0E+00	0.0%
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00		0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.0E+00	3.00E-02	0.0E+00	0.0%
Total Dermal Contact Cancer Risk:											4.6E-09	

Cancer Hazard Index Calculations

Contaminant	RME Soil Concentration (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Antimony	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-04	0.0E+00	0.0%
Arsenic	1.15E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	7.38E-09	3.00E-04	2.5E-05	57.1%
Cadmium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.00E-03	0.0E+00	0.0%
Chromium (Total)	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	9.00E-01	0.0E+00	0.0%
Copper	3.28E+01	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.11E-08	3.71E-02	5.7E-07	1.3%
Di-n-butylphthalate	2.77E+01	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.78E-06	1.00E-01	1.8E-05	41.3%
Lead	0.00E+00											
Mercury	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-04	0.0E+00	0.0%
Nickel	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	2.00E-02	0.0E+00	0.0%
Silver	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-03	0.0E+00	0.0%
Toluene	3.80E-01	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.44E-08	2.00E-01	1.2E-07	0.3%
Trichlorofluoromethane	1.00E-03	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	6.42E-11	3.00E-01	2.1E-10	0.0%
Vanadium	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	7.00E-03	0.0E+00	0.0%
Zinc	0.00E+00	4.10E+03	1.00E+00	1.00E-03	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E-01	0.0E+00	0.0%
1,1,2-Trichloro-1,2,2-flu	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	3.00E+01	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	4.10E+03	1.00E+00	1.00E-01	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	5.00E-04	0.0E+00	0.0%
Dermal Contact Hazard Index:											4.3E-05	

K-61

Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of Surface Soil COCs
 Exposure Location: SWMU 9

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.5-5
IR (Inhalation Rate)	= 2.5 m3/hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic	1.33E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	7.46E-12	1.51E+01	1.1E-10	100.0%
Cadmium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00	0.0%
Chromium (VI)	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00	0.0%
Nickel	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										1.1E-10	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	1.33E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	2.09E-11			
Cadmium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00	
Chromium (Total)	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Copper	3.81E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.96E-11			
Di-n-butylphthalate	3.21E-08	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	5.03E-11			
Lead	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA	
Mercury	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00	
Nickel	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Silver	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	
Trichlorofluoromethane	1.16E-12	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	1.82E-15			
Vanadium	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	4.00E+00	4.00E+00	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										0.0E+00	

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Appendix Table K.6-1d Exposure Point Concentrations (EPCs) for SWMU 9 Current Use Worker
 Scenario--Worst Case Exposure Evaluation

SWMU 9	RME Soil Concentration (mg/kg)
<u>Contaminant</u>	
Antimony	
Arsenic	11.5
Cadmium	
Chromium (Total)	
Copper	32.8
Di-n-butylphthalate	27.7
Lead	
Mercury	
Nickel	
Silver	
Toluene	0.38
Trichlorofluoromethane	0.001
Vanadium	
Zinc	
1,1,2-Trichloro-1,2,2-fluoroethane	
2,4,6-Trinitrotoluene	

<u>Contaminant</u>	Modeled Air Concentration (mg/m3)	<u>Conversion Factor (m3/kg soil)</u>
Antimony	0.00E+00	8.62E+08
Arsenic	1.33E-08	
Cadmium	0.00E+00	
Chromium (Total)	0.00E+00	
Copper	3.81E-08	
Di-n-butylphthalate	3.21E-08	
Lead	0.00E+00	
Mercury	0.00E+00	
Nickel	0.00E+00	
Silver	0.00E+00	
Toluene		<i>Toluene not modeled using PEF conversion factor</i>
Trichlorofluoromethane	1.16E-12	<i>(as not appropriate)</i>
Vanadium	0.00E+00	
Zinc	0.00E+00	
1,1,2-Trichloro-1,2,2-fluoroethane	0.00E+00	
2,4,6-Trinitrotoluene	0.00E+00	

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Appendix Table K.6-2: Inhalation Risks Associated with Dispersion of SWMU 9 Soils:
Worst-Case Screening Level Analysis

Exposure Scenario: Current Use
 Exposed Population: Area 2 Warehouse Worker
 Exposure Pathway: Inhalation of Airborne SWMU 9 Soil COCs
 Exposure Location: Area 2 Warehouses

Exposure Pathway Variables		
CA (Air Concentration)	=	See Table 5.5-5
IR (Inhalation Rate)	=	2.5 m3/hour
ET (Exposure Time)	=	8 hours/day
EF (Exposure Frequency)	=	250 days/year
ED (Exposure Duration)	=	25 years
BW (Body Weight)	=	70 kg
AT (Averaging Time, Carcinogenic Effects)	=	25550 days
AT (Noncarcinogenic Effects)	=	9125 days

Intake and Risk Calculation Equations
$CDI (mg/kg/day) = (CA \cdot IR \cdot ET \cdot EF \cdot ED) / (BW \cdot AT)$
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Arsenic	1.33E-08	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	9.32E-10	1.51E+01	1.4E-08	100.0%
Cadmium	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	6.30E+00	0.0E+00	0.0%
Chromium (VI)	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	4.20E+01	0.0E+00	0.0%
Nickel	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00	1.68E+00	0.0E+00	0.0%
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	2.56E+04	0.00E+00		0.0E+00	0.0%
Total Soil Inhalation Cancer Risk:										1.4E-08	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m3)	Inhalation Rate (m3/hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Antimony	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Arsenic	1.33E-08	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	2.61E-09			
Cadmium	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	1.43E-04	0.0E+00	
Chromium (Total)	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Copper	3.81E-08	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	7.45E-09			
Di-n-butylphthalate	3.21E-08	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	6.29E-09			
Lead	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	NA	NA	
Mercury	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	8.57E-05	0.0E+00	
Nickel	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Silver	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Toluene	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00	4.00E-01	0.0E+00	
Trichlorofluoromethane	1.16E-12	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	2.27E-13			
Vanadium	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Zinc	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
1,1,2-Trichloro-1,2,2-flu	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
2,4,6-Trinitrotoluene	0.00E+00	2.50E+00	8.00E+00	2.50E+02	2.50E+01	7.00E+01	9.13E+03	0.00E+00			
Soil Inhalation Hazard Index:										0.0E+00	

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Exposure Scenario: Current Use
 Exposed Population: Environmental Management Staff
 Exposure Pathway: Inhalation of SWMU 9 VOC Air COCs
 Exposure Location: SWMU 9

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.5-5
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 4 hours/day
EF (Exposure Frequency)	= 4 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day) ⁻¹	Inhalation Cancer Risk	% Cont.
Chloroform		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	8.05E-02	0.0E+00	0.0%
Methylene chloride	1.42E-03	2.5	4.0	4.0	25.0	70.0	2.56E+04	7.94E-07	1.65E-03	1.3E-09	100.0%
Tetrachloroethene		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	2.03E-03	0.0E+00	0.0%
Trichloroethene		2.5	4.0	4.0	25.0	70.0	2.56E+04	0.00E+00	6.16E-03	0.0E+00	0.0%
Total VOC Soil Inhalation Cancer Risk:										1.3E-09	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Chloroform		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Ethyl Benzene	8.23E-04	2.5	4.0	4.0	25.0	70.0	9.13E+03	1.29E-06	2.86E-01	4.5E-06	63.5%
Methylene chloride	1.42E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	2.22E-06	8.57E-01	2.6E-06	36.5%
Tetrachloroethene	1.22E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	1.91E-06			0.0%
Toluene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00	1.14E-01	0.0E+00	0.0%
Trichloroethene		2.5	4.0	4.0	25.0	70.0	9.13E+03	0.00E+00			0.0%
Xylenes	4.00E-03	2.5	4.0	4.0	25.0	70.0	9.13E+03	6.26E-06			0.0%
Soil Inhalation Hazard Index:										7.1E-06	

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Exposure Scenario: Potential Post-Excavation
 Exposed Population: Industrial Worker
 Exposure Pathways: Soil Ingestion + Dermal Contact + Inhalation
 Exposure Location: SWMU 30

Cancer Risk Calculations

Soil COC	Max Soil Concentration (mg/kg)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	(Oral) SF (mg/kg/day)-1	Dermal Cancer Risk	Inhalation Slope Factor (mg/kg/day)-1	Inhalation Cancer Risk	Total Cancer Risk	% of Total CR
Aluminum	-								
Arsenic	540.00	1.8E+00	1.7E-04	1.8E+00	1.4E-05	1.5E+00	1.2E-08	1.8E-04	100.0%
Barium	-								
Beryllium	-	4.3E+00	0.0E+00	4.3E+00	0.0E+00	8.4E+00	0.0E+00	0.0E+00	0.0%
Cadmium	10.10					6.3E+00	9.7E-10	9.7E-10	0.0%
Chromium III	93.60								
Chromium VI	10.40					4.2E+01	6.6E-09	6.6E-09	0.0%
Chromium (Total)	104.00								
Cobalt	-								
Copper	356.00								
Lead	-								
Manganese	-								
Mercury	-								
Nickel	41.50					1.7E+00	1.1E-09	1.1E-09	0.0%
Silver	-								
Thallium	-								
Vanadium	-								
Zinc	669.00								
Cyanide (Total)	-								
Pathway-Specific Totals--		Ingestion:	1.7E-04	Dermal:	1.4E-05	Inhalation:	2.1E-08	1.8E-04	

Noncancer Hazard Index Calculations

Soil COC	Max Soil Concentration (mg/kg)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	(Oral) RfD (mg/kg/day)	Dermal Hazard Quotient	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	Total Hazard Quotient	% of Hazard Index
Aluminum	-	1.0E+00	0.0E+00	1.0E+00	0.0E+00			0.0E+00	0.0%
Arsenic	540.00	3.0E-04	8.8E-01	3.0E-04	7.2E-02			9.5E-01	98.6%
Barium	-	7.0E-02	0.0E+00	7.0E-02	0.0E+00	1.4E-04	0.0E+00	0.0E+00	0.0%
Beryllium	-	5.0E-03	0.0E+00	5.0E-03	0.0E+00			0.0E+00	0.0%
Cadmium	10.10	1.0E-03	4.9E-03	1.0E-03	4.1E-04			5.3E-03	0.6%
Chromium III	93.60	1.0E+00	4.6E-05	1.0E+00	3.8E-06			5.0E-05	0.0%
Chromium VI	10.40	5.0E-03	1.0E-03	5.0E-03	8.3E-05			1.1E-03	0.1%
Chromium (Total)	104.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00				
Cobalt	-	0.0E+00	0.0E+00	0.0E+00	0.0E+00				
Copper	356.00	3.7E-02	4.7E-03	3.7E-02	3.8E-04			5.1E-03	0.5%
Lead	-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00		
Manganese	-	1.4E-01	0.0E+00	1.4E-01	0.0E+00	1.4E-05	0.0E+00	0.0E+00	0.0%
Mercury	-	3.0E-04	0.0E+00	3.0E-04	0.0E+00	8.6E-05	0.0E+00	0.0E+00	0.0%
Nickel	41.50	2.0E-02	1.0E-03	2.0E-02	8.3E-05			1.1E-03	0.1%
Silver	-	5.0E-03	0.0E+00	5.0E-03	0.0E+00			0.0E+00	0.0%
Thallium	-	8.0E-05	0.0E+00	8.0E-05	0.0E+00			0.0E+00	0.0%
Vanadium	-	7.0E-03	0.0E+00	7.0E-03	0.0E+00			0.0E+00	0.0%
Zinc	669.00	3.0E-01	1.1E-03	3.0E-01	8.9E-05			1.2E-03	0.1%
Cyanide (Total)	-	2.0E-02	0.0E+00	2.0E-02	0.0E+00			0.0E+00	0.0%
Pathway-Specific Totals--		Ingestion:	8.9E-01	Dermal:	7.3E-02	Inhalation:	0.0E+00	9.7E-01	

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Appendix Table K.7-1a Industrial Worker Exposure Scenario: Risk Calculation Spreadsheet
for Soil Ingestion Pathway

Exposure Scenario: Potential Post-Excavation
Exposed Population: Industrial Worker
Exposure Pathway: Soil Ingestion
Exposure Location: SWMU 30

Exposure Pathway Variables	
CS (Chemical Concentration)	= Subsurface soil from TP-1 and TP-2
IR (Soil Ingestion Rate)	= 50.0 mg/day
CF (Conversion Factor)	= 0.000001 kg/mg
FI (Fraction Ingested)	= 1.00 (100%, unitless)
EF (Exposure Frequency)	= 250 days/year
ED (Exposure Duration)	= 25 years (per 70-yr lifetime)
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25,550 days
AT (Noncarc Effects)	= 9,125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CS*IR*CF*FI*EF*ED)/(BW*AT)
Cancer Risk = CDI * Oral SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Soil COC	Max Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral SF (mg/kg/day)-1	Soil Ingestion Cancer Risk	% Cont.
Aluminum	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Arsenic	540.00	50	1.0	250	25	70	2.6E+04	9.4E-05	1.8E+00	1.7E-04	100.0%
Barium	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Beryllium	-	50	1.0	250	25	70	2.6E+04	0.0E+00	4.3E+00	0.0E+00	0.0%
Cadmium	10.10	50	1.0	250	25	70	2.6E+04	1.8E-06			
Chromium III	93.60	50	1.0	250	25	70	2.6E+04	1.6E-05			
Chromium VI	10.40	50	1.0	250	25	70	2.6E+04	1.8E-06			
Chromium (Total)	104.00										
Cobalt	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Copper	356.00	50	1.0	250	25	70	2.6E+04	6.2E-05			
Lead	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Manganese	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Mercury	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Nickel	41.50	50	1.0	250	25	70	2.6E+04	7.3E-06			
Silver	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Thallium	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Vanadium	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Zinc	669.00	50	1.0	250	25	70	2.6E+04	1.2E-04			
Cyanide (Total)	-	50	1.0	250	25	70	2.6E+04	0.0E+00			
Total Soil Ingestion Cancer Risk:										1.7E-04	

Noncancer Hazard Index Calculations

Soil COC	Max Soil Concentration (mg/kg)	Soil Ingestion (mg/day)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Soil Ingestion CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Soil Ingestion Hazard Quotient	% Cont.
Aluminum	-	50	1.0	250	25	70	9.1E+03	0.0E+00	1.0E+00	0.0E+00	0.0%
Arsenic	540.00	50	1.0	250	25	70	9.1E+03	2.6E-04	3.0E-04	8.8E-01	98.6%
Barium	-	50	1.0	250	25	70	9.1E+03	0.0E+00	7.0E-02	0.0E+00	0.0%
Beryllium	-	50	1.0	250	25	70	9.1E+03	0.0E+00	5.0E-03	0.0E+00	0.0%
Cadmium	10.10	50	1.0	250	25	70	9.1E+03	4.9E-06	1.0E-03	4.9E-03	0.6%
Chromium III	93.60	50	1.0	250	25	70	9.1E+03	4.6E-05	1.0E+00	4.6E-05	0.0%
Chromium VI	10.40	50	1.0	250	25	70	9.1E+03	5.1E-06	5.0E-03	1.0E-03	0.1%
Chromium (Total)	104.00										
Cobalt	-	50	1.0	250	25	70	9.1E+03	0.0E+00			
Copper	356.00	50	1.0	250	25	70	9.1E+03	1.7E-04	3.7E-02	4.7E-03	0.5%
Lead	-	50	1.0	250	25	70	9.1E+03	0.0E+00			
Manganese	-	50	1.0	250	25	70	9.1E+03	0.0E+00	1.4E-01	0.0E+00	0.0%
Mercury	-	50	1.0	250	25	70	9.1E+03	0.0E+00	3.0E-04	0.0E+00	0.0%
Nickel	41.50	50	1.0	250	25	70	9.1E+03	2.0E-05	2.0E-02	1.0E-03	0.1%
Silver	-	50	1.0	250	25	70	9.1E+03	0.0E+00	5.0E-03	0.0E+00	0.0%
Thallium	-	50	1.0	250	25	70	9.1E+03	0.0E+00	8.0E-05	0.0E+00	0.0%
Vanadium	-	50	1.0	250	25	70	9.1E+03	0.0E+00	7.0E-03	0.0E+00	0.0%
Zinc	669.00	50	1.0	250	25	70	9.1E+03	3.3E-04	3.0E-01	1.1E-03	0.1%
Cyanide (Total)	-	50	1.0	250	25	70	9.1E+03	0.0E+00	2.0E-02	0.0E+00	0.00%
Soil Ingestion Hazard Index:										8.9E-01	

Exposure Scenario: Potential Post-Excavation
Exposed Population: Industrial Worker
Exposure Pathway: Dermal Contact (assumes soil exposed)
Exposure Location: SWMU 30

Exposure Pathway Variables	
CS (Chemical Concentration) =	Subsurface soil from TP-1 and TP-2
CF (Conversion Factor) =	1.0E-06 kg/mg
SA (Skin Surface Area) =	4,100 cm ² /event
AF (Adherence Factor) =	1.00 mg/cm ²
ABS (Absorption Factor) =	0.001 (unitless)
EF (Exposure Frequency) =	250 days/year
ED (Exposure Duration) =	25 years
BW (Body Weight) =	70 kg
AT (Averaging Time, Carcinogenic Effects) =	25,550 days
AT (Noncarcinogenic Effects) =	9,125 days

Intake and Risk Calculation Equations

Absorbed Dose (mg/kg/day) = (CS*CF*SA*AF*ABS*EF*ED)/(BW*AT)
Cancer Risk = Dermal CDI * (Oral) SF
Hazard Quotient = CDI/RfD

Cancer Risk Calculations

Soil COC	Max Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	Oral SF (mg/kg/day)	Dermal Cancer Risk	% Cont.
Aluminum	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Arsenic	540.00	4,100	1.0	0.001	250	25	70	2.6E+04	7.7E-06	1.8E+00	1.4E-05	100.0%
Barium	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Beryllium	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00	4.3E+00	0.0E+00	0.0%
Cadmium	10.10	4,100	1.0	0.001	250	25	70	2.6E+04	1.4E-07			
Chromium III	93.60	4,100	1.0	0.001	250	25	70	2.6E+04	1.3E-06			
Chromium VI	10.40	4,100	1.0	0.001	250	25	70	2.6E+04	1.5E-07			
Chromium (Total)	104.00											
Cobalt	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Copper	356.00	4,100	1.0	0.001	250	25	70	2.6E+04	5.1E-06			
Lead	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Manganese	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Mercury	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Nickel	41.50	4,100	1.0	0.001	250	25	70	2.6E+04	5.9E-07			
Silver	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Thallium	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Vanadium	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Zinc	669.00	4,100	1.0	0.001	250	25	70	2.6E+04	9.6E-06			
Cyanide (Total)	-	4,100	1.0	0.001	250	25	70	2.6E+04	0.0E+00			
Total Dermal Contact Cancer Risk:											1.4E-05	

Noncancer Hazard Index Calculations

Soil COC	Max Soil Conc. (mg/kg)	Skin Surface (cm ² /event)	Adherence Factor (mg/cm ²)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Dermal CDI (mg/kg/day)	Oral RfD (mg/kg/day)	Dermal Hazard Quotient	% Cont.
Aluminum	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	1.0E+00	0.0E+00	0.0%
Arsenic	540.00	4,100	1.0	0.001	250	25	70	9.1E+03	2.2E-05	3.0E-04	7.2E-02	98.6%
Barium	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	7.0E-02	0.0E+00	0.0%
Beryllium	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	5.0E-03	0.0E+00	0.0%
Cadmium	10.10	4,100	1.0	0.001	250	25	70	9.1E+03	4.1E-07	1.0E-03	4.1E-04	0.6%
Chromium III	93.60	4,100	1.0	0.001	250	25	70	9.1E+03	3.8E-06	1.0E+00	3.8E-06	0.0%
Chromium VI	10.40	4,100	1.0	0.001	250	25	70	9.1E+03	4.2E-07	5.0E-03	8.3E-05	0.1%
Chromium (Total)	104.00											
Cobalt	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00			
Copper	356.00	4,100	1.0	0.001	250	25	70	9.1E+03	1.4E-05	3.7E-02	3.8E-04	0.5%
Lead	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00			
Manganese	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	1.4E-01	0.0E+00	0.0%
Mercury	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	3.0E-04	0.0E+00	0.0%
Nickel	41.50	4,100	1.0	0.001	250	25	70	9.1E+03	1.7E-06	2.0E-02	8.3E-05	0.1%
Silver	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	5.0E-03	0.0E+00	0.0%
Thallium	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	8.0E-05	0.0E+00	0.0%
Vanadium	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	7.0E-03	0.0E+00	0.0%
Zinc	669.00	4,100	1.0	0.001	250	25	70	9.1E+03	2.7E-05	3.0E-01	8.9E-05	0.1%
Cyanide (Total)	-	4,100	1.0	0.001	250	25	70	9.1E+03	0.0E+00	2.0E-02	0.0E+00	0.00%
Dermal Contact Hazard Index:											7.3E-02	

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Exposure Scenario: Potential Post-Excavation
Exposed Population: Industrial Worker
Exposure Pathway: Inhalation of Subsurface Soil COCs
Exposure Location: SWMU 30

Exposure Pathway Variables	
CA (Air Concentration)	= EPA PEF Factor
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 8 hours/day
EF (Exposure Frequency)	= 250 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25,550 days
AT (Noncarcinogenic Effects)	= 9,125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Soil COC	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day) ⁻¹	Inhalation Cancer Risk	% Cont.
Aluminum	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Arsenic	1.2E-07	2.5	8.0	250	25	70	2.6E+04	8.2E-09	1.5E+00	1.2E-08	58.7%
Barium	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Beryllium	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00	8.4E+00	0.0E+00	0.00%
Cadmium	2.2E-09	2.5	8.0	250	25	70	2.6E+04	1.5E-10	6.3E+00	9.7E-10	4.6%
Chromium III	2.0E-08	2.5	8.0	250	25	70	2.6E+04	1.4E-09			
Chromium VI	2.3E-09	2.5	8.0	250	25	70	2.6E+04	1.6E-10	4.2E+01	6.6E-09	31.6%
Chromium (Total)	2.3E-08										
Cobalt	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Copper	7.7E-08	2.5	8.0	250	25	70	2.6E+04	5.4E-09			
Lead	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Manganese	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Mercury	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Nickel	9.0E-09	2.5	8.0	250	25	70	2.6E+04	6.3E-10	1.7E+00	1.1E-09	5.1%
Silver	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Thallium	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Vanadium	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Zinc	1.5E-07	2.5	8.0	250	25	70	2.6E+04	1.0E-08			
Cyanide (Total)	0.0E+00	2.5	8.0	250	25	70	2.6E+04	0.0E+00			
Total Soil Inhalation Cancer Risk:										2.1E-08	

Noncancer Hazard Index Calculations

Soil COC	Air Concentration (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Aluminum	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Arsenic	1.17E-07	2.5	8.0	250	25	70	9.1E+03	2.3E-08			
Barium	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00	1.4E-04	0.0E+00	#DIV/0!
Beryllium	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Cadmium	2.20E-09	2.5	8.0	250	25	70	9.1E+03	4.3E-10			
Chromium III	2.03E-08	2.5	8.0	250	25	70	9.1E+03	4.0E-09			
Chromium VI	2.26E-09	2.5	8.0	250	25	70	9.1E+03	4.4E-10			
Chromium (Total)	2.26E-08										
Cobalt	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Copper	7.74E-08	2.5	8.0	250	25	70	9.1E+03	1.5E-08			
Lead	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Manganese	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00	1.4E-05	0.0E+00	#DIV/0!
Mercury	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00	8.6E-05	0.0E+00	#DIV/0!
Nickel	9.02E-09	2.5	8.0	250	25	70	9.1E+03	1.8E-09			
Silver	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Thallium	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Vanadium	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Zinc	1.45E-07	2.5	8.0	250	25	70	9.1E+03	2.8E-08			
Cyanide (Total)	0.00E+00	2.5	8.0	250	25	70	9.1E+03	0.0E+00			
Soil Inhalation Hazard Index:										0.0E+00	

<u>Soil COCs</u> <i>Inorganics</i>	MAX Soil Concentration (mg/kg)	
Aluminum	-	
Arsenic	540.00	
Barium	-	
Beryllium	-	
Cadmium	10.10	
Chromium III	93.60	<i>Note: In accordance with EPA Region 8 protocols, this analysis assumes that 10% of the detected (total) chromium is in the hexavalent form; the remaining 90% is assumed to be trivalent.</i>
Chromium VI	10.40	
Chromium (Total)	104.00	
Cobalt	-	
Copper	356.00	
Lead	-	
Manganese	-	
Mercury	-	
Nickel	41.50	
Silver	-	
Thallium	-	
Vanadium	-	
Zinc	669.00	
Cyanide	-	

<u>Soil COCs</u> <i>Inorganics</i>	Air Concentration (mg/m3)	PEF Factor
Aluminum	0.0E+00	4.6E+09
Arsenic	1.2E-07	4.6E+09
Barium	0.0E+00	4.6E+09
Beryllium	0.0E+00	4.6E+09
Cadmium	2.2E-09	4.6E+09
Chromium III	2.0E-08	4.6E+09
Chromium VI	2.3E-09	4.6E+09
Chromium (Total)	2.3E-08	4.6E+09
Cobalt	0.0E+00	4.6E+09
Copper	7.7E-08	4.6E+09
Lead	0.0E+00	4.6E+09
Manganese	0.0E+00	4.6E+09
Mercury	0.0E+00	4.6E+09
Nickel	9.0E-09	4.6E+09
Silver	0.0E+00	4.6E+09
Thallium	0.0E+00	4.6E+09
Vanadium	0.0E+00	4.6E+09
Zinc	1.5E-07	4.6E+09
Cyanide (Total)	0.0E+00	4.6E+09

Exposure Scenario: Current Use
 Exposed Population: SWMU 31 Demilitarization Area Workers
 Exposure Pathway: Inhalation of SWMU 31 VOC Air COCs
 Exposure Location: SWMU 31

Exposure Pathway Variables	
CA (Air Concentration)	= See Table 5.7-4
IR (Inhalation Rate)	= 2.5 m ³ /hour
ET (Exposure Time)	= 10 hours/day
EF (Exposure Frequency)	= 150 days/year
ED (Exposure Duration)	= 25 years
BW (Body Weight)	= 70 kg
AT (Averaging Time, Carcinogenic Effects)	= 25550 days
AT (Noncarcinogenic Effects)	= 9125 days

Intake and Risk Calculation Equations
CDI (mg/kg/day) = (CA*IR*ET*EF*ED)/(BW*AT)
Cancer Risk = CDI * Inhalation SF
Hazard Quotient = CDI/Inhalation RfD

Cancer Risk Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation Slope Factor (mg/kg/day)	Inhalation Cancer Risk	% Cont.
Chloroform		2.5	10.0	150.0	25.0	70.0	2.56E+04	0.00E+00	8.05E-02		
Methylene chloride	6.26E-04	2.5	10.0	150.0	25.0	70.0	2.56E+04	3.28E-05	1.65E-03	5.4E-08	34.8%
Tetrachloroethene	9.50E-04	2.5	10.0	150.0	25.0	70.0	2.56E+04	4.98E-05	2.03E-03	1.0E-07	65.2%
chloroethene		2.5	10.0	150.0	25.0	70.0	2.56E+04	0.00E+00	6.16E-03		
Total VOC Soil Inhalation Cancer Risk:										1.6E-07	

Noncancer Hazard Index Calculations

Contaminant	Air EPC (mg/m ³)	Inhalation Rate (m ³ /hour)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	Inhalation CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	Inhalation Hazard Quotient	% Cont.
Chloroform		2.5	10.0	150.0	25.0	70.0	9.13E+03	0.00E+00			
Ethyl Benzene	1.95E-03	2.5	10.0	150.0	25.0	70.0	9.13E+03	2.86E-04	2.86E-01	1.0E-03	8.0%
Methylene chloride	6.26E-04	2.5	10.0	150.0	25.0	70.0	9.13E+03	9.19E-05	8.57E-01	1.1E-04	0.9%
Tetrachloroethene	9.50E-04	2.5	10.0	150.0	25.0	70.0	9.13E+03	1.39E-04			
Toluene	8.91E-03	2.5	10.0	150.0	25.0	70.0	9.13E+03	1.31E-03	1.14E-01	1.1E-02	91.2%
Trichloroethene		2.5	10.0	150.0	25.0	70.0	9.13E+03	0.00E+00			
Xylenes	1.14E-02	2.5	10.0	150.0	25.0	70.0	9.13E+03	1.67E-03			
Soil Inhalation Hazard Index:										1.3E-02	

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