Remedial Investigation Report
for
Site 21 – Buildings 1517/1506 Area

Volume II of II

Naval Station Great Lakes
Great Lakes, Illinois

Naval Facilities Engineering Command Midwest

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APPENDIX G

HUMAN HEALTH RISK ASSESSMENT SUPPORTING DATA

TABLE G-1 UNCERTAINTY ASSESSMENT
COMPARE TABLE 5-11 AND IEPA PROPOSED TOXICITY VALUES - ORAL/DERMAL
SITE 21 - BUILDINGS 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		IEPA Proposed Subchronic RfD	Difference in Subchronic RfD - RA and IEPA values
		Value	Units		
CHRONIC					
Semivolatile Organic Compounds					
NAPHTHALENE	Chronic	0.02	mg/kg/day	0.6	**RA RfD is more conservative**
TCDD TEQ (use 2,3,7,8-TCDD)	Chronic	1.00E-09	mg/kg/day	2.00E-08	**RA RfD is more conservative**
PENTACHLOROPHENOL	Chronic	5.00E-03	mg/kg/day	0.001	Tier 3 Subchronic value lower than IRIS chronic. Therefore, no change proposed.
Pesticides/PCBs					
AROCLOR 1260	Chronic	2.00E-05	mg/kg/day	3.00E-05	**RA RfD is more conservative**
DELTA-HEXACHLOROCYCLOHEXANE	Chronic	8.00E-03	mg/kg/day	0.00001	Tier 3 Subchronic value lower than IRIS chronic. Therefore, no change proposed.
Volatile Organic Compound					
BENZENE	Chronic	4.00E-03	mg/kg/day	0.01	**RA RfD is more conservative**
TETRACHLOROETHYLENE	Chronic	1.00E-02	mg/kg/day	0.1	**RA RfD is more conservative**
Inorganics					
ALUMINUM	Chronic	1.0E+00	mg/kg/day	see below	
ANTIMONY	Chronic	4.0E-04	mg/kg/day	same	No difference
ARSENIC	Chronic	3.0E-04	mg/kg/day	see below	
BARIUM	Chronic	2.0E-01	mg/kg/day	no comment	No difference
CADMIUM	Chronic	1.0E-03	mg/kg/day	0.0005	Tier 3 Subchronic value lower than IRIS chronic. Therefore, no change proposed.
CHROMIUM VI	Chronic	3.0E-03	mg/kg/day	see below	
COBALT	Chronic	3.0E-04	mg/kg/day	0.003	**RA RfD is more conservative**
COPPER	Chronic	4.0E-02	mg/kg/day	0.01	Tier 3 Subchronic value lower than IRIS chronic. Therefore, no change proposed.
IRON	Chronic	7.0E-01	mg/kg/day	same	No difference
MANGANESE	Chronic	4.7E-02	mg/kg/day	0.023	**RA less conservative**
MERCURY	Chronic	3.0E-04	mg/kg/day	see below	
VANADIUM	Chronic	9.0E-03	mg/kg/day	0.005	**Based on new RSL. RA less conservative.**
SUBCHRONIC					
ALUMINUM	Subchronic	2.0E+00	mg/kg/day	1	**RA less conservative**
ARSENIC	Subchronic	5.0E-03	mg/kg/day	0.003	**RA less conservative**
Chromium VI	Subchronic	2.0E-02	mg/kg/day	0.005	Tier 3 Subchronic value lower than IRIS chronic. Therefore, no change proposed.
MERCURY	Subchronic	3.0E-03	mg/kg/day	no comment	No difference

Bold = Difference in HHRA and IEPA subchronic toxicity values.

TABLE G-2 UNCERTAINTY ASSESSMENT

COMPARE TABLE 5-12 AND IEPA PROPOSED TOXICITY VALUES - INHALATION
SITE 21 - BUILDINGS 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation Chronic RfC		IEPA Proposed Subchronic RfC	Difference in Subchronic RfC RA and IEPA values
		Value	Units		
Semivolatile Organic Compounds					
NAPHTHALENE	Chronic	3.0E-03	mg/m^3	3.0E-03	No difference
TCDD TEQs (use 2,3,7,8-TCDD tox valu	Chronic	4.0E-08	mg/m^3	same	No difference
Volatile Organic Compound					
BENZENE	Chronic	3.00E-02	mg/m^3	8.0E-02	**RA RfC is more conservative**
TETRACHLOROETHYLENE	Chronic	2.7E-01	mg/m^3	same	No difference
Inorganics					
ALUMINUM	Chronic	5.0E-03	mg/m^3	same	No difference
ARSENIC	Chronic	1.50E-05	mg/m^3	same	No difference
BARIUM	Chronic	5.0E-04	mg/m^3		
CADMIUM	Chronic	1.0E-05	mg/m^3	same	No difference
CHROMIUM VI	Chronic	1.0E-04	mg/m^3	3.0E-04	**RA RfC is more conservative**
COBALT	Chronic	6.0E-06	mg/m^3	2.0E-05	**RA RfC is more conservative**
IRON	NA	NA	NA		
MANGANESE	Chronic	5.0E-05	mg/m^3	same	No difference
MERCURY	Chronic	3.0E-05	mg/m^3	same	No difference
VANADIUM	Chronic	7.0E-06	mg/m^3	1.0E-04	**RA RfC is more conservative**

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	330	USEPA, December 2002	165	Professional Judgment	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	U.S. EPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	USEPA, December 1989	42	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	USEPA, July 2004	0.1	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical -specific	USEPA, July 2004	chemical -specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 5.54E-09
Noncancer Ingestion Intake - RME = 3.37E-06

Cancer Ingestion Intake - CTE = 2.77E-09
Noncancer Ingestion Intake - CTE = 1.68E-06

Cancer Dermal Intake - RME = 1.66E-08
Noncancer Dermal Intake - RME = 1.01E-05

Cancer Dermal Intake - CTE = 5.54E-09
Noncancer Dermal Intake - CTE = 3.37E-06

TABLE 7.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic[2] if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	1.7E-04	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	2.4E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.2E-01
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	1.1E-10	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.1E-01
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	9.9E-02	mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	5.0E-02
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	1.8E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	4.4E-02
	ARSENIC	4.84E+01	mg/kg	4.84E+01	1.6E-04	mg/kg-day	*5.0E-03*	mg/kg-day	NA	NA	3.3E-02
	BARIUM	2.34E+02	mg/kg	2.34E+02	7.9E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	3.9E-03
	CADMIUM	1.30E+01	mg/kg	1.30E+01	4.4E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.4E-02
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	5.5E-04	mg/kg-day	*2.0E-02*	mg/kg-day	NA	NA	2.7E-02
	COBALT	1.77E+01	mg/kg	1.77E+01	6.0E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.0E-01
	COPPER	8.35E+02	mg/kg	8.35E+02	2.8E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	7.0E-02
	IRON	6.95E+04	mg/kg	6.95E+04	2.3E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	3.3E-01
	MANGANESE	2.42E+03	mg/kg	2.42E+03	8.1E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	1.7E-01
	MERCURY	8.98E+00	mg/kg	8.98E+00	3.0E-05	mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	1.0E-02
	VANADIUM	2.57E+01	mg/kg	2.57E+01	8.7E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	9.6E-03
	(total)										1.E+00
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	6.6E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	1.0E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	5.1E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	1.0E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.0E-02
	ALUMINUM	2.95E+04	mg/kg	2.95E+04		mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	1.5E-05	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.9E-03
	BARIUM	2.34E+02	mg/kg	2.34E+02		mg/kg-day	2.0E-01	mg/kg-day	NA	NA	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	1.3E-07	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	5.3E-03
	CHROMIUM	1.63E+02	mg/kg	1.63E+02		mg/kg-day	*5.0E-04*	mg/kg-day	NA	NA	
	COBALT	1.77E+01	mg/kg	1.77E+01		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	COPPER	8.35E+02	mg/kg	8.35E+02		mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	IRON	6.95E+04	mg/kg	6.95E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	2.42E+03	mg/kg	2.42E+03		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	8.98E+00	mg/kg	8.98E+00		mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	
	VANADIUM	2.57E+01	mg/kg	2.57E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										6.9E-02
								Total Hazard Index Across All Exposure Routes/Pathways			**1.E+00**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Cadmium - 0.001 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	2.8E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.0E-06
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	4.0E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	8.0E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.9E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.8E-08
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M	1.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M	2.9E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	2.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.0E-07
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M	1.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	7.2E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M	9.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M	9.8E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M	4.6E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M	3.8E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M	1.3E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M	5.0E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M	1.4E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										2.48E-06
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	1.1E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	8.0E-07
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	1.7E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	3.3E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.7E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.5E-09
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	2.4E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	3.6E-08
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	2.2E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										8.4E-07
										Total Risk Across All Exposure Routes/Pathways	3.3E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):
Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.1a

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 2002	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	330	USEPA, December 2002	165	Professional Judgment	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	U.S. EPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	USEPA, December 1989	42	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 2002	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	USEPA, July 2004	0.1	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical -specific	USEPA, July 2004	chemical -specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 5.54E-09
Noncancer Ingestion Intake - RME = 3.37E-06

Cancer Ingestion Intake - CTE = 2.77E-09
Noncancer Ingestion Intake - CTE = 1.68E-06

Cancer Dermal Intake - RME = 1.66E-08
Noncancer Dermal Intake - RME = 1.01E-05

Cancer Dermal Intake - CTE = 5.54E-09
Noncancer Dermal Intake - CTE = 3.37E-06

TABLE 7.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic[2] if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	6.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	2.6E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.3E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	5.6E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.6E-02
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	1.3E-02	mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	6.4E-03
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	1.8E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	4.5E-03
	ARSENIC	1.25E+01	mg/kg	1.25E+01	2.1E-05	mg/kg-day	*5.0E-03*	mg/kg-day	NA	NA	4.2E-03
	BARIUM	7.64E+01	mg/kg	7.64E+01	1.3E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	6.4E-04
	CADMIUM	2.30E+00	mg/kg	2.30E+00	3.9E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	3.9E-03
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	3.4E-05	mg/kg-day	*2.0E-02*	mg/kg-day	NA	NA	1.7E-03
	COBALT	6.59E+00	mg/kg	6.59E+00	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.7E-02
	COPPER	9.36E+01	mg/kg	9.36E+01	1.6E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	3.9E-03
	IRON	2.68E+04	mg/kg	2.68E+04	4.5E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	6.4E-02
	MANGANESE	5.89E+02	mg/kg	5.89E+02	9.9E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	2.1E-02
	MERCURY	5.68E-01	mg/kg	5.68E-01	9.6E-07	mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	3.2E-04
	VANADIUM	1.67E+01	mg/kg	1.67E+01	2.8E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	3.1E-03
	(total)										0.2
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	7.3E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.6E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	3.4E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	3.4E-03
	ALUMINUM	7.62E+03	mg/kg	7.62E+03		mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	1.3E-06	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.5E-04
	BARIUM	7.64E+01	mg/kg	7.64E+01		mg/kg-day	2.0E-01	mg/kg-day	NA	NA	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	7.7E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	3.1E-04
	CHROMIUM	2.03E+01	mg/kg	2.03E+01		mg/kg-day	*5.0E-04*	mg/kg-day	NA	NA	
	COBALT	6.59E+00	mg/kg	6.59E+00		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	COPPER	9.36E+01	mg/kg	9.36E+01		mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	IRON	2.68E+04	mg/kg	2.68E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	5.89E+02	mg/kg	5.89E+02		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	5.68E-01	mg/kg	5.68E-01		mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	
	VANADIUM	1.67E+01	mg/kg	1.67E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										7.6E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.2**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Cadmium - 0.001 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	9.9E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.2E-08
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	4.3E-10	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	8.5E-10
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	9.3E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.4E-08
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	2.1E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	2.9E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	3.4E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.2E-08
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	2.1E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	6.4E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	5.6E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	1.8E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	2.6E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	7.4E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	1.6E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M	1.6E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	4.6E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.39E-07
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	2.6E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.9E-08
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	1.2E-10	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-10
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	5.6E-15	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	8.3E-10
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	2.1E-09	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.1E-09
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	1.3E-11	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										2.3E-08
										Total Risk Across All Exposure Routes/Pathways	1.6E-07

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):
Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	95% UCL or Max	USEPA, May 1993	Intake (mg/kg/day) = $\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.27E+06	USEPA, December 2002	1.27E+06	USEPA, December 2002	
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.91E-04 Cancer Inhalation Intake(CTE) = 1.96E-04
Noncancer Inhalation Intake(RME) = 2.38E-01 Noncancer Inhalation Intake(CTE) = 1.19E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future
Medium: Subsurfce Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS

Parameter	Value	Definition	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene	0.52	Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	7.42E-06	3.82E-10	7.42E-06
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.2. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation [1]	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration (Subchronic [2] if available)	Reference Concentration Units	Hazard Quotient
Inhalation	NAPHTHALENE (partic.)	5.20E-01	mg/kg	4.1E-07	mg/m^3	R	9.7E-08	mg/m^3	3.0E-03	mg/m^3	3.E-05
	ALUMINUM	2.95E+04	mg/kg	2.3E-02	mg/m^3	R	5.5E-03	mg/m^3	5.0E-03	mg/m^3	1.E+00
	ARSENIC	4.84E+01	mg/kg	3.8E-05	mg/m^3	R	9.1E-06	mg/m^3	1.5E-05	mg/m^3	6.E-01
	BARIUM	2.34E+02	mg/kg	1.8E-04	mg/m^3	R	4.4E-05	mg/m^3	*5.0E-03*	mg/m^3	9.E-03
	CADMIUM	1.30E+01	mg/kg	1.0E-05	mg/m^3	R	2.4E-06	mg/m^3	1.0E-05	mg/m^3	2.E-01
	CHROMIUM	1.63E+02	mg/kg	1.3E-04	mg/m^3	R	3.1E-05	mg/m^3	1.0E-04	mg/m^3	3.E-01
	COBALT	1.77E+01	mg/kg	1.4E-05	mg/m^3	R	3.3E-06	mg/m^3	6.0E-06	mg/m^3	6.E-01
	MANGANESE	2.42E+03	mg/kg	1.9E-03	mg/m^3	R	4.5E-04	mg/m^3	5.0E-05	mg/m^3	9.E+00
	MERCURY	8.98E+00	mg/kg	7.1E-06	mg/m^3	R	1.7E-06	mg/m^3	3.0E-05	mg/m^3	6.E-02
	NAPHTHALENE (vol.)	5.20E-01	mg/kg	7.4E-06	mg/m^3	R	1.8E-06	mg/m^3	3.0E-03	mg/m^3	6.E-04
	(total)										12
										Total Hazard Index Across All Exposure Routes/Pathways	**12**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

8.2. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	ARSENIC	4.84E+01	mg/kg	3.8E-05	mg/m^3	R	1.5E-08	mg/m^3	4.3E+00	$(mg/m^3)^{-1}$	6.4E-08
	CADMIUM	1.30E+01	mg/kg	1.0E-05	mg/m^3	R	4.0E-09	mg/m^3	1.8E+00	$(mg/m^3)^{-1}$	7.2E-09
	CHROMIUM	1.63E+02	mg/kg	1.3E-04	mg/m^3	R	5.0E-08	mg/m^3	1.2E+01	$(mg/m^3)^{-1}$	6.0E-07
	COBALT	1.77E+01	mg/kg	1.4E-05	mg/m^3	R	5.5E-09	mg/m^3	9.0E+00	$(mg/m^3)^{-1}$	4.9E-08
	(total)										7.2E-07
										Total Risk Across All Exposure Routes/Pathways	**7.E-07**

TABLE 4.2a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	95% UCL or Max	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.27E+06	USEPA, December 2002	1.27E+06	USEPA, December 2002	$CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED$
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	$AT \times 24$
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.91E-04 Cancer Inhalation Intake(CTE) = 1.96E-04
Noncancer Inhalation Intake(RME) = 2.38E-01 Noncancer Inhalation Intake(CTE) = 1.19E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene	2.29E-01	Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	3.27E-06	1.68E-10	3.27E-06
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.2a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation[1]	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration (Subchronic[2] if available)	Reference Concentration Units	Hazard Quotient
Inhalation	NAPHTHALENE (particulate)	2.29E-01	mg/kg	1.8E-07	mg/m^3	R	2.1E-08	mg/m^3	3.0E-03	mg/m^3	7.2E-06
	ALUMINUM	7.62E+03	mg/kg	6.0E-03	mg/m^3	R	7.1E-04	mg/m^3	5.0E-03	mg/m^3	1.4E-01
	ARSENIC	1.25E+01	mg/kg	9.8E-06	mg/m^3	R	1.2E-06	mg/m^3	1.5E-05	mg/m^3	7.8E-02
	BARIUM	7.64E+01	mg/kg	6.0E-05	mg/m^3	R	7.2E-06	mg/m^3	*5.0E-03*	mg/m^3	1.4E-03
	CADMIUM	2.30E+00	mg/kg	1.8E-06	mg/m^3	R	2.2E-07	mg/m^3	1.0E-05	mg/m^3	2.2E-02
	CHROMIUM	2.03E+01	mg/kg	1.6E-05	mg/m^3	R	1.9E-06	mg/m^3	1.0E-04	mg/m^3	1.9E-02
	COBALT	6.59E+00	mg/kg	5.2E-06	mg/m^3	R	6.2E-07	mg/m^3	6.0E-06	mg/m^3	1.0E-01
	MANGANESE	5.89E+02	mg/kg	4.6E-04	mg/m^3	R	5.5E-05	mg/m^3	5.0E-05	mg/m^3	1.1E+00
	MERCURY	5.68E-01	mg/kg	4.5E-07	mg/m^3	R	5.3E-08	mg/m^3	3.0E-05	mg/m^3	1.8E-03
	NAPHTHALENE (vol.)	2.29E-01	mg/kg	3.3E-06	mg/m^3	R	3.9E-07	mg/m^3	3.0E-03	mg/m^3	1.3E-04
	(total)										1.47

Total Hazard Index Across All Exposure Routes/Pathways **1**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

8.2a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	ARSENIC	1.25E+01	mg/kg	9.8E-06	mg/m^3	R	1.9E-09	mg/m^3	4.3E+00	$(mg/m^3)^{-1}$	8.3E-09
	CADMIUM	2.30E+00	mg/kg	1.8E-06	mg/m^3	R	3.5E-10	mg/m^3	1.8E+00	$(mg/m^3)^{-1}$	6.4E-10
	CHROMIUM	2.03E+01	mg/kg	1.6E-05	mg/m^3	R	3.1E-09	mg/m^3	1.2E+01	$(mg/m^3)^{-1}$	3.7E-08
	COBALT	6.59E+00	mg/kg	5.2E-06	mg/m^3	R	1.0E-09	mg/m^3	9.0E+00	$(mg/m^3)^{-1}$	9.1E-09
	(total)										5.5E-08
										Total Risk Across All Exposure Routes/Pathways	**6.E-08**

TABLE 4.3
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	330	USEPA, December 2002	165	Professional Judgment	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	U.S. EPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	USEPA, December 1989	42	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	USEPA, July 2004	0.1	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical -specific	USEPA, July 2004	chemical -specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 5.54E-09
Noncancer Ingestion Intake - RME = 3.37E-06

Cancer Ingestion Intake - CTE = 2.77E-09
Noncancer Ingestion Intake - CTE = 1.68E-06

Cancer Dermal Intake - RME = 1.66E-08
Noncancer Dermal Intake - RME = 1.01E-05

Cancer Dermal Intake - CTE = 5.54E-09
Noncancer Dermal Intake - CTE = 3.37E-06

TABLE 7.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic[2] if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	1.3E-04	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00	1.5E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.7E-04
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	1.5E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	7.4E-02
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	1.9E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.9E-02
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	8.2E-02	mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	4.1E-02
	ARSENIC	8.50E+01	mg/kg	8.50E+01	2.9E-04	mg/kg-day	*5.0E-03*	mg/kg-day	NA	NA	5.7E-02
	CADMIUM	9.62E+00	mg/kg	9.62E+00	3.2E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	3.2E-02
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	1.2E-04	mg/kg-day	*2.0E-02*	mg/kg-day	NA	NA	5.8E-03
	COBALT	2.38E+01	mg/kg	2.38E+01	8.0E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.7E-01
	IRON	6.58E+04	mg/kg	6.58E+04	2.2E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	3.2E-01
	MANGANESE	1.69E+03	mg/kg	1.69E+03	5.7E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	1.2E-01
	MERCURY	4.84E-01	mg/kg	4.84E-01	1.6E-06	mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	5.4E-04
	VANADIUM	3.35E+01	mg/kg	3.35E+01	1.1E-04	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	1.3E-02
	(total)										**9.E-01**
Dermal	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	5.2E-05	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00		mg/kg-day	2.0E-02	mg/kg-day	NA	NA	
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	6.2E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.1E-02
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	1.7E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.7E-03
	ALUMINUM	2.43E+04	mg/kg	2.43E+04		mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	2.6E-05	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	5.2E-03
	CADMIUM	9.62E+00	mg/kg	9.62E+00	9.7E-08	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	3.9E-03
	CHROMIUM	3.43E+01	mg/kg	3.43E+01		mg/kg-day	*5.0E-04*	mg/kg-day	NA	NA	
	COBALT	2.38E+01	mg/kg	2.38E+01		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	IRON	6.58E+04	mg/kg	6.58E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	1.69E+03	mg/kg	1.69E+03		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	4.84E-01	mg/kg	4.84E-01		mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	
	VANADIUM	3.35E+01	mg/kg	3.35E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										**4.2E-02**
								Total Hazard Index Across All Exposure Routes/Pathways			**9.9E-01**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Cadmium - 0.001 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	mg/kg	M	2.2E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.6E-06
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00	mg/kg	M	2.5E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	2.4E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	4.9E-09
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	3.1E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	4.7E-09
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M	1.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	4.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	7.1E-07
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	5.3E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M	1.9E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M	1.3E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M	3.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M	9.4E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M	2.7E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M	1.9E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.31E-06**
Dermal	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	mg/kg	M	8.5E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.2E-07
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	1.0E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	2.0E-09
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	2.8E-15	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	4.2E-10
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	4.2E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	6.4E-08
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	1.6E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**6.9E-07**
										Total Risk Across All Exposure Routes/Pathways	**3.0E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):
Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.3a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	330	USEPA, December 2002	165	Professional Judgment	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	U.S. EPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	USEPA, December 1989	42	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	USEPA, July 2004	0.1	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical -specific	USEPA, July 2004	chemical -specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Daily Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 5.54E-09
Noncancer Ingestion Intake - RME = 3.37E-06

Cancer Ingestion Intake - CTE = 2.77E-09
Noncancer Ingestion Intake - CTE = 1.68E-06

Cancer Dermal Intake - RME = 1.66E-08
Noncancer Dermal Intake - RME = 1.01E-05

Cancer Dermal Intake - CTE = 5.54E-09
Noncancer Dermal Intake - CTE = 3.37E-06

TABLE 7.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic[2] if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	3.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.33E-01	mg/kg	4.33E-01	7.3E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.6E-05
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	1.2E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	5.9E-03
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	9.5E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	9.5E-03
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	1.6E-02	mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	7.9E-03
	ARSENIC	1.21E+01	mg/kg	1.21E+01	2.0E-05	mg/kg-day	*5.0E-03*	mg/kg-day	NA	NA	4.1E-03
	CADMIUM	1.24E+00	mg/kg	1.24E+00	2.1E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	2.1E-03
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	2.5E-05	mg/kg-day	*2.0E-02*	mg/kg-day	NA	NA	1.3E-03
	COBALT	8.90E+00	mg/kg	8.90E+00	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.0E-02
	IRON	2.70E+04	mg/kg	2.70E+04	4.5E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	6.5E-02
	MANGANESE	6.62E+02	mg/kg	6.62E+02	1.1E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	2.4E-02
	MERCURY	9.99E-02	mg/kg	9.99E-02	1.7E-07	mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	5.6E-05
	VANADIUM	1.90E+01	mg/kg	1.90E+01	3.2E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	3.6E-03
	(total)										**2.E-01**
Dermal	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	1.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.33E-01	mg/kg	4.33E-01		mg/kg-day	2.0E-02	mg/kg-day	NA	NA	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	3.3E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.7E-03
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	5.7E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.7E-04
	ALUMINUM	9.34E+03	mg/kg	9.34E+03		mg/kg-day	*2.0E+00*	mg/kg-day	NA	NA	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	1.2E-06	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.4E-04
	CADMIUM	1.24E+00	mg/kg	1.24E+00	4.2E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	1.7E-04
	CHROMIUM	1.51E+01	mg/kg	1.51E+01		mg/kg-day	*5.0E-04*	mg/kg-day	NA	NA	
	COBALT	8.90E+00	mg/kg	8.90E+00		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	IRON	2.70E+04	mg/kg	2.70E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	6.62E+02	mg/kg	6.62E+02		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	9.99E-02	mg/kg	9.99E-02		mg/kg-day	*3.0E-03*	mg/kg-day	NA	NA	
	VANADIUM	1.90E+01	mg/kg	1.90E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										**2.6E-03**
								Total Hazard Index Across All Exposure Routes/Pathways			**0.2**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Cadmium - 0.001 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	mg/kg	M	6.4E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.7E-08
	NAPHTHALENE	4.33E-01	mg/kg	4.33E-01	mg/kg	M	1.2E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	1.9E-10	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	3.9E-10
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	1.6E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.3E-09
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M	2.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	3.3E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.0E-08
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	3.4E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M	4.2E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M	2.5E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M	7.5E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M	1.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M	2.8E-10	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M	5.3E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**9.97E-08**
Dermal	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	mg/kg	M	1.7E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-08
	NAPHTHALENE	4.33E-01	mg/kg	4.33E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	5.5E-11	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-10
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	9.3E-16	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.4E-10
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	2.0E-09	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.0E-09
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	6.9E-12	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.5E-08**
										Total Risk Across All Exposure Routes/Pathways	**1.E-07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):
Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.4
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	$\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	PEF	Particulate emission factor	m^3/kg	1.27E+06	USEPA, December 2002	1.27E+06	USEPA, December 2002	
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.91E-04 Cancer Inhalation Intake(CTE) = 1.96E-04
Noncancer Inhalation Intake(RME) = 2.38E-01 Noncancer Inhalation Intake(CTE) = 1.19E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene	4.60E+00	Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	6.57E-05	3.38E-09	6.57E-05

TABLE 7.4. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation [1]	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration (Subchronic [2] if available)	Reference Concentration Units	Hazard Quotient
	NAPHTHALENE (partic.)	4.60E+00	mg/kg	3.6E-06	mg/m^3	R	8.6E-07	mg/m^3	3.0E-03	mg/m^3	2.9E-04
	ALUMINUM	2.43E+04	mg/kg	1.9E-02	mg/m^3	R	4.6E-03	mg/m^3	5.0E-03	mg/m^3	9.1E-01
	ARSENIC	8.50E+01	mg/kg	6.7E-05	mg/m^3	R	1.6E-05	mg/m^3	1.5E-05	mg/m^3	1.1E+00
	CADMIUM	9.62E+00	mg/kg	7.6E-06	mg/m^3	R	1.8E-06	mg/m^3	1.0E-05	mg/m^3	1.8E-01
	CHROMIUM	3.43E+01	mg/kg	2.7E-05	mg/m^3	R	6.4E-06	mg/m^3	1.0E-04	mg/m^3	6.4E-02
	COBALT	2.38E+01	mg/kg	1.9E-05	mg/m^3	R	4.5E-06	mg/m^3	6.0E-06	mg/m^3	7.4E-01
	MANGANESE	1.69E+03	mg/kg	1.3E-03	mg/m^3	R	3.2E-04	mg/m^3	5.0E-05	mg/m^3	6.3E+00
	MERCURY	4.84E-01	mg/kg	3.8E-07	mg/m^3	R	9.1E-08	mg/m^3	3.0E-05	mg/m^3	3.0E-03
	NAPHTHALENE (vol.)	4.60E+00	mg/kg	6.6E-05	mg/m^3	R	1.6E-05	mg/m^3	3.0E-03	mg/m^3	5.2E-03
	(total)										9.3E+00
									Total Hazard Index Across All Exposure Routes/Pathways		**9**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

8.4. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
	ARSENIC	8.50E+01	mg/kg	6.7E-05	mg/m^3	R	2.6E-08	mg/m^3	4.3E+00	$(mg/m^3)^{-1}$	1.1E-07
	CADMIUM	9.62E+00	mg/kg	7.6E-06	mg/m^3	R	3.0E-09	mg/m^3	1.8E+00	$(mg/m^3)^{-1}$	5.3E-09
	CHROMIUM	3.43E+01	mg/kg	2.7E-05	mg/m^3	R	1.1E-08	mg/m^3	1.2E+01	$(mg/m^3)^{-1}$	1.3E-07
	COBALT	2.38E+01	mg/kg	1.9E-05	mg/m^3	R	7.3E-09	mg/m^3	9.0E+00	$(mg/m^3)^{-1}$	6.6E-08
	(total)										3.1E-07
										Total Risk Across All Exposure Routes/Pathways	**3.1E-07**

TABLE 4.4a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	95% UCL or Max	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	$\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	PEF	Particulate emission factor	m^3/kg	1.27E+06	USEPA, December 2002	1.27E+06	USEPA, December 2002	
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.91E-04 Cancer Inhalation Intake(CTE) = 1.96E-04
Noncancer Inhalation Intake(RME) = 2.38E-01 Noncancer Inhalation Intake(CTE) = 1.19E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene	4.33E-01	Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	6.18E-06	3.18E-10	6.18E-06

TABLE 7.4a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation [1]	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration (Subchronic [2] If available)	Reference Concentration Units	Hazard Quotient
Inhalation	NAPHTHALENE (partic.)	4.33E-01	mg/kg	3.4E-07	mg/m^3	R	4.1E-08	mg/m^3	3.0E-03	mg/m^3	1.4E-05
	AROCLOR 1260	7.04E-02	mg/kg	5.5E-08	mg/m^3	R	6.6E-09	mg/m^3		mg/m^3	
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	4.4E-12	mg/m^3	R	5.3E-13	mg/m^3	4.00E-08	mg/m^3	
	ALUMINUM	9.34E+03	mg/kg	7.4E-03	mg/m^3	R	8.8E-04	mg/m^3	5.0E-03	mg/m^3	1.8E-01
	ANTIMONY		mg/kg		mg/m^3	R		mg/m^3	2.0E-04	mg/m^3	
	ARSENIC	1.21E+01	mg/kg	9.5E-06	mg/m^3	R	1.1E-06	mg/m^3	1.5E-05	mg/m^3	7.5E-02
	BARIUM		mg/kg		mg/m^3	R		mg/m^3	*5.0E-03*	mg/m^3	
	CADMIUM	1.24E+00	mg/kg	9.8E-07	mg/m^3	R	1.2E-07	mg/m^3	1.0E-05	mg/m^3	1.2E-02
	CHROMIUM	1.51E+01	mg/kg	1.2E-05	mg/m^3	R	1.4E-06	mg/m^3	1.0E-04	mg/m^3	1.4E-02
	COBALT	8.90E+00	mg/kg	7.0E-06	mg/m^3	R	8.3E-07	mg/m^3	6.0E-06	mg/m^3	1.4E-01
	COPPER		mg/kg		mg/m^3	R		mg/m^3		mg/m^3	
	IRON	2.70E+04	mg/kg	2.1E-02	mg/m^3	R	2.5E-03	mg/m^3		mg/m^3	
	MANGANESE	6.62E+02	mg/kg	5.2E-04	mg/m^3	R	6.2E-05	mg/m^3	5.0E-05	mg/m^3	1.2E+00
	MERCURY	9.99E-02	mg/kg	7.9E-08	mg/m^3	R	9.4E-09	mg/m^3	3.0E-05	mg/m^3	3.1E-04
	NAPHTHALENE (vol.)	4.33E-01	mg/kg	6.2E-06	mg/m^3	R	7.4E-07	mg/m^3	3.0E-03	mg/m^3	2.5E-04
	(total)										1.7E+00
										Total Hazard Index Across All Exposure Routes/Pathways	**2**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

8.4a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	ARSENIC	1.21E+01	mg/kg	9.5E-06	mg/m^3	R	1.9E-09	mg/m^3	4.3E+00	$(mg/m^3)^{-1}$	8.0E-09
	CADMIUM	1.24E+00	mg/kg	9.8E-07	mg/m^3	R	1.9E-10	mg/m^3	1.8E+00	$(mg/m^3)^{-1}$	3.4E-10
	CHROMIUM	1.51E+01	mg/kg	1.2E-05	mg/m^3	R	2.3E-09	mg/m^3	1.2E+01	$(mg/m^3)^{-1}$	2.8E-08
	COBALT	8.90E+00	mg/kg	7.0E-06	mg/m^3	R	1.4E-09	mg/m^3	9.0E+00	$(mg/m^3)^{-1}$	1.2E-08
	(total)										4.9E-08
										Total Risk Across All Exposure Routes/Pathways	**4.9E-08**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4.5
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF FUTURE CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	3,300	U.S. EPA, July 2004	3,300	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration	years	1	Professional Judgement	1	U.S. EPA, May 1993	of the text.
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	4.0	Professional Judgement	2	Professional Judgement	USEPA, July 2004
	t*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	70	USEPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	U.S. EPA, December 1989	

Daily Intake Calculations

Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Dermal Intake(RME) = 5.54E-02
Noncancer Dermal Intake(RME) = 3.37E+01

Cancer Dermal Intake(CTE) = 5.54E-02
Noncancer Dermal Intake(CTE) = 3.37E+01

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
REASONABLE MAXIMUM EXPOSURE (RME) — FUTURE CONSTRUCTION WORKERS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/01/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS:
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	DAevent	FA	DAevent
BAP EQUIVALENT (FULL DL)	0.00006146	o	1.17E+01	4.00E+00	2.69E+00	7.01E-01	4.27E+00	3.91E-07	1	3.91E-07
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	4.00E+00	6.82E+00	8.10E-01	5.60E+00	1.44E-10	0.5	7.19E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	4.00E+00	3.30E+00	3.90E-01	2.50E+00	3.05E-05	0.9	2.75E-05
BENZENE	0.00096	o	7.00E-01	4.00E+00	2.90E-01	1.50E-02	1.00E-01	6.15E-08	1	6.15E-08
TETRACHLOROETHYLENE	0.00085	o	2.18E+00	4.00E+00	9.10E-01	3.30E-02	2.00E-01	1.54E-07	1	1.54E-07
DELTA-BHC (ALPHA-BHC SURROGATE	0.00002	o	1.10E+01	4.00E+00	4.57E+00	1.10E-02	1.00E-01	2.60E-09	0.9	2.34E-09
ARSENIC	0.00726	i		4.00E+00		1.00E-03		2.90E-08	1	2.90E-08
CADMIUM	0.00345	i		4.00E+00		1.00E-03		1.38E-08	1	1.38E-08
COBALT	0.0153	i		4.00E+00		1.00E-03		6.12E-08	1	6.12E-08
IRON	34	i		4.00E+00		1.00E-03		1.36E-04	1	1.36E-04
MANGANESE	5.4	i		4.00E+00		1.00E-03		2.16E-05	1	2.16E-05

TABLE 7.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic (2) if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
	(total)												
Dermal	BAP EQUIVALENT (FULL DL)	6.1E-05	mg/L	6.15E-05	mg/L	M	(3)	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(3)	mg/kg-day	1.00E-09	mg/kg-day	NA	NA	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(3)	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	2.1E-06	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	5.2E-04
	TETRACHLOROETHYLENE	8.5E-04	mg/L	8.50E-04	mg/L	M	5.2E-06	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	5.2E-04
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	7.9E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	2.6E-04
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	9.8E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	2.0E-04
	CADMIUM	3.5E-03	mg/L	3.45E-03	mg/L	M	4.6E-07	mg/kg-day	2.50E-05	mg/kg-day	NA	NA	1.9E-02
	COBALT	1.5E-02	mg/L	1.53E-02	mg/L	M	2.1E-06	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	6.9E-03
	IRON	3.4E+01	mg/L	3.40E+01	mg/L	M	4.6E-03	mg/kg-day	7.00E-01	mg/kg-day	NA	NA	6.5E-03
	MANGANESE	5.4E+00	mg/L	5.40E+00	mg/L	M	7.3E-04	mg/kg-day	1.88E-03	mg/kg-day	NA	NA	3.9E-01
			mg/L										
	(total)												4.2E-01
												Total Hazard Index Across All Exposure Routes/Pathways	**0.4**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Subchronic values in *italics*.

TABLE 8.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	BAP EQUIVALENT (FULL	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(2)	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	3.4E-09	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	1.9E-10
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	8.6E-09	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	4.6E-09
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	1.3E-10	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	8.2E-10
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	1.6E-09	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-09
	(total)										8.0E-09
										Total Risk Across All Exposure Routes/Pathways	**8.0E-09**

TABLE 4.5a
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for for estimating DAevent and the chemical-specific dermally absorbed dose from water (DAD) are provided in Section 6.2.4.4 of the text.
	A	Skin Surface Area	cm^2	3,300	U.S. EPA, July 2004	3,300	U.S. EPA, July 2004	
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	
	ED	Exposure Duration	years	1	Professional Judgement	1	U.S. EPA, May 1993	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	4.0	Professional Judgement	2	Professional Judgement	USEPA, July 2004
	t*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	70	USEPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	U.S. EPA, December 1989	

Daily Intake Calculations

Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Dermal Intake(RME) = 5.54E-02
Noncancer Dermal Intake(RME) = 3.37E+01

Cancer Dermal Intake(CTE) = 5.54E-02
Noncancer Dermal Intake(CTE) = 3.37E+01

TABLE 4.5a
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF FUTURE CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	3,300	U.S. EPA, July 2004	3,300	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration	years	1	Professional Judgement	1	U.S. EPA, May 1993	of the text.
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	4.0	Professional Judgement	2	Professional Judgement	USEPA, July 2004
	t*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	70	USEPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	U.S. EPA, December 1989	

Daily Intake Calculations

Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Cancer Dermal Intake(RME) = 5.54E-02
Noncancer Dermal Intake(RME) = 3.37E+01

Cancer Dermal Intake(CTE) = 5.54E-02
Noncancer Dermal Intake(CTE) = 3.37E+01

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
REASONABLE MAXIMUM EXPOSURE (RME) — FUTURE CONSTRUCTION WORKERS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/01/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS:
IF tevent < t*, DAevent = 2FA x Kp x C x CF x $(6T \times tevent/3.1416)^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x $((tevent/(1 + B)) + (2T \times ((1+3B+3B^2)/(1 + B)^2)))$

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	DAevent	FA	DAevent
BAP EQUIVALENT (1/2 DL)	0.00006146	o	1.17E+01	2.00E+00	2.69E+00	7.01E-01	4.27E+00	2.76E-07	1	2.76E-07
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	2.00E+00	6.82E+00	8.10E-01	5.60E+00	1.02E-10	0.5	5.09E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	2.00E+00	3.30E+00	3.90E-01	2.50E+00	2.16E-05	0.9	1.94E-05
BENZENE	0.00096	o	7.00E-01	2.00E+00	2.90E-01	1.50E-02	1.00E-01	3.54E-08	1	3.54E-08
TETRACHLOROETHYLENE	0.00085	o	2.18E+00	2.00E+00	9.10E-01	3.30E-02	2.00E-01	1.05E-07	1	1.05E-07
DELTA-BHC (ALPHA-BHC SURROGATE	0.00002	o	1.10E+01	2.00E+00	4.57E+00	1.10E-02	1.00E-01	1.84E-09	0.9	1.65E-09
ARSENIC	0.00726	i		2.00E+00		1.00E-03		1.45E-08	1	1.45E-08
CADMIUM	0.00345	i		2.00E+00		1.00E-03		6.90E-09	1	6.90E-09
COBALT	0.0153	i		2.00E+00		1.00E-03		3.06E-08	1	3.06E-08
IRON	34	i		2.00E+00		1.00E-03		6.80E-05	1	6.80E-05
MANGANESE	5.4	i		2.00E+00		1.00E-03		1.08E-05	1	1.08E-05

TABLE 7.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (Subchronic (2) if available)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	BAP EQUIVALENT (1/2 DL)	6.1E-05	mg/L	6.15E-05	mg/L	M	(3)	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(3)	mg/kg-day	1.00E-09	mg/kg-day	NA	NA	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(3)	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	1.2E-06	mg/kg-day	4.00E-03	mg/kg-day	NA	NA	3.0E-04
	TETRACHLOROETHYLENE	8.5E-04	mg/L	8.50E-04	mg/L	M	3.5E-06	mg/kg-day	1.00E-02	mg/kg-day	NA	NA	3.5E-04
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	5.6E-08	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	1.9E-04
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	4.9E-07	mg/kg-day	5.00E-03	mg/kg-day	NA	NA	9.8E-05
	CADMIUM	3.5E-03	mg/L	3.45E-03	mg/L	M	2.3E-07	mg/kg-day	2.50E-05	mg/kg-day	NA	NA	9.3E-03
	COBALT	1 5E-02	mg/L	1.53E-02	mg/L	M	1.0E-06	mg/kg-day	3.00E-04	mg/kg-day	NA	NA	3.4E-03
	IRON	3.4E+01	mg/L	3.40E+01	mg/L	M	2.3E-03	mg/kg-day	7.00E-01	mg/kg-day	NA	NA	3.3E-03
	MANGANESE	5.4E+00	mg/L	5.40E+00	mg/L	M	3.6E-04	mg/kg-day	9 60E-04	mg/kg-day	NA	NA	3.8E-01
			mg/L										
	(total)												4.0E-01
												Total Hazard Index Across All Exposure Routes/Pathways	**0.4**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Subchronic values in *italics*.

TABLE 8.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	BAP EQUIVALENT (1/2 DL	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(2)	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	2.0E-09	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	1.1E-10
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	5.8E-09	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	3.1E-09
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	9.2E-11	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	5.8E-10
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	8.0E-10	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-09
	(total)										5.0E-09
										Total Risk Across All Exposure Routes/Pathways	**5.0E-09**

TABLE 4.6
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM GW IN TRENCH
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, May 1993	Intake (mg/kg/day) = $\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	ET	Exposure Time	hours/day	4	USEPA, December 2002	2	USEPA, December 2002	
	EF	Exposure Frequency	days/year	30	IEPA, April 2004	30	IEPA, April 2004	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	42	IEPA, Janaury 2003	42	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 1.96E-04 Cancer Inhalation Intake(CTE) = 9.78E-05
Noncancer Inhalation Intake(RME) = 1.19E-01 Noncancer Inhalation Intake(CTE) = 5.95E-02

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 21
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure point concentrations
(inhalation) for construction/utility workers
in a trench
Groundwater less than 15 feet deep

For Mass Transfer Coefficients

Kg,H2O	0.833	cm/s
MWH2O	18	
Kg,O2	0.002	cm/s
MWO2	32	
T	77	F
T	298	K
R	8.20E-05	atm-m3/mol-K

For Emission Flux and Concentration in Tren Trench dimensions

CF1	1.00E-03	L/cm3	Length	8	ft
CF2	1.00E+04	cm2/m2		2.44	m
CF3	3600	s/hr	Width	11	ft
F	1			3.35	m
ACH	360	hr-1	Depth	10	ft
				3.05	m
			Width/Depth	1.10	

Error in Calcs? No = 0, Yes = 1

Chemical	Concentration of Contaminant in Groundwater Cgw ug/L	Is Chemical a VOC ?	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench mg/m3	Concentration of Contaminant in Trench Ctrench mg/m3
BENZENE	9.60E-01	Y	7.81E+01	5.56E-03	5.09E-01	1.28E-03	1.27E-03	4.15E-02	3.99E-05	3.99E-05
TETRACHLOROETHYL	8.50E-01	Y	165.83	1.84E-02	3.96E-01	8.79E-04	8.76E-04	2.87E-02	2.44E-05	2.44E-05

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future
Medium: Subsurfce Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene	0.52	Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	7.42E-06	3.82E-10	7.42E-06
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.6. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM GW IN TRENCH
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation[1]	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration (Subchronic[2] if available)	Reference Concentration Units	Hazard Quotient
Inhalation	BENZENE	9.60E-01	ug/L	4.0E-05	mg/m^3	R	4.7E-06	mg/m^3	3.0E-02	mg/m3	1.6E-04
	TETRACHLOROETHYLENE	7.20E-01	ug/L	2.4E-05	mg/m^3	R	2.9E-06	mg/m^3	2.7E-01	mg/m3	1.1E-05
	(total)										1.69E-04
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0002**

[1] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

[2] Subchronic values in *italics*.

8.6. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION WORKERS BY INHALATION FROM GW IN TRENCH
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	BENZENE	9.60E-01	mg/kg	4.0E-05	mg/m^3	R	7.8E-09	mg/m^3	7.8E-03	$(mg/m^3)^{-1}$	6.1E-11
	TETRACHLOROETHYLENE	7.20E-01	mg/kg	2.4E-05	mg/m^3	R	4.8E-09	mg/m^3	5.9E-03	$(mg/m^3)^{-1}$	2.8E-11
	(total)										8.9E-11
										Total Risk Across All Exposure Routes/Pathways	**9.E-11**

TABLE 4.7
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS TO SOIL (POSSIBLE FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 2002	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	250	USEPA, May 1993	219	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration	years	25	USEPA, May 1993	9	USEPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, December 1989	3,285	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 2002	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.02	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	250	USEPA, May 1993	219	USEPA, May 1993	
	ED	Exposure Duration	years	25	USEPA, May 1993	9	USEPA, May 1993	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, December 1989	3,285	USEPA, December 1989	

Daily Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.49E-07
Noncancer Ingestion Intake - RME = 9.78E-07

Cancer Dermal Intake - RME = 2.31E-06
Noncancer Dermal Intake - RME = 6.46E-06

Cancer Ingestion Intake - CTE = 5.51E-08
Noncancer Ingestion Intake - CTE = 4.29E-07

Cancer Dermal Intake - CTE = 7.27E-08
Noncancer Dermal Intake - CTE = 5.66E-07

TABLE 7.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs)	1.35E+01	mg/kg	1.35E+01	1.3E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	2.2E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.1E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	3.3E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	3.3E-02
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	9.7E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	9.7E-03
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	2.0E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	5.0E-03
	ARSENIC	2.38E+01	mg/kg	2.38E+01	2.3E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.8E-02
	BARIUM	9.47E+01	mg/kg	9 47E+01	9.3E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	4.6E-04
	CADMIUM	6.44E+00	mg/kg	6.44E+00	6.3E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.3E-03
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	4.9E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.6E-02
	COBALT	8.07E+00	mg/kg	8.07E+00	7.9E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.6E-02
	COPPER	2.58E+02	mg/kg	2.58E+02	2.5E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.3E-03
	IRON	3.36E+04	mg/kg	3.36E+04	3.3E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	4.7E-02
	MANGANESE	7.69E+02	mg/kg	7.69E+02	7.5E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	1.6E-02
	MERCURY	2.33E+00	mg/kg	2.33E+00	2.3E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.6E-03
	VANADIUM	1.86E+01	mg/kg	1.86E+01	1.8E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	2.0E-03
	(total)										2.6E-01
Dermal	BAP EQUIVALENT (FULL DLs)	1.35E+01	mg/kg	1.35E+01	1.1E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	2.0E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.0E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	6.5E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	6.5E-03
	ALUMINUM	9.89E+03	mg/kg	9.89E+03		mg/kg-day		mg/kg-day	NA	NA	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	4.6E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.5E-02
	BARIUM	9.47E+01	mg/kg	9.47E+01		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	6.44E+00	mg/kg	6.44E+00	4.2E-08	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	1.7E-03
	CHROMIUM	5.05E+01	mg/kg	5.05E+01		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	8.07E+00	mg/kg	8.07E+00		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	2.58E+02	mg/kg	2.58E+02		mg/kg-day		mg/kg-day	NA	NA	
	IRON	3.36E+04	mg/kg	3.36E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	7.69E+02	mg/kg	7.69E+02		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	2.33E+00	mg/kg	2.33E+00		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.86E+01	mg/kg	1.86E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										3.4E-02
										Total Hazard Index Across All Exposure Routes/Pathways	**3.0E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.7- REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	1.35E+01	mg/kg	1.35E+01	mg/kg	M	4.7E-06	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.4E-05
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	7.8E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.6E-07
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.2E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.8E-06
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M	3.5E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M	7.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	8.3E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.2E-05
	BARIUM	9.47E+01	mg/kg	9.47E+01	mg/kg	M	3.3E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	6.44E+00	mg/kg	6.44E+00	mg/kg	M	2.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	mg/kg	M	1.8E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	8.07E+00	mg/kg	8.07E+00	mg/kg	M	2.8E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	2.58E+02	mg/kg	2.58E+02	mg/kg	M	9.0E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	3.36E+04	mg/kg	3.36E+04	mg/kg	M	1.2E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	7.69E+02	mg/kg	7.69E+02	mg/kg	M	2.7E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	2.33E+00	mg/kg	2.33E+00	mg/kg	M	8.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.86E+01	mg/kg	1.86E+01	mg/kg	M	6.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										4.9E-05
Dermal	BAP EQUIVALENT (FULL DLs	1.35E+01	mg/kg	1.35E+01	mg/kg	M	4.0E-06	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.9E-05
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	7.2E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.4E-07
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	2.3E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	3.5E-07
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	1.6E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.5E-06
	BARIUM	9.47E+01	mg/kg	9.47E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	6.44E+00	mg/kg	6.44E+00	mg/kg	M	1.5E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	8.07E+00	mg/kg	8.07E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	2.58E+02	mg/kg	2.58E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	3.36E+04	mg/kg	3.36E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	7.69E+02	mg/kg	7.69E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	2.33E+00	mg/kg	2.33E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.86E+01	mg/kg	1.86E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										3.2E-05
										Total Risk Across All Exposure Routes/Pathways	**8.1E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.7a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF OCCUPATIONAL WORKERS TO SOIL (POSSIBLE FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	95% UCL or Max	USEPA, December 2002	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	250	USEPA, May 1993	219	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration	years	25	USEPA, May 1993	9	USEPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, December 1989	3,285	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	95% UCL or Max	USEPA, December 2002	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	USEPA, July 2004	3,300	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.02	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	250	USEPA, May 1993	219	USEPA, May 1993	
	ED	Exposure Duration	years	25	USEPA, May 1993	9	USEPA, May 1993	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	USEPA, December 1989	3,285	USEPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.49E-07
Noncancer Ingestion Intake - RME = 9.78E-07

Cancer Ingestion Intake - CTE = 5.51E-08
Noncancer Ingestion Intake - CTE = 4.29E-07

Cancer Dermal Intake - RME = 2.31E-06
Noncancer Dermal Intake - RME = 6.46E-06

Cancer Dermal Intake - CTE = 7.27E-08
Noncancer Dermal Intake - CTE = 5.66E-07

TABLE 7.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs)	3.57E+00	mg/kg	3.57E+00	1.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE		mg/kg			mg/kg-day	2.0E-02	mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	6.6E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.3E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	1.4E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.4E-02
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	3.3E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.3E-03
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	4.5E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.1E-03
	ARSENIC	1.25E+01	mg/kg	1.25E+01	5.3E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.8E-02
	BARIUM	7.64E+01	mg/kg	7.64E+01	3.3E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.6E-04
	CADMIUM	2.30E+00	mg/kg	2.30E+00	9.9E-07	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	9.9E-04
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	8.7E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.9E-03
	COBALT	6.59E+00	mg/kg	6.59E+00	2.8E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.4E-03
	COPPER	9.36E+01	mg/kg	9.36E+01	4.0E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.0E-03
	IRON	2.68E+04	mg/kg	2.68E+04	1.1E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.6E-02
	MANGANESE	5.89E+02	mg/kg	5.89E+02	2.5E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	5.4E-03
	MERCURY	5.68E-01	mg/kg	5.68E-01	2.4E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.1E-04
	VANADIUM	1.67E+01	mg/kg	1.67E+01	7.1E-06	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	7.9E-04
	(total)										7.8E-02
Dermal	BAP EQUIVALENT (FULL DLs)	3.57E+00	mg/kg	3.57E+00	2.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	1.2E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	6.1E-04
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	5.7E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.7E-04
	ALUMINUM	7.62E+03	mg/kg	7.62E+03		mg/kg-day		mg/kg-day	NA	NA	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	2.1E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.0E-04
	BARIUM	7.64E+01	mg/kg	7.64E+01		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	1.3E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	5.2E-05
	CHROMIUM	2.03E+01	mg/kg	2.03E+01		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	6.59E+00	mg/kg	6.59E+00		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	9.36E+01	mg/kg	9.36E+01		mg/kg-day		mg/kg-day	NA	NA	
	IRON	2.68E+04	mg/kg	2.68E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	5.89E+02	mg/kg	5.89E+02		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	5.68E-01	mg/kg	5.68E-01		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.67E+01	mg/kg	1.67E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										1.9E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**8.0E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	2.0E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.4E-06
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	8.5E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.7E-08
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.8E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.8E-07
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	4.2E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	5.8E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	6.9E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.0E-06
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	4.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	1.3E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	1.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	3.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	5.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	1.5E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	3.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M	3.1E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	9.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										2.8E-06
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	3.4E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.5E-07
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	1.6E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	3.1E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	7.3E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.1E-08
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	2.7E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.1E-08
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										3.0E-07
										Total Risk Across All Exposure Routes/Pathways	3.1E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.8
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	95% UCL or Max	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	$\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	250	IEPA, April 2004	120	??	
	ED	Exposure Duration	years	25	Professional Judgement	9	USEPA 1997??	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9125	IEPA, Janaury 2003	3285	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.15E-02 Cancer Inhalation Intake(CTE) = 7.05E-03
Noncancer Inhalation Intake(RME) = 2.28E-01 Noncancer Inhalation Intake(CTE) = 5.48E-02

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

TABLE 7.8 REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	2.33E+00	mg/kg	1.7E-09	mg/m^3	R	3.9E-10	mg/m^3	3.0E-05	mg/m^3	1.3E-05
	(total)										1.3E-05
										Total Hazard Index Across All Exposure Routes/Pathways	**0.000013**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.8 REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF OCCUPATIONAL/MAINTENANCE WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation											
	No carcinogenic COPCs for inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4.8a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF OCCUPATIONAL WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	95% UCL or Max	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	$CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED$
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	
	ET	Exposure Time	hours/day	8	USEPA, December 2002	4	USEPA, December 2002	
	EF	Exposure Frequency	days/year	250	IEPA, April 2004	120	??	$AT \times 24$
	ED	Exposure Duration	years	25	Professional Judgement	9	USEPA 1997??	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9125	IEPA, Janaury 2003	3285	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.15E-02 Cancer Inhalation Intake(CTE) = 7.05E-03
Noncancer Inhalation Intake(RME) = 2.28E-01 Noncancer Inhalation Intake(CTE) = 5.48E-02

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

TABLE 7.8a CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF OCCUPATIONAL WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	5.68E-01	mg/kg	4.2E-10	mg/m^3	R	2.3E-11	mg/m^3	3.0E-05	mg/m^3	7.6E-07
	(total)										7.6E-07
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0000008**

8.8a CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF OCCUPATIONAL WORKERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
	No carcinogenic COPCs for inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.E+00**

TABLE 4.9
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	Professional Judgement	Csoil x IR x Fi x EF x ED x CF / BW x AT
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	U.S. EPA, December 1989
	ED	Exposure Duration	years	10	Adolescent, Age 7 - 16	10	Adolescent, Age 7 - 16	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	42	USEPA, August 1997	42	USEPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, December 1989	3,650	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED / BW x AT
	SA	Skin Surface Area	cm^2/day	3,280	USEPA, August 1997	3,100	USEPA, August 1997	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.04	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	
	ED	Exposure Duration	years	10	Adolescent, Age 7 - 16	10	Adolescent, Age 7 - 16	
	BW	Body Weight	kg	42	USEPA, August 1997	42	USEPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, December 1989	3,650	USEPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.42E-08
Noncancer Ingestion Intake - RME = 1.70E-07

Cancer Ingestion Intake - CTE = 6.06E-09
Noncancer Ingestion Intake - CTE = 4.24E-08

Cancer Dermal Intake - RME = 1.59E-07
Noncancer Dermal Intake - RME = 1.11E-06

Cancer Dermal Intake - CTE = 1.50E-08
Noncancer Dermal Intake - CTE = 1.05E-07

TABLE 7.9 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	1.347E+01	mg/kg	1.35E+01	mg/kg	M	2.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	3.8E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.9E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	5.7E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.7E-03
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M	1.7E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.7E-03
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M	3.4E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	8.6E-04
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	4.0E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.3E-02
	BARIUM	9.47E+01	mg/kg	9.47E+01	mg/kg	M	1.6E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	8.0E-05
	CADMIUM	6.44E+00	mg/kg	6.44E+00	mg/kg	M	1.1E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.1E-03
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	mg/kg	M	8.6E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.9E-03
	COBALT	8.07E+00	mg/kg	8.07E+00	mg/kg	M	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.6E-03
	COPPER	2.58E+02	mg/kg	2.58E+02	mg/kg	M	4.4E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E-03
	IRON	3.36E+04	mg/kg	3.36E+04	mg/kg	M	5.7E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	8.1E-03
	MANGANESE	7.69E+02	mg/kg	7.69E+02	mg/kg	M	1.3E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	2.8E-03
	MERCURY	2.33E+00	mg/kg	2.33E+00	mg/kg	M	4.0E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.3E-03
	VANADIUM	1.86E+01	mg/kg	1.86E+01	mg/kg	M	3.1E-06	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	3.5E-04
	(total)												4.6E-02
Dermal	BAP EQUIVALENT (FULL DLs	1.347E+01	mg/kg	1.35E+01	mg/kg	M	1.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	3.5E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.7E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg		mg/kg	M	1.1E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.1E-03
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M		mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	8.0E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.7E-03
	BARIUM	9.47E+01	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	6.44E+00	mg/kg		mg/kg	M	7.2E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	2.9E-04
	CHROMIUM	5.05E+01	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	8.07E+00	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	2.58E+02	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	IRON	3.36E+04	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	7.69E+02	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	2.33E+00	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.86E+01	mg/kg		mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	(total)												5.8E-03
												Total Hazard Index Across All Exposure Routes/Pathways	0.05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.9 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	1.35E+01	mg/kg	1.35E+01	mg/kg	M	9.8E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.1E-06
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	5.4E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.1E-08
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	8.1E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.2E-07
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M	2.4E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M	4.9E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	5.8E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	8.7E-07
	BARIUM	9.47E+01	mg/kg	9.47E+01	mg/kg	M	2.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	6.44E+00	mg/kg	6.44E+00	mg/kg	M	1.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	mg/kg	M	1.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	8.07E+00	mg/kg	8.07E+00	mg/kg	M	2.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	2.58E+02	mg/kg	2.58E+02	mg/kg	M	6.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	3.36E+04	mg/kg	3.36E+04	mg/kg	M	8.1E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	7.69E+02	mg/kg	7.69E+02	mg/kg	M	1.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	2.33E+00	mg/kg	2.33E+00	mg/kg	M	5.6E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.86E+01	mg/kg	1.86E+01	mg/kg	M	4.5E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										8.1E-06
Dermal	BAP EQUIVALENT (FULL DLs	1.35E+01	mg/kg	1.35E+01	mg/kg	M	8.3E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.1E-06
	AROCLOR 1260	2.23E-01	mg/kg	2.23E-01	mg/kg	M	5.0E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	9.9E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.6E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.4E-08
	ALUMINUM	9.89E+03	mg/kg	9.89E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	2.03E+00	mg/kg	2.03E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	2.38E+01	mg/kg	2.38E+01	mg/kg	M	1.1E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.7E-07
	BARIUM	9.47E+01	mg/kg	9.47E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	6.44E+00	mg/kg	6.44E+00	mg/kg	M	1.0E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	5.05E+01	mg/kg	5.05E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	8.07E+00	mg/kg	8.07E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	2.58E+02	mg/kg	2.58E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	3.36E+04	mg/kg	3.36E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	7.69E+02	mg/kg	7.69E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	2.33E+00	mg/kg	2.33E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.86E+01	mg/kg	1.86E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										6.3E-06
										Total Risk Across All Exposure Routes/Pathways	1.4E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.9a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	Professional Judgement	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	U.S. EPA, December 1989
	ED	Exposure Duration	years	10	Adolescent, Age 7 - 16	10	Adolescent, Age 7 - 16	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	42	USEPA, August 1997	42	USEPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, December 1989	3,650	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, December 1989	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,280	USEPA, August 1997	3,100	USEPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.04	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	
	ED	Exposure Duration	years	10	Adolescent, Age 7 - 16	10	Adolescent, Age 7 - 16	
	BW	Body Weight	kg	42	USEPA, August 1997	42	USEPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	USEPA, December 1989	3,650	USEPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.42E-08
Noncancer Ingestion Intake - RME = 1.70E-07

Cancer Ingestion Intake - CTE = 6.06E-09
Noncancer Ingestion Intake - CTE = 4.24E-08

Cancer Dermal Intake - RME = 1.59E-07
Noncancer Dermal Intake - RME = 1.11E-06

Cancer Dermal Intake - CTE = 1.50E-08
Noncancer Dermal Intake - CTE = 1.05E-07

TABLE 7.9a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 18 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	1.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	6.5E-09	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.3E-04
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.4E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.4E-03
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	3.2E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.2E-04
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	4.5E-08	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.1E-04
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	5.3E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.8E-03
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	3.2E-06	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.6E-05
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	9.8E-08	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	9.8E-05
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	8.6E-07	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.9E-04
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	2.8E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.3E-04
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	4.0E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	9.9E-05
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	1.1E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.6E-03
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	2.5E-05	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	5.3E-04
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M	2.4E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.0E-05
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	7.1E-07	mg/kg-day	9 0E-03	mg/kg-day	NA	NA	7.9E-05
	(total)												7.7E-03
Dermal	BAP EQUIVALENT (FULL DLs	3.568E+00	mg/kg	3.57E+00	mg/kg	M	4.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	2.3E-09	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.1E-04
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1 1E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.1E-04
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	3.9E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.3E-04
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	2.4E-10	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	9.7E-06
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		mg/kg-day	NA	NA	
	(total)												3.6E-04
												Total Hazard Index Across All Exposure Routes/Pathways	0.008

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.9a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	6.5E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.7E-07
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	9.3E-10	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.9E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	2.0E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	3.0E-08
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	4.6E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	6.4E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	7.5E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.1E-07
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	4.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	1.4E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	1.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	4.0E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	5.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	1.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	3.6E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M	3.4E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	1.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										6.2E-07
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	2.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.5E-07
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	3.2E-10	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	6.5E-10
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.5E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.3E-09
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	5.6E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	8.4E-09
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	3.5E-11	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										1.6E-07
										Total Risk Across All Exposure Routes/Pathways	7.8E-07

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.10
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, December 1989	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	$CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED$
	ET	Exposure Time	hours/day	2	Professional Judgment	1	Professional Judgment	
	EF	Exposure Frequency	days/year	26	Professional Judgment	13	Professional Judgment	$AT \times 24$
	ED	Exposure Duration	years	10	Professional Judgement	10	Professional Judgment	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3650	IEPA, Janaury 2003	3650	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.48E-04 Cancer Inhalation Intake(CTE) = 2.12E-04
Noncancer Inhalation Intake(RME) = 5.94E-03 Noncancer Inhalation Intake(CTE) = 1.48E-03

Cancer risk from inhalation = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from inhalation = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

TABLE 7.10 REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	2.33E+00	mg/kg	1.7E-09	mg/m^3	R	1.0E-11	mg/m^3	3.0E-05	mg/m^3	3.4E-07
	(total)										3.4E-07
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0000003**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.10 REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
	No carcinogenic COPCs for inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

TABLE 4.10a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, December 1989	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	$CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED$
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	
	ET	Exposure Time	hours/day	2	Professional Judgment	1	Professional Judgment	$AT \times 24$
	EF	Exposure Frequency	days/year	26	Professional Judgment	13	Professional Judgment	
	ED	Exposure Duration	years	10	Professional Judgement	10	Professional Judgment	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3650	IEPA, Janaury 2003	3650	IEPA, Janaury 2003	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.48E-04 Cancer Inhalation Intake(CTE) = 2.12E-04
Noncancer Inhalation Intake(RME) = 5.94E-03 Noncancer Inhalation Intake(CTE) = 1.48E-03

Cancer risk from inhalation = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from inhalation = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

TABLE 7.10a CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	5.68E-01	mg/kg	4.2E-10	mg/m^3	R	6.2E-13	mg/m^3	3.0E-05	mg/m^3	2.1E-08
	(total)										2.1E-08
										Total Hazard Index Across All Exposure Routes/Pathways	**0.00000002**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.10a CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF ADOLESCENT TRESPASSERS BY INHALATION FROM SOIL (POTENTIAL FUTURE SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (7 - 16 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
	No carcinogenic COPCs for inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

TABLE 4.11
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL (HYPOTHETICAL FUTURE)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x FI x EF x ED x CF
	FI	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,700	USEPA, July 2004	5,700	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, July 2004	0.01	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	

Unit Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-30) - RME = 4.70E-07
Cancer Dermal Intake (Ages 6-30) - RME = 1.87E-06

Cancer Ingestion Intake - CTE = 4.58E-08
Cancer Dermal Intake - CTE = 5.22E-08

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 1.96E-07
Cancer Ingestion Intake (Ages 17-30) - RME = 2.74E-07
Cancer Dermal Intake (Ages 6-16) - RME = 7.81E-07
Cancer Dermal Intake (Ages 17-30) - RME = 1.09E-06

Non-carcinogenic Chemicals

Noncancer Ingestion Intake - RME = 1.37E-06
Noncancer Dermal Intake - RME = 5.47E-06

Noncancer Ingestion Intake - CTE = 4.58E-07
Noncancer Dermal Intake - CTE = 5.22E-07

TABLE 7.11 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	6.9E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	9.9E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	4.9E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	4.6E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	4.6E-02
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	4.0E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	4.0E-02
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	7.2E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.8E-02
	ARSENIC	4.84E+01	mg/kg	4.84E+01	6.6E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.2E-01
	BARIUM	2.34E+02	mg/kg	2.34E+02	3.2E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.6E-03
	CADMIUM	1.30E+01	mg/kg	1.30E+01	1.8E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.8E-02
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	2.2E-04	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	7.4E-02
	COBALT	1.77E+01	mg/kg	1.77E+01	2.4E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.1E-02
	COPPER	8.35E+02	mg/kg	8.35E+02	1.1E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.9E-02
	IRON	6.95E+04	mg/kg	6.95E+04	9.5E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.4E-01
	MANGANESE	2.42E+03	mg/kg	2.42E+03	3.3E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	7.1E-02
	MERCURY	8.98E+00	mg/kg	8.98E+00	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.1E-02
	VANADIUM	2.57E+01	mg/kg	2.57E+01	3.5E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	3.9E-03
	(total)										8.3E-01
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	3.6E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	5.5E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	2.8E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	5.5E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.5E-03
	ALUMINUM	2.95E+04	mg/kg	2.95E+04		mg/kg-day		mg/kg-day	NA	NA	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	7.9E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.6E-02
	BARIUM	2.34E+02	mg/kg	2.34E+02		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	7.1E-08	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	2.8E-03
	CHROMIUM	1.63E+02	mg/kg	1.63E+02		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	1.77E+01	mg/kg	1.77E+01		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	8.35E+02	mg/kg	8.35E+02		mg/kg-day		mg/kg-day			
	IRON	6.95E+04	mg/kg	6.95E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	2.42E+03	mg/kg	2.42E+03		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	8.98E+00	mg/kg	8.98E+00		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	2.57E+01	mg/kg	2.57E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										6.2E-02
										Total Hazard Index Across All Exposure Routes/Pathways	**0.9**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.11 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	4.4E-05	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.2E-04
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	3.4E-07	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	6.8E-07
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.6E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.4E-06
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M	1.4E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M	2.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	2.3E-05	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	3.4E-05
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M	1.1E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	6.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M	7.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M	8.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M	3.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M	3.3E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M	1.1E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M	4.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M	1.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										3.6E-04
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	2.3E-05	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.6E-04
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	1.9E-07	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	3.8E-07
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.9E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.8E-07
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	2.7E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.1E-06
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	2.4E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										1.7E-04
										Total Risk Across All Exposure Routes/Pathways	5.E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.11a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE ADULT RESIDENTS TO SOIL (HYPOTHETICAL FUTURE - SURFACE SOIL)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,700	USEPA, July 2004	5,700	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, July 2004	0.01	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	

Unit Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-30) - RME = 4.70E-07
Cancer Dermal Intake (Ages 6-30) - RME = 1.87E-06
Cancer Ingestion Intake - CTE = 4.58E-08
Cancer Dermal Intake - CTE = 5.22E-08

Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-16) - RME = 1.96E-07
Cancer Ingestion Intake (Ages 17-30) - RME = 2.74E-07
Cancer Dermal Intake (Ages 6-16) - RME = 7.81E-07
Cancer Dermal Intake (Ages 17-30) - RME = 1.09E-06

Non-carcinogenic Chemicals
Noncancer Ingestion Intake - RME = 1.37E-06
Noncancer Dermal Intake - RME = 5.47E-06
Noncancer Ingestion Intake - CTE = 4.58E-07
Noncancer Dermal Intake - CTE = 5.22E-07

TABLE 7.11a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1 54E-01	mg/kg	1.54E-01	7.1E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.5E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	1.5E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.5E-02
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	3.5E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.5E-03
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	4.9E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.2E-03
	ARSENIC	1.25E+01	mg/kg	1.25E+01	5.7E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.9E-02
	BARIUM	7.64E+01	mg/kg	7.64E+01	3.5E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.7E-04
	CADMIUM	2.30E+00	mg/kg	2.30E+00	1.1E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.1E-03
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	9.3E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	3.1E-03
	COBALT	6.59E+00	mg/kg	6.59E+00	3.0E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.0E-02
	COPPER	9.36E+01	mg/kg	9.36E+01	4.3E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E-03
	IRON	2.68E+04	mg/kg	2.68E+04	1.2E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.8E-02
	MANGANESE	5.89E+02	mg/kg	5.89E+02	2.7E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	5.7E-03
	MERCURY	5.68E-01	mg/kg	5.68E-01	2.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.7E-04
	VANADIUM	1.67E+01	mg/kg	1.67E+01	7.6E-06	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	8.5E-04
	(total)										8.3E-02
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	1.1E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	5.6E-04
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	5.2E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	5.2E-04
	ALUMINUM	7.62E+03	mg/kg	7.62E+03		mg/kg-day		mg/kg-day	NA	NA	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	2.0E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.5E-04
	BARIUM	7 64E+01	mg/kg	7.64E+01		mg/kg-day		mg/kg-day	NA	NA	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	1.2E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	4.8E-05
	CHROMIUM	2.03E+01	mg/kg	2.03E+01		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	6.59E+00	mg/kg	6.59E+00		mg/kg-day		mg/kg-day	NA	NA	
	COPPER	9.36E+01	mg/kg	9.36E+01		mg/kg-day		mg/kg-day			
	IRON	2.68E+04	mg/kg	2.68E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	5.89E+02	mg/kg	5.89E+02		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	5.68E-01	mg/kg	5.68E-01		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.67E+01	mg/kg	1.67E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										1.8E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.08**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.11a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	1.6E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.2E-06
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	7.1E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.4E-08
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.5E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.3E-07
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	3.5E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	4.9E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	5.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	8.6E-07
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	3.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	1.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	9.3E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	3.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	4.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	1.2E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	2.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M	2.6E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	7.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										2.3E-06
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	2.4E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.8E-07
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	1.1E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	2.3E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	5.2E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	7.9E-09
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	2.0E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.9E-08
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	1.2E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										2.2E-07
										Total Risk Across All Exposure Routes/Pathways	3.E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.12
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, May 1993	Intake (mg/kg/day) = $\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	
	ET	Exposure Time	hours/day	24	USEPA, December 2002	24	USEPA, December 2002	
	EF	Exposure Frequency	days/year	350	IEPA, April 2004	234	USEPA, May 1993	
	ED	Exposure Duration	years	24	Professional Judgement	7	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8760	IEPA, Janaury 2003	2555	USEPA, December 1989	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.29E-01 Cancer Inhalation Intake(CTE) = 6.41E-02
Noncancer Inhalation Intake(RME) = 9.59E-01 Noncancer Inhalation Intake(CTE) = 6.41E-01

Cancer risk from inhalation = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from innhalation = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future	
Medium: Surface/Subsurface Soil	
Exposure Medium: Air	
Exposure Point:	Site 9
Receptor Population:	Resident
Receptor Age: Adult	Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS

Parameter	Value	Definition	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene		Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	0.00E+00	0.00E+00	0.00E+00
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.12. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	8.98E+00	mg/kg	6.6E-09	mg/m^3	R	6.3E-09	mg/m^3	3.0E-05	mg/m^3	2.1E-04
	(total)										2.11E-04
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0002**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.12. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	No carcinogenic COPCs for inhalation pathways										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4.12a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	Mean	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	$CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED$
	ET	Exposure Time	hours/day	24	USEPA, December 2002	24	USEPA, December 2002	
	EF	Exposure Frequency	days/year	350	IEPA, April 2004	234	USEPA, May 1993	$AT \times 24$
	ED	Exposure Duration	years	24	Professional Judgement	7	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8760	IEPA, Janaury 2003	2555	USEPA, December 1989	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 3.29E-01 Cancer Inhalation Intake(CTE) = 6.41E-02
Noncancer Inhalation Intake(RME) = 9.59E-01 Noncancer Inhalation Intake(CTE) = 6.41E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future	
Medium: Surface/Subsurface Soil	
Exposure Medium: Air	
Exposure Point:	Site 9
Receptor Population:	Resident
Receptor Age: Adult	Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene		Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	0.00E+00	0.00E+00	0.00E+00
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.12a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	5.70E-01	mg/kg	4.2E-10	mg/m^3	R	2.7E-10	mg/m^3	3.0E-05	mg/m^3	9.0E-06
	(total)										8.96E-06
										Total Hazard Index Across All Exposure Routes/Pathways	**0.000009**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.12a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF ADULT RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Unit Risk	Cancer Unit Risk Units	Cancer Risk
Inhalation	No carcinogenic COPCs for inhalation pathways										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

TABLE 4.13
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL (HYPOTHETICAL FUTURE)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF / BW x AT
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED / BW x AT
	SA	Skin Surface Area	cm^2/day	5,700	USEPA, July 2004	5,700	USEPA, July 2004	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, July 2004	0.01	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	

Unit Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-30) - RME = 4.70E-07
Cancer Dermal Intake (Ages 6-30) - RME = 1.87E-06

Cancer Ingestion Intake - CTE = 4.58E-08
Cancer Dermal Intake - CTE = 5.22E-08

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 1.96E-07
Cancer Ingestion Intake (Ages 17-30) - RME = 2.74E-07
Cancer Dermal Intake (Ages 6-16) - RME = 7.81E-07
Cancer Dermal Intake (Ages 17-30) - RME = 1.09E-06

Non-carcinogenic Chemicals

Noncancer Ingestion Intake - RME = 1.37E-06
Noncancer Dermal Intake - RME = 5.47E-06

Noncancer Ingestion Intake - CTE = 4.58E-07
Noncancer Dermal Intake - CTE = 5.22E-07

TABLE 7.13 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	5.4E-05	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00	6.3E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.2E-04
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	6.0E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.0E-02
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	7.7E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	7.7E-03
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	3.3E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.3E-02
	ARSENIC	8.50E+01	mg/kg	8.50E+01	1.2E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.9E-01
	CADMIUM	9.62E+00	mg/kg	9.62E+00	1.3E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.3E-02
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	4.7E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.6E-02
	COBALT	2.38E+01	mg/kg	2.38E+01	3.3E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.1E-01
	IRON	6.58E+04	mg/kg	6.58E+04	9.0E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.3E-01
	MANGANESE	1.69E+03	mg/kg	1.69E+03	2.3E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	4.9E-02
	MERCURY	4.84E-01	mg/kg	4.84E-01	6.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.2E-03
	VANADIUM	3.35E+01	mg/kg	3.35E+01	4.6E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	5.1E-03
	(total)										7.8E-01
Dermal	BAP EQUIVALENT (FULL DLs	3.94E+01	mg/kg	3.94E+01	2.8E-05	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.60E+00	mg/kg	4.60E+00		mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	3.4E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.7E-02
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	9.2E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	9.2E-04
	ALUMINUM	2.43E+04	mg/kg	2.43E+04		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	1.4E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.6E-02
	CADMIUM	9.62E+00	mg/kg	9.62E+00	5.3E-08	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	2.1E-03
	CHROMIUM	3.43E+01	mg/kg	3.43E+01		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	2.38E+01	mg/kg	2.38E+01		mg/kg-day		mg/kg-day	NA	NA	
	IRON	6.58E+04	mg/kg	6.58E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	1.69E+03	mg/kg	1.69E+03		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	4.84E-01	mg/kg	4.84E-01		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	3.35E+01	mg/kg	3.35E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										6.6E-02
										Total Hazard Index Across All Exposure Routes/Pathways	**0.8**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.13 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs)	3.94E+01	mg/kg	3.94E+01	mg/kg	M	3.4E-05	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.5E-04
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	2.1E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	4.1E-07
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	2.6E-12	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	4.0E-07
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M	1.1E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	4.0E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.0E-05
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	4.5E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M	1.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M	1.1E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M	3.1E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M	7.9E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M	2.3E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M	1.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										3.1E-04
Dermal	BAP EQUIVALENT (FULL DLs)	3.94E+01	mg/kg	3.94E+01	mg/kg	M	1.8E-05	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.3E-04
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	1.2E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	2.3E-07
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	3.2E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	4.7E-08
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	4.8E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7.2E-06
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	1.8E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.4E-04
										Total Risk Across All Exposure Routes/Pathways	4.E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.13a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL (HYPOTHETICAL FUTURE)
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	USEPA, May 1993	50	USEPA, May 1993	Csoil x IR x FI x EF x ED x CF
	FI	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,700	USEPA, July 2004	5,700	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, July 2004	0.01	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	USEPA, May 1993	
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	USEPA, May 1993	70	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	USEPA, December 1989	2,555	USEPA, December 1989	

Unit Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-30) - RME = 4.70E-07
Cancer Dermal Intake (Ages 6-30) - RME = 1.87E-06
Cancer Ingestion Intake - CTE = 4.58E-08
Cancer Dermal Intake - CTE = 5.22E-08

Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-16) - RME = 1.96E-07
Cancer Ingestion Intake (Ages 17-30) - RME = 2.74E-07
Cancer Dermal Intake (Ages 6-16) - RME = 7.81E-07
Cancer Dermal Intake (Ages 17-30) - RME = 1.09E-06

Non-carcinogenic Chemicals
Noncancer Ingestion Intake - RME = 1.37E-06
Noncancer Dermal Intake - RME = 5.47E-06
Noncancer Ingestion Intake - CTE = 4.58E-07
Noncancer Dermal Intake - CTE = 5.22E-07

TABLE 7.13a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	1.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.33E-01	mg/kg	4.33E-01	2.0E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	9.9E-06
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	3.2E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.6E-03
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	2.6E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	2.6E-03
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	4.3E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	4.3E-03
	ARSENIC	1.21E+01	mg/kg	1.21E+01	5.5E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.8E-02
	CADMIUM	1.24E+00	mg/kg	1.24E+00	5.7E-07	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5.7E-04
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	6.9E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.3E-03
	COBALT	8.90E+00	mg/kg	8.90E+00	4.1E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.4E-02
	IRON	2.70E+04	mg/kg	2.70E+04	1.2E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.8E-02
	MANGANESE	6.62E+02	mg/kg	6.62E+02	3.0E-04	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	6.4E-03
	MERCURY	9.99E-02	mg/kg	9.99E-02	4.6E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.5E-04
	VANADIUM	1.90E+01	mg/kg	1.90E+01	8.7E-06	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	9.7E-04
	(total)										6.9E-02
Dermal	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	1.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	NAPHTHALENE	4.33E-01		4.33E-01		mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	5.1E-09	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	2.6E-04
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	8.8E-14	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	8.8E-05
	ALUMINUM	9.34E+03	mg/kg	9.34E+03		mg/kg-day		mg/kg-day	NA	NA	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	1.9E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.3E-04
	CADMIUM	1.24E+00	mg/kg	1.24E+00	6.5E-10	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	2.6E-05
	CHROMIUM	1.51E+01	mg/kg	1.51E+01		mg/kg-day		mg/kg-day	NA	NA	
	COBALT	8.90E+00	mg/kg	8.90E+00		mg/kg-day		mg/kg-day	NA	NA	
	IRON	2.70E+04	mg/kg	2.70E+04		mg/kg-day		mg/kg-day	NA	NA	
	MANGANESE	6.62E+02	mg/kg	6.62E+02		mg/kg-day		mg/kg-day	NA	NA	
	MERCURY	9.99E-02	mg/kg	9.99E-02		mg/kg-day		mg/kg-day	NA	NA	
	VANADIUM	1.90E+01	mg/kg	1.90E+01		mg/kg-day		mg/kg-day	NA	NA	
	(total)										1.0E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.13a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE ADULT RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	mg/kg	M	1.1E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.8E-07
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	3.2E-09	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	6.4E-09
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	2.6E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.9E-08
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M	4.3E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	5.5E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.3E-07
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	5.7E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M	6.9E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M	4.1E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M	1.2E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M	3.0E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M	4.6E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M	8.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.6E-06
Dermal	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	mg/kg	M	1.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-07
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	5.1E-10	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-09
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	8.8E-15	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.3E-09
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	1.9E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.8E-08
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	6.5E-11	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.5E-07
										Total Risk Across All Exposure Routes/Pathways	**2.E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.14
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	2	U.S. EPA, May 1993	1.4	U.S. EPA, May 1993	Cgw x IRgw x EF x ED
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	BW x AT
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	U.S. EPA, May 1993	CDI = Chronic Daily Intake
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	18,000	U.S. EPA, July 2004	18,000	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	U.S. EPA, May 1993	of the text.
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	0.33	Professional Judgement	0.25	Professional Judgement	USEPA, July 2004
	t^*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake(RME) = 9.39E-03
Cancer Dermal Intake(RME) = 8.45E+01

Cancer Ingestion Intake(CTE) = 1.28E-03
Cancer Dermal Intake(CTE) = 1.65E+01

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 3.91E-03
Cancer Ingestion Intake (Ages 17-30) - RME = 5.48E-03
Cancer Dermal Intake (Ages 6-16) - RME = 3.52E+01
Cancer Dermal Intake (Ages 17-30) - RME = 4.93E+01

Non-carcinogenic Chemicals

Noncancer Ingestion Intake(RME) = 2.74E-02
Noncancer Dermal Intake(RME) = 2.47E+02

Noncancer Ingestion Intake(CTE) = 1.28E-02
Noncancer Dermal Intake(CTE) = 1.65E+02

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
REASONABLE MAXIMUM EXPOSURE (RME — FUTURE ADULT RESIDENTS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/02/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS: IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$

IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
BAP EQUIVALENT (FULL DL)	0.00006146	o	1.17E+01	3.30E-01	2.69E+00	7.01E-01	4.27E+00	1	1.12E-07
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	3.30E-01	6.82E+00	8.10E-01	5.60E+00	0.5	2.07E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	3.30E-01	3.30E+00	3.90E-01	2.50E+00	0.9	7.90E-06
BENZENE	0.00096	o	7.00E-01	3.30E-01	2.90E-01	1.50E-02	1.00E-01	1	1.23E-08
TETRACHLOROETHYLENE	0.00085	o	2.18E+00	3.30E-01	9.10E-01	3.30E-02	2.00E-01	1	4.25E-08
DELTA-BHC (ALPHA-BHC SURROGATE	0.00002	o	1.10E+01	3.30E-01	4.57E+00	1.10E-02	1.00E-01	0.9	6.72E-10
ARSENIC	0.00726	i		3.30E-01		1.00E-03		1	2.40E-09
CADMIUM	0.00345	i		3.30E-01		1.00E-03		1	1.14E-09
COBALT	0.0153	i		3.30E-01		1.00E-03		1	5.05E-09
IRON	34	i		3.30E-01		1.00E-03		1	1.12E-05
MANGANESE	5.4	i		3.30E-01		1.00E-03		1	1.78E-06

TABLE 7.14 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point Entire Site
Receptor Population Resident
Receptor Age Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	1 7E-06	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	3 4E-10	mg/kg-day	1 00E-09	1 00E-09	NA	NA	3 4E-01
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	2 1E-04	mg/kg-day	5 00E-03	5 00E-03	NA	NA	4 3E-02
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	2 6E-05	mg/kg-day	4 00E-03	4 00E-03	NA	NA	6 6E-03
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	2 3E-05	mg/kg-day	1 00E-02	1 00E-02	NA	NA	2 3E-03
	DELTA-BHC (ALPHA-BHC S	2 0E-05	mg/L	2 00E-05	mg/L	M	5 5E-07	mg/kg-day	8 00E-03	3 00E-04	NA	NA	6 8E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	2 0E-04	mg/kg-day	3 00E-04	5 00E-03	NA	NA	6 6E-01
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	9 5E-05	mg/kg-day	1 00E-03	5 00E-04	NA	NA	9 5E-02
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	4 2E-04	mg/kg-day	3 0E-04	3 0E-04	NA	NA	1 4E+00
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	9 3E-01	mg/kg-day	7 0E-01	7 0E-01	NA	NA	1 3E+00
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	1 5E-01	mg/kg-day	4 70E-02	4 70E-02	NA	NA	3 1E+00
	(total)												**7.0E+00**
Dermal	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	(2)	mg/kg-day			NA	NA	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1 23E-08	mg/L	M	(2)	mg/kg-day	1 00E-09	1 00E-09	NA	NA	NA
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	(2)	mg/kg-day	5 00E-03	5 00E-03	NA	NA	NA
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	3 0E-06	mg/kg-day	4 00E-03	4 00E-03	NA	NA	7 6E-04
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	1 0E-05	mg/kg-day	1 00E-02	1 00E-02	NA	NA	1 0E-03
	DELTA-BHC (ALPHA-BHC S	2 0E-05	mg/L	2 00E-05	mg/L	M	1 7E-07	mg/kg-day	8 00E-03	3 00E-04	NA	NA	2 1E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	5 9E-07	mg/kg-day	3 00E-04	5 00E-03	NA	NA	2 0E-03
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	2 8E-07	mg/kg-day	2 50E-05	2 50E-05	NA	NA	1 1E-02
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	1 2E-06	mg/kg-day	3 00E-04	3 00E-04	NA	NA	4 1E-03
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	2 8E-03	mg/kg-day	7 00E-01	7 00E-01	NA	NA	4 0E-03
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	4 4E-04	mg/kg-day	1 88E-03	1 88E-03	NA	NA	2 3E-01
	(total)												**2.6E-01**
												Total Hazard Index Across All Exposure Routes/Pathways	**7**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation

(2) Chemical with very high log Kow and therefore outside of the predictive range of the EPA dermal uptake model from water

NA = Not assessed for this pathway

TABLE 8.14 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: *Entire Site*
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	1.1E-06	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	7.7E-06
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	1.2E-10	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	1.7E-05
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	7.3E-05	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	2.9E-05
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	9.0E-06	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	5.0E-07
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	8.0E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	4.3E-06
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	1.9E-07	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	6.8E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-04
	(total)										**1.6E-04**
Dermal	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(2)	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	1.0E-06	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	5.7E-08
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	3.6E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-06
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	5.7E-08	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-07
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	2.0E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.0E-07
	(total)										**2.7E-06**
										Total Risk Across All Exposure Routes/Pathways	**1.7E-04**

TABLE 4.14a
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: *Future*
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	2	U.S. EPA, May 1993	1.4	U.S. EPA, May 1993	Cgw x IRgw x EF x ED / BW x AT
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U S. EPA, May 1993	
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	U.S. EPA, May 1993	CDI = Chronic Daily Intake
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	18,000	U.S. EPA, July 2004	18,000	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration (Age 6-16) - RME	years	10	USEPA, May 1993, 2005	7	U.S. EPA, May 1993	of the text.
	ED	Exposure Duration (Age 17-30) - RME	years	14	USEPA, May 1993, 2005	NA	NA	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	0.33	Professional Judgement	0.25	Professional Judgement	USEPA, July 2004
	t^*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake(RME) = 9.39E-03
Cancer Dermal Intake(RME) = 8.45E+01

Cancer Ingestion Intake(CTE) = 1.28E-03
Cancer Dermal Intake(CTE) = 1.65E+01

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 3.91E-03
Cancer Ingestion Intake (Ages 17-30) - RME = 5.48E-03
Cancer Dermal Intake (Ages 6-16) - RME = 3.52E+01
Cancer Dermal Intake (Ages 17-30) - RME = 4.93E+01

Non-carcinogenic Chemicals

Noncancer Ingestion Intake(RME) = 2.74E-02
Noncancer Dermal Intake(RME) = 2.47E+02

Noncancer Ingestion Intake(CTE) = 1.28E-02
Noncancer Dermal Intake(CTE) = 1.65E+02

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
CENTRAL TENDENCY EXPOSURE (CTE) — FUTURE ADULT RESIDENTS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/02/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS:
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
BAP EQUIVALENT (FULL DL)	0.06146	o	1.17E+01	2.50E-01	2.69E+00	7.01E-01	4.27E+00	1	9.77E-05
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	2.50E-01	6.82E+00	8.10E-01	5.60E+00	0.5	1.80E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	2.50E-01	3.30E+00	3.90E-01	2.50E+00	0.9	6.87E-06
BENZENE	0.00096	o	7.00E-01	2.50E-01	2.90E-01	1.50E-02	1.00E-01	1	1.07E-08
TETRACHLOROETHYLENE	0.00085	o	2.18E+00	2.50E-01	9.10E-01	3.30E-02	2.00E-01	1	3.70E-08
DELTA-BHC (ALPHA-BHC SURROGATE	0.00002	o	1.10E+01	2.50E-01	4.57E+00	1.10E-02	1.00E-01	0.9	5.85E-10
ARSENIC	0.00726	i		2.50E-01		1.00E-03		1	1.82E-09
CADMIUM	0.00345	i		2.50E-01		1.00E-03		1	8.63E-10
COBALT	0.0153	i		2.50E-01		1.00E-03		1	3.83E-09
IRON	34	i		2.50E-01		1.00E-03		1	8.50E-06
MANGANESE	5.4	i		2.50E-01		1.00E-03		1	1.35E-06

TABLE 7.14a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point Entire Site
Receptor Population Resident
Receptor Age Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	7 9E-07	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	1 6E-10	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	1 6E-01
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	1 0E-04	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	2 0E-02
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	1 2E-05	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	3 1E-03
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	1 1E-05	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	1 1E-03
	DELTA-BHC (ALPHA-BHC SURROGATE)	2 0E-05	mg/L	2 00E-05	mg/L	M	2 6E-07	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	3 2E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	9 3E-05	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	3 1E-01
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	4 4E-05	mg/kg-day	1 00E-03	mg/kg-day	NA	NA	4 4E-02
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	2 0E-04	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	6 5E-01
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	4 4E-01	mg/kg-day	7 0E-01	mg/kg-day	NA	NA	6 2E-01
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	6 9E-02	mg/kg-day	4 70E-02	mg/kg-day	NA	NA	1 5E+00
	(total)												**3.E+00**
Dermal	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	(2)	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	(2)	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	NA
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	(2)	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	NA
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	1 8E-06	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	4 4E-04
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	6 1E-06	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	6 1E-04
	DELTA-BHC (ALPHA-BHC SURROGATE)	2 0E-05	mg/L	2 00E-05	mg/L	M	9 6E-08	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	1 2E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	3 0E-07	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	1 0E-03
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	1 4E-07	mg/kg-day	2 50E-05	mg/kg-day	NA	NA	5 7E-03
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	6 3E-07	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	2 1E-03
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	1 4E-03	mg/kg-day	7 00E-01	mg/kg-day	NA	NA	2 0E-03
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	2 2E-04	mg/kg-day	1 88E-03	mg/kg-day	NA	NA	1 2E-01
	(total)												**1.3E-01**

Total Hazard Index Across All Exposure Routes/Pathways **3**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation

(2) Chemical with very high log Kow and therefore outside of the predictive range of the EPA dermal uptake model from water

NA = Not assessed for this pathway

TABLE 8.14a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL	6.1E-05	mg/L	6.15E-05	mg/L	M	7.9E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	5.8E-07
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	1.6E-11	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	2.4E-06
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	1.0E-05	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	4.0E-06
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	1.2E-06	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	6.8E-08
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	1.1E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	5.9E-07
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	2.6E-08	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.6E-07
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	9.3E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-05
	(total)										**2.2E-05**
Dermal	BAP EQUIVALENT (FULL	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	1.1E-04	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	1.8E-07	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	9.7E-09
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	6.1E-07	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	3.3E-07
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	9.6E-09	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	6.1E-08
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	3.0E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.5E-08
	(total)										**4.4E-07**
										Total Risk Across All Exposure Routes/Pathways	**2.2E-05**

TABLE 4-15
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURES
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Residents	Adult	Site 21 GW	S	Volatile Chemical Generation Rate	Derived	mg/m3-min shower	Foster&Chrostowski 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
				IRsh	Inhalation Rate of volatiles in shower	0.6	m3/hr	U.S. EPA, 1991	
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1991	S x IRsh x K x EF x ED
				K	Mass Transfer Coefficient	Derived	min	Foster&Chrostowski 1987	BW x AT x Ra x CF
				ED	Exposure Duration	24	years	U.S. EPA, 1991	
				BW	Body Weight	70	kg	U.S. EPA, 1991	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
				Ra	Air Exchange Rate	0.017	min-1	Foster&Chrostowski 1987	
				CF	Conversion Factor	60	min/hr		
				Ds	Shower Duration	15	min	U.S. EPA, 2004	
				Dt	Total Time in Bathroom	20	min	Professional judgement	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Noncancer)	8760	days	U.S. EPA ,1989	

Sources

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 1991: Risk Assessment Guidance for Superfund - Supplemental Guidance- Standard Default Exposure Factors Interim Final.

U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Foster, S.A. and P.C. Chrostowski, 1987. Inhalation Exposure to Volatile Organic Contaminants in the Shower.

0

Unit Intake Calculations (calculates a dose of mg/kg-day that is more consistent with Foster/Chrostowski model)

Inhalation Intake = (IRsh x EF x ED)/(BW x AT x Ra x CF)

Cancer Inhalation Intake = 2.82E-03 Noncancer Inhalation Intake = 8.22E-03

Volatilization From Showering
Source: Foster & Chrostowski, 1987.

Scenario Timeframe: Future	
Medium: Groundwater	
Exposure Medium: Air	
Exposure Point:	SWMU 3 - Old Jeep Trail
Receptor Population:	Residents
Receptor Age: Adult	Adult

Parameter	Value	Definition
Ra	0.0167	air exchange rate, (min^{-1})
Ds	15	shower duration, (min)
Dt	20	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	320	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	2.79	mass transfer coefficient, (min)

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cw (ug/L)	Volatile	MW (g/mole)	H (atm-m^3/mol	Kl (cm/hr)	Kg (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd mg/L	S	S x K	S x K
BENZENE	0.960	Y	7.81E+01	5.56E-03	15.01	1440.23	1.44E+01	1.90E+01	4.50E-04	3.75E-04	1.05E-03	1.05E-03
TETRACHLOROETHYLE	0.85	Y	1.66E+02	1.84E-02	10.30	988.38	1.02E+01	1.34E+01	3.06E-04	2.55E-04	7.12E-04	7.12E-04

TABLE 7.15. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Inhalation Reference Dose	Reference Dose Units	Hazard Quotient
Inhalation	BENZENE	9.60E-01	mg/L	1.0E-03	mg/m^3	R	8.6E-06	mg/kg-day	0.0086	mg/kg-day	1.0E-03
	TETRACHLOROETHYLENE	8.50E-01	mg/L	7.1E-04	mg/m^3	R	5.9E-06	mg/kg-day	0.077	mg/kg-day	7.6E-05
	(total)										1.08E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.001**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient

TABLE 8.15. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISK
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Risk Calculation[2]	Intake (Cancer)	Intake (Cancer) Units	Inhalation Cancer Slope Factor	CSFi Units	Cancer Risk
Inhalation	BENZENE	9.60E-01	mg/L	1.05E-03	mg/m^3	R	2.9E-06	mg/kg-day	2.7E-02	$(mg/kg\text{-}day)^{-1}$	8.0E-08
	TETRACHLOROETHYLENE	8.50E-01	mg/L	7.12E-04	mg/m^3	R	2.0E-06	mg/kg-day	2.1E-02	$(mg/kg\text{-}day)^{-1}$	4.1E-08
	(total)										1.2E-07
										Total Risk Across All Exposure Routes/Pathways	**1.2E-07**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient
[2] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4.15a
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Residents	Adult	Site 21 GW	S	Volatile Chemical Generation Rate	Derived	mg/m3-min shower	Foster&Chrostowski 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
				IRsh	Inhalation Rate of volatiles in shower	0.6	m3/hr	U.S. EPA, 1991	
				EF	Exposure Frequency	234	days/year	U.S. EPA, 1991	S x IRsh x K x EF x ED
				K	Mass Transfer Coefficient	Derived	min	Foster&Chrostowski 1987	BW x AT x Ra x CF
				ED	Exposure Duration	7	years	U.S. EPA, 1991	
				BW	Body Weight	70	kg	U.S. EPA, 1991	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
				Ra	Air Exchange Rate	0.016666667	min-1	Foster&Chrostowski 1987	
				CF	Conversion Factor	60	min/hr		
				Ds	Shower Duration	10	min	U.S. EPA, 2004	
				Dt	Total Time in Bathroom	15	min	Professional judgement	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Noncancer)	2555	days	U.S. EPA ,1989	

Sources

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 1991: Risk Assessment Guidance for Superfund - Supplemental Guidance- Standard Default Exposure Factors Interim Final.

U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Foster, S.A. and P.C. Chrostowski, 1987. Inhalation Exposure to Volatile Organic Contaminants in the Shower.

0

Volatilization From Showering
Source: Foster & Chrostowski, 1987.

Scenario Timeframe: Future	
Medium: Groundwater	
Exposure Medium: Air	
Exposure Point: Site 21 GW	
Receptor Population:	Residents
Receptor Age: Adult	Adult

Parameter	Value	Definition
Ra	0.0167	air exchange rate, (min^{-1})
Ds	10	shower duration, (min)
Dt	15	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	320	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	1.53	mass transfer coefficient, (min)

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cw (ug/L)	Volatile	MW (g/mole)	H (atm-m^3/mol	Kl (cm/hr)	Kg (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd mg/L	S	S x K	S x K
BENZENE	0.960	Y	7.81E+01	5.56E-03	15.01	1440.23	1.44E+01	1.90E+01	4.50E-04	3.75E-04	5.72E-04	5.72E-04
TETRACHLOROETHYLE	0.85	Y	1.66E+02	1.84E-02	10.30	988.38	1.02E+01	1.34E+01	3.06E-04	2.55E-04	3.89E-04	3.89E-04

TABLE 7.15a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Site 21 GW
Receptor Population:
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Inhalation Reference Dose	Reference Dose Units	Hazard Quotient
Inhalation	BENZENE	9.60E-01	mg/L	5.7E-04	mg/m^3	R	3.1E-06	mg/kg-day	0.0086	mg/kg-day	3.7E-04
	TETRACHLOROETHYLENE	8.50E-01	mg/L	3.9E-04	mg/m^3	R	2.1E-06	mg/kg-day	0.077	mg/kg-day	2.8E-05
	(total)										3.94E-04
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0004**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient

TABLE 8.15a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISK
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Adult Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Inhalation Cancer Slope Factor	CSFi Units	Cancer Risk
Inhalation	BENZENE	9.60E-01	mg/L	5.72E-04	mg/m^3		3.1E-07	mg/kg-day	2.7E-02	$(mg/kg\text{-}day)^{-1}$	8.6E-09
	TETRACHLOROETHYLENE	8.50E-01	mg/L	3.89E-04	mg/m^3		2.1E-07	mg/kg-day	2.1E-02	$(mg/kg\text{-}day)^{-1}$	4.4E-09
	(total)										1.3E-08
										Total Risk Across All Exposure Routes/Pathways	**1.3E-08**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient

TABLE 4.16
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	USEPA, May 1993	100	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	2,800	USEPA, July 2004	2,800	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.04	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	

Unit Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-30) - RME = 1.10E-06
Cancer Dermal Intake (Ages 6-30) - RME = 3.07E-06
Cancer Ingestion Intake - CTE = 1.22E-07
Cancer Dermal Intake - CTE = 1.37E-07

Mutagenic Chemicals
Cancer Ingestion Intake (Ages 0-2) - RME = 3.65E-07
Cancer Ingestion Intake (Ages 3-6) - RME = 7.31E-07
Cancer Dermal Intake (Ages 0-2) - RME = 1.02E-06
Cancer Dermal Intake (Ages 3-6) - RME = 2.05E-06

Non-carcinogenic Chemicals
Noncancer Ingestion Intake - RME = 1.28E-05
Noncancer Dermal Intake - RME = 3.58E-05
Noncancer Ingestion Intake - CTE = 4.27E-06
Noncancer Dermal Intake - CTE = 4.79E-06

TABLE 7.16 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	6.5E-04	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	9.2E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	4.6E-01
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	4.3E-10	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	4.3E-01
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	3.8E-01	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.8E-01
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	6.7E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.7E-01
	ARSENIC	4.84E+01	mg/kg	4.84E+01	6.2E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.1E+00
	BARIUM	2.34E+02	mg/kg	2.34E+02	3.0E-03	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.5E-02
	CADMIUM	1.30E+01	mg/kg	1.30E+01	1.7E-04	mg/kg-day	1 0E-03	mg/kg-day	NA	NA	1.7E-01
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	2.1E-03	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	6.9E-01
	COBALT	1.77E+01	mg/kg	1.77E+01	2.3E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.5E-01
	COPPER	8.35E+02	mg/kg	8.35E+02	1.1E-02	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.7E-01
	IRON	6.95E+04	mg/kg	6.95E+04	8.9E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.3E+00
	MANGANESE	2.42E+03	mg/kg	2.42E+03	3 1E-02	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	6.6E-01
	MERCURY	8.98E+00	mg/kg	8.98E+00	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.8E-01
	VANADIUM	2.57E+01	mg/kg	2.57E+01	3.3E-04	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	3.7E-02
	(total)										7.7E+00
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	2.4E-04	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	3.6E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.8E-01
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3 35E-05	3.6E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	3.6E-02
	ALUMINUM	2.95E+04	mg/kg	2.95E+04		mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	5.2E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1 7E-01
	BARIUM	2.34E+02	mg/kg	2.34E+02		mg/kg-day	2.0E-01	mg/kg-day	NA	NA	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	4.7E-07	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	1.9E-02
	CHROMIUM	1.63E+02	mg/kg	1.63E+02		mg/kg-day	7.5E-05	mg/kg-day	NA	NA	
	COBALT	1.77E+01	mg/kg	1.77E+01		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	COPPER	8.35E+02	mg/kg	8.35E+02		mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	IRON	6.95E+04	mg/kg	6.95E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	2.42E+03	mg/kg	2.42E+03		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	8.98E+00	mg/kg	8.98E+00		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	VANADIUM	2.57E+01	mg/kg	2.57E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										4.1E-01
										Total Hazard Index Across All Exposure Routes/Pathways	**8**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14 Cadmium - 0.001
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.16 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	3.0E-04	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-03
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	7.9E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.6E-06
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	3.7E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	5.5E-06
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M	3.2E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M	5.7E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	5.3E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.0E-05
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M	2.6E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	1.4E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M	1.8E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M	1.9E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M	9.2E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M	7.6E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M	2.7E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M	9.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M	2.8E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										2.2E-03
Dermal	BAP EQUIVALENT (FULL DLs	5.06E+01	mg/kg	5.06E+01	mg/kg	M	1.1E-04	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.9E-04
	AROCLOR 1260	7.20E-01	mg/kg	7.20E-01	mg/kg	M	3.1E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	6.2E-07
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	3.1E-12	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	4.6E-07
	ALUMINUM	2.95E+04	mg/kg	2.95E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ANTIMONY	5.22E+00	mg/kg	5.22E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	4.84E+01	mg/kg	4.84E+01	mg/kg	M	4.5E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.7E-06
	BARIUM	2.34E+02	mg/kg	2.34E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CADMIUM	1.30E+01	mg/kg	1.30E+01	mg/kg	M	4.0E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.63E+02	mg/kg	1.63E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	1.77E+01	mg/kg	1.77E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COPPER	8.35E+02	mg/kg	8.35E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.95E+04	mg/kg	6.95E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	2.42E+03	mg/kg	2.42E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	8.98E+00	mg/kg	8.98E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	2.57E+01	mg/kg	2.57E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										7.9E-04
										Total Risk Across All Exposure Routes/Pathways	3.0E-03

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.16a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	USEPA, May 1993	100	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	2,800	USEPA, July 2004	2,800	USEPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.04	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	

Unit Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals
Cancer Ingestion Intake (Ages 6-30) - RME = 1.10E-06
Cancer Dermal Intake (Ages 6-30) - RME = 3.07E-06
Cancer Ingestion Intake - CTE = 1.22E-07
Cancer Dermal Intake - CTE = 1.37E-07

Mutagenic Chemicals
Cancer Ingestion Intake (Ages 0-2) - RME = 3.65E-07
Cancer Ingestion Intake (Ages 3-6) - RME = 7.31E-07
Cancer Dermal Intake (Ages 0-2) - RME = 1.02E-06
Cancer Dermal Intake (Ages 3-6) - RME = 2.05E-06

Non-carcinogenic Chemicals
Noncancer Ingestion Intake - RME = 1.28E-05
Noncancer Dermal Intake - RME = 3.58E-05
Noncancer Ingestion Intake - CTE = 4.27E-06
Noncancer Dermal Intake - CTE = 4.79E-06

TABLE 7.16a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	1.5E-05	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	6.6E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.3E-02
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	1.4E-10	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	1.4E-01
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	3.3E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.3E-02
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	4.5E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.1E-02
	ARSENIC	1.25E+01	mg/kg	1.25E+01	5.3E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.8E-01
	BARIUM	7.64E+01	mg/kg	7.64E+01	3.3E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.6E-03
	CADMIUM	2.30E+00	mg/kg	2.30E+00	9.8E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	9.8E-03
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	8.7E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.9E-02
	COBALT	6.59E+00	mg/kg	6.59E+00	2.8E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.4E-02
	COPPER	9.36E+01	mg/kg	9.36E+01	4.0E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.0E-02
	IRON	2.68E+04	mg/kg	2.68E+04	1.1E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.6E-01
	MANGANESE	5.89E+02	mg/kg	5.89E+02	2.5E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	5.4E-02
	MERCURY	5.68E-01	mg/kg	5.68E-01	2.4E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.1E-03
	VANADIUM	1.67E+01	mg/kg	1.67E+01	7.1E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	7.9E-03
	(total)										7.7E-01
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	2.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	1.0E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	5.2E-03
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	4.8E-12	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	4.8E-03
	ALUMINUM	7.62E+03	mg/kg	7.62E+03		mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00		mg/kg-day	4.0E-04	mg/kg-day	NA	NA	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	1.8E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6 0E-03
	BARIUM	7.64E+01	mg/kg	7.64E+01		mg/kg-day	2.0E-01	mg/kg-day	NA	NA	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	1.1E-08	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	4.4E-04
	CHROMIUM	2.03E+01	mg/kg	2.03E+01		mg/kg-day	7.5E-05	mg/kg-day	NA	NA	
	COBALT	6.59E+00	mg/kg	6.59E+00		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	COPPER	9.36E+01	mg/kg	9.36E+01		mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	IRON	2.68E+04	mg/kg	2.68E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	5.89E+02	mg/kg	5.89E+02		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	5.68E-01	mg/kg	5.68E-01		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	VANADIUM	1.67E+01	mg/kg	1.67E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										1.6E-02
										Total Hazard Index Across All Exposure Routes/Pathways	**0.8**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14 Cadmium - 0.001

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.16a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	4.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.2E-06
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	1.9E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	3.8E-08
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	4.1E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	6.1E-07
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M	9.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M	1.3E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	1.5E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.3E-06
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M	9.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	2.8E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M	2.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M	8.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M	1.1E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M	3.3E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M	7.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5 68E-01	mg/kg	5.68E-01	mg/kg	M	6.9E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M	2.0E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										6.1E-06
Dermal	BAP EQUIVALENT (FULL DLs	3.57E+00	mg/kg	3.57E+00	mg/kg	M	6.3E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4 6E-07
	AROCLOR 1260	1.54E-01	mg/kg	1.54E-01	mg/kg	M	2.9E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	5.9E-09
	TCDD TEQs (FULL DLs)	3.35E-05	mg/kg	3.35E-05	mg/kg	M	1.4E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.1E-08
	ALUMINUM	7.62E+03	mg/kg	7.62E+03	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ANTIMONY	1.06E+00	mg/kg	1.06E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	ARSENIC	1.25E+01	mg/kg	1.25E+01	mg/kg	M	5.1E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	7.7E-08
	BARIUM	7.64E+01	mg/kg	7.64E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	CADMIUM	2.30E+00	mg/kg	2.30E+00	mg/kg	M	3.1E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	CHROMIUM	2.03E+01	mg/kg	2.03E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COBALT	6.59E+00	mg/kg	6.59E+00	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	COPPER	9.36E+01	mg/kg	9.36E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	IRON	2.68E+04	mg/kg	2.68E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MANGANESE	5.89E+02	mg/kg	5.89E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	MERCURY	5.68E-01	mg/kg	5.68E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	VANADIUM	1.67E+01	mg/kg	1.67E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										5.7E-07
										Total Risk Across All Exposure Routes/Pathways	7.E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.17
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	mean	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	$\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	BW	Body Weight	kg	15	USEPA, December 1989	15	USEPA, December 1989	
	IR	Inhalation Rate (2)	m3/hr	3.46E-01		3.46E-01		
	ET	Exposure Time	hours/day	24	USEPA, December 2002	24	USEPA, December 2002	
	EF	Exposure Frequency	days/year	350	IEPA, April 2004	234	USEPA, May 1993	
	ED	Exposure Duration	years	6	Professional Judgement	2	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2190	IEPA, Janaury 2003	730	USEPA, December 1989	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.22E-02 Cancer Inhalation Intake(CTE) = 1.83E-02
Noncancer Inhalation Intake(RME) = 9.59E-01 Noncancer Inhalation Intake(CTE) = 6.41E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

TABLE 7.17. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	8.98E+00	mg/kg	6.6E-09	mg/m^3	R	6.3E-09	mg/m^3	3.0E-05	mg/m^3	2.1E-04
	(total)										0.0002
										Total Hazard Index Across All Exposure Routes/Pathways	**0.0002**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.17. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor Inh.	Units	Cancer Risk
	No Carcinogenic COPCs for Inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4.17a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	USEPA, May 1993	mean	USEPA, May 1993	Intake (mg/kg/day) =
	VF	Volatilization factor - Chemical Specific	m^3/kg	(1)	USEPA, December 2002	(1)	USEPA, December 2002	
	PEF	Particulate emission factor	m^3/kg	1.36E+09	USEPA, December 2002	1.36E+09	USEPA, December 2002	$\frac{CS \times \left[\frac{1}{VF} + \frac{1}{PEF}\right] \times ET \times EF \times ED}{AT \times 24}$
	BW	Body Weight	kg	15	USEPA, December 1989	15	USEPA, December 1989	
	IR	Inhalation Rate (2)	m3/hr	3.46E-01		3.46E-01		
	ET	Exposure Time	hours/day	24	USEPA, December 2002	24	USEPA, December 2002	
	EF	Exposure Frequency	days/year	350	IEPA, April 2004	234	USEPA, May 1993	
	ED	Exposure Duration	years	6	Professional Judgement	2	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, December 1989	25550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2190	IEPA, Janaury 2003	730	USEPA, December 1989	

Notes:
(1) - Calculated according to USEPA Soil Screening Guidance, December 2002.

Daily Intake Calculations
Inhalation Intake = (ET x EF x ED x (1/PEF)+(1/VF)) / (AT x 24)

Cancer Inhalation Intake(RME) = 8.22E-02 Cancer Inhalation Intake(CTE) = 1.83E-02
Noncancer Inhalation Intake(RME) = 9.59E-01 Noncancer Inhalation Intake(CTE) = 6.41E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Cancer Inhalation Unit Risk (IUR)
Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Reference Air Concentration (RfCi)

CALCULATION OF AMBIENT AIR CONCENTRATION
SOURCE: U.S. EPA SOIL SCREENING GUIDANCE

Scenario Timeframe: Future	
Medium: Surface/Subsurface Soil	
Exposure Medium: Air	
Exposure Point:	
Receptor Population:	Resident
Receptor Age: Adult	Adult

Purpose: To calculate ambient air concentrations resulting from fugitive dust and volatilization from soil.

Relevant Equations:

$$Cair = Cs \times (1/PEF + 1/VF)$$

$$VF = \frac{Q/C \times (3.14 \times DA \times T)^{1/2} \times 10^{-4}\ m^2/cm^2}{2 \times pb \times DA}$$

$$DA = \frac{[(\theta a^{10/3} \times Di \times H + \theta w^{10/3} \times Dw)/n^2)]}{pb \times Kd + \theta w + \theta a \times H}$$

$$Csat = S/pb \times (Kd \times pb + \theta w + H \times \theta a)$$

INPUT PARAMTERS			
Parameter	**Value**	**Definition**	
Q/C = :	97.78	Inverse of mean conc. at center of source (g/m^2-s per kg/m^3).	
T = :	7.6E+08	Exposure interval (seconds).	
pb = :	1.5	Dry soil bulk density (g/cm^3).	
ps = :	2.65	soil particle density (g/cm^3).	
n = :	0.434	Total soil porosity (L_{pore}/L_{soil}).	
θw = :	0.15	Water-filled soil porosity (L_{pore}/L_{soil}).	
θa = :	0.284	Air-filled soil porosity (L_{air}/L_{soil}).	
Di = :	Chemical specific	Diffusivity in air (cm^2/sec).	
H' = :	Chemical specific	Dimensionless Henry's Law Constant.	
Dw = :	Chemical specific	Diffusivity in water (cm^2/sec).	
DA = :	Chemical specific	Apparent diffusivity (cm^2/sec).	
Kd = :	Chemical specific	Soil-water partition coefficient (cm^3/g).	
Koc = :	Chemical specific	Soil organic carbon partition coefficient (cm^3/g).	
foc = :	0.006	Fraction organic carbon in soil (g/g).	
F_D = :	1	dispersion correction factor	
V =:	0.5	Fraction of vegatative cover (unitless)	
Um =:	3.44	Mean annual wind speed (m/s)	
Ut =:	11.32	equivalent threshold value of windspeed at 7 m (m/s)	2.92
F(x) =:	0.0086	Function dependent on Um/Ut	0.0085
PEF = :	1.36E+09	Particulate emission factor (m^3/kg)	8.1E+10

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cs (mg/kg)	Volatile	Chemical Properties					Intermediate Calculations				Results		
			Koc (cm^3/g)	Di (cm^2/sec)	Dw (cm^2/sec)	S (mg/L)	H'	Kd (cm^3/g)	Da (cm^2/sec)	VF (m^3/kg)	Csat (mg/kg)	CaV (mg/m^3)	CaP (mg/m^3)	CaTot (mg/m^3)
All Soil														
naphthalene		Y	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	1.20E+01	5.15E-06	7.00E+04	3.75E+02	0.00E+00	0.00E+00	0.00E+00
tetrachloroethylene		Y	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	9.30E-01	2.47E-03	3.20E+03	2.35E+02	0.00E+00	0.00E+00	0.00E+00

TABLE 7.17a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Concentration Units	Hazard Quotient
Inhalation	MERCURY	5.70E-01	mg/kg	4.2E-10	mg/m^3	R	2.7E-10	mg/m^3	3.0E-05	mg/m^3	9.0E-06
	(total)										0.000009
										Total Hazard Index Across All Exposure Routes/Pathways	**0.000009**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

8.17a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF CHILD RESIDENTS BY INHALATION FROM SURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Child Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor Inh.	Units	Cancer Risk
	No Carcinogenic COPCs for inhalation pathway										
	(total)										0.0E+00
										Total Risk Across All Exposure Routes/Pathways	**0.0E+00**

TABLE 8.18. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs)	3.94E+01	mg/kg	3.94E+01	mg/kg	M	2.3E-04	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-03
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	4.8E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	9.6E-07
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	6.2E-12	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	9.2E-07
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M	2.7E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	9.3E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-04
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	1.1E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M	3.8E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M	2.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M	7.2E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M	1.9E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M	5.3E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M	3.7E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.8E-03
Dermal	BAP EQUIVALENT (FULL DLs)	3.94E+01	mg/kg	3.94E+01	mg/kg	M	8.4E-05	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.1E-04
	AROCLOR 1260	4.40E-01	mg/kg	4.40E-01	mg/kg	M	1.9E-07	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	3.8E-07
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	5.2E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	7.8E-08
	ALUMINUM	2.43E+04	mg/kg	2.43E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	8.50E+01	mg/kg	8.50E+01	mg/kg	M	7.8E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-05
	CADMIUM	9.62E+00	mg/kg	9.62E+00	mg/kg	M	3.0E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	3.43E+01	mg/kg	3.43E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	2.38E+01	mg/kg	2.38E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	6.58E+04	mg/kg	6.58E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	1.69E+03	mg/kg	1.69E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	4.84E-01	mg/kg	4.84E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	3.35E+01	mg/kg	3.35E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										6.2E-04
										Total Risk Across All Exposure Routes/Pathways	2.4E-03

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.18a
VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF FUTURE CHILD RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Ingestion Intake (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	USEPA, May 1993	100	USEPA, May 1993	Csoil x IR x Fi x EF x ED x CF / BW x AT
	Fi	Fraction Ingested	unitless	1	USEPA, May 1993	1	USEPA, May 1993	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	USEPA, December 2002	Mean	USEPA, May 1993	Dermal Intake (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	USEPA, December 1989	1.0E-06	USEPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED / BW x AT
	SA	Skin Surface Area	cm^2/day	2,800	USEPA, July 2004	2,800	USEPA, July 2004	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, July 2004	0.04	USEPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	USEPA, July 2004	chemical specific	USEPA, July 2004	
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	USEPA, May 1993	
	ED	Exposure Duration (Age 0-2) - RME	years	2	USEPA, May 1993, 2005)	2	USEPA, May 1993	
	ED	Exposure Duration (Age 3-6) - RME	years	4	USEPA, May 1993, 2005)	NA	NA	
	BW	Body Weight	kg	15	USEPA, May 1993	15	USEPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, December 1989	25,550	USEPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	USEPA, December 1989	730	USEPA, December 1989	

Unit Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-30) - RME = 1.10E-06
Cancer Dermal Intake (Ages 6-30) - RME = 3.07E-06

Cancer Ingestion Intake - CTE = 1.22E-07
Cancer Dermal Intake - CTE = 1.37E-07

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 0-2) - RME = 3.65E-07
Cancer Ingestion Intake (Ages 3-6) - RME = 7.31E-07
Cancer Dermal Intake (Ages 0-2) - RME = 1.02E-06
Cancer Dermal Intake (Ages 3-6) - RME = 2.05E-06

Non-carcinogenic Chemicals

Noncancer Ingestion Intake - RME = 1.28E-05
Noncancer Dermal Intake - RME = 3.58E-05

Noncancer Ingestion Intake - CTE = 4.27E-06
Noncancer Dermal Intake - CTE = 4.79E-06

TABLE 7.18a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	9.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	3.0E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.5E-02
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	2.4E-11	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	2.4E-02
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	4.0E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	4.0E-02
	ARSENIC	1.21E+01	mg/kg	1.21E+01	5.2E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.7E-01
	CADMIUM	1.24E+00	mg/kg	1.24E+00	5.3E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5.3E-03
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	6.5E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.2E-02
	COBALT	8.90E+00	mg/kg	8.90E+00	3.8E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.3E-01
	IRON	2.70E+04	mg/kg	2.70E+04	1.2E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.6E-01
	MANGANESE	6.62E+02	mg/kg	6.62E+02	2.8E-03	mg/kg-day	4.7E-02	mg/kg-day	NA	NA	6.0E-02
	MERCURY	9.99E-02	mg/kg	9.99E-02	4.3E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.4E-03
	VANADIUM	1.90E+01	mg/kg	1.90E+01	8.1E-05	mg/kg-day	9.0E-03	mg/kg-day	NA	NA	9.0E-03
	(total)										6.4E-01
Dermal	BAP EQUIVALENT (FULL DLs	2.32E+00	mg/kg	2.32E+00	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	4.7E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	2.4E-03
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	8.1E-13	mg/kg-day	1.0E-09	mg/kg-day	NA	NA	8.1E-04
	ALUMINUM	9.34E+03	mg/kg	9.34E+03		mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	1.7E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.8E-03
	CADMIUM	1.24E+00	mg/kg	1.24E+00	5.9E-09	mg/kg-day	2.5E-05	mg/kg-day	NA	NA	2.4E-04
	CHROMIUM	1.51E+01	mg/kg	1.51E+01		mg/kg-day	7.5E-05	mg/kg-day	NA	NA	
	COBALT	8.90E+00	mg/kg	8.90E+00		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	IRON	2.70E+04	mg/kg	2.70E+04		mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	MANGANESE	6.62E+02	mg/kg	6.62E+02		mg/kg-day	1.9E-03	mg/kg-day	NA	NA	
	MERCURY	9.99E-02	mg/kg	9.99E-02		mg/kg-day	3.0E-04	mg/kg-day	NA	NA	
	VANADIUM	1.90E+01	mg/kg	1.90E+01		mg/kg-day	9.0E-03	mg/kg-day	NA	NA	
	(total)										9.2E-03
										Total Hazard Index Across All Exposure Routes/Pathways	1

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14 Cadmium - 0.001

PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 8.18a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF HYPOTHETICAL FUTURE CHILD RESIDENTS TO SUBSURFACE SOIL
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL DLs)	2.32E+00	mg/kg	2.32E+00	mg/kg	M	2.8E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.1E-06
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	8.6E-09	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-08
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	6.9E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.0E-07
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M	1.1E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	1.5E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-06
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	1.5E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M	1.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M	1.1E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M	3.3E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M	8.1E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M	1.2E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M	2.3E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										4.4E-06
Dermal	BAP EQUIVALENT (FULL DLs)	2.32E+00	mg/kg	2.32E+00	mg/kg	M	4.1E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.0E-07
	AROCLOR 1260	7.04E-02	mg/kg	7.04E-02	mg/kg	M	1.3E-09	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	2.7E-09
	TCDD TEQs (FULL DLs)	5.62E-06	mg/kg	5.62E-06	mg/kg	M	2.3E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.5E-09
	ALUMINUM	9.34E+03	mg/kg	9.34E+03	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	ARSENIC	1.21E+01	mg/kg	1.21E+01	mg/kg	M	4.9E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7.4E-08
	CADMIUM	1.24E+00	mg/kg	1.24E+00	mg/kg	M	1.7E-10	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	CHROMIUM	1.51E+01	mg/kg	1.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	COBALT	8.90E+00	mg/kg	8.90E+00	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	IRON	2.70E+04	mg/kg	2.70E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MANGANESE	6.62E+02	mg/kg	6.62E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	MERCURY	9.99E-02	mg/kg	9.99E-02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	VANADIUM	1.90E+01	mg/kg	1.90E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										3.8E-07
										Total Risk Across All Exposure Routes/Pathways	4.8E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

Dioxins/furans - 0.03 Arsenic - 0.03 Aroclor 1260 - 0.14
PAHs - 0.13 Other Metals and Volatiles - not evaluated for dermal contact with soil.

TABLE 4.19
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	1.5	USEPA, August 1997	0.66	U.S. EPA, May 1993	Cgw x IRgw x EF x ED
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	U.S. EPA, May 1993	BW x AT
	ED	Exposure Duration (Age 6-16) - RME	years	2	USEPA, May 1993, 2005	2	U.S. EPA, May 1993	CDI = Chronic Daily Intake
	ED	Exposure Duration (Age 17-30) - RME	years	4	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	6,600	U.S. EPA, July 2004	6,600	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration (Age 6-16) - RME	years	2	USEPA, May 1993, 2005	2	U.S. EPA, May 1993	of the text.
	ED	Exposure Duration (Age 17-30) - RME	years	4	USEPA, May 1993, 2005	NA	NA	
	EF	Exposure Frequency	days/year	350	U.S EPA, May 1993	234	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	0.33	Professional Judgement	0.25	Professional Judgement	USEPA, July 2004
	t*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake(RME) = 8.22E-03
Cancer Dermal Intake(RME) = 3.62E+01

Cancer Ingestion Intake(CTE) = 8.06E-04
Cancer Dermal Intake(CTE) = 8.06E+00

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 2.74E-03
Cancer Ingestion Intake (Ages 17-30) - RME = 5.48E-03
Cancer Dermal Intake (Ages 6-16) - RME = 1.21E+01
Cancer Dermal Intake (Ages 17-30) - RME = 2.41E+01

Non-carcinogenic Chemicals

Noncancer Ingestion Intake(RME) = 9.59E-02
Noncancer Dermal Intake(RME) = 4.22E+02

Noncancer Ingestion Intake(CTE) = 8.06E-03
Noncancer Dermal Intake(CTE) = 8.06E+01

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
REASONABLE MAXIMUM EXPOSURE (RME — FUTURE CHILD RESIDENTS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/02/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS:
IF tevent < t*, DAevent = 2FA x Kp x C x CF x (6T x tevent/3.1416)$^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x ((tevent/(1 + B)) + (2T x ((1+3B+3B^2)/(1 + B)^2)))

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
BAP EQUIVALENT (FULL DL)	0.00006146	o	1.17E+01	3.30E-01	2.69E+00	7.01E-01	4.27E+00	1	1.12E-07
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	3.30E-01	6.82E+00	8.10E-01	5.60E+00	0.5	2.07E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	3.30E-01	3.30E+00	3.90E-01	2.50E+00	0.9	7.90E-06
BENZENE	0.00096	o	7.00E-01	3.30E-01	2.90E-01	1.50E-02	1.00E-01	1	1.23E-08
TETRACHLOROETHYLENE	0.00085	o	2.18E+00	3.30E-01	9.10E-01	3.30E-02	2.00E-01	1	4.25E-08
DELTA-BHC (ALPHA-BHC SURROGATE	0.00002	o	1.10E+01	3.30E-01	4.57E+00	1.10E-02	1.00E-01	0.9	6.72E-10
ARSENIC	0.00726	i		3.30E-01		1.00E-03		1	2.40E-09
CADMIUM	0.00345	i		3.30E-01		1.00E-03		1	1.14E-09
COBALT	0.0153	i		3.30E-01		1.00E-03		1	5.05E-09
IRON	34	i		3.30E-01		1.00E-03		1	1.12E-05
MANGANESE	5.4	i		3.30E-01		1.00E-03		1	1.78E-06

TABLE 7.19 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point Entire Site
Receptor Population Resident
Receptor Age Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL	6 1E-05	mg/L	6 15E-05	mg/L	M	5 9E-06	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	1 2E-09	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	1
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	7 5E-04	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	0 1
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	9 2E-05	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	0 023
	TETRACHLOROETHYLEN	8 5E-04	mg/L	8 50E-04	mg/L	M	8 2E-05	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	0 008
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	1 9E-06	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	0 0002
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	7 0E-04	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	2 3
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	3 3E-04	mg/kg-day	1 00E-03	mg/kg-day	NA	NA	0 3
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	1 5E-03	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	4 9
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	3 3E+00	mg/kg-day	7 0E-01	mg/kg-day	NA	NA	4 7
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	5 2E-01	mg/kg-day	0 047	mg/kg-day	NA	NA	11 1
	(total)												**25**
Dermal	BAP EQUIVALENT (FULL	6 1E-05	mg/L	6 15E-05	mg/L	M	(2)	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	(2)	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	NA
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	(2)	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	NA
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	5 2E-06	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	0 0013
	TETRACHLOROETHYLEN	8 5E-04	mg/L	8 50E-04	mg/L	M	1 8E-05	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	0 0018
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2 00E-05	mg/L	M	2.8E-07	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	0 0000
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	1 0E-06	mg/kg-day	*3 00E-04*	mg/kg-day	NA	NA	0 0034
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	4 8E-07	mg/kg-day	2 50E-05	mg/kg-day	NA	NA	0 0192
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	2 1E-06	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	0 0071
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	4 7E-03	mg/kg-day	7 00E-01	mg/kg-day	NA	NA	0 0068
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	7 5E-04	mg/kg-day	1 87E-03	mg/kg-day	NA	NA	0 4
	(total)												0 4
										Total Hazard Index Across All Exposure Routes/Pathways			**25**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation

(2) Chemical with very high log Kow and therefore outside of the predictive range of the EPA dermal uptake model from water

NA = Not assessed for this pathway

TABLE 8.19 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	8.4E-07	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	6.1E-06
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	1.0E-10	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	1.5E-05
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	6.4E-05	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	2.6E-05
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	7.9E-06	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	4.3E-07
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	7.0E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	3.8E-06
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	1.6E-07	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-06
	ARSENIC	7.3E-03	0E+00	7.26E-03	0E+00	M	6.0E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	9.0E-05
	(total)										**1.4E-04**
Dermal	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(2)	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	4.5E-07	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	2.4E-08
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	1.5E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	8.3E-07
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	2.4E-08	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	8.7E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.3E-07
	(total)										**1.1E-06**
										Total Risk Across All Exposure Routes/Pathways	**1.4E-04**

TABLE 4.19a
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF
FUTURE CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	Ingestion CDI (mg/kg/day) =
	IRgw	Water Ingestion Rate	L/day	1.5	USEPA, August 1997	0.66	U.S. EPA, May 1993	Cgw x IRgw x EF x ED
	EF	Exposure Frequency	days/year	350	USEPA, May 1993	234	U.S. EPA, May 1993	BW x AT
	ED	Exposure Duration (Age 6-16) - RME	years	2	USEPA, May 1993, 2005	2	U.S. EPA, May 1993	CDI = Chronic Daily Intake
	ED	Exposure Duration (Age 17-30) - RME	years	4	USEPA, May 1993, 2005	NA	NA	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	USEPA, December 1989
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	Maximum	U.S. EPA, December 2002	Maximum	U.S. EPA, December 2002	The equations and parameters for
	A	Skin Surface Area	cm^2	6,600	U.S. EPA, July 2004	6,600	U.S. EPA, July 2004	for estimating DAevent and the chemical-
	DAevent	Absorbed Dose per Event	mg/cm^2-event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	specific dermally absorbed dose from
	EV	Event Frequency	event/day	1	Professional Judgement	1	Professional Judgement	water (DAD) are provided in Section 6.2.4.4
	ED	Exposure Duration (Age 6-16) - RME	years	2	USEPA, May 1993, 2005	2	U.S. EPA, May 1993	of the text.
	ED	Exposure Duration (Age 17-30) - RME	years	4	USEPA, May 1993, 2005	NA	NA	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	
	t_{event}	Duration of Event	hour/event	0.33	Professional Judgement	0.25	Professional Judgement	USEPA, July 2004
	t*	Time to reach steady state	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	T	Lag Time	hour/event	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	B	Bunge Model Constant	dimensionless	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	Kp	Permeability Coefficient from Water	cm/hour	chemical-specific	U.S. EPA, July 2004	chemical-specific	U.S. EPA, July 2004	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	

Daily Intake Calculations

Ingestion Intake = (IRgw x EF x ED) / (BW x AT)
Dermal Intake = (A x EV x ED x EF) / (BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake(RME) = 8.22E-03
Cancer Dermal Intake(RME) = 3.62E+01

Cancer Ingestion Intake(CTE) = 8.06E-04
Cancer Dermal Intake(CTE) = 8.06E+00

Mutagenic Chemicals

Cancer Ingestion Intake (Ages 6-16) - RME = 2.74E-03
Cancer Ingestion Intake (Ages 17-30) - RME = 5.48E-03
Cancer Dermal Intake (Ages 6-16) - RME = 1.21E+01
Cancer Dermal Intake (Ages 17-30) - RME = 2.41E+01

Non-carcinogenic Chemicals

Noncancer Ingestion Intake(RME) = 9.59E-02
Noncancer Dermal Intake(RME) = 4.22E+02

Noncancer Ingestion Intake(CTE) = 2.82E-02
Noncancer Dermal Intake(CTE) = 2.82E+02

CALCULATION OF DAevent - EXPOSURES THROUGH DERMAL CONTACT WITH GROUNDWATER
CENTRAL TENDENCY EXPOSURE (CTE) — FUTURE CHILD RESIDENTS TO GROUNDWATER

SITE NAME: SITE 21 - BUILDING 1517
LOCATION: NAVAL STATION GREAT LAKES, ILLINOIS
DATE: 02/02/11

REFERENCES: U.S. EPA, July 2004

DERMAL CONTACT:

DAD = (DAevent x EV x ED x EF x A)/(BW x AT)

WHERE: DAD = DERMALLY ABSORBED DOSE (MG/KG/DAY)
DAevent = ABSORBED DOSE PER EVENT (MG/CM^2/EVENT)
A = SKIN SURFACE AREA AVAILABLE FOR CONTACT(CM^2)
EV = EVENT FREQUENCY (EVENTS/DAY)
ED = EXPOSURE DURATION (YEARS)
EF = EXPOSURE FREQUENCY (DAYS/YEAR)
BW = BODY WEIGHT(KG)
AT = AVERAGING TIME (DAYS)

FOR INORGANICS: DAevent = Kp x C x tevent x CF

FOR ORGANICS:
IF tevent < t*, DAevent = 2FA x Kp x C x CF x $(6T \times tevent/3.1416)^{0.5}$
IF tevent > t*, DAevent = FA x Kp x C x CF x $((tevent/(1 + B)) + (2T \times ((1+3B+3B^2)/(1 + B)^2)))$

WHERE:
FA = FRACTION ABSORBED (DIMENSIONLESS)
Kp = PERMEABILITY COEFFICIENT FROM WATER (CM/HR)
C = CONCENTRATION OF CHEMICAL IN WATER (MG/L)
tevent = DURATION OF EVENT (HR/EVENT)
CF = CONVERSION FACTOR (1L/1000 CM^3)
t* = TIME IT TAKES TO REACH STEADY-STATE (HOUR/EVENT)
T = LAG TIME (HOUR/EVENT)
B = BUNGE MODEL CONSTANT (DIMENSIONLESS)

CHEMICAL	GW CONC. (mg/L)	ORGANIC OR INORGANIC?	t* (HR)	tevent	T (HR)	Kp (CM/HR)	B	FA	DAevent
BAP EQUIVALENT (FULL DL)	0.00006146	o	1.17E+01	2.50E-01	2.69E+00	7.01E-01	4.27E+00	1	9.77E-08
TCDD TEQs (FULL DLs)	1.23E-08	o	3.01E+01	2.50E-01	6.82E+00	8.10E-01	5.60E+00	0.5	1.80E-11
PENTACHLOROPHENOL	0.0078	o	1.38E+01	2.50E-01	3.30E+00	3.90E-01	2.50E+00	0.9	6.87E-06
BENZENE	0.00096	o	7.00E-01	2.50E-01	2.90E-01	1.50E-02	1.00E-01	1	1.07E-08

TABLE 7.19a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point Entire Site
Receptor Population Resident
Receptor Age Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	1 7E-06	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	3 5E-10	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	3 5E-01
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	2 2E-04	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	4 4E-02
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	2 7E-05	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	6 8E-03
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	2 4E-05	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	2 4E-03
	DELTA-BHC (ALPHA-BHC SURROGATE)	2 0E-05	mg/L	2 00E-05	mg/L	M	5 6E-07	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	7 1E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	2 0E-04	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	6 8E-01
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	9 7E-05	mg/kg-day	1 00E-03	mg/kg-day	NA	NA	9 7E-02
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	4 3E-04	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	1 4E+00
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	9 6E-01	mg/kg-day	7 0E-01	mg/kg-day	NA	NA	1 4E+00
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	1 5E-01	mg/kg-day	4 70E-02	mg/kg-day	NA	NA	3 2E+00
	(total)												**7.2E+00**
Dermal	BAP EQUIVALENT (FULL DL	6 1E-05	mg/L	6 15E-05	mg/L	M	(2)	mg/kg-day		mg/kg-day	NA	NA	NA
	TCDD TEQs (FULL DLs)	1 2E-08	mg/L	1 23E-08	mg/L	M	(2)	mg/kg-day	1 00E-09	mg/kg-day	NA	NA	NA
	PENTACHLOROPHENOL	7 8E-03	mg/L	7 80E-03	mg/L	M	(2)	mg/kg-day	5 00E-03	mg/kg-day	NA	NA	NA
	BENZENE	9 6E-04	mg/L	9 60E-04	mg/L	M	3 0E-06	mg/kg-day	4 00E-03	mg/kg-day	NA	NA	7 6E-04
	TETRACHLOROETHYLENE	8 5E-04	mg/L	8 50E-04	mg/L	M	1 0E-05	mg/kg-day	1 00E-02	mg/kg-day	NA	NA	1 0E-03
	DELTA-BHC (ALPHA-BHC SURROGATE)	2 0E-05	mg/L	2 00E-05	mg/L	M	1 7E-07	mg/kg-day	8 00E-03	mg/kg-day	NA	NA	2 1E-05
	ARSENIC	7 3E-03	mg/L	7 26E-03	mg/L	M	5 1E-07	mg/kg-day	*3 00E-04*	mg/kg-day	NA	NA	1 7E-03
	CADMIUM	3 5E-03	mg/L	3 45E-03	mg/L	M	2 4E-07	mg/kg-day	2 50E-05	mg/kg-day	NA	NA	9 7E-03
	COBALT	1 5E-02	mg/L	1 53E-02	mg/L	M	1 1E-06	mg/kg-day	3 00E-04	mg/kg-day	NA	NA	3 6E-03
	IRON	3 4E+01	mg/L	3 40E+01	mg/L	M	2 4E-03	mg/kg-day	7 00E-01	mg/kg-day	NA	NA	3 4E-03
	MANGANESE	5 4E+00	mg/L	5 40E+00	mg/L	M	3 8E-04	mg/kg-day	1 88E-03	mg/kg-day	NA	NA	2 0E-01
	(total)												**2.2E-01**
										Total Hazard Index Across All Exposure Routes/Pathways			**7**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation

(2) Chemical with very high log Kow and therefore outside of the predictive range of the EPA dermal uptake model from water

NA = Not assessed for this pathway

TABLE 8.19a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RESIDENTS TO GROUNDWATER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	5.0E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-07
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	9.9E-12	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	1.5E-06
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	6.3E-06	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	2.5E-06
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	7.7E-07	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	4.3E-08
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	6.9E-07	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	3.7E-07
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	1.6E-08	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-07
	ARSENIC	7.3E-03	0E+00	7.26E-03	0E+00	M	5.9E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.8E-06
	(total)										**1.4E-05**
Dermal	BAP EQUIVALENT (FULL I	6.1E-05	mg/L	6.15E-05	mg/L	M	(2)	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	NA
	TCDD TEQs (FULL DLs)	1.2E-08	mg/L	1.23E-08	mg/L	M	(2)	mg/kg-day	1.50E+05	$(mg/kg\text{-}day)^{-1}$	NA
	PENTACHLOROPHENOL	7.8E-03	mg/L	7.80E-03	mg/L	M	(2)	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
	BENZENE	9.6E-04	mg/L	9.60E-04	mg/L	M	8.6E-08	mg/kg-day	5.50E-02	$(mg/kg\text{-}day)^{-1}$	4.8E-09
	TETRACHLOROETHYLEN	8.5E-04	mg/L	8.50E-04	mg/L	M	3.0E-07	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	1.6E-07
	DELTA-BHC (ALPHA-BHC SURROGATE)	2.0E-05	mg/L	2.00E-05	mg/L	M	4.7E-09	mg/kg-day	6.30E+00	$(mg/kg\text{-}day)^{-1}$	3.0E-08
	ARSENIC	7.3E-03	mg/L	7.26E-03	mg/L	M	1.5E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-08
	(total)										**2.2E-07**
										Total Risk Across All Exposure Routes/Pathways	**1.4E-05**

TABLE 4-20
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURES
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Residents	Child	Site 21 GW	S	Volatile Chemical Generation Rate	Derived	mg/m3-min shower	Foster&Chrostowski 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
				IRsh	Inhalation Rate of volatiles in shower	0.6	m3/hr	U.S. EPA, 1991	
				EF	Exposure Frequency	350	days/year	U.S. EPA, 1991	S x IRsh x K x EF x ED / BW x AT x Ra x CF
				K	Mass Transfer Coefficient	Derived	min	Foster&Chrostowski 1987	
				ED	Exposure Duration	6	years	U.S. EPA, 1991	
				BW	Body Weight	15	kg	U.S. EPA, 1991	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
				Ra	Air Exchange Rate	0.017	min-1	Foster&Chrostowski 1987	
				CF	Conversion Factor	60	min/hr		
				Ds	Shower Duration	15	min	U.S. EPA, 2004	
				Dt	Total Time in Bathroom	20	min	Professional judgement	
				AT-C	Averaging Time (Cancer)	25550	days	U.S. EPA, 1989	
				AT-N	Averaging Time (Noncancer)	2190	days	U.S. EPA ,1989	

Sources

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 1991: Risk Assessment Guidance for Superfund - Supplemental Guidance- Standard Default Exposure Factors Interim Final.

U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Foster, S.A. and P.C. Chrostowski, 1987. Inhalation Exposure to Volatile Organic Contaminants in the Shower.

Unit Intake Calculations (calculates a dose of mg/kg-day that is more consistent with Foster/Chrostowski model)

Inhalation Intake = (IRsh x EF x ED)/(BW x AT x Ra x CF)

Cancer Inhalation Intake = 3.29E-03 Noncancer Inhalation Intake = 3.84E-02

Volatilization From Showering
Source: Foster & Chrostowski, 1987.

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point:
Receptor Population:
Receptor Age: Child

Parameter	Value	Definition
Ra	0.0167	air exchange rate, (min^{-1})
Ds	15	shower duration, (min)
Dt	20	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	320	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	2.79	mass transfer coefficient, (min)

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cw (ug/L)	Volatile	MW (g/mole)	H (atm-m^3/mol	Kl (cm/hr)	Kg (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd mg/L	S	S x K	S x K
BENZENE	0.960	Y	7.81E+01	5.56E-03	15.01	1440.23	1.44E+01	1.90E+01	4.50E-04	3.75E-04	1.05E-03	1.05E-03
TETRACHLOROETHYLE	0.85	Y	1.66E+02	1.84E-02	10.30	988.38	1.02E+01	1.34E+01	3.06E-04	2.55E-04	7.12E-04	7.12E-04

TABLE 7.20. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Inhalation Reference Dose	Reference Dose Units	Hazard Quotient
Inhalation	BENZENE	9.60E-01	mg/L	1.0E-03	mg/m^3	R	4.0E-05	mg/kg-day	0.0086	mg/kg-day	4.7E-03
	TETRACHLOROETHYLENE	8.50E-01	mg/L	7.1E-04	mg/m^3	R	2.7E-05	mg/kg-day	0.077	mg/kg-day	3.5E-04
	(total)										5.03E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.005**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient

TABLE 8.20. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISK
EXPOSURE OF ADULT RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Risk Calculation [2]	Intake (Cancer)	Intake (Cancer) Units	Inhalation Cancer Slope Factor	CSFi Units	Cancer Risk
Inhalation	BENZENE	9.60E-01	mg/L	1.05E-03	mg/m^3	R	3.4E-06	mg/kg-day	2.7E-02	$(mg/kg\text{-}day)^{-1}$	9.4E-08
	TETRACHLOROETHYLENE	8.50E-01	mg/L	7.12E-04	mg/m^3	R	2.3E-06	mg/kg-day	2.1E-02	$(mg/kg\text{-}day)^{-1}$	4.8E-08
	(total)										1.4E-07
										Total Risk Across All Exposure Routes/Pathways	**1.4E-07**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient
[2] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 4-20a
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Residents	Child	Site 21 GW	S	Volatile Chemical Generation Rate	Derived	mg/m3-min shower	Foster&Chrostowski , 1987	Chronic Daily Intake (CDI) (mg/kg-day)=
				IRsh	Inhalation Rate of volatiles in shower	0.6	m3/hr	USEPA, December 1989	
				EF	Exposure Frequency	350	days/year	USEPA, May 1993	S x IRsh x K x EF x ED / BW x AT x Ra x CF
				K	Mass Transfer Coefficient	Derived	min	Foster&Chrostowski , 1987	
				ED	Exposure Duration	2	years	USEPA, May 1993	
				BW	Body Weight	15	kg	USEPA, May 1993	K = Ds + exp(-Ra x Dt)/Ra - [exp(Ra) x (Ds-Dt)]/Ra
				Ra	Air Exchange Rate	0.017	min-1	Foster&Chrostowski , 1987	
				CF	Conversion Factor	60	min/hr		
				Ds	Shower Duration	10	min	Professional Judgement	
				Dt	Total Time in Bathroom	15	min	Professional Judgement	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, December 1989	
				AT-N	Averaging Time (Noncancer)	730	days	USEPA, December 1989	

Sources

U.S. EPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

U.S. EPA, 1991: Risk Assessment Guidance for Superfund - Supplemental Guidance- Standard Default Exposure Factors Interim Final.

U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Foster, S.A. and P.C. Chrostowski, 1987. Inhalation Exposure to Volatile Organic Contaminants in the Shower.

Unit Intake Calculations (calculates a dose of mg/kg-day that is more consistent with Foster/Chrostowski model)

Inhalation Intake = (IRsh x EF x ED)/(BW x AT x Ra x CF)

Cancer Inhalation Intake = 1.10E-03 Noncancer Inhalation Intake = 3.84E-02

Volatilization From Showering
Source: Foster & Chrostowski, 1987.

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air
Exposure Point:
Receptor Population:
Receptor Age: Child

Parameter	Value	Definition
Ra	0.0167	air exchange rate, (min^{-1})
Ds	10	shower duration, (min)
Dt	15	total time in bathroom, (min)
Fr	10	shower water flow rate, (L/min)
Sv	12	shower room air volume, (m^3)
ts	2	shower dropler drop time, (sec)
d	1	shower droplet diameter, (mm)
T1	293	calibration water temperature, (K)
Ts	320	shower water temperature, (K)
m1	0.982	water viscosity at T1, (cp)
ms	0.616	water viscosity at Ts, (cp)
K	1.53	mass transfer coefficient, (min)

Error in Calcs? No = 0, Yes > 0 0

Chemical	Cw (ug/L)	Volatile	MW (g/mole)	H (atm-m^3/mol	Kl (cm/hr)	Kg (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd mg/L	S	S x K	S x K	
BENZENE	0.960	Y	7.81E+01	5.56E-03	15.01	1440.23	1.44E+01	1.90E+01	4.50E-04	3.75E-04	5.72E-04	5.72E-04	0
TETRACHLOROETHYLE	0.85	Y	1.66E+02	1.84E-02	10.30	988.38	1.02E+01	1.34E+01	3.06E-04	2.55E-04	3.89E-04	3.89E-04	

TABLE 7.20a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CHILD RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Inhalation Reference Dose	Reference Dose Units	Hazard Quotient
Inhalation	BENZENE	9.60E-01	mg/L	5.7E-04	mg/m^3	R	2.2E-05	mg/kg-day	0.0086	mg/kg-day	2.6E-03
	TETRACHLOROETHYLENE	8.50E-01	mg/L	3.9E-04	mg/m^3	R	1.5E-05	mg/kg-day	0.077	mg/kg-day	1.9E-04
	(total)										2.75E-03
										Total Hazard Index Across All Exposure Routes/Pathways	**0.003**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient

TABLE 8.20a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISK
EXPOSURE OF CHILD RESIDENTS BY INHALATION OF VOLATILES RELEASED FROM GROUNDWATER THROUGH SHOWERING
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC (SxK)[1]	Route EPC Units	EPC Selected for Risk Calculation [2]	Intake (Cancer)	Intake (Cancer) Units	Inhalation Cancer Slope Factor	CSFi Units	Cancer Risk
Inhalation	BENZENE	9.60E-01	mg/L	5.72E-04	mg/m^3	R	6.3E-07	mg/kg-day	2.7E-02	$(mg/kg\text{-}day)^{-1}$	1.7E-08
	TETRACHLOROETHYLENE	8.50E-01	mg/L	3.89E-04	mg/m^3	R	4.3E-07	mg/kg-day	2.1E-02	$(mg/kg\text{-}day)^{-1}$	8.8E-09
	(total)										2.6E-08
										Total Risk Across All Exposure Routes/Pathways	**2.6E-08**

[1] S = Volatile Chemical Generation Rate. K = Mass Transfer Coefficient
[2] Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 9.1. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	2.04E-06		8.0E-07	2.8E-06	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)		3.2E-05		3.2E-05
			AROCLOR 1260	7.97E-09		3.3E-09	1.1E-08	AROCLOR 1260	Eye, Immunological	1.2E-01		5.1E-02	1.7E-01
			TCDD TEQs	2.78E-08		2.5E-09	3.0E-08	TCDD TEQs	Developmental	1.1E-01		1.0E-02	1.2E-01
			ALUMINUM					ALUMINUM	CNS	5.0E-02	1.1E+00		1.2E+00
			ANTIMONY					ANTIMONY	Longevity (general)	4.4E-02			4 4E-02
			ARSENIC	4.02E-07	6.4E-08	3.6E-08	5.0E-07	ARSENIC	Skin, CVS	3.3E-02	6.0E-01	2.9E-03	6.4E-01
			BARIUM					BARIUM	Kidney	3.9E-03	8 8E-03		1.3E-02
			CADMIUM		7.2E-09		7.2E-09	CADMIUM	Kidney	4.4E-02	2.4E-01	5.3E-03	2.9E-01
			CHROMIUM		6 0E-07		6.0E-07	CHROMIUM	Fetotoxicity/GS/Bone	2.7E-02	3 1E-01		3.3E-01
			COBALT		4.9E-08		4.9E-08	COBALT	Blood	2.0E-01	5.5E-01		7.5E-01
			COPPER					COPPER	Gastrointestinal System	7.0E-02			7.0E-02
			IRON					IRON	Gastrointestinal System	3.3E-01			3.3E-01
			MANGANESE					MANGANESE	CNS	1.7E-01	9 1E+00		9.2E+00
			MERCURY					MERCURY	CNS	1.0E-02	5.6E-02		6.6E-02
			VANADIUM					VANADIUM	Kidney	9 6E-03			9.6E-03
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)		5.9E-04		5.9E-04
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	1.59E-06		6.2E-07	2.2E-06	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)	7.7E-04	2.9E-04		1.1E-03
			AROCLOR 1260	4.87E-09		2.0E-09	6.9E-09	AROCLOR 1260	Eye, Immunological	7.4E-02		3.1E-02	1.1E-01
			TCDD TEQs (FULL DLs)	4.67E-09		4.2E-10	5.1E-09	TCDD TEQs (FULL DLs)	Developmental	1.9E-02		1.7E-03	2.1E-02
			ALUMINUM					ALUMINUM	CNS	4 1E-02	9 1E-01		9.5E-01
			ARSENIC	7.06E-07	1.1E-07	6.4E-08	8.8E-07	ARSENIC	Skin, CVS	5.7E-02	1.1E+00	5.2E-03	1.1E+00
			CADMIUM		5.3E-09		5.3E-09	CADMIUM	Kidney	3.2E-02	1.8E-01	3.9E-03	2.2E-01
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	5.8E-03			5.8E-03
			COBALT		6.6E-08		6.6E-08	COBALT	Blood	2.7E-01	7.4E-01		1.0E+00
			IRON					IRON	Gastrointestinal System	3.2E-01			3.2E-01
			MANGANESE					MANGANESE	CNS	1.2E-01	6.3E+00		6.5E+00
			MERCURY					MERCURY	CNS	5.4E-04	3.0E-03		3.6E-03
			VANADIUM					VANADIUM	Kidney	1.3E-02			1.3E-02
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)		5.2E-03		5.2E-03
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)			NA		BAP EQUIVALENT (FULL DL)	NA			NA	
			TCDD TEQs (FULL DLs)			NA		TCDD TEQs (FULL DLs)	Developmental			NA	
			PENTACHLOROPHENOL			NA		PENTACHLOROPHENOL	Liver			NA	
			BENZENE		6.1E-11	1.9E-10	2.5E-10	BENZENE	Hematological		1.6E-04	5.2E-04	6.8E-04
			TETRACHLOROETHYLENE		2.8E-11	4.6E-09	4.6E-09	TETRACHLOROETHYLENE	Liver		1.1E-05	5.2E-04	5.3E-04
			DELTA-BHC (ALPHA-BHC)			8.2E-10	8.2E-10	DELTA-BHC (ALPHA-BHC)	Liver			2.6E-04	2.6E-04
			ARSENIC			2.4E-09	2.4E-09	ARSENIC	Skin, CVS			2.0E-04	2.0E-04
			CADMIUM					CADMIUM	Kidney			1.9E-02	1.9E-02
			COBALT					COBALT	Blood			6.9E-03	6.9E-03
			IRON					IRON	Gastrointestinal System			6.5E-03	6.5E-03
			MANGANESE					MANGANESE	CNS			3.9E-01	3.9E-01
			Total Risk for Surface Soil				4.0E-06		Total HI for Surface Soil				13.3
			Total Risk for Subsurface Soil				3.2E-06		Total HI for Subsurface Soil				10.2
			Total Risk for Groundwater				8.1E-09		Total HI for Groundwater				0 4

Total Risk Across All Media and All Exposure Routes: 4.E-06

Total HI Across All Media and All Exposure Routes: 12

Total Immune System HI =	0.28	Total Gastrointestinal HI =	0.73
Total Blood HI =	1.8	Total Kidney HI =	0.56
Total CVS HI =	1.8	Total Fetotoxicity & Devel HI =	0 48
Total Neurological (inc. CNS) HI =	18.3	Liver HI =	0 0008
Body Weight & Longevity (General)=	0.05		

TABLE 9.2. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - OCCUPATIONAL/MAINTENANCE WORKER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Occupational Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	3.44E-05		2.9E-05	6.4E-05	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.56E-07		1.4E-07	3.0E-07	AROCLOR 1260	Eye, immunological	1.1E-02		1.0E-02	2.1E-02
			TCDD TEQs	1.76E-06		3.5E-07	2.1E-06	TCDD TEQs	Developmental	3.3E-02		6.5E-03	3.9E-02
			ALUMINUM					ALUMINUM	CNS	9.7E-03			9.7E-03
			ANTIMONY					ANTIMONY	Longevity (general)	5.0E-03			5.0E-03
			ARSENIC	1.25E-05		2.5E-06	1.5E-05	ARSENIC	Skin, CVS	7.8E-02		1.5E-02	9.3E-02
			BARIUM					BARIUM	Kidney	4.6E-04			4.6E-04
			CADMIUM					CADMIUM	Kidney	6.3E-03		1.7E-03	8.0E-03
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	1.6E-02			1.6E-02
			COBALT					COBALT	Blood	2.6E-02			2.6E-02
			COPPER					COPPER	Gastrointestinal System	6.3E-03			6.3E-03
			IRON					IRON	Gastrointestinal System	4.7E-02			4.7E-02
			MANGANESE					MANGANESE	CNS	1.6E-02			1.6E-02
			MERCURY					MERCURY	CNS	7.6E-03	1.3E-05		7.6E-03
			VANADIUM					VANADIUM	Kidney	2.0E-03			2.0E-03
						Total Risk for Surface Soil	8.1E-05					Total HI for Surface Soil	0.3

Total Risk Across All Media and All Exposure Routes: 8.E-05

Total HI Across All Media and All Exposure Routes: 0.3

Total Immune System HI =	0.02	Total Gastrointestinal HI =	0.05
Total Blood HI =	0.03	Total Kidney HI =	0.01
Total CVS HI =	0.09	Total Fetotoxicity & Devel HI =	0.06
Total Neurological*(inc. CNS) HI =	0.03	Liver HI =	
Body Weight & Longevity (General)=	0.005		

TABLE 9.3. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - YOUTH TRESPASSER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	7.15E-06		6.1E-06	1.3E-05	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)				
			AROCLOR 1260	1.08E-08		9.9E-09	2.1E-08	AROCLOR 1260	Eye, immunological	1.9E-03		1.7E-03	3.6E-03
			TCDD TEQs	1.22E-07		2.4E-08	1.5E-07	TCDD TEQs	Developmental	5.7E-03		1.1E-03	6.8E-03
			ALUMINUM					ALUMINUM	CNS	1.7E-03			1.7E-03
			ANTIMONY					ANTIMONY	Longevity (general)	8.6E-04			8.6E-04
			ARSENIC	8.66E-07		1.7E-07	1.0E-06	ARSENIC	Skin, CVS	1.3E-02		2.7E-03	1.6E-02
			BARIUM					BARIUM	Kidney	8.0E-05			8.0E-05
			CADMIUM					CADMIUM	Kidney	1.1E-03		2.9E-04	1.4E-03
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.9E-03			2.9E-03
			COBALT					COBALT	Blood	4.6E-03			4.6E-03
			COPPER					COPPER	Gastrointestinal System	1.1E-03			1.1E-03
			IRON					IRON	Gastrointestinal System	8.1E-03			8.1E-03
			MANGANESE					MANGANESE	CNS	2.8E-03			2.8E-03
			MERCURY					MERCURY	CNS	1.3E-03	3.4E-07		1.3E-03
			VANADIUM					VANADIUM	Kidney	3.5E-04			3.5E-04
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)				
						Total Risk for Surface Soil	1.4E-05					Total HI for Surface Soil	0.05

Total Risk Across All Media and All Exposure Routes: 1.E-05

Total HI Across All Media and All Exposure Routes: 0.05

Total Immune System HI =	0.004	Total Gastrointestinal HI =	0.009
Total Blood HI =	0.005	Total Kidney HI =	0.002
Total CVS HI =	0.02	Total Fetotoxicity & Devel HI =	0.0097
Total Neurological (inc. CNS) HI =	0.006	Liver HI =	
Body Weight & Longevity (General)=	0.0009		

TABLE 9 4. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE ADULT RESIDENT
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Adult Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	3.18E-04		1.6E-04	4.8E-04	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	5.76E-07		3.8E-07	1.1E-06	AROCLOR 1260	Eye, Immunological	4.9E-02		2.8E-02	7.7E-02
			TCDD TEQs	2.36E-06		2.8E-07	2.6E-06	TCDD TEQs	Developmental	4.6E-02		5.5E-03	5.1E-02
			ALUMINUM					ALUMINUM	CNS	4.0E-02			4.0E-02
			ANTIMONY					ANTIMONY	Longevity (general)	1.8E-02			1.8E-02
			ARSENIC	3 41E-05		4.1E-06	3.8E-05	ARSENIC	Skin, CVS	2.2E-01		2.6E-02	2.5E-01
			BARIUM					BARIUM	Kidney	1.6E-03			1.6E-03
			CADMIUM					CADMIUM	Kidney	1.8E-02		2.8E-03	2.1E-02
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	7 4E-02			7.4E-02
			COBALT					COBALT	Blood	8.1E-02			8 1E-02
			COPPER					COPPER	Gastrointestinal System	2.9E-02			2.9E-02
			IRON					IRON	Gastrointestinal System	1.4E-01			1.4E-01
			MANGANESE					MANGANESE	CNS	7.1E-02			7.1E-02
			MERCURY					MERCURY	CNS	4.1E-02	2 1E-04		4 1E-02
			VANADIUM					VANADIUM	Kidney	3.9E-03			3.9E-03
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)				
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	2.48E-04		1.3E-04	3.8E-04	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE					NAPHTHALENE	Body Weight (general)	3.2E-04			3.2E-04
			AROCLOR 1260	4 13E-07		2.3E-07	6 4E-07	AROCLOR 1260	Eye, Immunological	3 0E-02		1.7E-02	4.7E-02
			TCDD TEQs (FULL DLs)	3.96E-07		4.7E-08	4.4E-07	TCDD TEQs (FULL DLs)	Developmental	7.7E-03		9.2E-04	8.6E-03
			ALUMINUM					ALUMINUM	CNS	3.3E-02			3.3E-02
			ARSENIC	5.99E-05		7.2E-06	6.7E-05	ARSENIC	Skin, CVS	3.9E-01		4.6E-02	4.3E-01
			CADMIUM					CADMIUM	Kidney	1.3E-02		2.1E-03	1.5E-02
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	1.6E-02			1.6E-02
			COBALT					COBALT	Blood	1.1E-01			1.1E-01
			IRON					IRON	Gastrointestinal System	1.3E-01			1.3E-01
			MANGANESE					MANGANESE	CNS	4.9E-02			4.9E-02
			MERCURY					MERCURY	CNS	2.2E-03			2.2E-03
			VANADIUM					VANADIUM	Kidney	5.1E-03			5.1E-03
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	7.7E-06		NA	7.7E-06	BAP EQUIVALENT (FULL DL)	NA	NA		NA	
			TCDD TEQs (FULL DLs)	1.7E-05		NA	1.7E-05	TCDD TEQs (FULL DLs)	Developmental	3.4E-01		NA	3.4E-01
			PENTACHLOROPHENOL	2.9E-05		NA	2.9E-05	PENTACHLOROPHENOL	Liver	4.3E-02		NA	4.3E-02
			BENZENE	5.0E-07	8.0E-08	5.7E-08	6.3E-07	BENZENE	Hematological	6 6E-03	1 0E-03	7.6E-04	8.3E-03
			TETRACHLOROETHYLENE	4.3E-06	4.1E-08	1.9E-06	6.3E-06	TETRACHLOROETHYLENE	Liver	2.3E-03	7.6E-05	1.0E-03	3.5E-03
			DELTA-BHC (ALPHA-BHC)	1.2E-06		3.6E-07	1.5E-06	DELTA-BHC (ALPHA-BHC)	Liver	1.8E-03		5.5E-04	2.4E-03
			ARSENIC	1.0E-04		3.0E-07	1.0E-04	ARSENIC	Skin, CVS	4.0E-02		1.2E-04	4.0E-02
			CADMIUM					CADMIUM	Kidney	1.9E-01		1.1E-02	2.0E-01
			COBALT					COBALT	Blood	1 4E+00		4 1E-03	1.4E+00
			IRON					IRON	Gastrointestinal System	1.3E+00		4.0E-03	1.3E+00
			MANGANESE					MANGANESE	CNS	3.1E+00		2.3E-01	3.4E+00
			Total Risk for Surface Soil				5.2E-04		Total HI for Surface Soil				0.9
			Total Risk for Subsurface Soil				4 4E-04		Total HI for Subsurface Soil				0.8
			Total Risk for Groundwater				1.7E-04		Total HI for Groundwater				6 8

Total Risk Across All Media and All Exposure Routes: 7.E-04

Total HI Across All Media and All Exposure Routes: 8

Total Immune System HI =	0.12	Total Gastrointestinal HI =	1.63
Total Blood HI =	1.6	Total Kidney HI =	0.247
Total CVS HI =	0.7	Total Fetotoxicity & Devel HI =	0 48
Total Neurological (inc. CNS) HI =	3.6	Liver HI =	0.0486
Body Weight & Longevity (General)=	0.02		

TABLE 9.5. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE CHILD RESIDENT
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Child Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	2.16E-03		7.9E-04	2.9E-03	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.58E-06		6.2E-07		AROCLOR 1260	Eye, Immunological	4.6E-01		1.8E-01	6.4E-01
			TCDD TEQs	5.51E-06		4 6E-07	6 0E-06	TCDD TEQs	Developmental	4.3E-01		3 6E-02	4 6E-01
			ALUMINUM					ALUMINUM	CNS	3.8E-01			3.8E-01
			ANTIMONY					ANTIMONY	Longevity (general)	1.7E-01			1.7E-01
			ARSENIC	7.96E-05		6.7E-06	8.6E-05	ARSENIC	Skin, CVS	2.1E+00		1.7E-01	2.2E+00
			BARIUM					BARIUM	Kidney	1.5E-02			1.5E-02
			CADMIUM					CADMIUM	Kidney	1.7E-01		1.9E-02	1.8E-01
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	6.9E-01			6.9E-01
			COBALT					COBALT	Blood	7.5E-01			7.5E-01
			COPPER					COPPER	Gastrointestinal System	2.7E-01			2.7E-01
			IRON					IRON	Gastrointestinal System	1.3E+00			1.3E+00
			MANGANESE					MANGANESE	CNS	6.6E-01			6.6E-01
			MERCURY					MERCURY	CNS	3.8E-01	2.1E-04		3.8E-01
			VANADIUM					VANADIUM	Kidney	3.7E-02			3.7E-02
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	1.68E-03		6.1E-04	2.3E-03	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)	2.9E-03			2.9E-03
			AROCLOR 1260	9 64E-07		3.8E-07	1.3E-06	AROCLOR 1260	Eye, Immunological	2.8E-01		1 1E-01	3.9E-01
			TCDD TEQs (FULL DLs)	9.24E-07		7.8E-08	1.0E-06	TCDD TEQs (FULL DLs)	Developmental	7.2E-02		6.0E-03	7.8E-02
			ALUMINUM					ALUMINUM	CNS	3.1E-01			3.1E-01
			ARSENIC	1.40E-04		1.2E-05	1.5E-04	ARSENIC	Skin, CVS			3.0E-01	3.0E-01
			CADMIUM					CADMIUM	Kidney	3.6E+00		1.4E-02	3.6E+00
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone				
			COBALT					COBALT	Blood	1.2E-01			1.2E-01
			IRON					IRON	Gastrointestinal System	1.5E-01			1.5E-01
			MANGANESE					MANGANESE	CNS	1.0E+00			1.0E+00
			MERCURY					MERCURY	CNS				
			VANADIUM					VANADIUM	Kidney	1.2E+00			1.2E+00
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)	4.6E-01			4.6E-01
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	6.1E-06		NA		BAP EQUIVALENT (FULL DL)	NA	NA		NA	
			TCDD TEQs (FULL DLs)	1.5E-05		NA		TCDD TEQs (FULL DLs)	Developmental	1.2E+00		NA	1.2E+00
			PENTACHLOROPHENOL	2.6E-05		NA		PENTACHLOROPHENOL	Liver	1.5E-01		NA	1.5E-01
			BENZENE	4.3E-07	9 4E-08	2.4E-08	5.5E-07	BENZENE	Hematological	2.3E-02	4.7E-03	1.3E-03	2.9E-02
			TETRACHLOROETHYLENE	3.8E-06	4.8E-08	8.3E-07	4.7E-06	TETRACHLOROETHYLENE	Liver	8.2E-03	3.5E-04	1.8E-03	1.0E-02
			DELTA-BHC (ALPHA-BHC)	1.0E-06		1.5E-07	1.2E-06	DELTA-BHC (ALPHA-BHC)	Liver	6.4E-03		9.5E-04	7.3E-03
			ARSENIC	8.0E-05		1.3E-07	8.0E-05	ARSENIC	Skin, CVS	1.4E-01		2.0E-04	1.4E-01
			CADMIUM					CADMIUM	Kidney	6.6E-01		1.9E-02	6.8E-01
			COBALT					COBALT	Blood	4.9E+00		7 1E-03	4.9E+00
			IRON					IRON	Gastrointestinal System	4.7E+00		6.8E-03	4.7E+00
			MANGANESE					MANGANESE	CNS	1.1E+01		4.0E-01	1.1E+01
			Total Risk for Surface Soil				3.0E-03		Total HI for Surface Soil				8.1
			Total Risk for Subsurface Soil				2.4E-03		Total HI for Subsurface Soil				7.7
			Total Risk for Groundwater				9.6E-05		Total HI for Groundwater				23.3

Total Risk Across All Media and All Exposure Routes: 3.E-03

Total HI Across All Media and All Exposure Routes: 31

Total Immune System HI =	1.0	Total Gastrointestinal HI =	6.35
Total Blood HI =	5.8	Total Kidney HI =	5.76
Total CVS HI =	2.7	Total Fetotoxicity & Devel HI =	2.42
Total Neurological (inc CNS) HI =	14.2	Liver HI =	0 17
Body Weight & Longevity (General)=	0.63		

TABLE 9.6 REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - TOTAL RESIDENTIAL ILCRS
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	3.4E-03		9.5E-04	4.4E-03
			NAPHTHALENE (partic.)				
			AROCLOR 1260	1.1E-06		1.0E-06	2.1E-06
			TCDD TEQs	8.6E-06		7.5E-07	9.4E-06
			ALUMINUM				
			ANTIMONY				
			ARSENIC	1.2E-04		1.1E-05	1.4E-04
			BARIUM				
			CADMIUM				
			CHROMIUM				
			COBALT				
			COPPER				
			IRON				
			MANGANESE				
			MERCURY				
			VANADIUM				
			NAPHTHALENE (volatile)				
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	1.9E-03		7.4E-04	2.7E-03
			NAPHTHALENE				
			AROCLOR 1260	1.4E-06		6.1E-07	2.0E-06
			TCDD TEQs (FULL DLs)	1.3E-06		1.2E-07	1.4E-06
			ALUMINUM				
			ARSENIC	2.0E-04		1.9E-05	2.2E-04
			CADMIUM				
			CHROMIUM				
			COBALT				
			IRON				
			MANGANESE				
			MERCURY				
			VANADIUM				
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	1.4E-05			1.4E-05
			TCDD TEQs (FULL DLs)	3.2E-05			3.2E-05
			PENTACHLOROPHENOL	5.5E-05			5.5E-05
			BENZENE	9.3E-07	1.7E-07	8.2E-08	1.2E-06
			TETRACHLOROETHYLENE	8.1E-06	9.0E-08	2.8E-06	1.1E-05
			DELTA-BHC (ALPHA-BHC)	2.2E-06		5.1E-07	2.7E-06
			ARSENIC	1.9E-04		4.3E-07	1.9E-04
			CADMIUM				
			COBALT				
			IRON				
			MANGANESE				
						Total Risk for Surface Soil	4.5E-03
						Total Risk for Subsurface Soil	2.9E-03
						Total Risk for Groundwater	3.1E-04

Total Risk Across All Media and All Exposure Routes: 4.0E-03

TABLE 9.1a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	7.20E-08		1.9E-08	9.1E-08	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)		7.2E-06		7.2E-06
			AROCLOR 1260	8.52E-10		2.4E-10	1.1E-09	AROCLOR 1260	Eye, immunological	1.3E-02		3.6E-03	1.7E-02
			TCDD TEQs	1.39E-06		8.3E-10	1.5E-06	TCDD TEQs	Developmental	5.6E-02		3.4E-03	6.0E-02
			ALUMINUM					ALUMINUM	CNS	6.4E-03	1.4E-01		1.5E-01
			ANTIMONY					ANTIMONY	Longevity (general)	4.5E-03			4.5E-03
			ARSENIC	5.17E-08	8.3E-09	3.1E-09	6.3E-08	ARSENIC	Skin, CVS	4.2E-03	7.8E-02	2.5E-04	8.2E-02
			BARIUM					BARIUM	Kidney	6.4E-04	1.4E-03		2.1E-03
			CADMIUM		6.4E-10		6.4E-10	CADMIUM	Kidney	3.9E-03	2.2E-02	3.1E-04	2.6E-02
			CHROMIUM		3.7E-08		3.7E-08	CHROMIUM	Fetotoxicity/GS/Bone	1.7E-03	1.9E-02		2.1E-02
			COBALT		9.1E-09		9.1E-09	COBALT	Blood	3.7E-02	1.0E-01		1.4E-01
			COPPER					COPPER	Gastrointestinal System	3.9E-03			3.9E-03
			IRON					IRON	Gastrointestinal System	6.4E-02			6.4E-02
			MANGANESE					MANGANESE	CNS	2.1E-02	1.1E+00		1.1E+00
			MERCURY					MERCURY	CNS	3.2E-04	1.8E-03		2.1E-03
			VANADIUM					VANADIUM	Kidney	3.1E-03			3.1E-03
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)		1.3E-04		1.3E-04
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	4.69E-08		1.2E-08	5.9E-08	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE (partic.)					NAPHTHALENE (partic.)	Body Weight (general)	3.6E-05	1.4E-05		5.0E-05
			AROCLOR 1260	3.90E-10		1.1E-10	5.0E-10	AROCLOR 1260	Eye, immunological	5.9E-03		1.7E-03	7.6E-03
			TCDD TEQs (FULL DLs)	2.33E-09		1.4E-10	2.5E-09	TCDD TEQs (FULL DLs)	Developmental	9.5E-03		5.7E-04	1.0E-02
			ALUMINUM					ALUMINUM	CNS	7.9E-03	1.8E-01		1.8E-01
			ARSENIC	5.01E-08	8.0E-09	3.0E-09	6.1E-08	ARSENIC	Skin, CVS	4.1E-03	7.5E-02	2.4E-04	8.0E-02
			CADMIUM		3.4E-10		3.4E-10	CADMIUM	Kidney	2.1E-03	1.2E-02	1.7E-04	1.4E-02
			CHROMIUM		2.8E-08		2.8E-08	CHROMIUM	Fetotoxicity/GS/Bone	1.3E-03	1.4E-02		1.5E-02
			COBALT		1.2E-08		1.2E-08	COBALT	Blood	5.0E-02	1.4E-01		1.9E-01
			IRON					IRON	Gastrointestinal System	6.5E-02			6.5E-02
			MANGANESE					MANGANESE	CNS	2.4E-02	1.2E+00		1.3E+00
			MERCURY					MERCURY	CNS	5.6E-05	3.1E-04		3.7E-04
			VANADIUM					VANADIUM	Kidney	3.6E-03			3.6E-03
			NAPHTHALENE (volatile)					NAPHTHALENE (volatile)	Body Weight (general)		2.5E-04		2.5E-04
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)			NA		BAP EQUIVALENT (FULL DL)	NA			NA	
			TCDD TEQs (FULL DLs)			NA		TCDD TEQs (FULL DLs)	Developmental			NA	
			PENTACHLOROPHENOL			NA		PENTACHLOROPHENOL	Liver			NA	
			BENZENE			1.1E-10	1.1E-10	BENZENE	Hematological			3.0E-04	3.0E-04
			TETRACHLOROETHYLENE			3.1E-09	3.1E-09	TETRACHLOROETHYLENE	Liver			3.5E-04	3.5E-04
			DELTA-BHC (ALPHA-BHC)			5.8E-10	5.8E-10	DELTA-BHC (ALPHA-BHC)	Liver			1.9E-04	1.9E-04
			ARSENIC			1.2E-09	1.2E-09	ARSENIC	Skin, CVS			9.8E-05	9.8E-05
			CADMIUM					CADMIUM	Kidney			9.3E-03	9.3E-03
			COBALT					COBALT	Blood			3.4E-03	3.4E-03
			IRON					IRON	Gastrointestinal System			3.3E-03	3.3E-03
			MANGANESE					MANGANESE	CNS			3.8E-01	3.8E-01
			Total Risk for Surface Soil				2.2E-07		Total HI for Surface Soil				1.7
			Total Risk for Subsurface Soil				1.6E-07		Total HI for Subsurface Soil				1.8
			Total Risk for Groundwater				5.0E-09		Total HI for Groundwater				0.4

Total Risk Across All Media and All Exposure Routes: 2.E-07

Total HI Across All Media and All Exposure Routes: 2

Total Immune System HI =	0.02	Total Gastrointestinal HI =	0.14
Total Blood HI =	0.3	Total Kidney HI =	0.06
Total CVS HI =	0.2	Total Fetotoxicity & Devel HI =	0.11
Total Neurological (inc. CNS) HI =	3.1	Liver HI =	0.0005
Body Weight & Longevity (General)=	0.005		

TABLE 9.2a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - OCCUPATIONAL/MAINTENANCE WORKER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Occupational Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	1.43E-06		2.5E-07	1.7E-06	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.70E-08		3.1E-09	2.0E-08	AROCLOR 1260	Eye, immunological	3.3E-03		6.1E-04	3.9E-03
			TCDD TEQs	2.77E-07		1.1E-08	2.9E-07	TCDD TEQs	Developmental	1.4E-02		5.7E-04	1.5E-02
			ALUMINUM					ALUMINUM	CNS	3.3E-03			3.3E-03
			ANTIMONY					ANTIMONY	Longevity (general)	1.1E-03			1.1E-03
			ARSENIC	1.03E-06		4.1E-08	1.1E-06	ARSENIC	Skin, CVS	1.8E-02		7.0E-04	1.9E-02
			BARIUM					BARIUM	Kidney	1.6E-04			1.6E-04
			CADMIUM					CADMIUM	Kidney	9.9E-04		5.2E-05	1.0E-03
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.9E-03			2.9E-03
			COBALT					COBALT	Blood	9.4E-03			9.4E-03
			COPPER					COPPER	Gastrointestinal System	1.0E-03			1.0E-03
			IRON					IRON	Gastrointestinal System	1.6E-02			1.6E-02
			MANGANESE					MANGANESE	CNS	5.4E-03			5.4E-03
			MERCURY					MERCURY	CNS	8.1E-04	7.6E-07		8.1E-04
			VANADIUM					VANADIUM	Kidney	7.9E-04			7.9E-04
						Total Risk for Surface Soil	3.1E-06					Total HI for Surface Soil	0.08

Total Risk Across All Media and All Exposure Routes: 3.E-06

Total HI Across All Media and All Exposure Routes: 0.08

Total Immune System HI =	0.004	Total Gastrointestinal HI =	0.02
Total Blood HI =	0.009	Total Kidney HI =	0.002
Total CVS HI =	0.02	Total Fetotoxicity & Devel HI =	0.02
Total Neurological (inc. CNS) HI =	0.009	Liver HI =	
Body Weight & Longevity (General)=	0.001		

TABLE 9.3a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - YOUTH TRESPASSER
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Youth

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface	Entire Site	BAP EQUIVALENT (FULL DLs)	4.73E-07		1.5E-07	6.3E-07	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.87E-09		6.5E-10	2.5E-09	AROCLOR 1260	Eye, immunological	3.3E-04		1.1E-04	4.4E-04
			TCDD TEQs	3.04E-08		2.3E-09	3.3E-08	TCDD TEQs	Developmental	1.4E-03		1.1E-04	1.5E-03
			ALUMINUM					ALUMINUM	CNS	3.2E-04			3.2E-04
			ANTIMONY					ANTIMONY	Longevity (general)	1.1E-04			1.1E-04
			ARSENIC	1.13E-07		8.4E-09	1.2E-07	ARSENIC	Skin, CVS	1.8E-03		1.3E-04	1.9E-03
			BARIUM					BARIUM	Kidney	1.6E-05			1.6E-05
			CADMIUM					CADMIUM	Kidney	9.8E-05		9.7E-06	1.1E-04
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.9E-04			2.9E-04
			COBALT					COBALT	Blood	9.3E-04			9.3E-04
			COPPER					COPPER	Gastrointestinal System	9.9E-05			9.9E-05
			IRON					IRON	Gastrointestinal System	1.6E-03			1.6E-03
			MANGANESE					MANGANESE	CNS	5.3E-04			5.3E-04
			MERCURY					MERCURY	CNS	8.0E-05	2.1E-08		8.0E-05
			VANADIUM					VANADIUM	Kidney	7.9E-05			7.9E-05
							Total Risk for Surface Soil 7.8E-07						Total HI for Surface Soil 0.008

Total Risk Across All Media and All Exposure Routes: 8.E-07

Total HI Across All Media and All Exposure Routes: 0.008

Total Immune System HI =	0.0004	Total Gastrointestinal HI =	0.002
Total Blood HI =	0.0009	Total Kidney HI =	0.0002
Total CVS HI =	0.0019	Total Fetotoxicity & Devel HI =	0.0018
Total Neurological (inc. CNS) HI =	0.0009	Liver HI =	
Body Weight & Longevity (General)=	0.0001		

TABLE 9.4a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE ADULT RESIDENT
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Adult Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	1 19E-06		1.8E-07	1 4E-06	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.41E-08		2.3E-09	1.6E-08	AROCLOR 1260	Eye, immunological	3.5E-03		5.6E-04	4.1E-03
			TCDD TEQs	2.30E-07		7.9E-09	2.4E-07	TCDD TEQs	Developmental	1.5E-02		5.2E-04	1.6E-02
			ALUMINUM					ALUMINUM	CNS	3.5E-03			3.5E-03
			ANTIMONY					ANTIMONY	Longevity (general)	1.2E-03			1.2E-03
			ARSENIC	8.56E-07		2.9E-08	8.9E-07	ARSENIC	Skin, CVS	1.9E-02		6.5E-04	2.0E-02
			BARIUM					BARIUM	Kidney	1.7E-04			1.7E-04
			CADMIUM					CADMIUM	Kidney	1.1E-03		4.8E-05	1.1E-03
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	3.1E-03			3.1E-03
			COBALT					COBALT	Blood	1.0E-02			1.0E-02
			COPPER					COPPER	Gastrointestinal System	1.1E-03			1.1E-03
			IRON					IRON	Gastrointestinal System	1.8E-02			1.8E-02
			MANGANESE					MANGANESE	CNS	5.7E-03			5.7E-03
			MERCURY					MERCURY	CNS	8.7E-04	9.0E-06		8.8E-04
			VANADIUM					VANADIUM	Kidney	8.5E-04			8.5E-04
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	7.76E-07		1.1E-07	8.9E-07	BAP EQUIVALENT (FULL DLs)	NA				
			NAPHTHALENE					NAPHTHALENE	Body Weight (general)	9.9E-06			9.9E-06
			AROCLOR 1260	6.45E-09		1.0E-09	7.5E-09	AROCLOR 1260	Eye, immunological	1 6E-03		2.6E-04	1.9E-03
			TCDD TEQs (FULL DLs)	3.86E-08		1.3E-09	4.0E-08	TCDD TEQs (FULL DLs)	Developmental	2.6E-03		8.8E-05	2.7E-03
			ALUMINUM					ALUMINUM	CNS	4.3E-03			4.3E-03
			ARSENIC	8.28E-07		2.8E-08	8.6E-07	ARSENIC	Skin, CVS	1.8E-02		6.3E-04	1.9E-02
			CADMIUM					CADMIUM	Kidney	5.7E-04		2.6E-05	5.9E-04
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.3E-03			2.3E-03
			COBALT					COBALT	Blood	1.4E-02			1.4E-02
			IRON					IRON	Gastrointestinal System	1.8E-02			1.8E-02
			MANGANESE					MANGANESE	CNS	6.4E-03			6.4E-03
			MERCURY					MERCURY	CNS	1.5E-04			1.5E-04
			VANADIUM					VANADIUM	Kidney	9.7E-04			9 7E-04
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	5.8E-07		NA	5.8E-07	BAP EQUIVALENT (FULL DL)	NA	NA		NA	
			TCDD TEQs (FULL DLs)	2.4E-06		NA	2.4E-06	TCDD TEQs (FULL DLs)	Developmental	1.6E-01		NA	1.6E-01
			PENTACHLOROPHENOL	4.0E-06		NA	4.0E-06	PENTACHLOROPHENOL	Liver	2.0E-02		NA	2.0E-02
			BENZENE	6.8E-08	8.6E-09	9.7E-09	8.6E-08	BENZENE	Hematological	3.1E-03	3.7E-04	4 4E-04	3.9E-03
			TETRACHLOROETHYLENE	5.9E-07	4.4E-09	3.3E-07	9.2E-07	TETRACHLOROETHYLENE	Liver	1.1E-03	2.8E-05	6.1E-04	1.7E-03
			DELTA-BHC (ALPHA-BHC)	1.6E-07		6.1E-08	2.2E-07	DELTA-BHC (ALPHA-BHC)	Liver	8.5E-04		3.2E-04	1.2E-03
			ARSENIC	1.4E-05		4.5E-08	1 4E-05	ARSENIC	Skin, CVS	1.9E-02		6.0E-05	1.9E-02
			CADMIUM					CADMIUM	Kidney	8.8E-02		5.7E-03	9 4E-02
			COBALT					COBALT	Blood	6.5E-01		2.1E-03	6.6E-01
			IRON					IRON	Gastrointestinal System	6.2E-01		2.0E-03	6.2E-01
			MANGANESE					MANGANESE	CNS	2.9E+00		2.3E-01	3.1E+00
						Total Risk for Surface Soil	2.5E-06					Total HI for Surface Soil	0 08
						Total Risk for Subsurface Soil	1.8E-06					Total HI for Subsurface Soil	0.08
						Total Risk for Groundwater	2.2E-05					Total HI for Groundwater	4 7

Total Risk Across All Media and All Exposure Routes: 2.E-05

Total HI Across All Media and All Exposure Routes: 5

Total Immune System HI =	0.006	Total Gastrointestinal HI =	0.66
Total Blood HI =	0 7	Total Kidney HI =	0.098
Total CVS HI =	0.06	Total Fetotoxicity & Devel HI =	0 18
Total Neurological (Inc. CNS) HI =	3.1	Liver HI =	0.023
Body Weight & Longevity (General)=	0.008		

TABLE 9.5a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FUTURE CHILD RESIDENT
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Current/Future
Receptor Population: Child Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	3.18E-06		4 6E-07	3.6E-06	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	3.76E-06		5.9E-09	4.4E-06	AROCLOR 1260	Eye, Immunological	3.3E-02		5.2E-03	3 8E-02
			TCDD TEQs	6 14E-07		2.1E-08	6.3E-07	TCDD TEQs	Developmental	1.4E-01		4.8E-03	1.5E-01
			ALUMINUM					ALUMINUM	CNS	3.3E-02			3.3E-02
			ANTIMONY					ANTIMONY	Longevity (general)	1 1E-02			1.1E-02
			ARSENIC	2.28E-06		7.7E-08	2.4E-06	ARSENIC	Skin, CVS	1.8E-01		6.0E-03	1.8E-01
			BARIUM					BARIUM	Kidney	1.6E-03			1.6E-03
			CADMIUM					CADMIUM	Kidney	9.8E-03		4 4E-04	1 0E-02
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.9E-02			2.9E-02
			COBALT					COBALT	Blood	9.4E-02			9.4E-02
			COPPER					COPPER	Gastrointestinal System	1.0E-02			1.0E-02
			IRON					IRON	Gastrointestinal System	1 6E-01			1.6E-01
			MANGANESE					MANGANESE	CNS	5 4E-02			5.4E-02
			MERCURY					MERCURY	CNS	8 1E-03	9.0E-06		8.1E-03
			VANADIUM					VANADIUM	Kidney	7.9E-03			7.9E-03
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	2.07E-06		3.0E-07	2.4E-06	BAP EQUIVALENT (FULL DLs)	NA				
			AROCLOR 1260	1.72E-08		2.7E-09	2.0E-08	AROCLOR 1260	Eye, Immunological	1.5E-02		2.4E-03	1.7E-02
			TCDD TEQs (FULL DLs)	1.03E-07		3.5E-09	1.1E-07	TCDD TEQs (FULL DLs)	Developmental	2.4E-02		8 1E-04	2.5E-02
			ALUMINUM					ALUMINUM	CNS	4.0E-02			4.0E-02
			ARSENIC	2.21E-06		7.4E-08	2.3E-06	ARSENIC	Skin, CVS	1.7E-01		5.8E-03	1.8E-01
			CADMIUM					CADMIUM	Kidney	5.3E-03		2.4E-04	5.5E-03
			CHROMIUM					CHROMIUM	Fetotoxicity/GS/Bone	2.2E-02			2.2E-02
			COBALT					COBALT	Blood	1.3E-01			1.3E-01
			IRON					IRON	Gastrointestinal System	1.6E-01			1.6E-01
			MANGANESE					MANGANESE	CNS	6.0E-02			6.0E-02
			MERCURY					MERCURY	CNS	1.4E-03			1.4E-03
			VANADIUM					VANADIUM	Kidney	9.0E-03			9 0E-03
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	3.6E-07		NA		BAP EQUIVALENT (FULL DL)	NA	NA		NA	
			TCDD TEQs (FULL DLs)	1.5E-06		NA		TCDD TEQs (FULL DLs)	Developmental	3.5E-01		NA	3.5E-01
			PENTACHLOROPHENOL	2.5E-06		NA		PENTACHLOROPHENOL	Liver	4.4E-02		NA	4.4E-02
			BENZENE	4.3E-08	1.7E-08	4.8E-09	6.4E-08	BENZENE	Hematological	6.8E-03	2.6E-03	7.6E-04	1.0E-02
			TETRACHLOROETHYLENE	3.7E-07	8.8E-09	1.6E-07	5.4E-07	TETRACHLOROETHYLENE	Liver	2.4E-03	1.9E-04	1.0E-03	3.6E-03
			DELTA-BHC (ALPHA-BHC)	1.0E-07		3.0E-08	1.3E-07	DELTA-BHC (ALPHA-BHC)	Liver	1.9E-03		5.5E-04	2.4E-03
			ARSENIC	8.8E-06		2.2E-08	8.8E-06	ARSENIC	Skin, CVS	4.1E-02		1.0E-04	4.1E-02
			CADMIUM					CADMIUM	Kidney	1.9E-01		9 7E-03	2.0E-01
			COBALT					COBALT	Blood	1 4E+00		3 6E-03	1.4E+00
			IRON					IRON	Gastrointestinal System	1.4E+00		3.4E-03	1.4E+00
			MANGANESE					MANGANESE	CNS	6.3E+00		4.0E-01	6.7E+00
			Total Risk for Surface Soil				6.7E-06		Total HI for Surface Soil				0.8
			Total Risk for Subsurface Soil				4.8E-06		Total HI for Subsurface Soil				0.6
			Total Risk for Groundwater				9.5E-06		Total HI for Groundwater				10.2

Total Risk Across All Media and All Exposure Routes: 2.E-05

Total HI Across All Media and All Exposure Routes: 11

Total Immune System HI =	0.06	Total Gastrointestinal HI =	1 71
Total Blood HI =	1.7	Total Kidney HI =	0.24
Total CVS HI =	0.4	Total Fetotoxicity & Devel HI =	0.57
Total Neurological (inc. CNS) HI =	6.9	Liver HI =	0 05
Body Weight & Longevity (General)=	0.01		

TABLE 9.6a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - TOTAL RESIDENTIAL ILCRS
SITE 21 - BUILDING 1517
NAVAL STATION GREAT LAKES, ILLINOIS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	4.4E-06		6.4E-07	5.0E-06
			NAPHTHALENE (partic.)				
			AROCLOR 1260	5.2E-08		8.1E-09	6.0E-08
			TCDD TEQs	8.4E-07		2.8E-08	8.7E-07
			ALUMINUM				
			ANTIMONY				
			ARSENIC	3.1E-06		1.1E-07	3.2E-06
			BARIUM				
			CADMIUM				
			CHROMIUM				
			COBALT				
			COPPER				
			IRON				
			MANGANESE				
			MERCURY				
			VANADIUM				
			NAPHTHALENE (volatile)				
Soil	Subsurface Soil	Entire Site	BAP EQUIVALENT (FULL DLs)	2.8E-06		4.2E-07	3.3E-06
			NAPHTHALENE				
			AROCLOR 1260	2.4E-08		3.7E-09	2.7E-08
			TCDD TEQs (FULL DLs)	1.4E-07		4.8E-09	1.5E-07
			ALUMINUM				
			ARSENIC	3.0E-06		1.0E-07	3.1E-06
			CADMIUM				
			CHROMIUM				
			COBALT				
			IRON				
			MANGANESE				
			MERCURY				
			VANADIUM				
Groundwater	Groundwater	Entire Site	BAP EQUIVALENT (FULL DL)	9.4E-07			9.4E-07
			TCDD TEQs (FULL DLs)	3.9E-06			3.9E-06
			PENTACHLOROPHENOL	6.5E-06			6.5E-06
			BENZENE	1.1E-07	2.6E-08	1.4E-08	1.5E-07
			TETRACHLOROETHYLENE	9.6E-07	1.3E-08	4.9E-07	1.5E-06
			DELTA-BHC (ALPHA-BHC)	2.6E-07		9.0E-08	3.5E-07
			ARSENIC	2.3E-05		6.7E-08	2.3E-05
			CADMIUM				
			COBALT				
			IRON				
			MANGANESE				
						Total Risk for Surface Soil	9.2E-06
						Total Risk for Subsurface Soil	6.6E-06
						Total Risk for Groundwater	3.6E-05

Total Risk Across All Media and All Exposure Routes: 4.4E-05

DERMAL INORGANIC SAMPLE CALCULATIONS
EXAMPLE CALCULATIONS

CLIENT: NAVAL STATION GREAT LAKES, ILLINOIS	**JOB NUMBER:** 0148
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER ADULT RESIDENT	
BASED ON: USEPA, DEC. 1989, 2001	

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from dermal contact with groundwater by an adult resident.

EQUATION:

$$DAD = \frac{DAevent \times EV \times ED \times EF \times A}{BW \times AT}$$

Where:

DAD	=	dermally absorbed dose (mg/kg/day)
DAevent	=	absorbed does per event (mg/cm^2/event)
EV	=	event frequency (events/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
A	=	skin surface available for contact (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFd	=	dermal carcinogenic slope factor ((mg/kg/day)$^{-1}$)
RfDd	=	dermal noncarcinogenic reference dose (mg/kg/day)

RISKS:

ICLR (Carcinogens) = DAD (mg/kg/day) x CSFd (mg/kg/day)$^{-1}$
HQ (Noncarcinogens) = DAD (mg/kg/day) / RFDd (mg/kg/day)

EQUATIONS for DAevent:

For Inorganics:

DAevent = Kp x Cw x CF x tevent

For Organics:

$$\text{If } tevent \le t^*, \text{ then: } DAevent = 2 \times FA \times Kp \times Cw \times CF \times \sqrt{\frac{6 \times tau \times tevent}{\pi}}$$

$$\text{If } tevent > t^*, \text{ then: } DAevent = FA \times Kp \times Cw \times CF \times \left[\frac{tevent}{1+B} + 2 \times tau \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

CLIENT: NAVAL STATION GREAT LAKES, ILLINOIS	JOB NUMBER: 0148
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER ADULT RESIDENT	
BASED ON: USEPA, DEC. 1989, 2001	

Where:

Kp	=	permeability coefficient from water (cm/hr)
Cgw	=	concentration of chemical in groundwater (mg/L)
tevent	=	duration of event (hr/event)
CF	=	conversion factor (0.001 L/cm^3)

EXAMPLE CALCULATION OF DAevent

ASSUMPTIONS:

Cgw	=	0.0033	mg/L	Chemical: Arsenic
Kp	=	1.00E-03	cm/hr	
tevent	=	0.33	hr/event	
CF	=	0.001	L/cm^3	

DAevent = 0.001 cm/hr x 0.0033 mg/L x 0.001 L/cm3

DAevent = 1.09E-09 mg/cm2-event

RISK CALCULATIONS

ASSUMPTIONS:

A	=	18000	cm^2/day
EV	=	1	event/day
ED	=	24	years
EF	=	350	days/year
BW	=	70	kg
ATc	=	25550	days
ATnc	=	8760	days
CSFd	=	1.5E+00	(mg/kg/day)$^{-1}$
RfDd	=	3.0E-04	(mg/kg/day)

CLIENT: NAVAL STATION GREAT LAKES, ILLINOIS	JOB NUMBER: 0148
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH GROUNDWATER ADULT RESIDENT	
BASED ON: USEPA, DEC. 1989, 2001	

EXAMPLE CARCINOGENIC CALCULATION

$$DADc = \frac{1.09E\text{-}09 mg/cm2\text{-}event \times 1\ event/day \times 24\ years \times 350\ days/year \times 18000\ cm2/day}{70\ kg \times 25550\ days}$$

DADc = 9.21E-08 mg/kg/day

ICLR = Not applicable, No CSF available.

EXAMPLE NONCARCINOGENIC CALCULATION

$$DADnc = \frac{1.09E\text{-}09 mg/cm2\text{-}event \times 1\ event/day \times 24\ years \times 350\ days/year \times 18000\ cm2/day}{70\ kg \times 8760\ days}$$

DADnc = 2.69E-07 mg/kg/day

HQ = 2.69E-07 mg/kg/day / 3.00E-04 (mg/kg/day) = Hazard Quotient

HQ = 0.0009

Methods for Air Modeling: PEF for On-Site Air Concentrations

The PEF for estimating on-Site air concentrations from wind-generation of particulates was adopted from the U.S. EPA's *Soil Screening Guidance: Technical Background Document* (U.S. EPA, 1996). The particulate emission factor relates the concentration of contaminant in soil with the concentration of fugitive dust particles in the air due to wind erosion. This factor is conservative as it is based on an "unlimited reservoir" model and does not assume any depletion of constituents in the soil.

The PEF is calculated according to the following equation:

$$PEF\ (m^3/kg) = Q/C \times \frac{3600\ s/h}{(0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x))}$$

Where:

Q/C	=	inverse of the mean concentration at center of square source (g/m^2-s per kg/m^3)
V	=	fraction of vegetative cover (unitless) (conservatively assumed: 0.5)
Um	=	mean annual windspeed (default U.S. EPA, 1996 – 4.69 m/s)
Ut	=	equivalent threshold value of windspeed at 7 m (default U.S. EPA, 1996 –11.32 m/s)
F(x)	=	function dependent on Um/Ut derived using Cowherd et al. (default U.S. EPA, 1996 – 0.194)

The Q/C term represents the dispersion of the particulates into the atmosphere. In U.S. EPA validation of the model, calculated Q/C values have been found to approximate closely true conditions for both on-Site and near-field receptors. This term is dependent on the site's size and meteorological conditions. However, for the purposes of this BHHRA, the Q/C value of 90.5 g/m^2-s per kg/m^3, which is based on Zone VII – average of Q/C for Chicago and Cleveland assuming ½ acre exposed area, was selected because these were the closest cities listed (Part 2, Table 3 of Technical Guidance Manual – U.S. EPA, 1996).

An on-Site wind-generated PEF of 1.36×10^9 m^3/kg was obtained using the default values of many of the criteria (as specified in the guidance and noted above) and including the conservative assumption of fraction vegetative cover of 0.5. The PEF was used to calculate air concentrations by dividing surface soil EPCs by the PEF. Resulting air concentrations are presented in the Risk Characterization tables found in Appendix D.

CLIENT:	JOB NUMBER:
NAVSTA, GREAT LAKES, ILLINOIS	0148
SUBJECT: CALCULATION OF PARTICUALATE EMISSION FACTOR FOR CONSTRUCTION WORKERS	
BASED ON: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, Dec. 2002)	

Equation 5-5
Derivation of the Particulate Emission Factor
Construction Scenario - Construction Worker

$$PEF_{sc} = Q/C_{sr} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left(\frac{W}{3}\right)^{0.4} \times \frac{(365d/yr - p)}{365d/yr} \times_{e} VKT} \right]$$

Parameter/Definition (units)	Default
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	site-specific
Q/C_{sr}/ inverse of 1-h average air concentration along a straight road segment bisecting a 0.5-acre square site (g/m^2-s per kg/m^3)	23.02
F_D/dispersion correction factor (unitless)	0.185 (Appendix E)
T/total time over which construction occurs (s)	site-specific
A_R/surface area of contaminated road segment (m^2) L_R/length of road segment (ft) W_R/width of road segment (ft)	274.213 ($A_R = L_R \times W_R \times 0.092903 m^2/ft^2$)
W/mean vehicle weight (tons)	site-specific
p/number of days with at least 0.01 inches of precipitation (days/year) (see Figure 5-2)	site-specific
• VKT/sum of fleet vehicle kilometers traveled during the exposure duration (km)	site-specific

Calculation of PEF for Construction Workers

Q/C	23.02	(g/m2-s per kg/m3)	
Fd	0.185	dispersion correction factor (unitless)	
T	8.64E+05	sec	3600 sec/hr x 8hr/day x 30days/yr
Area (A)	274.213	m^2	
W	8	tons	
p	110	day/year	
VKT	40.5	km	

PEF = 1.27E+06 m^3/kg

	A	B	C	D	E	F	G	H	I	J	K	L
1						Example ProUCL output						
2				General UCL Statistics for Full Data Sets								
3			User Selected Options									
4			From File	WorkSheet.wst								
5			Full Precision	OFF								
6			Confidence Coefficient	95%								
7			Number of Bootstrap Operations	2000								
8												
9												
10	Mn SS Site 21											
11												
12						General Statistics						
13					Number of Valid Observations	22				Number of Distinct Observations	22	
14												
15					Raw Statistics					Log-transformed Statistics		
16					Minimum	173				Minimum of Log Data	5.153	
17					Maximum	2420				Maximum of Log Data	7.792	
18					Mean	588.6				Mean of log Data	6.142	
19					Median	460				SD of log Data	0.665	
20					SD	500.9						
21					Coefficient of Variation	0.851						
22					Skewness	2.6						
23												
24						Relevant UCL Statistics						
25					Normal Distribution Test					Lognormal Distribution Test		
26					Shapiro Wilk Test Statistic	0.719				Shapiro Wilk Test Statistic	0.965	
27					Shapiro Wilk Critical Value	0.911				Shapiro Wilk Critical Value	0.911	
28					Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level		
29												
30					Assuming Normal Distribution					Assuming Lognormal Distribution		
31					95% Student's-t UCL	772.4				95% H-UCL	793.9	
32					95% UCLs (Adjusted for Skewness)					95% Chebyshev (MVUE) UCL	950.1	
33					95% Adjusted-CLT UCL (Chen-1995)	827.5				97.5% Chebyshev (MVUE) UCL	1113	
34					95% Modified-t UCL (Johnson-1978)	782.3				99% Chebyshev (MVUE) UCL	1434	
35												
36					Gamma Distribution Test					Data Distribution		
37					k star (bias corrected)	1.994				Data appear Gamma Distributed at 5% Significance Level		
38					Theta Star	295.1						
39					MLE of Mean	588.6						
40					MLE of Standard Deviation	416.8						
41					nu star	87.76						
42					Approximate Chi Square Value (.05)	67.16				Nonparametric Statistics		
43					Adjusted Level of Significance	0.0386				95% CLT UCL	764 3	
44					Adjusted Chi Square Value	65.82				95% Jackknife UCL	772.4	
45										95% Standard Bootstrap UCL	763.1	
46					Anderson-Darling Test Statistic	0.567				95% Bootstrap-t UCL	909.6	
47					Anderson-Darling 5% Critical Value	0.754				95% Hall's Bootstrap UCL	1511	
48					Kolmogorov-Smirnov Test Statistic	0.139				95% Percentile Bootstrap UCL	768.8	
49					Kolmogorov-Smirnov 5% Critical Value	0.188				95% BCA Bootstrap UCL	842	
50					Data appear Gamma Distributed at 5% Significance Level					95% Chebyshev(Mean, Sd) UCL	1054	

	A	B	C	D	E	F	G	H	I	J	K	L
51											97.5% Chebyshev(Mean, Sd) UCL	1256
52			Assuming Gamma Distribution								99% Chebyshev(Mean, Sd) UCL	1651
53					95% Approximate Gamma UCL	769.2						
54					95% Adjusted Gamma UCL	784.9						
5												
56			Potential UCL to Use								Use 95% Approximate Gamma UCL	769.2
57												
58			Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.									
59			These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)									
60			and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.									
61												
62												
63	Mn SS Site 21 wo max											
64												
65					General Statistics							
66					Number of Valid Observations	21					Number of Distinct Observations	21
67												
68			Raw Statistics						Log-transformed Statistics			
69					Minimum	173					Minimum of Log Data	5.153
70					Maximum	1250					Maximum of Log Data	7.131
71					Mean	501.4					Mean of log Data	6.064
72					Median	456					SD of log Data	0.567
73					SD	296.3						
74					Coefficient of Variation	0.591						
75					Skewness	1.209						
6												
77					Relevant UCL Statistics							
78			Normal Distribution Test						Lognormal Distribution Test			
79					Shapiro Wilk Test Statistic	0.883					Shapiro Wilk Test Statistic	0.973
80					Shapiro Wilk Critical Value	0.908					Shapiro Wilk Critical Value	0.908
81			Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level			
82												
83			Assuming Normal Distribution						Assuming Lognormal Distribution			
84					95% Student's-t UCL	612.9					95% H-UCL	654.9
85			95% UCLs (Adjusted for Skewness)								95% Chebyshev (MVUE) UCL	783.2
86					95% Adjusted-CLT UCL (Chen-1995)	626					97.5% Chebyshev (MVUE) UCL	905.6
87					95% Modified-t UCL (Johnson-1978)	615.8					99% Chebyshev (MVUE) UCL	1146
88												
89			Gamma Distribution Test						Data Distribution			
90					k star (bias corrected)	2.952			Data appear Gamma Distributed at 5% Significance Level			
91					Theta Star	169.8						
92					MLE of Mean	501.4						
93					MLE of Standard Deviation	291.8						
94					nu star	124						
95					Approximate Chi Square Value (.05)	99.28			Nonparametric Statistics			
5					Adjusted Level of Significance	0.0383					95% CLT UCL	607.8
97					Adjusted Chi Square Value	97.58					95% Jackknife UCL	612.9
98											95% Standard Bootstrap UCL	604.4
99					Anderson-Darling Test Statistic	0.287					95% Bootstrap-t UCL	635.9
100					Anderson-Darling 5% Critical Value	0.749					95% Hall's Bootstrap UCL	635.1

	A	B	C	D	E	F	G	H	I	J	K	L
101				Kolmogorov-Smirnov Test Statistic		0.129				95% Percentile Bootstrap UCL		610
102				Kolmogorov-Smirnov 5% Critical Value		0.191				95% BCA Bootstrap UCL		619
103			Data appear Gamma Distributed at 5% Significance Level							95% Chebyshev(Mean, Sd) UCL		783.2
104										97.5% Chebyshev(Mean, Sd) UCL		905.2
105			Assuming Gamma Distribution							99% Chebyshev(Mean, Sd) UCL		1145
106				95% Approximate Gamma UCL		626.3						
107				95% Adjusted Gamma UCL		637.2						
108												
109			Potential UCL to Use							Use 95% Approximate Gamma UCL		626.3
110												
111	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
112	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iacl (2002)											
113	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											

H

APPENDIX H

STATISTICAL SUPPORTING DOCUMENTATION

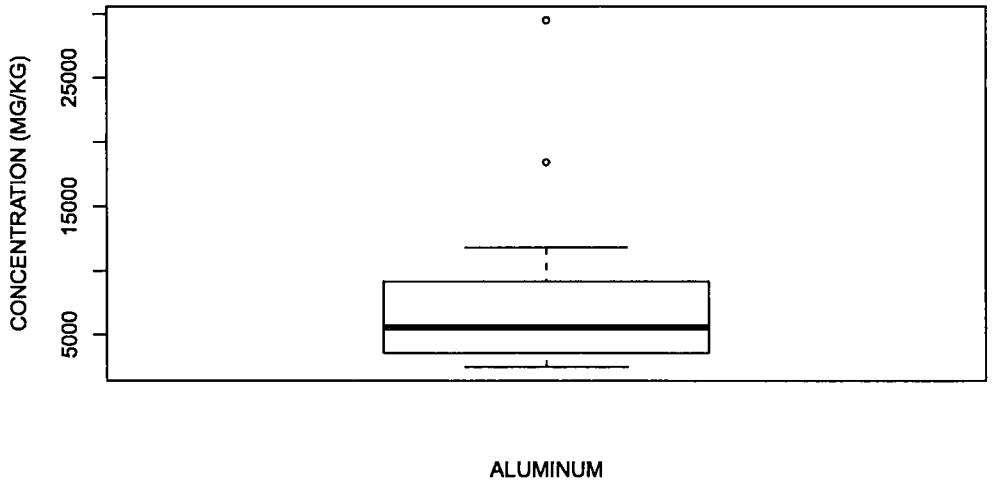
For inorganic chemical with average concentrations less than the Illinois background values a statistical evaluation was conducted to determine if on average the site concentrations were within background. The statistical evaluation consisted of a graphical component (boxplots, normal probability plots, and histograms) and a one sample hypothesis test comparing the mean/median concentration at Site 21 to the background concentration. For the one sample hypothesis test the Wilcoxon Signed Rank test was used because the Shapiro Wilks Normality Test determined that none of the data follow a normal distribution. A five percent significance level was used for all statistical tests. The null hypothesis for the Wilcoxon Signed Rank test assumed that the median site concentration was within background (less than or equal to background) while the alternative hypothesis assumed that site concentrations were greater than background. Based on the Wilcoxon Signed Rank Test only the median concentration of iron is statistically greater than background.

PARAMETER	SHAPIRO WILK P-VALUE	SHAPIRO WILKS CONCLUSION
ALUMINUM	2.32E-22	Not Normal
ANTIMONY	2.32E-22	Not Normal
ARSENIC	2.32E-22	Not Normal
BARIUM	2.32E-22	Not Normal
COBALT	2.32E-22	Not Normal
IRON	2.32E-22	Not Normal
MANGANESE	2.32E-22	Not Normal
VANADIUM	2.32E-22	Not Normal

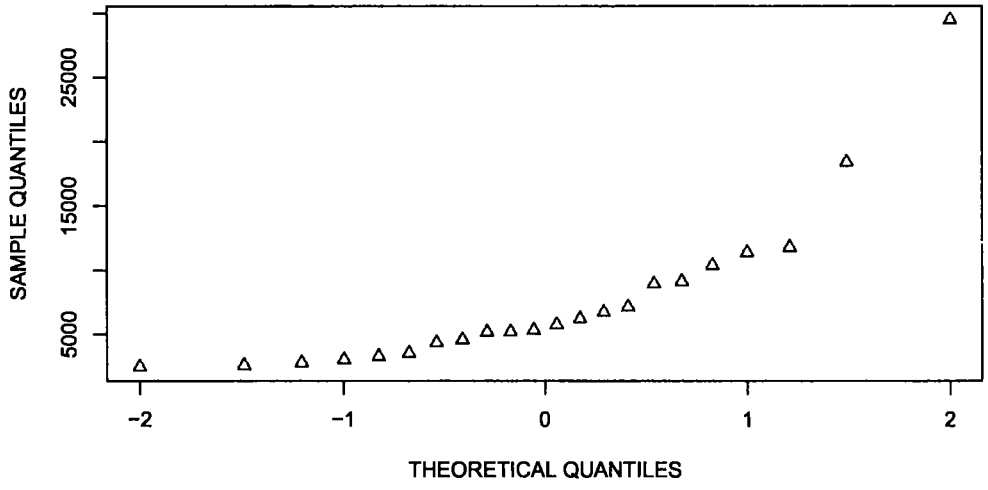
WILCOXON SIGN RANK TEST	WILCOXON SIGN RANK CONCLUSION
0.9914	Within Background
1	Within Background
0.9836	Within Background
0.9982	Within Background
0.9989	Within Background
0.0002563	Not within Background
0.9356	Within Background
1	Within Background

ALUMINUM SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

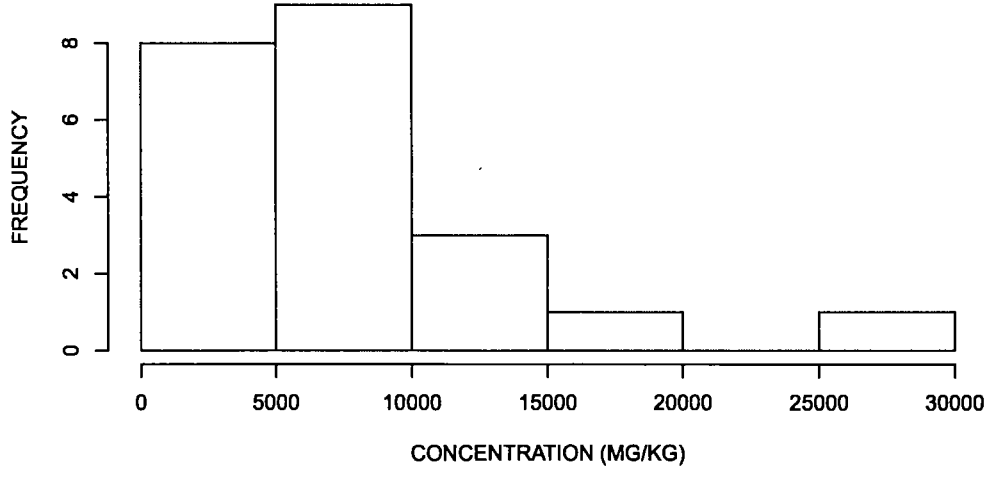
BOXPLOT



NORMAL PROBABILITY PLOT

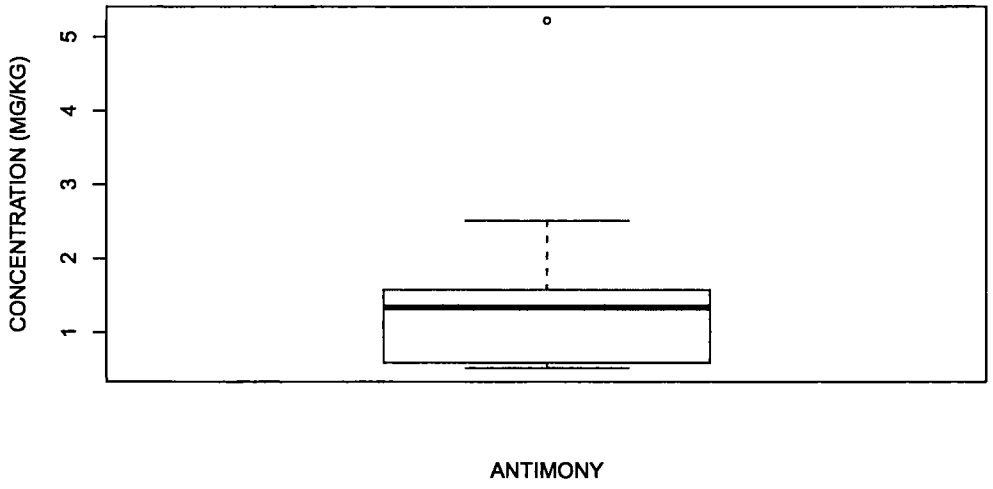


HISTOGRAM

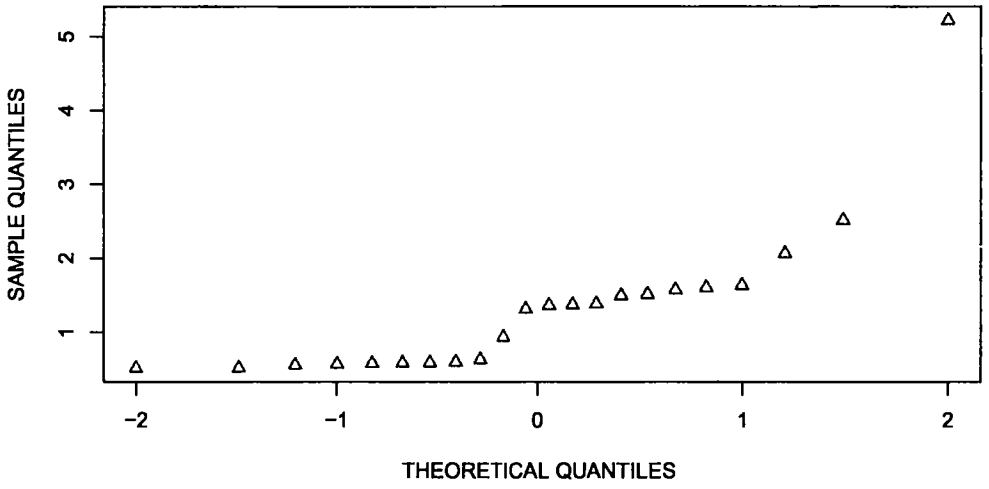


ANTIMONY SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

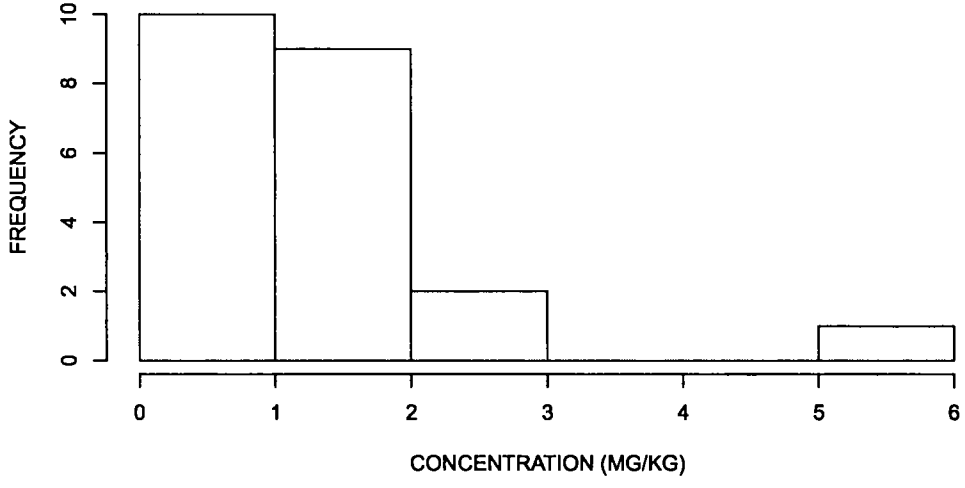
BOXPLOT



NORMAL PROBABILITY PLOT

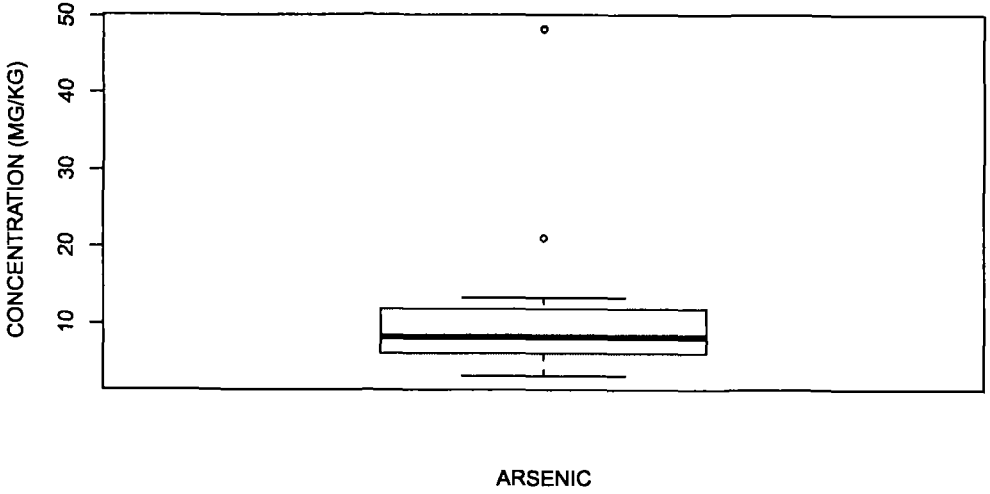


HISTOGRAM



ARSENIC SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

BOXPLOT



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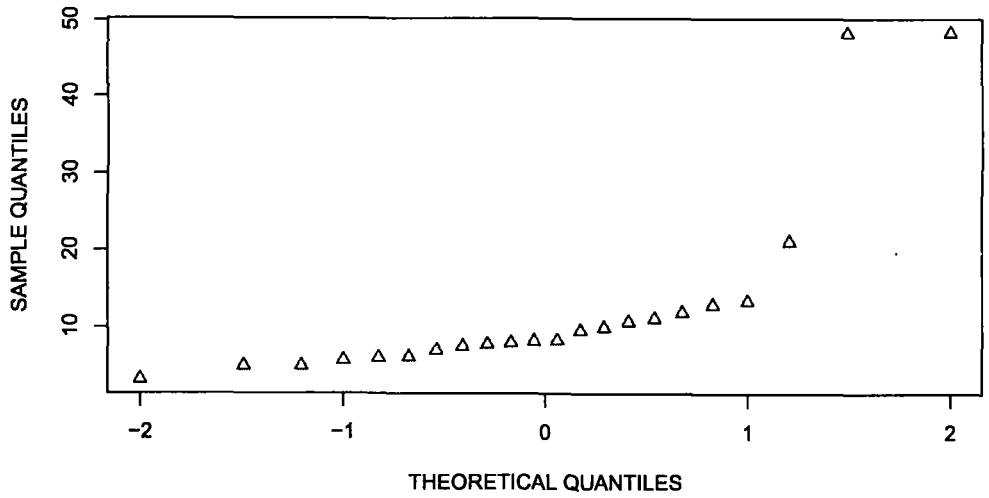

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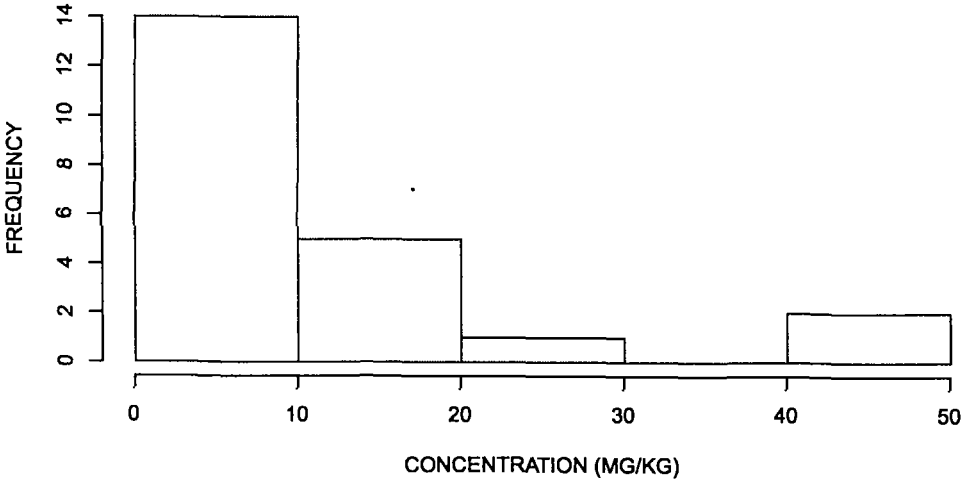
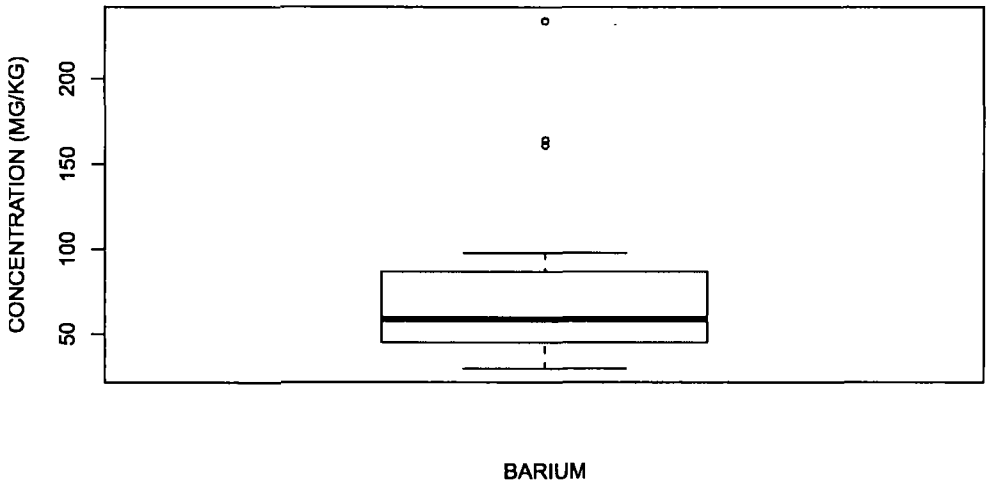
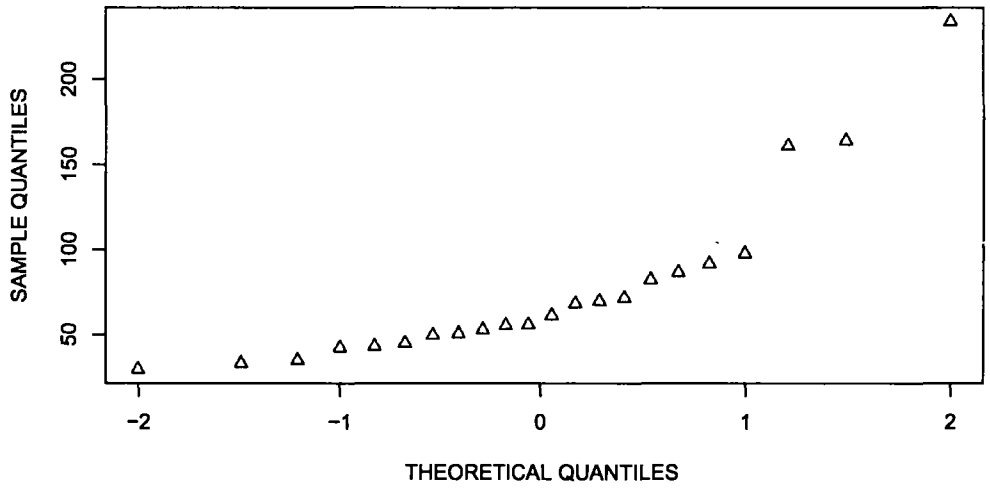


BARIUM SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

BOXPLOT



NORMAL PROBABILITY PLOT



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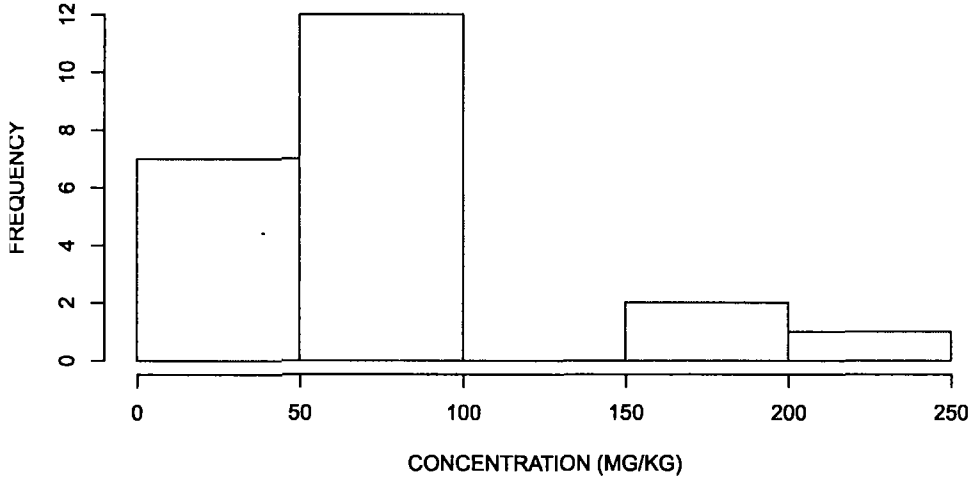
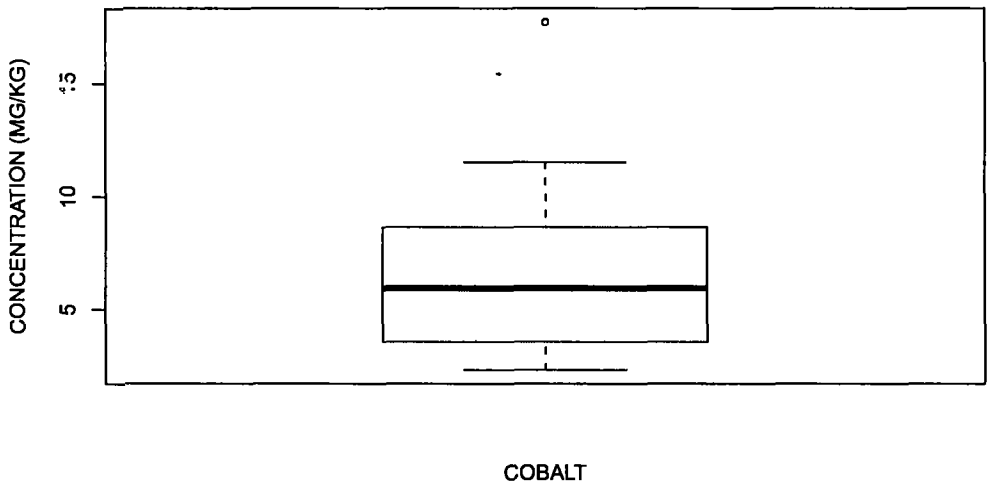
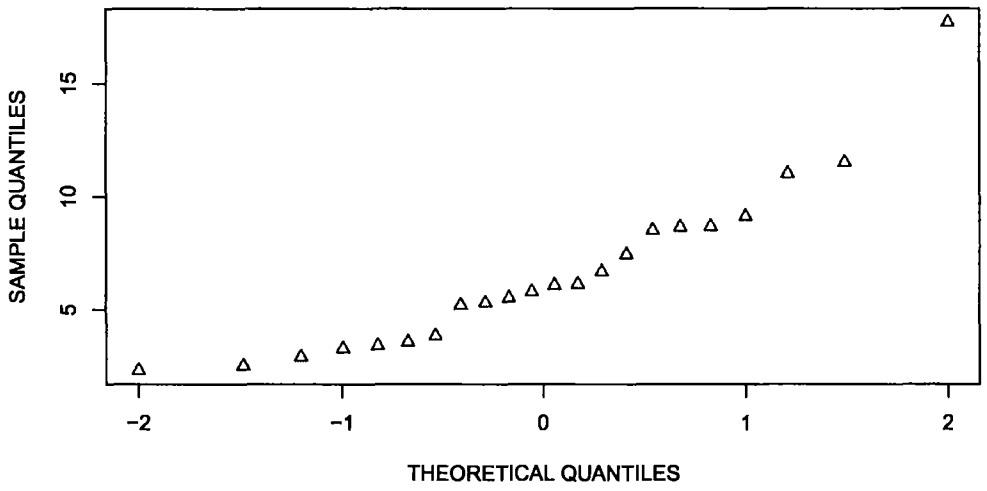


COBALT SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

BOXPLOT



NORMAL PROBABILITY PLOT



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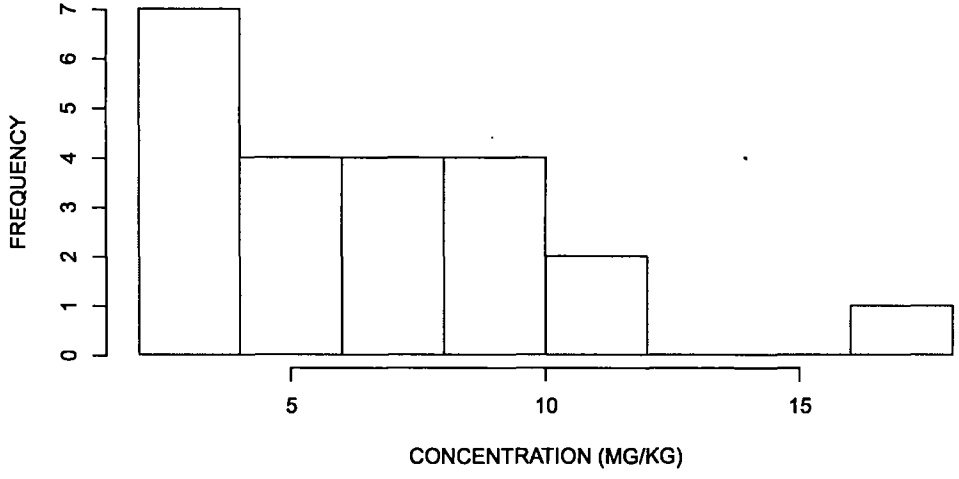
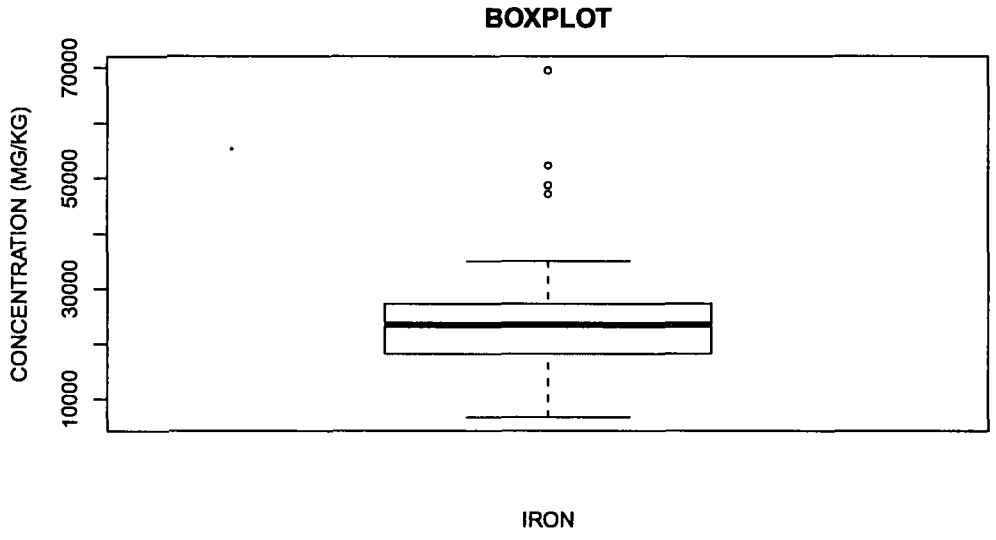
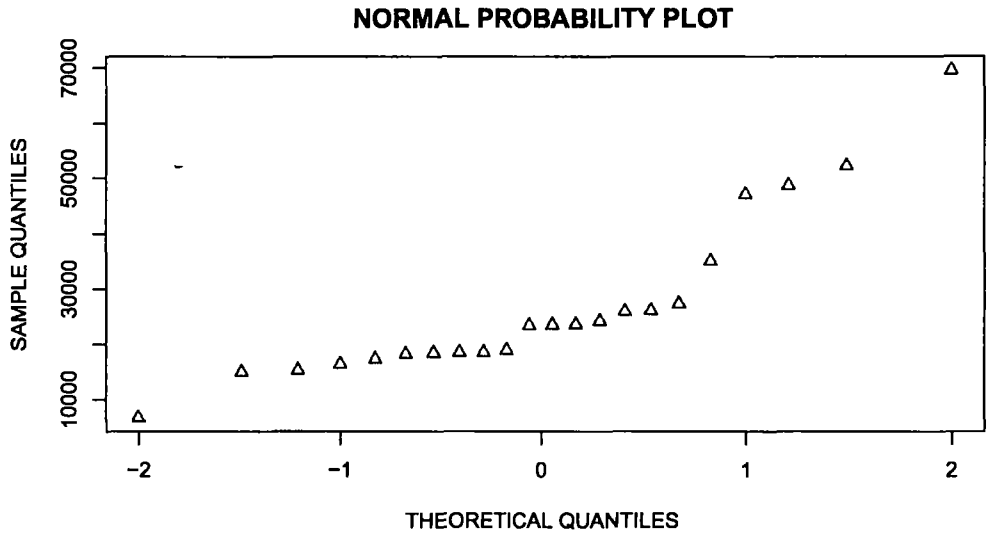
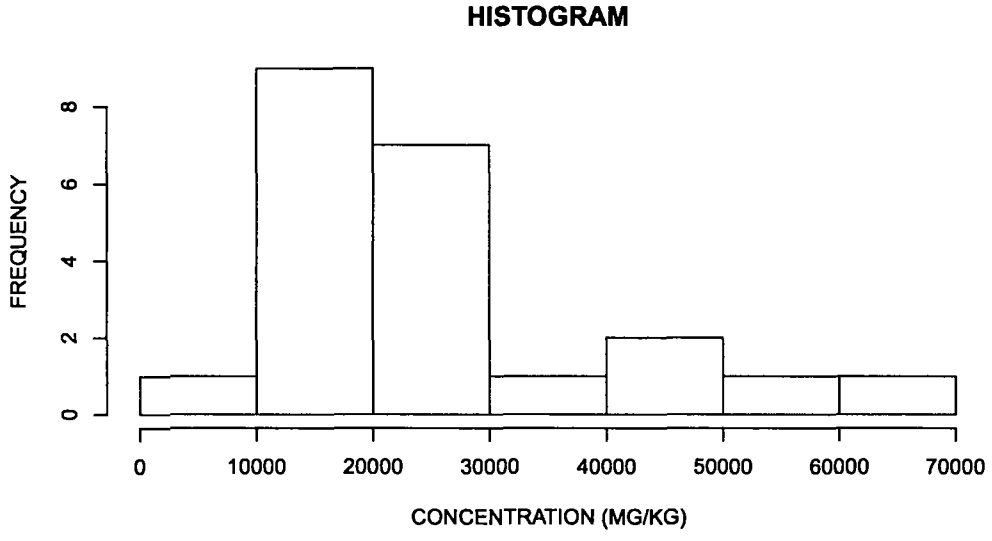


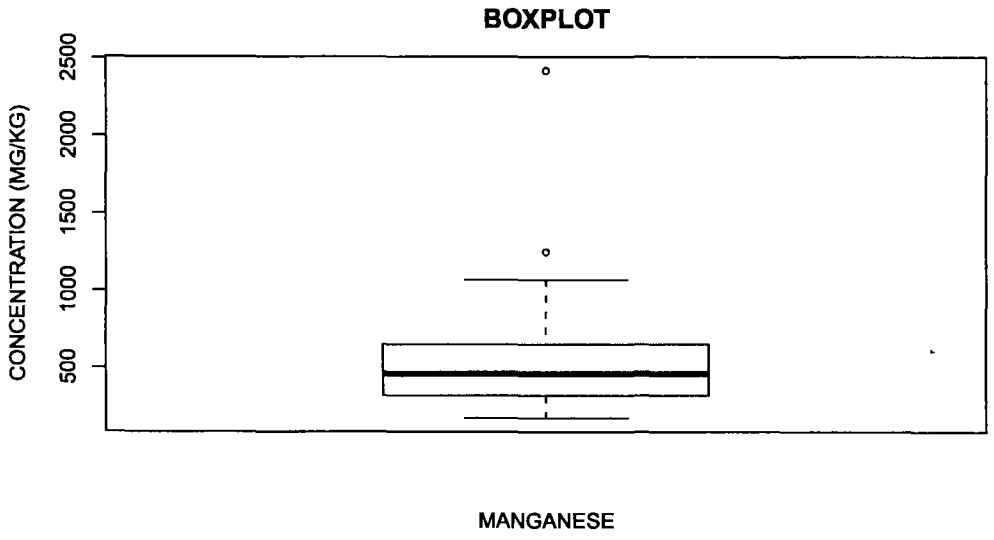
IRON SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

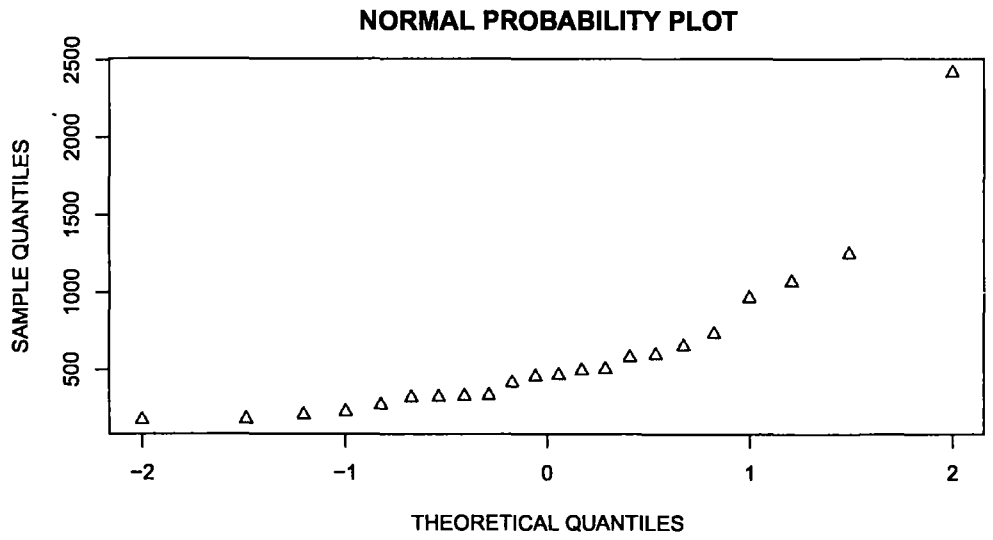


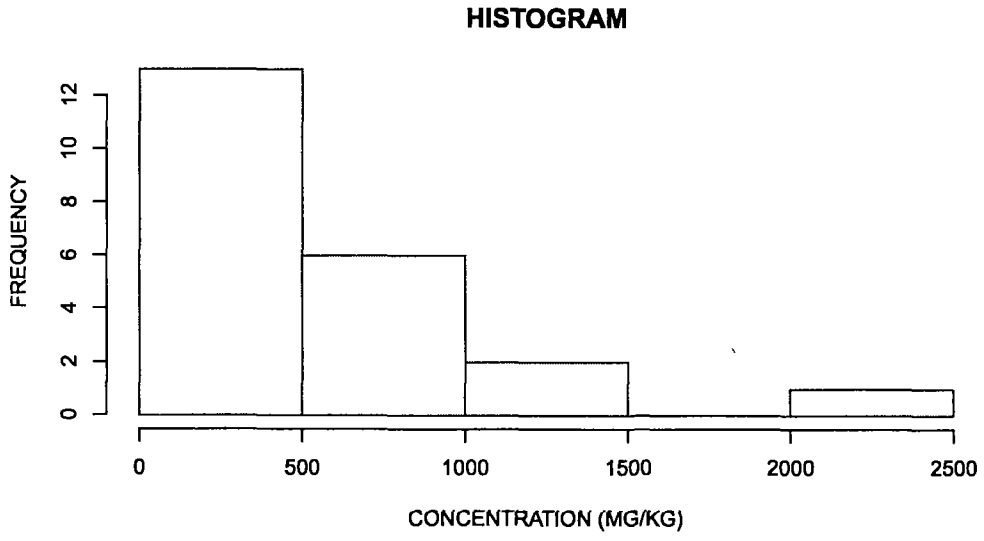




MANGANESE SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

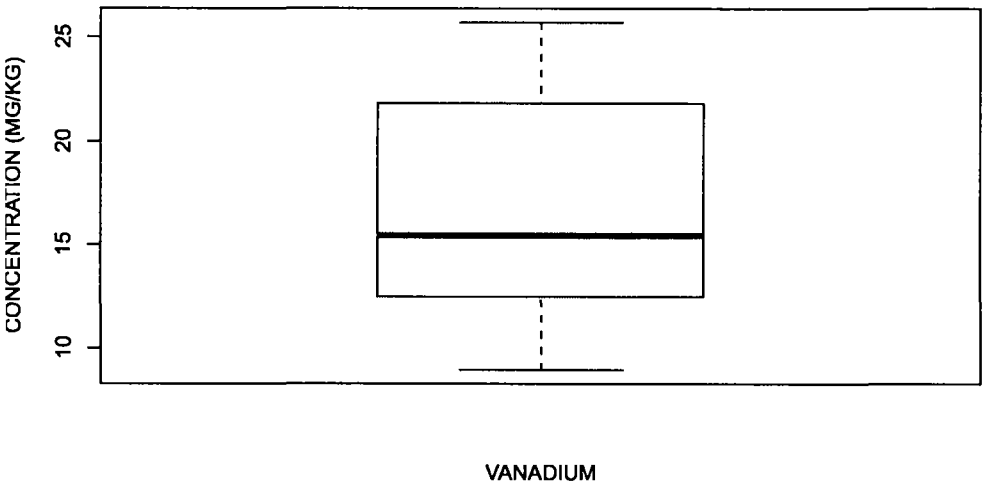




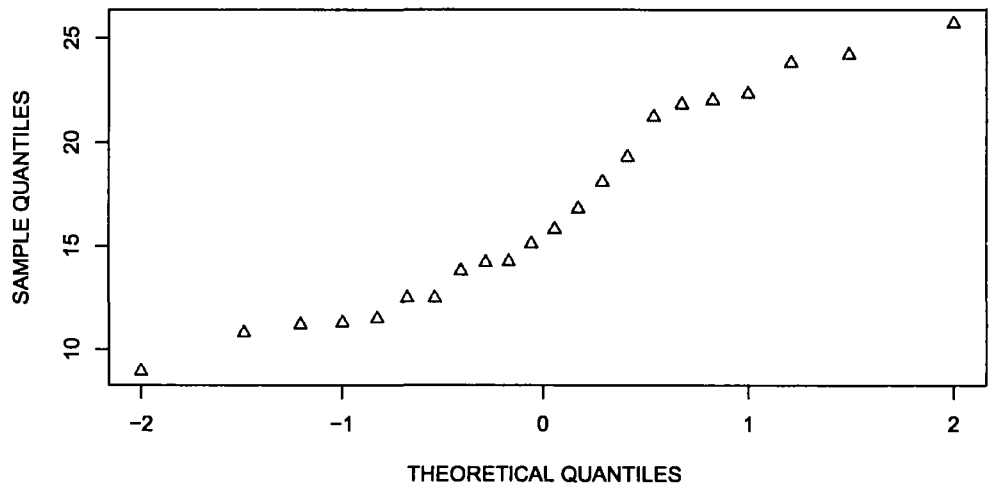
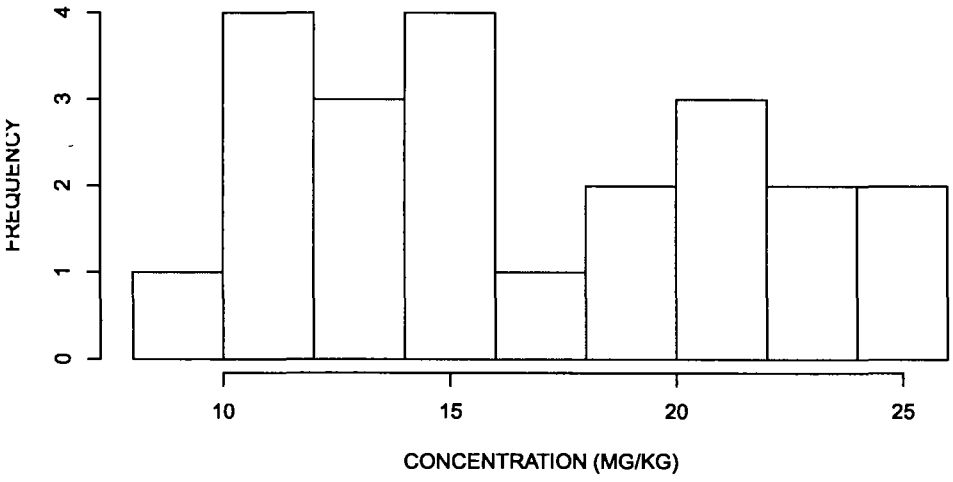


VANADIUM SURFACESOIL GRAPHICAL DISPLAYS
SITE 21 – BUILDING 1517/1506 AREA
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

BOXPLOT



NORMAL PROBABILITY PLOT



HISTOGRAM