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NAB LITTLE CREEK
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DRAFT SUPPLEMENTAL INVESTIGATION REPORT FOR SITE 12 AND 13 APPENDICES H THROUGH K NAB LITTLE CREEK VA

1/22/1996

FOSTER WHEELER ENVIRONMENTAL SERVICES, INC.

DRAFT
REPORT

APPENDICES H - K

for
SUPPLEMENTAL REMEDIAL INVESTIGATION

SITE 12 - EXCHANGE LAUNDRY WASTE DISPOSAL AREA
SITE 13 - PUBLIC WORKS PCP DIP-TANK AND WASH RACK

at
NAVAL AMPHIBIOUS BASE, LITTLE CREEK
VIRGINIA BEACH, VIRGINIA
CONTRACT TASK ORDER 0247

Prepared For:
NAVAL FACILITIES
ENGINEERING COMMAND
ATLANTIC DIVISION
Norfolk, Virginia

Under:
Contract N62470-89-D-4814

Prepared By:
FOSTER WHEELER ENVIRONMENTAL SERVICES, INC.
Livingston, New Jersey

through
BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

January 22, 1996

APPENDIX H

RISK-BASED CONCENTRATION TABLES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Street
Philadelphia, Pennsylvania 19107

cc: G. King
N. Apte
P. Scia

October 20, 1995

SUBJECT: Risk-Based Concentration Table, July - December 1995

FROM: Roy L. Smith, Ph.D.
Office of RCRA
Technical & Program Support Branch (3HW70)

TO: RBC Table mailing list

Attached is the EPA Region III risk-based concentration (RBC) table, which we distribute semi-annually to all interested parties.

IMPORTANT MESSAGE

EPA Region III has established a homepage on the World Wide Web which you can find at http://earth1.epa.gov:80/ or http://www.epa.gov/. Our homepage will soon include the RBC table in downloadable form. We strongly encourage all RBC table users having Internet access to obtain the table electronically rather than on paper. In this way, users can obtain the most current issue immediately in a form that can be used directly as input for risk assessment calculations. This distribution method will also save large amounts of paper and cost substantially less.

For those lacking Internet access, it's once again time to re-register to receive a paper copy of the RBC table. We need to hear from you periodically to ensure that you still have an interest and that we have your correct address. Please fax your registration request to Vanessa Sizer at 215-597-9890, including your name, address, and phone number. Please don't phone to re-register; we need hard copy to document your continued interest. If we don't hear from you by March 30, 1996, we'll assume you no longer need a paper copy. Thanks for your cooperation.

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The table contains reference doses and carcinogenic potency slopes (obtained from IRIS through September 1, 1995, HEAST through May 1995, the EPA-NCEA Superfund Health Risk Technical Support Center, and other EPA sources) for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (*i.e.*, a hazard quotient of 1, or lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The RBC table also includes soil screening levels (SSLs) for protection of groundwater

ANSWERS TO FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than either the inhalation rate for a child (12) or for an adult (20)?

Age-adjusted factors are not intake rates, but rather partial calculations which have different units than intake rates do. The fact that these partial calculations have values similar to intake rates is really coincidental, an artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. Why does arsenic appear in the RBC table separately as a carcinogen and a non-carcinogen, while other contaminants do not?

Arsenic is double-entered to ensure that the risk assessor realizes that non-carcinogenic concerns are significant for arsenic. Otherwise, one might be tempted to accept a 1e-4 risk (37 ppm in residential soil), when the oral reference dose would be exceeded at 23 ppm.

Also, EPA has a little-known risk management policy for arsenic (dating from 1988) that suggests that arsenic-related cancer risks of up to 1e-3 can be accepted because the cancers are squamous cell carcinomas with a low mortality rate. Thus, noncarcinogenic RBCs represent an important limitation on acceptable arsenic concentrations.

3. Many contaminants have no inhaled reference dose or carcinogenic potency slope in IRIS, yet these numbers appear in the RBC table with IRIS given as the source. Where did the numbers come from?

Most inhaled reference doses and potency slopes in the RBC table are converted from reference concentrations and unit risk values which do appear in IRIS. These conversions assume 70-kg persons inhaling 20 m^3/d. For example, the inhalation unit risk for arsenic (4.3e-3 risk per $\mu g/m^3$) is divided by 20 m^3/d and multiplied by 70 kg times 1000 μg/mg, yielding a CPSi of 15.1 risk per mg/kg/d.

4. Why does the RBC table base soil RBCs for cadmium and manganese on reference doses that apply only to drinking water?

The RBC table's use of the drinking water RfDs for cadmium and manganese reflects (1) the limited space available in the already-crowded table, and (2) the intended use of the table as a screening tool rather than a source of cleanup levels (thereby making false positives acceptable). For a formal risk assessment, Region III would use the food RfDs for soil ingestion.

At this time, only two substances (as far as we know) have distinct oral RfDs for water and food--cadmium and manganese. Adding the two food RfDs to the table would require an entire column, which would be about 99.9% blank. The table has become so crowded that it would be difficult to accommodate another column. Also, we given this problem a relatively low

reference dose or potency slope for inorganic lead, so it wasn't possible to calculate risk-based concentrations. EPA considers lead a special case because:

(1) Lead is ubiquitous in all media, so human exposure comes from multiple sources. Comparing single-medium exposures with a reference dose would be misleading.

(2) If EPA did develop a reference dose for lead by the same methods other reference doses, we would probably find that most people already exceed it. Since EPA already knows this and is moving aggressively to lower lead releases nationally, such findings at individual sites would be irrelevant and unduly alarming.

(3) EPA decided to take a new approach to separate important lead exposures from trivial ones. EPA developed a computer model (the IEUBK model) which predicts children's blood lead concentrations using lead levels in various media as inputs. The idea is to evaluate a child's entire environment, and reduce lead exposures in the most cost-effective way.

On the practical side, there are several EPA policies which effectively substitute for RBCs. The EPA Office of Solid Waste has released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 ppm be considered safe for residential use. Above that level, the document suggests collecting certain types of data and modeling children's blood lead with the IEUBK model. For the purposes of the RBC table, the de facto residential soil number would be 400 mg/kg. For water, we suggest 15 ppb (from the national EPA Action Level), and for air, the National Ambient Air Quality Standard.

9. Where did the potency slopes for carcinogenic PAHs come from?

The source of the potency slopes for PAHs is "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons", Final Draft, EPA Environmental Criteria and Assessment Office, Cincinnati, OH. It's available from NTIS as document number ECAO-CIN-842 (March, 1993). The slopes are expressed in terms of order-of-magnitude equivalence factors relating the compounds to benzo[a]pyrene; we have converted these TEQs to potency slopes to fit the format of the table.

10. May I please have a copy of the January 1991 RBC table?

We're sorry, but no. The RBC table doesn't represent regulation or guidance, so past issues should have no legal importance. Each time we update the table we destroy all obsolete copies, electronic and paper. We do this to ensure that only one set of RBCs, that based on current information, exists at any time.

11. I've noticed that some soil RBCs are 1 million parts per million. Since some of these substances are liquids, that's obviously ridiculous. What is that basis for these calculations?

A soil RBC of 1 million parts per million means that no amount of the contaminant in soil will cause a receptor to exceed the oral reference dose by incidental ingestion of soil. In

It has been NCEA's policy to deny requests for documentation of interim toxicity constants. Although Region 3 has sometimes provided this documentation on request, for the above-stated reasons we have no assurance that the documentation, or even the interim numbers, are current. We've decided to discontinue distributing information that may be misleading. If one of the "E"-coded contaminants is a major risk contributor at your site, we strongly suggest that you work with EPA to develop an up-to-date reference dose or slope factor.

CHANGES IN THIS ISSUE OF THE RBC TABLE

New or revised EPA toxicity constants are now marked with "**" before the contaminant name. This is to help users quickly pick out substances with new RBCs. Formerly these contaminants were printed in underlined boldface type that copied badly. A new basis code, "M" for MCL, has been added to the upper right corner of each page. This code denotes soil screening levels for groundwater protection that are based on EPA Maximum Contaminant Levels.

If you want to raise issues or get answers to questions about the RBC table, please call the Technical Support Help Line at 215-597-1116. The line has a voice mail system to take your calls if we're not available. We'll return your call as soon as we can. Please limit calls to RBC issues; if you have a question about applying RBCs to a site, please call the EPA Regional office handling the project. Thanks for your help and cooperation, and we hope the RBC table continues to be a useful resource.

Attachment

Exposure variables	Value	Symbol
Occupational:		
Exposure frequency (d/y):	250	EFo
Exposure duration (y):	25	EDo
Fraction of contaminated soil ingested (unitless)	0.5	FC

*: Contaminant-specific toxicological constants. The priority among sources of toxicological constants was as follows: (1) IRIS, (2) HEAST, (3) HEAST alternative method, (4) EPA-NCEA Superfund Health Risk Technical Support Center, (5) withdrawn from IRIS or HEAST, and (6) other EPA documents. Each source was used only if numbers from higher-priority sources were unavailable. The EPA Superfund Health Risk Technical Support Center, part of the EPA National Center for Environmental Assessment in Cincinnati, develops provisional RfDs and CPSs on request for contaminants not in IRIS or HEAST. These provisional values are labeled "E = EPA-NCEA provisional" in the table. It is possible they may be obsolete. If one of the "E" constants is important to a Superfund risk assessment, consider requesting, through a Regional risk assessor, a new provisional value.

Age-adjusted factors

Because contact rates with tap water, ambient air, and residential soil are different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors. These factors approximated the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure durations for two age groups - small children and adults. The age-adjusted factor for soil was obtained from RAGS IB; the others were developed by analogy.

Air inhalation

$$IFAadj \ \frac{m^3 \cdot y}{kg \cdot d} = \frac{EDc \cdot IRAc}{BWc} + \frac{(EDtot - EDc) \cdot IRAa}{BWa}$$

Tap water ingestion

$$IFWadj \ \frac{L \cdot y}{kg \cdot d} = \frac{EDc \cdot IRWc}{BWc} + \frac{(EDtot - EDc) \cdot IRWa}{BWa}$$

Soil ingestion

$$IFSadj \ \frac{mg \cdot y}{kg \cdot d} = \frac{EDc \cdot IRSc}{BWc} + \frac{(EDtot - EDc) \cdot IRSa}{BWa}$$

Residential water

Volatilization terms were calculated only for compounds with a mark in the "VOC" column. Compounds having a Henry's Law constant greater than 10^{-5} were considered volatile. The list may be incomplete, but is unlikely to include false positives. The equations and the volatilization factor (K, above) were obtained from RAGS IB. Oral potency slopes and reference doses were used for both oral and inhaled exposures for volatile compounds lacking inhalation values. Inhaled potency slopes were substituted for unavailable oral potency slopes only for volatile compounds; inhaled RfDs were substituted for unavailable

Commercial/industrial soil ingestion

RBCs were based on adult occupational exposure, including an assumption that only 50% of total soil ingestion is work-related.

Carcinogens

$$RBC\ \frac{mg}{kg} = \frac{TR\ BWa\ ATc}{EFo\ EDo \cdot \frac{IRSa}{10^6\ \frac{mg}{kg}} \cdot FC \cdot CPSo}$$

Non-carcinogens

$$RBC\ \frac{mg}{kg} = \frac{THQ\ RfDo \cdot BWa \cdot ATn}{EFo \cdot EDo \cdot \frac{IRSa}{10^6\ \frac{mg}{kg}} \cdot FC}$$

Residential soil ingestion

RBCs for carcinogens were based on combined childhood and adult exposure; RBCs for non-carcinogens were based on childhood exposure only.

Carcinogens

$$RBC\ \frac{mg}{kg} = \frac{TR \cdot ATc}{EFr \cdot \frac{IFSadj}{10^6\ \frac{mg}{kg}} \cdot CPSo}$$

Non-carcinogens

$$RBC\ \frac{mg}{kg} = \frac{THQ\ RfDo \cdot BWc \cdot ATn}{EFr \cdot EDc \cdot \frac{IRSc}{10^6\ \frac{mg}{kg}}}$$

Development of Soil Screening Levels

General

In December 1994 the EPA Office of Solid Waste and Emergency Response proposed Soil Screening Guidance (Document 9355.4-1, PB95-963530, EPA540/R-94/101, available through NTIS at 703-487-4650). This draft document provides (1) a framework in which soil screening levels are to be used, (2) a detailed methodology for calculating soil screening levels, and (3) soil screening levels for 107 substances.

Consistent with this new guidance, the risk-based concentration table now includes two columns of generic soil screening levels (SSLs). OSWER's 107 proposed soil screening levels have been added verbatim. In addition, the proposed SSL methodology has been used to calculate soil screening levels for more substances, which are also included in the

consulting that document. The "unofficial" SSLs were developed under the following conditions:

Soil Screening Levels for Inhalation

Inhaled reference doses and potency slopes were used if available. If inhalation values were not available, oral RfDs and potency slopes were substituted. SSLs were calculated only for substances for which aqueous solubility, Koc, Henry's Law constant, and diffusivity in air were available. SSLs were calculated only for substances for which a volatilization factor could be calculated. This was done because OSWER's large proposed particulate emission factor rendered it pointless to estimate SSLs for particulate emissions alone. The final calculated SSL shown in the RBC table is the smaller of the risk-based SSL and the soil saturation concentration. All calculated SSLs were rounded to 2 significant figures.

The OSWER risk algorithms for inhalation were revised in order to be consistent with the rest of the RBC table. Only calculated SSLs were affected by this; SSLs proposed by OSWER are presented verbatim. Calculated SSLs for inhalation of carcinogens were based on an integrated lifetime exposure rather than adult exposure. SSLs for inhalation of noncarcinogens were based on adult exposure for 350 days per year rather than 365 days per year. The following algorithms were used to calculate inhalation SSLs:

Carcinogens

$$SSL \ \frac{mg}{kg} = \frac{TR \cdot ATc}{EFr \cdot IFAadj \cdot \left(\frac{1}{VF} + \frac{1}{PEF}\right) \cdot CPSi}$$

Non-carcinogens

$$SSL \ \frac{mg}{kg} = \frac{THQ \cdot BWa \cdot ATn \cdot RfDi}{EFr \cdot EDtot \cdot IRAa \cdot \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Soil Screening Levels for Groundwater Use

All algorithms were as proposed by OSWER. MCLs were used as target groundwater concentrations if available. If MCLs were unavailable the risk-based concentration in the "tap water" column of the RBC table was used as the target groundwater concentration. All SSLs for groundwater are based on a dilution-attenuation factor (DAF) of 10. Since these SSLs scale linearly with DAF, the SSLs for DAF=1 would be ten times lower. They were omitted to conserve space. All groundwater SSLs were rounded to 2 significant figures and capped at unity.

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis: C=carcinogenic effects N=noncarcinogenic effects E=EPA draft Soil Screening Level S=soil saturation concentration M=EPA MCL.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Risk-Based Concentrations: Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Soil Ingestion: Industrial mg/kg	Soil Ingestion: Residential mg/kg	Soil Screening Levels-Transfers from Soil to: Air mg/kg	Groundwater mg/kg
Arsine	7784421		1.43E-05 i				0.52 n	0.052 n					
Assure	76578148	9.00E-03 i					330 n	33 n	12 n	18000 n	700 n		
Asulam	3337711	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Atrazine	1912249	3.50E-02 i		2.22E-01 n			0.3 c	0.028 c	0.014 c	26 c	2.9 c		
Avermectin B1	65195553	4.00E-04 i					15 n	1.5 n	0.54 n	820 n	31 n		
Azobenzene	103333			1.10E-01 i	1.08E-01 i		0.61 c	0.058 c	0.029 c	52 c	5.8 c		
Barium and compounds	7440393	7.00E-02 i	1.43E-04 a				2600 n	0.52 n	95 n	140000 n	5500 n	350000 e	32 e
Baygon	114261	4.00E-03 i					150 n	15 n	5.4 n	8200 n	310 n		
Bayleton	43121433	3.00E-02 i					1100 n	110 n	41 n	61000 n	2300 n		
Baythroid	68359375	2.50E-02 i					910 n	91 n	34 n	51000 n	2000 n		
Benefin	1861401	3.00E-01 i					11000 n	1100 n	410 n	610000 n	23000 n		
Benomyl	17804352	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Bentazon	25057890	2.50E-03 i					91 n	9.1 n	3.4 n	5100 n	200 n		
Benzaldehyde	100527	1.00E-01 i				☒	610 n	370 n	140 n	200000 n	7800 n		
Benzene	71432		1.71E-03 e	2.90E-02 i	2.90E-02 i	☒	0.36 c	0.22 c	0.11 c	200 c	22 c	0.5 e	0.02 e
Benzenethiol	108985	1.00E-05 n					0.37 n	0.037 n	0.014 n	20 n	0.78 n		
Benzidine	92875	3.00E-03 i		2.30E+02 i	2.35E+02 i		0.00029 c	0.00003 c	0.00001 c	0.025 c	0.0028 c	1.3 c	1.100E-06 c
Benzoic acid	65850	4.00E+00 i					150000 n	15000 n	5400 n	1E+06 n	310000 n	320 e	280 e
Benzotrichloride	98077			1.30E+01 i			0.0052 c	0.00048 c	0.00024 c	0.44 c	0.049 c	0.012 c	0.000073 c
Benzyl alcohol	100516	3.00E-01 n					11000 n	1100 n	410 n	610000 n	23000 n		
Benzyl chloride	100447			1.70E-01 i		☒	0.062 c	0.037 c	0.019 c	34 c	3.8 c	0.5 c	0.00036 c
Beryllium and compounds	7440417	5.00E-03 i		4.30E+00 i	8.40E+00 i		0.016 c	0.00075 c	0.00073 c	1.3 c	0.15 c	690 e	180 e
Bidrin	141662	1.00E-04 i					3.7 n	0.37 n	0.14 n	200 n	7.8 n		
Biphenthrin (Talstar)	82657043	1.50E-02 i					550 n	55 n	20 n	31000 n	1200 n		
1,1-Biphenyl	92524	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n	9000 e	110 n
Bis(2-chloroethyl)ether	111444			1.10E+00 i	1.16E+00 i	☒	0.0092 c	0.0054 c	0.0029 c	5.2 c	0.58 c	0.3 e	0.0003 e
Bis(2-chloroisopropyl)ether	39638329	4.00E-02 i		7.00E-02 n	3.50E-02 n	☒	0.26 c	0.18 c	0.045 c	82 c	9.1 c		
Bis(chloromethyl)ether	542881			2.20E+02 i	2.17E+02 i	☒	0.00005 c	0.00003 c	0.00001 c	0.026 c	0.0029 c	0.00004 c	1.000E-07 c
Bis(2-chloro-1-methylethyl)ether				7.00E-02 w	7.00E-02 w		0.96 c	0.089 c	0.045 c	82 c	9.1 c		
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02 i		1.40E-02 i			4.8 c	0.45 c	0.23 c	410 c	46 c	210 e	11 e
Bisphenol A	80057	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Boron (and borates)	7440428	9.00E-02 i	5.71E-03 n				3300 n	21 n	120 n	180000 n	7000 n		
Boron trifluoride	7637072		2.00E-04 n				7.3 n	0.73 n					
Bromodichloromethane	75274	2.00E-02 i		6.20E-02 i		☒	0.17 c	0.1 c	0.051 c	92 c	10 c	1800 e	0.3 e
Bromoethene	593602				1.10E-01 n	☒	0.096 c	0.057 c					
Bromoform (tribromomethane)	75252	2.00E-02 i		7.90E-03 i	3.85E-03 i	☒	2.4 c	1.6 c	0.4 c	720 c	81 c	46 e	0.5 e
Bromomethane	74839	1.40E-03 i	1.43E-03 i			☒	8.7 n	5.2 n	1.9 n	2900 n	110 n	2 e	0.1 e
4-Bromophenyl phenyl ether	101553	5.80E-02 o					2100 n	210 n	78 n	120000 n	4500 n		
Bromophos	2104963	5.00E-03 n					180 n	18 n	6.8 n	10000 n	390 n		

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Risk-Based Concentrations: Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Soil Ingestion: Industrial mg/kg	Soil Ingestion: Residential mg/kg	Soil Screening Levels-Transfers from Soil to: Air mg/kg	Groundwater mg/kg
Chlorodifluoromethane	75456		1.43e+01 i			☒	87000 n	52000 n					
Chloroethane	75003	4.00E-01 e	2.86E+00 i			☒	8600 n	10000 n	540 n	820000 n	31000 n	2600 s	33 n
2-Chloroethyl vinyl ether	110758	2.50E-02 o				☒	150 n	91 n	34 n	51000 n	2000 n		
Chloroform	67663	1.00E-02 i		6.10E-03 i	8.05E-02 i	☒	0.15 c	0.078 c	0.52 c	940 c	100 c	0.2 e	0.3 e
Chloromethane	74873			1.30E-02 n	6.30E-03 n	☒	1.4 c	0.99 c	0.24 c	440 c	49 c	0.063 c	0.0066 c
4-Chloro-2,2-methylaniline hydrochloride	3165933			4.60E-01 n			0.15 c	0.014 c	0.0069 c	12 c	1.4 c		
4-Chloro-2-methylaniline	95692			5.80E-01 n			0.12 c	0.011 c	0.0054 c	9.9 c	1.1 c		
beta-Chloronaphthalene	91587	8.00E-02 i					2900 n	290 n	110 n	160000 n	6300 n	2.8 s	140 n
o-Chloronitrobenzene	88733			2.50E-02 n		☒	0.42 c	0.25 c	0.13 c	230 c	26 c		
p-Chloronitrobenzene	100005			1.80E-02 n		☒	0.59 c	0.35 c	0.18 c	320 c	35 c		
2-Chlorophenol	95578	5.00E-03 i					180 n	18 n	6.8 n	10000 n	390 n	53000 e	2 e
2-Chloropropane	75296		2.86E-02 n			☒	170 n	100 n				22 n	0.64 n
Chlorothalonil	1897456	1.50E-02 i		1.10E-02 n			6.1 c	0.57 c	0.29 c	520 c	58 c		
o-Chlorotoluene	95498	2.00E-02 i				☒	120 n	73 n	27 n	41000 n	1600 n	1200 n	5.6 n
Chlorpropham	101213	2.00E-01 i					7300 n	730 n	270 n	410000 n	16000 n		
Chlorpyrifos	2921882	3.00E-03 i					110 n	11 n	4.1 n	6100 n	230 n		
Chlorpyrifos-methyl	5598130	1.00E-02 n					370 n	37 n	14 n	20000 n	780 n		
Chlorsulfuron	64902723	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Chlorthiophos	60238564	8.00E-04 n					29 n	2.9 n	1.1 n	1600 n	63 n		
Chromium III and compounds	16065831	1.00E+00 i	5.71E-07 w				37000 n	0.0021 n	1400 n	1E+06 n	78000 n		
Chromium VI and compounds	18540299	5.00E-03 i			4.20E+01 i		180 n	0.00015 c	6.8 n	10000 n	390 n	140 e	19 e
Coal tar	8001589				2.20E+00 w			0.0028 c					
Cobalt	7440484	6.00E-02 e					2200 n	220 n	81 n	120000 n	4700 n		
Coke Oven Emissions	8007452				2.17E+00 i			0.0029 c					
**Copper and compounds	7440508	4.00E-02 e					1500 n	150 n	54 n	82000 n	3100 n		
Crotonaldehyde	123739	1.00E-02 w		1.90E+00 n	1.90E+00 w		0.035 c	0.0033 c	0.0017 c	3 c	0.34 c		
Cumene	98828	4.00E-02 i	2.57E-03 n				1500 n	9.4 n	54 n	82000 n	3100 n	81 n	65 n
Cyanides:													
Barium cyanide	542621	1.00E-01 w					3700 n	370 n	140 n	200000 n	7800 n		
Calcium cyanide	592018	4.00E-02 i					1500 n	150 n	54 n	82000 n	3100 n		
Copper cyanide	544923	5.00E-03 i					180 n	18 n	6.8 n	10000 n	390 n		
Cyanazine	21725462	2.00E-03 n		8.40E-01 n			0.08 c	0.0075 c	0.0038 c	6.8 c	0.76 c		
Cyanogen	460195	4.00E-02 i					1500 n	150 n	54 n	82000 n	3100 n		
Cyanogen bromide	506683	9.00E-02 i					3300 n	330 n	120 n	180000 n	7000 n		
Cyanogen chloride	506774	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Free cyanide	57125	2.00E-02 i					730 n	73 n	27 n	41000 n	1600 n		
Hydrogen cyanide	74908	2.00E-02 i	8.57E-04 i				730 n	3.1 n	27 n	41000 n	1600 n		
Potassium cyanide	151508	5.00E-02 i					1800 n	180 n	68 n	100000 n	3900 n		
Potassium silver cyanide	506616	2.00E-01 i					7300 n	730 n	270 n	410000 n	16000 n		

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							Risk-Based Concentrations					Soil Screening Levels-Transfers from Soil to:	
										Soil Ingestion			
Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Industrial mg/kg	Residential mg/kg	Air mg/kg	Groundwater mg/kg
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03 i					290 n	29 n	11 n	16000 n	630 n		
1,2-Dichloropropane	78875		1.14E-03 i	6.80E-02 n		☒	0.16 c	0.092 c	0.046 c	84 c	9.4 c	11 s	0.02 s
2,3-Dichloropropanol	616239	3.00E-03 i					110 n	11 n	4.1 n	6100 n	230 n		
1,3-Dichloropropene	542756	3.00E-04 i	5.71E-03 i	1.75E-01 n	1.30E-01 n	☒	0.077 c	0.048 c	0.018 c	33 c	3.7 c	0.1 s	0.001 s
Dichlorvos	62737	5.00e-04 i	1.43E-04 i	2.90E-01 i			0.23 c	0.022 c	0.011 c	20 c	2.2 c	3.5 c	0.00072 c
Dicofol	115322			4.40E-01 w			0.15 c	0.014 c	0.0072 c	13 c	1.5 c		
Dicyclopentadiene	77736	3.00E-02 n	5.71E-05 a			☒	0.42 n	0.21 n	41 n	61000 n	2300 n		
Dieldrin	60571	5.00E-05 i		1.60E+01 i	1.61E+01 i		0.0042 c	0.00039 c	0.0002 c	0.36 c	0.04 c	2 s	0.001 s
Diesel emissions			1.43E-03 i				52 n	5.2 n					
Diethyl phthalate	84662	8.00E-01 i					29000 n	2900 n	1100 n	1E+06 n	63000 n	520 s	110 s
Diethylene glycol, monobutyl ether	112345		5.71E-03 n				210 n	21 n					
Diethylene glycol, monoethyl ether	111900	2.00E+00 n					73000 n	7300 n	2700 n	1E+06 n	160000 n		
Diethylforamide	617845	1.10E-02 n					400 n	40 n	15 n	22000 n	860 n		
Di(2-ethylhexyl)adipate	103231	6.00E-01 i		1.20E-03 i			56 c	5.2 c	2.6 c	4800 c	530 c		
Diethylstilbestrol	56531			4.70E+03 n			0.00001 c	1E-06 c	7E-07 c	0.0012 c	0.00014 c		
Difenzoquat (Avenge)	43222486	8.00E-02 i					2900 n	290 n	110 n	160000 n	6300 n		
Diflubenzuron	35367385	2.00E-02 i					730 n	73 n	27 n	41000 n	1600 n		
1,1-Difluoroethane	75376		1.14E+01 i			☒	69000 n	42000 n					
Diisopropyl methylphosphonate (DIMP)	1445756	8.00E-02 i					2900 n	290 n	110 n	160000 n	6300 n		
Dimethipin	55290647	2.00E-02 i					730 n	73 n	27 n	41000 n	1600 n		
Dimethoate	60515	2.00E-04 i					7.3 n	0.73 n	0.27 n	410 n	16 n		
3,3'-Dimethoxybenzidine	119904			1.40E-02 n			4.8 c	0.45 c	0.23 c	410 c	46 c		
Dimethylamine	124403		5.71E-06 w				0.21 n	0.021 n					
2,4-Dimethylaniline hydrochloride	21436964			5.80E-01 n			0.12 c	0.011 c	0.0054 c	9.9 c	1.1 c		
2,4-Dimethylaniline	95681			7.50E-01 n			0.09 c	0.0083 c	0.0042 c	7.6 c	0.85 c		
N-N-Dimethylaniline	121697	2.00E-03 i					73 n	7.3 n	2.7 n	4100 n	160 n		
3,3'-Dimethylbenzidine	119937			9.20E+00 n			0.0073 c	0.00068 c	0.00034 c	0.62 c	0.069 c	29 c	0.00039 c
N,N-Dimethylformamide	68122	1.00E-01 n	8.57E-03 i				3700 n	31 n	140 n	200000 n	7800 n		
1,1-Dimethylhydrazine	57147			2.60E+00 w	3.50E+00 w		0.026 c	0.0018 c	0.0012 c	2.2 c	0.25 c		
1,2-Dimethylhydrazine	540738			3.70E+01 w	3.70E+01 w		0.0018 c	0.00017 c	0.00009 c	0.15 c	0.017 c		
2,4-Dimethylphenol	105679	2.00E-02 i					730 n	73 n	27 n	41000 n	1600 n	5400 s	3 s
2,6-Dimethylphenol	576261	6.00E-04 i					22 n	2.2 n	0.81 n	1200 n	47 n		
3,4-Dimethylphenol	95658	1.00E-03 i					37 n	3.7 n	1.4 n	2000 n	78 n		
Dimethyl phthalate	131113	1.00E+01 n					370000 n	37000 n	14000 n	1E+06 n	780000 n	1600 s	1200 s
Dimethyl terephthalate	120616	1.00E-01 i					3700 n	370 n	140 n	200000 n	7800 n		
1,2-Dinitrobenzene	528290	4.00E-04 n					15 n	1.5 n	0.54 n	820 n	31 n		
1,3-Dinitrobenzene	99650	1.00E-04 i					3.7 n	0.37 n	0.14 n	200 n	7.8 n		
1,4-Dinitrobenzene	100254	4.00E-04 n					15 n	1.5 n	0.54 n	820 n	31 n		
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03 i					73 n	7.3 n	2.7 n	4100 n	160 n		

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Risk-Based Concentrations: Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Soil Ingestion: Industrial mg/kg	Soil Ingestion: Residential mg/kg	Soil Screening Levels-Transfers from Soil to: Air mg/kg	Groundwater mg/kg
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05 I					0.37 N	0.037 N	0.014 N	20 N	0.78 N		
Ethylnitrosourea	759739			1.40E+02 W			0.00048 C	0.00005 C	0.00002 C	0.041 C	0.0046 C		
Ethylphthalyl ethyl glycolate	84720	3.00E+00 I					110000 N	11000 N	4100 N	1E+06 N	230000 N		
Express	10120	8.00E-03 I					290 N	29 N	11 N	16000 N	630 N		
Fenamiphos	22224926	2.50E-04 I					9.1 N	0.91 N	0.34 N	510 N	20 N		
Fluometuron	2164172	1.30E-02 I					470 N	47 N	18 N	27000 N	1000 N		
Fluoride	7782414	6.00E-02 I					2200 N	220 N	81 N	120000 N	4700 N		
Fluoridone	59756604	8.00E-02 I					2900 N	290 N	110 N	160000 N	6300 N		
Flurprimidol	56425913	2.00E-02 I					730 N	73 N	27 N	41000 N	1600 N		
Flutolanil	66332965	6.00E-02 I					2200 N	220 N	81 N	120000 N	4700 N		
Fluvalinate	69409945	1.00E-02 I					370 N	37 N	14 N	20000 N	780 N		
Folpet	133073	1.00E-01 I		3.50E-03 I			19 C	1.8 C	0.9 C	1600 C	180 C		
Fomesafen	72178020			1.90E-01 I			0.35 C	0.033 C	0.017 C	30 C	3.4 C		
Fonofos	944229	2.00E-03 I					73 N	7.3 N	2.7 N	4100 N	160 N		
Formaldehyde	50000	2.00E-01 I			4.55E-02 I		7300 N	0.14 C	270 N	410000 N	16000 N		
Formic Acid	64186	2.00E+00 H					73000 N	7300 N	2700 N	1E+06 N	160000 N		
Fosetyl-al	39148248	3.00E+00 I					110000 N	11000 N	4100 N	1E+06 N	230000 N		
Furan	110009	1.00E-03 I					37 N	3.7 N	1.4 N	2000 N	78 N		
Furazolidone	67458			3.80E+00 H			0.018 C	0.0016 C	0.00083 C	1.5 C	0.17 C		
Furfural	98011	3.00E-03 I	1.43E-02 A				110 N	52 N	4.1 N	6100 N	230 N		
Furium	531828			5.00E+01 H			0.0013 C	0.00013 C	0.00006 C	0.11 C	0.013 C		
Furmecyclox	60568050			3.00E-02 I			2.2 C	0.21 C	0.11 C	190 C	21 C		
Glufosinate-ammonium	77182822	4.00E-04 I					15 N	1.5 N	0.54 N	820 N	31 N		
Glycidaldehyde	765344	4.00E-04 I	2.86E-04 H				15 N	1 N	0.54 N	820 N	31 N		
Glyphosate	1071836	1.00E-01 I					3700 N	370 N	140 N	200000 N	7800 N		
Haloxyfop-methyl	69806402	5.00E-05 I					1.8 N	0.18 N	0.068 N	100 N	3.9 N		
Harmony	79277273	1.30E-02 I					470 N	47 N	18 N	27000 N	1000 N		
HCH (alpha)	319846			6.30E+00 I	6.30E+00 I		0.011 C	0.00099 C	0.0005 C	0.91 C	0.1 C	0.9 E	0.0004 E
HCH (beta)	319857			1.80E+00 I	1.80E+00 I		0.037 C	0.0035 C	0.0018 C	3.2 C	0.35 C	16 E	0.002 E
HCH (gamma) Lindane	58899	3.00E-04 I		1.30E+00 H			0.052 C	0.0048 C	0.0024 C	4.4 C	0.49 C	4.2 C	0.006 E
HCH-technical	608731			1.80E+00 I	1.79E+00 I		0.037 C	0.0035 C	0.0018 C	3.2 C	0.35 C		
Heptachlor	76448	5.00E-04 I		4.50E+00 I	4.55E+00 I	☒	0,0023 C	0.0014 C	0.0007 C	1.3 C	0.14 C	0.3 E	0.06 E
Heptachlor epoxide	1024573	1.30E-05 I		9.10E+00 I	9.10E+00 I	☒	0.0012 C	0.00069 C	0.00035 C	0.63 C	0.07 C	1 E	0.03 E
Hexabromobenzene	87821	2.00E-03 I				☒	12 N	7.3 N	2.7 N	4100 N	160 N		
Hexachlorobenzene	118741	8.00E-04 I		1.60E+00 I	1.61E+00 I	☒	0.0066 C	0.0039 C	0.002 C	3.6 C	0.4 C	1 E	0.8 E
Hexachlorobutadiene	87683	2.00E-04 H		7.80E-02 I	7.70E-02 I	☒	0.14 C	0.081 C	0.04 C	73 C	8.2 C	1 E	0.1 E
Hexachlorocyclopentadiene	77474	7.00E-03 I	2.00E-05 H			☒	0.15 N	0.073 N	9.5 N	14000 N	550 N	2 E	10 E
Hexachlorodibenzo-p-dioxin mixture	19408743			6.20E+03 I	4.55E+03 I		0.00001 C	1E-06 C	5E-07 C	0.0009 C	0.0001 C		
Hexachloroethane	67721	1.00E-03 I		1.40E-02 I	1.40E-02 I	☒	0.75 C	0.45 C	0.23 C	410 C	46 C	49 E	0.2 E

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							Risk-Based Concentrations					Soil Screening Levels- Transfers from Soil to:	
							Tap Water	Ambient Air	Fish	Soil Ingestion			
		RfDo	RfDi	CPSo	CPSi	VOC				Industrial	Residential	Air	Groundwater
Contaminant	CAS	mg/kg/d	mg/kg/d	kg·d/mg	kg·d/mg		µg/L	µg/m3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Methamidophos	10265926	5.00E-05 I					1.8 N	0.18 N	0.068 N	100 N	3.9 N		
Methanol	67561	5.00E-01 I					18000 N	1800 N	680 N	1E+06 N	39000 N		
Methidathion	950378	1.00E-03 I					37 N	3.7 N	1.4 N	2000 N	78 N		
Methomyl	16752775	2.50E-02 I					910 N	91 N	34 N	51000 N	2000 N		
Methoxychlor	72435	5.00E-03 I					180 N	18 N	6.8 N	10000 N	390 N	41 S	62 S
2-Methoxyethanol acetate	110496	2.00E-03 A					73 N	7.3 N	2.7 N	4100 N	160 N		
2-Methoxyethanol	109864	1.00E-03 H	5.71E-03 I				37 N	21 N	1.4 N	2000 N	78 N		
2-Methoxy-5-nitroaniline	99592			4.60E-02 H			1.5 C	0.14 C	0.069 C	120 C	14 C		
Methyl acetate	79209	1.00E+00 H					37000 N	3700 N	1400 N	1E+06 N	78000 N		
Methyl acrylate	96333	3.00E-02 A					1100 N	110 N	41 N	61000 N	2300 N		
2-Methylaniline hydrochloride	636215			1.80E-01 H			0.37 C	0.035 C	0.018 C	32 C	3.5 C		
2-Methylaniline	95534			2.40E-01 H			0.28 C	0.026 C	0.013 C	24 C	2.7 C		
Methyl chlorocarbonate	79221	1.00E+00 W					37000 N	3700 N	1400 N	1E+06 N	78000 N		
4-(2-Methyl-4-chlorophenoxy) butyric acid	94815	1.00E-02 I					370 N	37 N	14 N	20000 N	780 N		
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04 I					18 N	1.8 N	0.68 N	1000 N	39 N		
2-(2-Methyl-14-chlorophenoxy)propionic acid	93652	1.00E-03 I					37 N	3.7 N	1.4 N	2000 N	78 N		
Methylcyclohexane	108872		8.57E-01 H				31000 N	3100 N				60 S	1500 N
Methylene bromide	74953	1.00E-02 A				☒	61 N	37 N	14 N	20000 N	780 N		
Methylene chloride	75092	6.00E-02 I	8.57E-01 H	7.50E-03 I	1.64E-03 I	☒	4.1 C	3.8 C	0.42 C	760 C	85 C	7 E	0.01 E
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04 H		1.30E-01 H	1.30E-01 H		0.52 C	0.048 C	0.024 C	44 C	4.9 C		
4,4'-Methylenebisbenzeneamine	101779			2.50E-01 W			0.27 C	0.025 C	0.013 C	23 C	2.6 C		
4,4'-Methylene bis(N,N'-dimethyl)aniline	101611			4.60E-02 I			1.5 C	0.14 C	0.069 C	120 C	14 C		
4,4'-Methylenediphenyl isocyanate	101688		5.71E-06 I			☒	0.035 N	0.021 N					
Methyl ethyl ketone	78933	6.00E-01 I	2.86E-01 I			☒	1900 N	1000 N	810 N	1E+06 N	47000 N		
Methyl hydrazine	60344			1.10E+00 W			0.061 C	0.0057 C	0.0029 C	5.2 C	0.58 C		
Methyl isobutyl ketone	108101	8.00E-02 H	2.29E-02 A				2900 N	84 N	110 N	160000 N	6300 N		
Methyl methacrylate	80626	8.00E-02 H					2900 N	290 N	110 N	160000 N	6300 N		
2-Methyl-5-nitroaniline	99558			3.30E-02 H			2 C	0.19 C	0.096 C	170 C	19 C		
Methyl parathion	298000	2.50E-04 I					9.1 N	0.91 N	0.34 N	510 N	20 N	28 S	0.041 N
2-Methylphenol (o-cresol)	95487	5.00E-02 I					1800 N	180 N	68 N	100000 N	3900 N	12000 S	6 E
3-Methylphenol (m-cresol)	103394	5.00E-02 I					1800 N	180 N	68 N	100000 N	3900 N		
4-Methylphenol (p-cresol)	106445	5.00E-03 H					180 N	18 N	6.8 N	10000 N	390 N		
Methyl styrene (mixture)	25013154	6.00E-03 A	1.14E-02 A			☒	60 N	42 N	8.1 N	12000 N	470 N	100 N	1 N
Methyl styrene (alpha)	98839	7.00E-02 A				☒	430 N	260 N	95 N	140000 N	5500 N	8.8 S	7.5 N
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03 E	8.57E-01 I			☒	180 N	3100 N	6.8 N	10000 N	390 N		
Metolaclor (Dual)	51218452	1.50E-01 H					5500 N	550 N	200 N	310000 N	12000 N		
Metribuzin	21087649	2.50E-02 I					910 N	91 N	34 N	51000 N	2000 N		
Mirex	2385855	2.00E-04 I		1.80E+00 W			0.037 C	0.0035 C	0.0018 C	3.2 C	0.35 C		
Molinate	2212671	2.00E-03 I					73 N	7.3 N	2.7 N	4100 N	160 N		

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Oxadiazon	19666309	5.00E-03 I					180 N	18 N	6.8 N	10000 N	390 N		
Oxamyl	23135220	2.50E-02 I					910 N	91 N	34 N	51000 N	2000 N		
Oxyfluorfen	42874033	3.00E-03 I					110 N	11 N	4.1 N	6100 N	230 N		
Paclobutrazol	76738620	1.30E-02 I					470 N	47 N	18 N	27000 N	1000 N		
Paraquat	1910425	4.50E-03 I					160 N	16 N	6.1 N	9200 N	350 N		
Parathion	56382	6.00E-03 H					220 N	22 N	8.1 N	12000 N	470 N	110 S	3.9 N
Pebulate	1114712	5.00E-02 H					1800 N	180 N	68 N	100000 N	3900 N		
Pendimethalin	40487421	4.00E-02 I					1500 N	150 N	54 N	82000 N	3100 N		
Pentabromo-6-chloro cyclohexane	87843			2.30E-02 H			2.9 C	0.27 C	0.14 C	250 C	28 C		
Pentabromodiphenyl ether	32534819	2.00E-03 I					73 N	7.3 N	2.7 N	4100 N	160 N		
Pentachlorobenzene	608935	8.00E-04 I				☒	4.9 N	2.9 N	1.1 N	1600 N	63 N	570 N	48 N
Pentachloronitrobenzene	82688	3.00E-03 I		2.60E-01 H		☒	0.041 C	0.024 C	0.012 C	22 C	2.5 C		
Pentachlorophenol	87865	3.00E-02 I		1.20E-01 I			0.56 C	0.052 C	0.026 C	48 C	5.3 C	7.9 C	0.2 E
Permethrin	52645531	5.00E-02 I					1800 N	180 N	68 N	100000 N	3900 N		
Phenmedipham	13684634	2.50E-01 I					9100 N	910 N	340 N	510000 N	20000 N		
Phenol	108952	6.00E-01 I					22000 N	2200 N	810 N	1E+06 N	47000 N	21000 S	49 E
m-Phenylenediamine	108452	6.00E-03 I					220 N	22 N	8.1 N	12000 N	470 N		
p-Phenylenediamine	106503	1.90E-01 H					6900 N	690 N	260 N	390000 N	15000 N		
Phenylmercuric acetate	62384	8.00E-05 I					2.9 N	0.29 N	0.11 N	160 N	6.3 N		
2-Phenylphenol	90437			1.94E-03 H			35 C	3.2 C	1.6 C	3000 C	330 C		
Phorate	298022	2.00E-04 H					7.3 N	0.73 N	0.27 N	410 N	16 N		
Phosmet	732116	2.00E-02 I					730 N	73 N	27 N	41000 N	1600 N		
**Phosphine	7803512	3.00E-04 I	8.57E-05 H				11 N	0.31 N	0.41 N	610 N	23 N		
**Phosphoric acid	7664382	I	2.86E-03				100 N	10 N					
Phosphorus (white)	7723140	2.00E-05 I					0.73 N	0.073 N	0.027 N	41 N	1.6 N		
p-Phthalic acid	100210	1.00E+00 H					37000 N	3700 N	1400 N	1E+06 N	78000 N		
Phthalic anhydride	85449	2.00E+00 I	3.43E-02 H				73000 N	130 N	2700 N	1E+06 N	160000 N		
Picloram	1918021	7.00E-02 I					2600 N	260 N	95 N	140000 N	5500 N		
Pirimiphos-methyl	29232937	1.00E-02 I					370 N	37 N	14 N	20000 N	780 N		
Polybrominated biphenyls		7.00E-06 H		8.90E+00 H			0.0076 C	0.0007 C	0.00035 C	0.64 C	0.072 C		
Polychlorinated biphenyls (PCBs)	1336363			7.70E+00 I			0.0087 C	0.00081 C	0.00041 C	0.74 C	0.083 C		
Aroclor 1016	12674112	7.00E-05 I					2.6 N	0.26 N	0.095 N	140 N	5.5 N		
Aroclor 1254	11097691	2.00E-05 I					0.73 N	0.073 N	0.027 N	41 N	1.6 N		
Polychlorinated terphenyls (PCTs)				4.50E+00 E			0.015 C	0.0014 C	0.0007 C	1.3 C	0.14 C		
Polynuclear aromatic hydrocarbons												110000 S	
Acenaphthene	83329	6.00E-02 I					2200 N	220 N	81 N	120000 N	4700 N	120 S	200 E
Anthracene	120127	3.00E-01 I					11000 N	1100 N	410 N	610000 N	23000 N	6.8 S	4300 E
Benz[a]anthracene	56553			7.30E-01 E	6.10E-01 E		0.092 C	0.01 C	0.0043 C	7.8 C	0.88 C	27 S	0.7 E
Benzo[b]fluoranthene	205992			7.30E-01 E	6.10E-01 E		0.092 C	0.01 C	0.0043 C	7.8 C	0.88 C	23 S	4 E

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis: C=carcinogenic effects N=noncarcinogenic effects E=EPA draft Soil Screening Level S=soil saturation concentration M=EPA MCL

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Risk-Based Concentrations: Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Soil Ingestion: Industrial mg/kg	Soil Ingestion: Residential mg/kg	Soil Screening Levels-Transfers from Soil to: Air mg/kg	Groundwater mg/kg
Silver and compounds	7440224	5.00E-03 i					180 n	18 n	6.8 n	10000 n	390 n		
Simazine	122349	5.00E-03 i		1.20E-01 n			0.56 c	0.052 c	0.026 c	48 c	5.3 c		
Sodium azide	26628228	4.00E-03 i					150 n	15 n	5.4 n	8200 n	310 n		
Sodium diethyldithiocarbamate	148185	3.00E-02 i		2.70E-01 n			0.25 c	0.023 c	0.012 c	21 c	2.4 c		
Sodium fluoroacetate	62748	2.00E-05 i					0.73 n	0.073 n	0.027 n	41 n	1.6 n		
Sodium metavanadate	13718268	1.00E-03 n					37 n	3.7 n	1.4 n	2000 n	78 n		
Strontium, stable	7440246	6.00E-01 i					22000 n	2200 n	810 n	1E+06 n	47000 n		
Strychnine	57249	3.00E-04 i					11 n	1.1 n	0.41 n	610 n	23 n		
Styrene	100425	2.00E-01 i	2.86E-01 i			☒	1600 n	1000 n	270 n	410000 n	16000 n	1400 e	2 e
Systhane	88671890	2.50E-02 i					910 n	91 n	34 n	51000 n	2000 n		
2,3,7,8-TCDD (dioxin)	1746016			1.56E+05 n	1.16E+05 n		4E-07 c	5E-08 c	c	4E-05 c	4E-06 c		
Tebuthiuron	34014181	7.00E-02 i					2600 n	260 n	95 n	140000 n	5500 n		
Temephos	3383968	2.00E-02 n					730 n	73 n	27 n	41000 n	1600 n		
Terbacil	5902512	1.30E-02 i					470 n	47 n	18 n	27000 n	1000 n		
Terbufos	13071799	2.50E-05 n					0.91 n	0.091 n	0.034 n	51 n	2 n		
Terbutryn	886500	1.00E-03 i					37 n	3.7 n	1.4 n	2000 n	78 n		
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04 i				☒	1.8 n	1.1 n	0.41 n	610 n	23 n	91 n	0.69 n
1,1,1,2-Tetrachloroethane	630206	3.00E-02 i		2.60E-02 i	2.59E-02 i	☒	0.41 c	0.24 c	0.12 c	220 c	25 c		
1,1,2,2-Tetrachloroethane	79345			2.00E-01 i	2.03E-01 i	☒	0.052 c	0.031 c	0.016 c	29 c	3.2 c	0.4 e	0.001 e
Tetrachloroethylene (PCE)	127184	1.00E-02 i		5.20E-02 e	2.03E-03 e	☒	1.1 c	3.1 c	0.061 c	110 c	12 c	11 e	0.04 e
2,3,4,6-Tetrachlorophenol	58902	3.00E-02 i					1100 n	110 n	41 n	61000 n	2300 n		
p,a,a,a-Tetrachlorotoluene	5216251			2.00E+01 n		☒	0.00053 c	0.00031 c	0.00016 c	0.29 c	0.032 c		
Tetrachlorovinphos	961115	3.00E-02 i		2.40E-02 n			2.8 c	0.26 c	0.13 c	240 c	27 c		
Tetraethyldithiopyrophosphate	3689245	5.00E-04 i					18 n	1.8 n	0.68 n	1000 n	39 n		
Tetraethyl lead	78002	1.00E-07 i					0.0037 n	0.00037 n	0.00014 n	0.2 n	0.0078 n	0.00068 n	0.000034 n
**1,1,1,2-Tetrafluoroethane	811972	i	2.29E+01			☒	140000 n	84000 n					
Thallic oxide	1314325	7.00E-05 w					2.6 n	0.26 n	0.095 n	140 n	5.5 n		
Thallium													0.4 s
Thallium acetate	563688	9.00E-05 i					3.3 n	0.33 n	0.12 n	180 n	7 n		
Thallium carbonate	6533739	8.00E-05 i					2.9 n	0.29 n	0.11 n	160 n	6.3 n		
Thallium chloride	7791120	8.00E-05 i					2.9 n	0.29 n	0.11 n	160 n	6.3 n		
Thallium nitrate	10102451	9.00E-05 i					3.3 n	0.33 n	0.12 n	180 n	7 n		
Thallium selenite	12039520	9.00E-05 w					3.3 n	0.33 n	0.12 n	180 n	7 n		
Thallium sulfate	7446186	8.00E-05 i					2.9 n	0.29 n	0.11 n	160 n	6.3 n		
Thiobencarb	28249776	1.00E-02 i					370 n	37 n	14 n	20000 n	780 n		
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02 n					1100 n	110 n	41 n	61000 n	2300 n		
Thiofanox	39196184	3.00E-04 n					11 n	1.1 n	0.41 n	610 n	23 n		
Thiophanate-methyl	23564058	8.00E-02 i					2900 n	290 n	110 n	160000 n	6300 n		
Thiram	137268	5.00E-03 i					180 n	18 n	6.8 n	10000 n	390 n		

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis: C=carcinogenic effects N=noncarcinogenic effects E=EPA draft Soil Screening Level S=soil saturation concentration M=EPA MCL.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Risk-Based Concentrations: Tap Water µg/L	Ambient Air µg/m3	Fish mg/kg	Soil Ingestion: Industrial mg/kg	Residential mg/kg	Soil Screening Levels-Transfers from Soil to: Air mg/kg	Groundwater mg/kg
Vanadium sulfate	36907423	2.00E-02 H					730 N	73 N	27 N	41000 N	1600 N		
Vernam	1929777	1.00E-03 I					37 N	3.7 N	1.4 N	2000 N	78 N		
Vinclozolin	50471448	2.50E-02 I					910 N	91 N	34 N	51000 N	2000 N		
Vinyl acetate	108054	1.00E+00 H	5.71E-02 I				37000 N	210 N	1400 N	1E+06 N	78000 N	370 E	84 E
Vinyl bromide	593602		8.57E-04 I			☒	5.2 N	3.1 N				2 N	0.018 M
Vinyl chloride	75014			1.90E+00 H	3.00E-01 H	☒	0.019 C	0.021 C	0.0017 C	3 C	0.34 C	0.002 E	0.01 E
Warfarin	81812	3.00E-04 I					11 N	1.1 N	0.41 N	610 N	23 N	0.046 N	1800 N
m-Xylene	108323	2.00E+00 H	2.00E-01 W			☒	1400 N	730 N	2700 N	1E+06 N	160000 N	950 S	240 M
o-Xylene	9.55E+04	2.00E+00 H	2.00E-01 W			☒	1400 N	730 N	2700 N	1E+06 N	160000 N	730 S	1.50E+02 M
p-Xylene	1.06E+05		8.57E-02 W			☒	520 N	310 N				1000 S	2.20E+02 M
Xylene (mixed)	1.33E+06	2.00E+00 I				☒	12000 N	7300 N	2700 N	1E+06 N	160000 N	320 E	7.40E+01 E
Zinc	7.44E+06	3.00E-01 I					11000 N	1100 N	410 N	610000 N	23000 N		4.20E+04 E
Zinc phosphide	1.31E+06	3.00E-04 I					11 N	1.1 N	0.41 N	610 N	23 N		
Zineb	1.21E+07	5.00E-02 I					1800 N	180 N	68 N	100000 N	3900 N		

APPENDIX I

EPA AND VA WATER QUALITY STANDARDS

DRINKING WATER REGULATIONS

AND HEALTH ADVISORIES

by

Office of Water
U.S. Environmental Protection Agency
Washington, D.C.
202-260-7571

SAFE DRINKING WATER HOTLINE
1-800-426-4791
Monday thru Friday, 8:30 AM to 5:00 PM EST

May 1993

LEGEND

Abbreviations column descriptions are:

MCLG - Maximum Contaminant Level Goal. A non-enforceable concentration of a drinking water contaminant that is protective of adverse human health effects and allows an adequate margin of safety.

MCL - Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

RfD - Reference Dose. An estimate of a daily exposure to the human population that is likely to be without appreciable risk of deleterious effects over a lifetime.

DWEL - Drinking Water Equivalent Level. A lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from a drinking water source.

(*) The codes for the Status Reg and Status HA columns are as follows:

F - final
D - draft
L - listed for regulation
P - proposed
T - tentative

Other codes found in the table include the following:

NA - not applicable
PS - performance standard 0.5 NTU - 1.0 NTU
TT - treatment technique

** - No more than 5% of the samples per month may be positive. For systems collecting fewer than 40 samples/month, no more than 1 sample per month may be positive.

*** - guidance

- Large discrepancies between Lifetime and Longer-term HA values may occur because of the Agency's conservative policies, especially with regard to carcinogenicity, relative source contribution, and less than lifetime exposures in chronic toxicity testing. These factors can result in a cumulative UF (uncertainty factor) of 10 to 1000 when calculating a Lifetime HA.

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
ORGANICS													
Acenaphthene	-	-	-	-	-	-	-	-	0.06	-			-
Acifluorfen	*T*	*zero*	-	F	2	2	0.1	0.4	0.013	0.4		0.1	B2
Acrylamide	F	zero	TT	F	1.6	0.3	0.02	0.07	0.0002	0.007		0.001	B2
Acrylonitrile	*T*	*zero*	-	D	-	-	-	-	-	-	-	0.006	B1*
Adipates (diethylhexyl)	P	0.5	0.5	-		-	-	-	0.7	20	0.5		C
Alachlor	F	zero	0.002	F	0.1	0.1	-		0.01	0.4		0.04	B2
Aldicarb	F	0.001	0.003	F	-	-	-	-	*0.001*	*0.035*	*0.007*		D
Aldicarb sulfone	F	0.001	0.002	F	-	-	-	-	*0.001*	*0.035*	*0.007*		D
Aldicarb sulfoxide	F	0.001	0.004	F	-	-	-	-	*0.001*	*0.035*	*0.007*		D
Aldrin	-	-	-	D	0.0003	0.0003	0.0003	0.0003	0.00003	0.001	-	0.0002	B2
Ametryn	-	-	-	F	9	9	0.9	3	0.009	0.3	0.06	-	D
Ammonium sulfamate	-	-	-	F	20	20	20	80	0.28	8	2	-	D
Anthracene (PAH)	-	-	-	-	-	-	-	-	0.3	-		-	D
Atrazine	F	0.003	0.003	F	0.1	0.1	0.05	0.2	*0.035*	0.2*	0.003*	-	C
Baygon	-	-	-	F	0.04	0.04	0.04	0.1	0.004	0.1	0.003		C
Bentazon	*T*	*0.02*	-	F	0.3	0.3	0.3	0.9	0.0025	0.09	0.02		D
Benz(a)anthracene (PAH)	P	zero	0.0001	-	-	-	-	-	-	-			B2
Benzene	F	zero	0.005	F	0.2	0.2	-	-	-	-	-	0.1	A
Benzo(a)pyrene (PAH)	F	zero	0.0002	-	-	-	-	-	-	-	-		B2*
Benzo(b)fluoranthene (PAH)	P	zero	0.0002	-	-	-	-	-	-	-	-		B2
Benzo(g,h,i)perylene (PAH)	-	-	-	-	-	-	-	-	-	-			D
Benzo(k)fluoranthene (PAH)	P	zero	0.0002	-	-	-	-	-	-	-		-	B2
bis 2-Chloroisopropyl ether	-	-	-	F.	4	4	4	13	0.04	1	0.3		D
Bromacil	L	-	-	F	5	5	3	9	0.13	5	0.09		C
Bromobenzene	L		-	D	-	-	-	-	-	-			

* Under review

(TT) Anthracene and Benzo(g,h,i)perylene not proposed in Phase V.

[illegible] Health and Bold Face order

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Bromochloroacetonitrile	L	-	-	D	-	-	-	-	-	-	-	-	-
Bromochloromethane	-	-	-	F	60	1	1	6	0.013	0.6	0.09	-	-
Bromodichloromethane (THM)	T	zero	0.1*	D	7	7	4	13	0.02	0.7	-	0.06	B2
Bromoform (THM)	T	zero	0.1*	D	6	2	2	6	0.02	0.7	-	0.4	B2
Bromomethane	T	-	-	F	0.1	0.1	0.1	0.6	0.001	0.04	0.01		D
Butyl benzyl phthalate (PAE)	P	zero	0.1	-	-	-	-	-	0.2	6	-	-	C
Butylate	-	-	-	F	2	2	1	4	0.05	2	0.35	-	D
Butylbenzene n-	-	-	-	D	-	-	-	-	-	-	-	-	-
Butylbenzene sec-	-	-	-	D	-	-	-	-	-	-	-		
Butylbenzene tert-	-	-	-	D	-	-	-	-	-	-	-	-	-
Carbaryl	-	-	-	F	1	1	1	1	0.1	4	0.7		D
Carbofuran	F	0.04	0.04	F	0.05	0.05	0.05	0.2	0.005	0.2	0.04	-	E
Carbon tetrachloride	F	zero	0.005	F	4	0.2	0.07	0.3	0.0007	0.03	-	0.03	B2
Carboxin	-	-	-	F	1	1	1	4	0.1	4	0.7	-	D
Chloral hydrate	T	0.06	-	D	7	1.4	0.2	0.6	0.0002	0.07	0.06		C
Chloramben	-	-	-	F	3	3	0.2	0.6	0.015	0.5	0.1	-	D
Chlordane	F	zero	0.002	F	0.06	0.06	-	-	0.00006	0.002	-	0.003	B2
Chlorodibromomethane (THM)	T	zero	0.1*	D	7	7	2	8	0.02	0.7	0.06	-	C
Chloroethane	L	-	-	D	-	-	-	-	-	-			-
Chloroform (THM)	T	zero	0.1*	D	4	4	0.1	0.4	0.01	0.4	-	0.6	B2
Chloromethane	L	-	-	F	9	0.4	0.4	1	0.004	0.1	0.003	-	C
Chlorophenol (2-)	-	-	-	D	0.05	0.05	0.05	0.2	0.005	0.2	0.04	-	D
p Chlorophenyl methyl sulfide/sulfone/sulfoxide	-	-	-	**	-	-	-	-	-	-			D
Chloropicrin	L	-	-	-	-	-	-	-	-	-	-	-	-
Chlorothalonil		-	-	F	0.2	0.2	0.2	0.6	0.015	0.5		0.15	B2
Chlorotoluene o	L			F	2	2	2	7	0.02	0.7	0.1	-	D
Chlorotoluene p	L			F	2	2	2	7	0.02	0.7	0.1		D
Chlorpyrifos				D	0.03	0.03	0.03	0.1	0.003	0.1	0.02		D
Chrysene (PAH)	P	zero	0.0002				-			-			B2

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Cyanogen chloride	L	-	-	-	-	-	-	-	-	-	-	-	-
Cymene p-	-	-	-	D	-	-	-	-	-	-	-	-	-
2,4-D	F	0.07	0.07	F	1	0.3	0.1	0.4	0.01	0.4	0.07		D
DCPA (Dacthal)	L	-	-	F	80	80	5	20	0.5	20	4	-	D
Dalapon	F	0.2	0.2	F	3	3	0.3	0.9	0.026	0.9	0.2		D
Di[2-ethylhexyl]adipate	F	0.4	0.4	-	20	20	20	60	0.6	20	0.4	3	C
Diazinon	-	-	-	F	0.02	0.02	0.005	0.02	0.00009	0.003	0.0006	-	E
Dibenz(a,h)anthracene (PAH)	P	zero	0.0003	-	-	-	-	-	-	-	-	-	B2
Dibromoacetonitrile	L	-	-	D	2	2	2	8	0.02	0.8	0.02		C
Dibromochloropropane (DBCP)	F	zero	0.0002	F	0.2	0.05	-	-	-	-	-	0.003	B2
Dibromomethane	L	-	-	-	-	-	-	-	-				D
Dibutyl phthalate (PAE)	-	-	-	-	-	-	-	-	0.1	4	-		D
Dicamba	L	-	-	F	0.3	0.3	0.3	1	0.03	1	0.2		D
Dichloroacetaldehyde	L	-	-	D	-	-	-	-	-	-	-	-	-
Dichloroacetic acid	T	zero	-	D	-	50	5	20	0.008	0.3	-	-	B2
Dichloroacetonitrile	L	-	-	D	1	1	0.8	3	0.008	0.3	0.006	-	C
Dichlorobenzene o-	F	0.6	0.6	F	9	9	9	30	0.09	3	0.6	-	D
Dichlorobenzene m- *	F	0.6	0.6	F	9	9	9	30	0.09	3	0.6	-	D
Dichlorobenzene p-	F	0.075	0.075	F	10	10	10	40	0.1	4	0.075	-	C
Dichlorodifluoromethane	L	-	-	F	40	40	9	30	0.2	5	1	-	D
Dichloroethane (1,1-)	L	-	-	D	-	-	-	-	-	-	-		
Dichloroethane (1,2-)	F	zero	0.005	F	0.7	0.7	0.7	2.6	-	-	-	0.04	B2
Dichloroethylene (1,1-)	F	0.007	0.007	F	2	1	1	4	0.009	0.4	0.007		C
Dichloroethylene (cis-1,2-)	F	0.07	0.07	F	4	3	3	11	0.01	0.4	0.07		D
Dichloroethylene (trans-1,2-)	F	0.1	0.1	F	20	2	2	6	0.02	0.6	0.1		D
Dichloromethane	F	zero	0.005	F	10	2	-	-	0.06	2	-	0.5	B2
Dichlorophenol (2,4-)	-	-	-	D	0.03	0.03	0.03	0.1	0.003	0.1	0.02		D
Dichloropropane (1,1-)	-	-	-	D	-	-	-	-	-	-	-		-
Dichloropropane (1,2-)	F	zero	0.005	F	-	0.09	-	-				0.05	B2
Dichloropropane (1,3-)	L	-	-	D	-	-	-	-	-	-	-		-

* The values for m-dichlorobenzene are based on data for o-dichlorobenzene.

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Dichloropropene (2,2-)	L	-	-	D	-	-	-	-	-	-	-		-
Dichloropropene (1,1-)	L	-	-	D	-	-	-	-	-	-	-		-
Dichloropropene (1,3-)	T	zero	-	F	0.03	0.03	0.03	0.1	0.0003	0.01	-	0.02	B2
Dieldrin	-	-	-	F	0.0005	0.0005	0.0005	0.002	0.00005	0.002	-	0.0002	B2
Diethyl phthalate (PAE)	-	-	-	D	-	-	-	-	0.8	30	5		D
Diethylene glycol dinitrate	-	-	-	**	-	-	-	-	-	-	-		-
Diethylhexyl phthalate (PAE)	F	zero	0.006	D	-	-	-	-	0.02	0.7	-	0.3	B2*
Diisopropyl methylphosphonate	-	-	-	F	8	8	8	30	0.08	3	0.6	-	D
Dimethrin	-	-	-	F	10	10	10	40	0.3	10	2		D
Dimethyl methylphosphonate	-	-	-	F	2	2	2	6	0.2	7	0.1	0.7	C
Dimethyl phthalate (PAE)	-	-	-	-	-	-	-	-	-	-			D
1,3-Dinitrobenzene	-	-	-	F	0.04	0.04	0.04	0.14	0.0001	0.005	0.001		D
Dinitrotoluene (2,4-)	L	-	-	F	0.50	0.50	0.30	1	0.002	0.1	-		-
Dinitrotoluene (2,6-)	L	-	-	F	0.40	0.40	0.40	1	0.001	0.04	-		-
tg 2,6 & 2,4 dinitrotoluene ***	-	-	-	-	-	-	-	-	-	-	-	*0.005*	*B2*
Dinoseb	F	0.007	0.007	F	0.3	0.3	0.01	0.04	0.001	0.04	0.007	-	D
Dioxane p-	-	-	-	F	4	0.4	-	-	-	-	-	0.7	B2
Diphenamid	-	-	-	F	0.3	0.3	0.3	1	0.03	1	0.2		D
Diphenylamine	-	-	-	F	1	1	0.3	1	0.03	1	0.2		D
Diquat	F	0.02	0.02	-	-	-	-	-	0.0022	0.08	0.02		D
Disulfoton	-	-	-	F	0.01	0.01	0.003	0.009	0.00004	0.001	0.0003		E
Dithiane (1,4-)	-	-	-	F	0.4	0.4	0.4	1	0.01	0.4	0.08		D
Diuron	-	-	-	F	1	1	0.3	0.9	0.002	0.07	0.01		D
Endothall	F	0.1	0.1	F	0.8	0.8	0.2	0.2	0.02	0.7	0.1	-	D
Endrin	F	0.002	0.002	F	0.02	0.02	0.003	0.01	0.0003	0.01	0.002		D
Epichlorohydrin	F	zero	TT	F	0.1	0.1	0.07	0.07	0.002	0.07	-	0.4	B2
Ethylbenzene	F	0.7	0.7	F	30	3	1	3	0.1	3	0.7		D
Ethylene dibromide (EDB)	F	zero	0.00005	F	0.008	0.008	-	-		-	-	0.00004	B2
[illegible]				F	20	6	6	20	2	40	7		D
[illegible]	L		-	F	0.3	0.3	0.1	0.4	0.00008	0.003		0.03	B2
[illegible]	-		-	F	0.009	0.009	0.005	0.02	0.00025	0.009	0.002		D

* Under review. ** A HA will not be developed due to insufficient data; a "Database Deficiency Report" has been published.

*** *tg = technical grade*

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Fluometron	-	-	-	F	2	2	2	5	0.013	0.4	0.09		D
Fluorene (PAH)	-	-	-	-	-	-	-	-	0.04	-			D
Fluorotrichloromethane	L	-	-	F	7	7	3	10	0.3	10	2		D
Fog Oil	-	-	-	D	-	-	-	-	-	-	-	-	-
Fonofos	-	-	-	F	0.02	0.02	0.02	0.07	0.002	0.07	0.01	-	D
Formaldehyde	-	-	-	D	10	5	5	20	0.15	5	1	-	B1
Gasoline, unleaded (benzene)	-	-	-	D	-	-	-	-	-	-	0.005	-	-
Glyphosate	F	0.7	0.7	F	20	20	1	1	0.1	4	0.7	-	D
Heptachlor	F	zero	0.0004	F	0.01	0.01	0.005	0.005	0.0005	0.02	-	0.0008	B2
Heptachlor epoxide	F	zero	0.0002	F	0.01	-	0.0001	0.0001	1.3E-05	0.0004	-	0.0004	B2
Hexachlorobenzene	F	zero	0.001	F	0.05	0.05	0.05	0.2	0.0008	0.03	-	0.002	B2
Hexachlorobutadiene	T	*0.001*	-	F	0.3	0.3	0.1	0.4	0.002	0.07	0.001		C
Hexachlorocyclopentadiene	F	0.05	0.05	-	-	-	-	-	0.007	0.2	-		D
Hexachloroethane	L	-	-	F	5	5	0.1	0.5	0.001	0.04	0.001		C
Hexane (n-)	-	-	-	F	10	4	4	10	-	-	-	-	D
Hexazinone	-	-	-	F	3	3	3	9	0.033	1	0.2		D
HMX	-	-	-	F	5	5	5	20	0.05	2	0.4	-	D
Indeno(1,2,3,-c,d)pyrene (PAH)	P	zero	0.0004	D	-	-	-	-	-	-	-	-	B2
Isophorone	L	-	-	F	15	15	15	15	0.2	7	0.1	4	C
Isopropyl methylphosphonate	-	-	-	D	30	30	30	100	0.1	4.0	0.7		D
Isopropylbenzene	-	-	-	D	-	-	-	-	-	-	-		-
Lindane*	F	0.0002	0.0002	F	1	1	0.03	0.1	0.0003	0.01	0.0002	-	C
Malathion	-	-	-	D	0.2	0.2	0.2	0.8	0.02	0.8	0.2	-	D
Maleic hydrazide	-	-	-	F	10	10	5	20	0.5	20	4	-	D
MCPA	-	-	-	F	0.1	0.1	0.1	0.4	0.0015	0.05	0.01	-	E
Methomyl	L	-	-	F	0.3	0.3	0.3	0.3	0.025	0.9	0.2		D
Methoxychlor	F	0.04	0.04	F	0.05	0.05	0.05	0.2	0.005	0.2	0.04		D
Methyl ethyl ketone		-	-	-									-
Methyl parathion	-	-	-	F	0.3	0.3	0.03	0.1	0.00025	0.009	0.002		D

* Under review

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Methyl tert butyl ether	L	-	-	D	3	3	0.5	2	0.005	0.2	0.04		D
Metolachlor	L	-	-	F	2	2	2	5	0.15	5	0.1		C
Metribuzin	L	-	-	F	5	5	0.3	0.9	0.025	0.9	0.2		D
Monochloroacetic acid	L	-	-	D	-	-	-	-	-	-	-		-
Monochlorobenzene	F	0.1	0.1	F	2	2	2	7	0.02	0.7	0.1		D
Naphthalene	-	-	-	F	0.5	0.5	0.4	1	0.004	0.1	0.02		D
Nitrocellulose (non-toxic)	-	-	-	F	-	-	-	-	-	-	-		-
Nitroguanidine	-	-	-	F	10	10	10	40	0.1	4	0.7		D
Nitrophenols p-	-	-	-	D	0.8	0.8	0.8	3	0.008	0.3	0.06		D
Oxamyl (Vydate)	F	0.2	0.2	F	0.2	0.2	0.2	0.9	0.025	0.9	0.2		E
Paraquat	-	-	-	F	0.1	0.1	0.05	0.2	0.0045	0.2	0.03		E
Pentachloroethane	-	-	-	D	-	-	-	-	-	-	-		-
Pentachlorophenol	F	zero	0.001	F	1	0.3	0.3	1	0.03	1	-	0.03	B2
Phenanthrene (PAH)	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	D	6	6	6	20	0.6	20	4		D
Picloram	F	0.5	0.5	F	20	20	0.7	2	0.07	2	0.5	-	D
Polychlorinated biphenyls (PCBs)	F	zero	0.0005	P	-	-	-	-	-	-	-	0.0005	B2
Prometon	L	-	-	F	0.2	0.2	0.2	0.5	0.015*	0.5*	0.1*	-	D
Pronamide	-	-	-	F	0.8	0.8	0.8	3	0.075	3	0.05		C
Propachlor	-	-	-	F	0.5	0.5	0.1	0.5	0.013	0.5	0.09		D
Propazine	-	-	-	F	1	1	0.5	2	0.02	0.7	0.01		C
Propham	-	-	-	F	5	5	5	20	0.02	0.6	0.1		D
Propylbenzene n-	-	-	-	D	-	-	-	-	-	-	-		-
Pyrene (PAH)	-	-	-	-	-	-	-	-	0.03	-			D
RDX	-	-	-	F	0.1	0.1	0.1	0.4	0.003	0.1	0.002	0.03	C
Simazine	F	0.004	0.004	F	0.07	0.07	0.07	0.07	0.005	0.2	0.004	-	C
Styrene	F	0.1	0.1	F	20	2	2	7	0.2	7	0.1		C
2,4,5-T	L	-	-	F	0.8	0.8	0.8	1	0.01	0.35	0.07		D
2,3,7,8 TCDD (Dioxin)	F	zero	3E-08	F	1E-06	1E-07	1E-08	4E-08	1E-09	4E-08		2E-08	B2

* Under review NOTE: Phenanthrene – not proposed.

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		10-kg Child			70-kg Adult					
					One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Tebuthiuron	-	-	-	F	3	3	0.7	2	0.07	2	0.5	-	D
Terbacil	-	-	-	F	0.3	0.3	0.3	0.9	0.013	0.4	0.09		E
Terbufos	-	-	-	F	0.005	0.005	0.001	0.005	0.00013	0.005	0.0009		D
Tetrachloroethane (1,1,1,2-)	L	-	-	F	2	2	0.9	3	0.03	1	0.07	0.1	C
Tetrachloroethane (1,1,2,2-)	L	-	-	D	-	-	-	-	-	-	-		-
Tetrachloroethylene	F	zero	0.005	F	2	2	1	5	0.01	0.5	-	0.07	-
Tetranitromethane	-	-	-	**	-	-	-	-	-	-	-		-
Toluene	F	1	1	F	20	2	2	7	0.2	7	1	-	D
Toxaphene	F	zero	0.003	F	0.5	0.04	-	-	0.1	0.0035	-	0.003	B2
2,4,5-TP	F	0.05	0.05	F	0.2	0.2	0.07	0.3	0.0075	0.3	0.05	-	D
1,1,2 Trichloro-1,2,2-trifluoroethane	-	-	-	-	-	-	-	-	-	-	-		
Trichloroacetic acid	T	0.1	-	D	-	2	4	13	0.04	1.3	1	-	C
Trichloroacetonitrile	L	-	-	D	0.05	0.05	-	-	-	-	-		-
Trichlorobenzene (1,2,4-)	F	0.07	0.07	F	0.1	0.1	0.1	0.5	0.01	0.4	0.07		D
Trichlorobenzene (1,3,5-)	-	-	-	F	0.6	0.6	0.6	2	0.006	0.2	0.04		D
Trichloroethane (1,1,1-)	F	0.2	0.2	F	100	40	40	100	0.035	1	0.2	-	D
Trichloroethane (1,1,2-)	F	0.003	0.005	F	0.6	0.4	0.4	1	0.004	0.1	0.003		C
Trichloroethanol (2,2,2-)	L	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	F	zero	0.005	F	-	-	-	-	-	0.3	-	0.3	B2
Trichlorophenol (2,4,6-)	L	-	-	D	-	-	-	-	-	-	-	0.3	B2
Trichloropropane (1,1,1-)	-	-	-	D	-	-	-	-	-	-	-		-
Trichloropropane (1,2,3-)	L	-	-	F	0.6	0.6	0.6	2	0.006	0.2	0.04		B2
Trifluralin	L	-	-	F	0.08	0.08	0.08	0.3	0.0075	0.3	0.005		C
Trimethylbenzene (1,2,4-)	-	-	-	D	-	-	-	-	-	-	-	-	-
Trimethylbenzene (1,3,5-)	-	-	-	D	-	-	-	-	-	-			-
Trinitroglycerol	-	-	-	F	0.005	0.005	0.005	0.005	-	-	0.005		-
Trinitrotoluene		-	-	F	0.02	0.02	0.02	0.02	0.0005	0.02	0.002	0.1	C
Vinyl chloride	F	zero	0.002	F	3	3	0.01	0.05	-	-	-	0.0015	A
Xylenes	F	10	10	F	40	40	40	100	2	60	10		D

** A HA will not be developed due to insufficient data, a "Database Deficiency Report" has been published.

Drinking Water Standards and Health Advisories

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
INORGANICS													
Aluminum	L	-	-	D	-	-	-	-	-	-			
Ammonia	-	-	-	D	-	-	-	-	-	-	30	-	D
Antimony	F	0.006	0.006	F	0.015	0.015	0.015	0.015	0.0004	0.015	0.003		D
Arsenic	*	-	0.05	D	-	-	-	-	-	-	-	0.002	A
Asbestos (fibers/l > 10μm length)	F	7 MFL	7 MFL	-	-	-	-	-	-	-	-	700 MFL	A
Barium	F	2	2	F	-	-	-	-	0.07	2	2		D
Beryllium	F	0.004	0.004	D	30	30	4	20	0.005	0.2	-	0.0008	B2
Boron	L	-	-	D	4	0.9	0.9	3	0.09	3	0.6	*	D
Cadmium	F	0.005	0.005	F	0.04	0.04	0.005	0.02	0.0005	0.02	0.005		D
Chloramine	T	4	-	D	1	1	1	1	0.1	3.3	2.6		-
Chlorate	L	-	-	D	-	-	-	-	-	-	-		-
Chlorine	T	4	-	D	-	-	-	-	-	-	-	-	D
Chlorine dioxide	T	0.08	-	D	-	-	-	-	0.003	0.1	0.08		D
Chlorite	L	-	-	D	-	-	-	-	-	-	-	-	D
Chromium (total)	F	0.1	0.1	F	1	1	0.2	0.8	0.005	0.2	0.1		D
Copper	F	1.3	TT**	-	-	-	-	-	-	-	-		D
Cyanide	P	0.2	0.2	F	0.2	0.2	0.2	0.8	0.022	0.8	0.2		D
Fluoride*	F	4	4	-	-	-	-	-	0.12	-	-	-	-
Hypochlorite	T	4	-	-	-	-	-	-	-	-	-		-
Hypochlorous acid	T	4	-	-	-	-	-	-	-	-	-		-
Lead (at tap)	F	zero	TT**	-	-	-	-	-	-	-	-		B2
Manganese	L	0.2	-	D.	-	-	-	-	0.14/ 0.005	-	-		-
Mercury (inorganic)	F	0.002	0.002	F	-	-		0.002	0.0003	0.01	0.002		D
Molybdenum	L	-	-	F	-	0.08	0.01	0.05	0.005	0.2	0.04		D
Nickel	F	0.1	0.1	F	1	1	0.5	1.7	0.02	0.6	0.1		D
Nitrate (as N)	F	10	10	F		10*	-	-	1.6				*

Drinking Water Standards and Health Advisories

May 1993

Chemicals	Standards			Health Advisories										Cancer Group
					10-kg Child			70-kg Adult						
	Status Reg.	MCLG (mg/l)	MCL (mg/l)	Status HA	One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk		
Nitrite (as N)	F	1	1	F	-	1*	-	-	0.16*	-	-	-		*
Nitrate + Nitrite (both as N)	F	10	10	F	-	-	-	-	-	-	-	-		*
Selenium	F	0.05	0.05	-	-	-	-	-	0.005	-	-	-		-
Silver	-	-	-	D	0.2	0.2	0.2	0.2	0.005	0.2	0.1	-		D
Sodium	-	-	-	D	-	-	-	-	-	20***	-	-		
Strontium	L	-	-	D	25	25	25	90	0.6	90	17	-		D
Sulfate	P	**	**	-	-	-	-	-	-	-	-	-		
Thallium	F	0.0005	0.002	F	0.007	0.007	0.007	0.02	0.00007	0.002	0.0004	-		
Vanadium	L	-	-	D	-	-	-	-	-	-	-	-		D
White phosphorous	-	-	-	F	-	-	-	-	0.00002	0.0005	0.0001	-		D
Zinc	L	-	-	F	6	6	3	12	0.3	11	2	-		D
Zinc chloride (measured as Zinc)	L	-	-	F	6	6	3	12	0.3	11	2	-		D
RADIONUCLIDES														
Beta particle and photon activity (formerly man-made radionuclides)	P	zero	4 mrem	-	-	-	-	-	-	-	-	4 mrem/y		A
Gross alpha particle activity	P	zero	15 pCi/L	-	-	-	-	-	-	-	-	15 pCi/L		A
Radium 226	P	zero	20 pCi/L	-	-	-	-	-	-	-	-	20 pCi/L		A
Radium 228	P	zero	20 pCi/L	-	-	-	-	-	-	-	-	20 pCi/L		A
Radon	P	zero	300 pCi/L	-	-	-	-	-	-	-	-	150 pCi/L		A
Uranium	P	30 µg/L	20 µg/L	-	-	-	-	-	-	-	-	70 µg/L		A

* Under review.
** Deferred.
*** Guidance.

Secondary Maximum Contaminant Levels

Chemicals	Status	SMCLs (mg/L)
Aluminum	F	0.05 to 0.2
Chloride	F	250
Color	F	15 color units
Copper	F	1.0
Corrosivity	F	non-corrosive
Fluoride*	F	2.0
Foaming agents	F	0.5
Iron	F	0.3
Manganese	F	0.05
Odor	F	3 threshold odor numbers
pH	F	6.5 – 8.5
Silver	F	0.1
Sulfate	F	250
Total dissolved solids (TDS)	F	500
Zinc	F	5

Status Codes: P – proposed, F – final

* Under review.

Microbiology

	Status	MCLG	MCL
Cryptosporidium	L	-	-
Giardia lamblia	F	zero	TT
Legionella	F'	zero	TT
Standard Plate Count	F'	NA	TT
Total Coliforms (after 12/31/90)	F	zero	••
Turbidity (after 12/31/90)	F	NA	PS
Viruses	F'	zero	TT

Key: PS, TT, F, defined as previously stated.

' Final for systems using surface water; also being considered for regulation under groundwater disinfection rule.

VR680-21-04.2 - Anti-degradation Policy for Groundwater

If the concentration of any constituent in groundwater is less than the limit set forth by groundwater standards, the natural quality for the constituent shall be maintained; natural quality shall also be maintained for all constituents, including temperature, not set forth in groundwater standards. If the concentration of any constituent in groundwater exceeds the limit in the standard for that constituent, no addition of that constituent to the naturally occurring concentration shall be made. Variance to this policy shall not be made unless it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development, that the degree of waste treatment necessary to preserve the existing quality cannot be economically or socially justified, and that the present and anticipated uses of such water will be preserved and protected.

GROUNDWATER QUALITY STANDARDS

PHYSIOGRAPHIC PROVINCES

1 Coastal Plain

2 Piedmont and Blue Ridge

3 Valley and Ridge

4 Cumberland Plateau

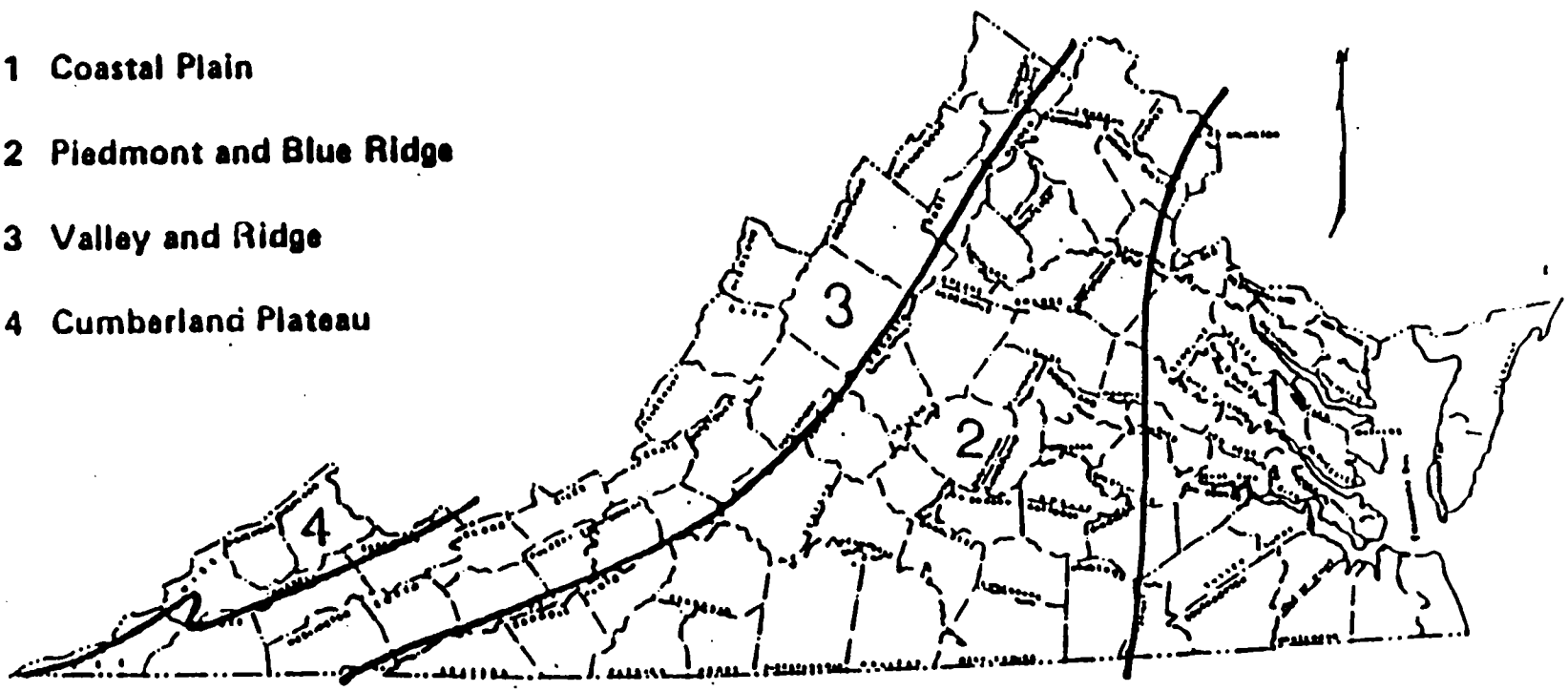

FIGURE 1 Water Quality Standards - 5/20/92

VR680-21-04.3 Groundwater Standards Applicable Statewide

CONSTITUENT	CONCENTRATION	
Sodium	270	mg/l
Foaming Agents as methylene blue active substances	0.05	mg/l
Petroleum hydrocarbons	1	mg/l
Arsenic	0.05	mg/l
Barium	1.0	mg/l
Cadmium	0.0004	mg/l
Chromium	0.05	mg/l
Copper	1.0	mg/l
Cyanide	0.005	mg/l
Lead	0.05	mg/l
Mercury	0.00005	mg/l
Phenols	0.001	mg/l
Selenium	0.01	mg/l
Silver	None	
Zinc	0.05	mg/l
Chlorinated Hydrocarbon Insecticides		
Aldrin/Dieldrin	0.003	ug/l
Chlordane	0.01	ug/l
DDT	0.001	ug/l
Endrin	0.004	ug/l
Heptachlor	0.001	ug/l
Heptachlor Epoxide	0.001	ug/l
Kepone	None	
Lindane	0.01	ug/l
Methoxychlor	0.03	ug/l
Mirex	None	
Toxaphene	None	
Chlorophenoxy Herbicides		
2,4-D	0.1	mg/l
Silvex	0.01	mg/l
Radioactivity		
Total Radium (Ra-226 & Ra-228)	5	pCi/l
Radium 226	3	pCi/l
Gross Beta Activity*	50	pCi/l
Gross Alpha Activity (excluding Radon & Uranium)	15	pCi/l
Tritium	20,000	pCi/l
Strontium-90	8	pCi/l
Manmade Radioactivity - Total Dose Equiv.**	4	mrem/yr

pCi/l = picocurie per liter
mrem/yr = millirems per year

*The gross beta value shall be used as a screening value only. If exceeded the water must be analyzed to determine the presence and quantity of radionuclids to determine compliance with the tritium, strontium, and manmade radioactivity standards.

**Combination of all sources should not exceed total dose equivalent of 4 mrem/year.

VR680-21-04.4 Groundwater Standards Applicable by Physiographic Province

CONSTITUENT	CONCENTRATION			
	Coastal Plain	Piedmont & Blue Ridge	Valley & Ridge	Cumberland Plateau
pH	6.5-9	5.5-8.5	6-9	5-8.5
Ammonia Nitrogen	0.025 mg/l	0.025 mg/l	0.025 mg/l	0.025 mg/l
Nitrite Nitrogen	0.025 mg/l	0.025 mg/l	0.025 mg/l	0.025 mg/l
Nitrate Nitrogen	5 mg/l	5 mg/l	5 mg/l	0.5 mg/l

VR680-21-05 WATER QUALITY CRITERIA FOR GROUNDWATER

VR680-21-05.1 General Requirements

These groundwater quality criteria apply primarily to groundwater constituents that occur naturally. Since natural groundwater quality can vary greatly from area to area for these constituents, enforceable standards were not adopted. These criteria are intended to provide guidance in preventing groundwater pollution. Groundwater criteria carry the same regulatory limitation as surface water criteria: they are not mandatory.

VR680-21-05.2 Groundwater Criteria

CONSTITUENT (mg/l)	GROUNDWATER CRITERIA BY PHYSIOGRAPHIC PROVINCE***			
	Coastal Plain	Piedmont & Blue Ridge	Valley & Ridge	Cumberland Plateau
Alkalinity	30-500	10-200	30-500	30-200
Total Diss. Solids	1000	250	500	500
Chloride	50*	25	25	25
Sulfate	50	25	100	150
Total Organic Carbon	10	10	10	10

CONSTITUENT (mg/l)	GROUNDWATER CRITERIA BY PHYSIOGRAPHIC PROVINCE***			
	Coastal Plain	Piedmont & Blue Ridge	Valley & Ridge	Cumberland Plateau
Color units	15	15	15	15
Iron	0.3	0.3	0.3	0.01-10
Manganese	0.05	0.05	0.05	0.01-0.5
Sodium	100*	25	25	100
Fluoride	1.4**	1.4	1.4	1.4
Hardness	120	120	300	180

* It is recognized that naturally occurring concentrations will exceed this limit in the eastern part of the Coastal Plain, especially toward the shoreline and with increased depth.

** Except within the cretaceous aquifer: concentration up to 5 mg/l and higher.

*** See Figure 1, for delineation of physiographic provinces.

VR680-21-06 PROCEDURAL REQUIREMENTS

VR680-21-06.1 Variance in Standards

A. The above standards notwithstanding, as a result of natural conditions, water quality may from time to time vary from established limits as a result of natural conditions.

B. When the maximum temperature of put and take trout waters exceeds, solely due to natural conditions, the maximum allowable temperature standard specified in Section VR680-21-01.5, the Board, on a case-by-case basis, may grant a variance to the maximum temperature standard and will use the naturally occurring maximum temperature in setting effluent limits in permits. The public notice for any permit proposed to be issued or reissued by the Board will contain reference to any proposed granting of such a variance.

C. Variances under Section 3.16(a) of the Clean Water Act and under B. above are site-specific case decisions that do not require a standards amendment.

VR680-21-06.2 Modification, Amendment, and Cancellation of Standards

Under the authority of Section 62.1-44.15(3)(b) of the State Water Control Law, the Board reserves the right at any time to modify, amend, or cancel any of the rules, policies, or standards set forth herein. Such modification, amendment, or cancellation shall be consistent with requirements of Section 303 of the Clean Water Act, as amended, and regulations promulgated thereunder.

VR680-21-06.3 Shellfish Buffer Zones - Public Hearing

Before acting on any proposal for a project that, while not contravening established numeric standards for shellfish waters, would result in condemnation by the State Health Department of shellfish beds, the Board shall convene a public hearing to determine the socio-economic effect of the proposal. Such proposals include discharge of treated waste or proposals to otherwise alter the biological, chemical or physical properties of State waters. If the Marine Resources Commission or the Virginia Institute of Marine Science certify that the project would have no effect on the shellfish use now and in the foreseeable future, the Board may dispense with such hearing.

When the Board finds that the proposed project will result in shellfish bed condemnation and if the condemnation will violate the general standard, it shall disapprove the proposal.

VR680-21-06.4 Analytical Procedures

Analytical testing should be done in accordance with accepted procedures in 40 CFR 136, as amended or other Board/EPA recognized and approved methods.

VR680-21-06.5 Tidal Water Sampling

Samples for determining compliance with standards established for estuarine or open ocean waters shall be collected at slack before flood tide or slack before ebb tide.

VR680-21-06.6 Classification of Tributary Streams

Any tributary stream which is not named in a specific section description, or otherwise, shall carry the same classification and standards of quality assigned to the stream or section to which it is tributary, except in the case of trout streams. Streams classified as trout waters are specifically named.

VR680-21-07 SPECIAL STANDARDS AND DESIGNATIONS

VR680-21-07.1 Special Standards and Requirements

The special standards are shown in small letters to correspond to lettering in the basin tables. The special standards are as follows:

APPENDIX J

TOXICOLOGY PROFILES

ALUMINUM

INTRODUCTION

Chemical Name:	Aluminum
CAS RN:	7429905
Molecular Formula:	Al
Molecular Weight:	26.98

Tin-white, malleable, ductile metal, with somewhat bluish tint; capable of taking brilliant polish which is retained in dry air. Aluminum, as pure metal or as alloys, uses include utensils, aircraft, apparatus, electrical conductors. The coarse powder is used in aluminothermics; the fine powder as flashlight in photography, in explosives, fireworks and in aluminum paints, etc.

FATE AND TRANSPORT

Solubility:	Soluble in dilute HCl, H_2SO_4 and alkalines
Vapor Pressure:	1 mm Hg @ 1284°C
Specific Gravity:	2.702

HUMAN EFFECTS

Aluminum is not generally regarded as in industrial poison. Inhale of finely divided aluminum powder has been reported as a cause of pulmonary fibrosis. May be implicated in alzheimers disease.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogen Classification:	Group D - not classified as a carcinogen
Noncarcinogenic Effects	
Oral RfD(1):	2.9 mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

3. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

ARSENIC

INTRODUCTION

Chemical Name:	Arsenic
CAS RN:	7440-38-2
Molecular Formula:	As
Molecular Weight:	74.92 g/mole

Arsenic (elemental) exists as a silvery to black, brittle, crystalline and amorphous metalloid. Arsenic is used in the production of glass, enamels, ceramics, oil, cloth, linoleum, electrical semiconductors, pigments, fireworks, pesticides, fungicides, veterinary pharmaceuticals and wood preservatives.

FATE AND TRANSPORT

BCF(1):	Accumulates to toxic levels in food chain organisms
Solubility:	
In Water:	Insoluble
In Organics:	Unknown (5); soluble in nitric acid
Vapor Pressure:	1 mm Hg @ 372°C (sublimes)
Specific Gravity:	5.727

HUMAN HEALTH EFFECTS

Principal toxic forms are trivalent arsenic compounds. Arsenic and its compounds may cause cardiac arrhythmia, anorexia, peripheral neuropathy, cirrhosis, jaundice, peripheral vascular disease and bladder, lung, liver, kidney, skin and colon cancer.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1): Group A - human carcinogen

Noncarcinogenic Effects

Oral RfD(1): 3×10^{-4} mg/kg/day

Carcinogenic Effects

Oral CSF(1): 1.75 $(mg/kg/day)^{-1}$

Inhalation CSF(1): 15.1 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. Dangerous Properties of Industrial Materials. Van Nostrand Reinhold Company, Inc. New York, New York. 1984.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

BARIUM

INTRODUCTION

Chemical Name:	Barium
CAS RN:	7440-39-3
Molecular Formula:	Ba
Molecular Weight:	137.3 g/mole

Barium is a silvery-white, slightly lustrous, somewhat malleable metal. Its uses include various alloys, paints, soap, paper, and rubber, and in the manufacture of ceramics and glass. Barium compounds also are used in diagnostic radiology.

FATE AND TRANSPORT

BCF(1):	Not Significant
Solubility(1):	
In Water:	Decomposes; combines with sulfate present in natural waters to form $BaSO_4$, which has a solubility of 1.6 mg/L @ 20°C
In Organics:	Soluble in alcohol, insoluble in benzene
Vapor Pressure:	Not Reported
Specific Gravity:	3.5

Barium is extremely reactive, decomposes in water, and readily forms insoluble carbonate and sulfate salts. It is generally present in surface water and groundwater only in trace amounts.

HUMAN HEALTH EFFECTS

Noncarcinogenic Effects

Soluble salts of barium, such as barium chloride and barium carbonate, are highly toxic by exposure via ingestion.

The most important effect of acute barium poisoning is a strong, prolonged stimulant action of muscle including smooth, cardiac, and skeletal muscles. This tends to lead to a transient increase in blood pressure due to vasoconstriction. Effects on the hematopoietic system and cerebral cortex have also been reported in humans. Accidental ingestion of soluble barium salts has resulted in gastroenteritis, muscular paralysis and ventricular fibrillation.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogen Classification:	Group D - not classified as a carcinogen
Noncarcinogenic Effects	
Oral RfD:	$7x10^{-2}$ mg/kg/day
Inhalation RFD(2)	$1.43x10^{-4}$ mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

BENZO(a)ANTHRACENE

INTRODUCTION

Chemical Name:	Benz(a)anthracene
CAS RN:	56553
Molecular Formula:	$C_{18}H_{12}$
Molecular Weight:	228.30

Substance comprised of colorless plates from glacial acetic acid or alcohol which sometimes exhibit greenish-yellow fluorescence.

FATE AND TRANSPORT

BCF:	Not Significant
Solubility:	Insoluble in water
	Soluble in most organic solvents

HUMAN HEALTH EFFECTS

Benzo(a)anthracene administration caused increase in the incidence of tumors. Although there are no human data that specifically link exposure of benzo(a) anthracene to human cancers, it is a component of mixtures that have been associated with human cancer.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B-2 - animal carcinogen
Carcinogenic Effects	
Oral CSF(1):	1.06 $(mg/kg/day)^{-1}$
Inhalation CSF(1):	0.885 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

BENZO(b)FLUORANTHENE

INTRODUCTION

Chemical Name:	Benz(e)acephenanthrylene
CAS RN:	205992
Molecular Formula:	$C_{20}H_{12}$
Molecular Weight:	252.32

HUMAN HEALTH EFFECTS

Benzo(b)fluoranthene has been shown to increase the incidence of tumors in animal studies.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B-2 - animal carcinogen

Carcinogenic Effects	
Oral CSF(1):	0.896 $(mg/kg/day)^{-1}$
Inhalation CSF(1):	0.749 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

BENZO(k)FLUORANTHENE

INTRODUCTON

Chemical Name:	Benzo(k) fluoranthene
CAS RN:	207089
Molecular Formula:	$C_{20}H_{12}$
Molecular Weight:	252.32

HUMAN HEALTH EFFECTS

Benzo(k)fluoranthene has been shown to increase the incidence of tumors in animal studies.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carocinogenic Classificatoin(4):	Group B-2 animal carcinogen
Carcinogenic Effects	
Oral CSF(4):	0.388 (mg/kg/day)
Inhalation CSF(4)	0.325 (mg/kg/day)

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. USEPA Region III, Setting Exposure Routes and Contaminants of Concern By Risk-Based Screening, USEPA Region III, Philadelphia, PA, EPA/903/R093-0-01, January, 1993.

5. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

BENZO(a)PYRENE

INTRODUCTION

Chemical Name:	Benzo(a)Pyrene
CAS RN:	50328
Molecular Formula:	$C_{20}H_{12}$
Molecular Weight:	252.32

Benzo(a)pyrene is comprised of monoclinic or orthorhombic crystals. These crystals form yellowish plates.

FATE AND TRANSPORT

BCF:	Practically insoluble in water Soluble in benzene, toluene, tylene, alcohol, methanol

HUMAN HEALTH EFFECTS

Benzo(a)pyrene has been demonstrated to cause stomach tumors in mice, rats and hamsters. Lung cancer has been shown to be induced in humans in various mixtures containing benzo(a)pyrene.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B-2 - animal carcinogen

Carcinogenic Effects	
Oral CSF(1):	7.30 $(mg/kg/day)^{-1}$
Inhalation CSF(2):	6.10 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand

Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

BERYLLIUM

INTRODUCTION

Chemical Name:	Beryllium
CAS RN:	7440417
Molecular Formula:	Be
Molecular Weight:	9.01 g/mole

A grayish-white metal exhibiting a local steel-like hardness in a thin film of oxide on the metal. Beryllium's uses include neutron reflector and moderator in nuclear reactors. In its compound forms uses include radio tube parts, television tube phosphors, fluorescent tubes and fluorescent powders.

FATE AND TRANSPORT

BCF:	19
Solubility:	Soluble in acids and caustic solutions
Specific Gravity:	1.85

HUMAN HEALTH EFFECTS

Alloys containing Be are dangerous. Be compounds may act locally on the skin. Exposure to Be compounds encountered in the extraction of the metal or its oxide from the ore, particularly the halide salts, has been attended, in certain individuals, by the development of dermatitis of an edematous and papulovesicular type, chronic skin ulcers, rhinitis, nasopharyngitis, epistaxis, bronchitis and in severe cases, by the development of an acute pneumonitis, with cough, scanty sputum, low-grade fever, rales, dyspnea and substernal pain. Several cases have been reported in which localized granulomatous lesions develop after penetrating wounds caused by splinters of glass from broken fluorescent light tubes. Several weeks or months following the accident, swellings were noted in the injured areas and excision revealed granulomatous tumors, which in one case was shown to contain beryllium. Several cases of beryllium granuloma have been reported in persons residing near processing plants and in families of Be workers.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1): Group B2 - animal carcinogen

Noncarcinogenic Effects
Oral RfD(1): $5x10^{-3}$ mg/kg/day

Carcinogenic Effects
Oral CSF(1): 4.3 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

CADMIUM

INTRODUCTION

Chemical Name:	Cadmium
CAS RN:	7440439
Molecular Formula:	Cd
Molecular Weight:	112.40 g/mole

Cadmium is silver-white, blue-tinged, lustrous metal; easily cut with a knife; available in the form of bars, sheets or wire or a gray granular powder. Cadmium uses are: a constituent of easily fusible alloys; soft solder and solder for aluminum; electroplating, etc.

FATE AND TRANSPORT

BCF(4):	81
Solubility:	Insoluble in water
	Readily soluble in dilute NO_3
	Slowly soluble in hot HCl
Vapor Pressure:	1 mm Hg @ 394°C
Specific Gravity:	8.642

HUMAN HEALTH EFFECTS

Ingestion: (metal and sol compounds): increased salivation, choking, vomiting, abdominal pain, diarrhea, tenesmus.

Inhalation: (dust or fumes): throat dryness, cough, headache, vomiting, chest pain, extreme restlessness and irritability, pneumonitis, possibly bronchopneumonia.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification:	Group D - not classified as a carcinogen
Noncarcinogenic Effects	
Oral RfD(1):	$5x10^{-4}$ mg/kg/day
Carcinogenic Effects	
Inhalation CSF(1):	6.3 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

CHLOROFORM

INTRODUCTION

Chemical Name:	Trichloromethane
CAS RN:	67663
Molecular Formula:	$CHCl_3$
Molecular Weight:	119.37

Colorless liquid, heavy, ethereal odor.

FATE AND TRANSPORT

BCF:(3)	3.75
Solubility:(4)	
Water:	8.22×10^3 mg/L at 20°C
Density:(4)	1.485 g/m^3 (20°C)

HUMAN HEALTH EFFECTS(2)

Chloroform causes irr of the conjunctiva. Upon inhal, it causes dilation of the pupils with reduced reaction to light, as well as reduced intraocular pressure (exper). The material is well known as an anesthetic.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(3):	Group B2 - probable human carcinogen
Noncarcinogenic Effects Oral RfD(1):	1×10^{-2} mg/kg/day
Carcinogenic Effects Oral(1):	6.1×10^{-3} (mg/kg/day)$^{-1}$
Carcinogenic Effects Inhalation CPF(1):	8.05×10^{-2} (mg/kg/day)$^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

3. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C. October 1986.

4. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Chloroform. Oak Ridge National Laboratory. October 1987.

CHROMIUM

INTRODUCTION

Chemical Name:	Hexavalent Chromium
CAS RN:	7440473
Molecular Formula:	Cr^{+6}
Molecular Weight:	52

Steel gray, lustrous hard metal. Chromium uses include manufacturing of chrome-steel, chrome-nickel-steel allows and chromeplating of metals.

FATE AND TRANSPORT

BCF:	16
Solubility:	Soluble in diluted HCl or H_2SO_4
Specific Gravity:	7-14

HUMAN HEALTH EFFECTS

Chromic acid and its salts have a corrosive action on the skin and mu mem. The lesions are confined to the exposed parts, affecting chiefly the skin of the hands and forearms and the mu mem of the nasal septum. The characteristic lesion is a deep, penetrating ulcer, which, for the most part, does not tend to suppurate, and which is slow in healing.

Small ulcers, about the size of a matchhead or end of a lead pencil, may be found, chiefly around the base of the nails, on the knuckles, dorsum of the hands and forearms. These ulcers tend to be clean and progress slowly. They are frequently painless, even though quite deep. They heal slowly and leave scars.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B - human carcinogen by inhalation
Noncarcinogenic Effects	
Oral RfD(1):	$5x10^{-3}$ mg/kg/day
Carcinogenic Effects	
Inhalation CPF(1):	42.0 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

COPPER

INTRODUCTION

Chemical Name:	Copper
CAS RN:	7440508
Molecular Formula:	Cu
Molecular Weight:	63.54 g/mole

Copper exists as a reddish, lustrous, ductile, malleable metal which becomes dull when exposed to air. Uses of copper include brass, copper alloys, electrical conductors, copper salts, art, etc.

FATE AND TRANSPORT

BCF:	200
Solubility:	Water soluble in salt form Soluble in acids and ammonia water
Vapor Pressure:	1 mm Hg @ 1628°C
Specific Gravity:	8.92

HUMAN HEALTH EFFECTS

Copper salts are strong irritants to skin and mucous membranes. Additionally, copper may influence the occurrence of hemochromatosis.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group D - not classified as a carcinogen
Noncarcinogenic Effects Oral RfD(1):	3.71×10^{-2} mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand

Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

1,1-DICHLOROETHENE

INTRODUCTION

Chemical Name:	1,1-Dichloroethene
Synonyms(3):	1,1-Dichloroethylene, Vinylidene dichloride, I,I-DCE
CAS RN:	75354
Molecular Formula:	$C_2H_2Cl_2$
Molecular Weight:	96.94 g/mole

1,1-Dichloroethene is a colorless volatile liquid which exhibits a mild, sweet odor similar to chloroform. Uses of 1,1-dichloroethene include its production as an intermediate while producing vinylidene polymer plastics, i.e. SARAN.

FATE AND TRANSPORT

BCF(4):	5.6
Solubility:	Practically insoluble in water Soluble in organic solvents
Density:	1.2129

HUMAN HEALTH EFFECTS

1,1-Dichloroethene has been classified as a probable human carcinogen. In addition this compound is an irritant to skin and mucous membranes. Experimental animals exhibit liver and kidney injury following large doses of this compound.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification:	Group C - probable human carcinogen
Noncarcinogenic Effects	
Oral RfD(1):	9.00×10^{-3} mg/kg/day
Carcinogenic Effects	
Oral CSF(1):	0.600 $(mg/kg/day)^{-1}$
Inhalation CSF(1):	0.175 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

1,4-DICHLOROBENZENE

INTRODUCTION

Chemical Name:	P-Dichlorobenzene
CAS RN:	106467
Molecular Formula:	$C_6H_4Cl_2$
Molecular Weight:	147

1,4-Dichlorobenzene are volatile crystals with a characteristic penetrating odor. Used largely for killing moths and their larvae, roaches, some other insects, peach-tree borers; for preserving furs, woolen cloths, rugs.

FATE AND TRANSPORT

BCF(4):(1)	56
Solubility:(2)	Practically insoluble in water Soluble in alcohol, ether, benzene, chloroform, carbon disulfide
Density:(3)	1.4581 at 20.5°C

HUMAN HEALTH EFFECTS

1,4-Dichlorobenzene has been classified as a probable human carcinogen. Continued exposure to this compound's vapors for months or years may cause headache, nausea, vomiting, weakness, portal cirrhosis, subacute yellow atrophy of liver, cataract, pulmonary granulomatosis, anemia, granulocytopenia. Irritation to skin, eyes, throat also may occur.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification:	Group C - probable human carcinogen
Noncarcinogenic Effects	
Inhalation RfD:(4)	2.29×10^{-1} mg/kg/day
Carcinogenic Effects	
Oral CSF:(5)	2.40×10^{-2} $(mg/kg/day)^{-1}$

REFERENCES

1. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

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INDENO(1,2,3)PYRENE

INTRODUCTION

Chemical Name:	Indeno(123-cd)pyrene
CAS RN:	193395
Molecular Formula:	$C_{22}H_{12}$
Molecular Weight:	276.34

HUMAN HEALTH EFFECTS

Ideno(1,2,3-cd)pyrene has been demonstrated to cause increased incidence of epidermoid carcinomas and skin tumors in animal studies. Although there are no human data that specifically link exposure to ideno(1,2,3-cd)pyrene to human cancers, chrysene is a component of mixtures that have been associated with human cancer.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B-2 - animal carcinogen
Carcinogenic Effects	
Oral CSF(1):	2.03 $(mg/kg/day)^{-1}$
Inhalation CSF(2):	1.70 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

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LEAD

INTRODUCTION

Chemical Name:	Lead
CAS Number:	7439-92-1
Molecular Formula:	Pb
Molecular Weight:	207.19 g/mole
Chemical Structure:	Pb

Elemental lead is a heavy, ductile, bluish-gray solid at ambient conditions. It is used widely in industry because of its softness, resistance to corrosion and radiation, and high density. Lead is also used as a paint pigment, in solder, and in storage batteries.

FATE AND TRANSPORT

Bioconcentration Factor (BCF):	49
Solubility:	Lead is insoluble in water and organic solvents. It does dissolve in dilute nitric acid(2), and hot, concentrated sulfuric acid(3)
Specific Gravity(2):	11.35 @ 20°C

Lead and lead compounds can be present in air, water, and soil and are extremely persistent in water and soil. Metallic lead and common lead minerals are insoluble in water while manufactured alkyl lead compounds are water soluble.

HUMAN HEALTH EFFECTS

Systemic Effects

Numerous studies have been conducted on the toxic effects of lead. The data present dose effect relationships and are expressed in terms of internal exposure measured in blood lead levels.

Lead affects various systems of the body. The endpoints elicited at low level exposure are neurobehavioral impairment, growth retardation in children, and hypertension in middle-aged men. High exposure levels produce encephalopathy, gastrointestinal effects, anemia, nephropathy, and electrocardiographic abnormalities.

Lead affects the hematopoietic system by interfering with heme biosynthesis and ferrochelatase. This interference results in a reduction of the hemoglobin concentration in blood and an increase in erythrocyte (red blood cell) destruction. The combination of these two effects produce

hypochromic, normocytic anemia with associated reticulocytosis.

Lead exposure also affects the central nervous system. Overt neurological signs have been documented in adults with blood levels ranging as low as 40 to 60 μg/dl. Encephalopathy can occur at blood lead levels of 100 to 200 μg/dl and 80 to 100 μg/dl for adults and children, respectively. As indicated by these levels, children are much more sensitive to neurological effects of lead. Death or irreversible health effects may occur as a result of central nervous system impairment.

A direct relationship has been drawn between blood lead level and children's height, weight, and chest circumference. The strongest relationship was drawn with height. As the blood level increases, the child's growth is retarded(4).

Exposure to lead has significantly effected the human reproductive system. Because lead accumulates in the bones and is sporadically released into the blood, exposure prior to pregnancy may affect the fetus. Blood lead reaches the fetus by crossing through the placental barrier. It was observed in animals that exposure to lead by non-natural routes (e.g., intravenous or intraperitoneal injection) resulted in malformation of the fetus.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(4):	Group B2 - possible human carcinogen
RfD (oral):	Not Available
RfC (inhalation):	Not Available
Cancer Slope Factor (oral, inhalation):	Not Available

REFERENCES

1. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. October 1986.

2. Toxicological Profile for Lead. U.S. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, and U.S. Environmental Protection Agency. Atlanta, Georgia. June 1990.

3. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

4. U.S. Environmental Protection Agency, Federal Register, Maximum Contaminant Level

Goals and National Primary Drinking Water Regulations for Lead and Copper, Vol. 56, No. 110, June 7, 1991.

5. Sax, N.I. and R.J. Lewis. Hazardous Chemical Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

MANGANESE

INTRODUCTION

Chemical Name:	Manganese
CAS Number:	7439-96-5
Molecular Formula:	Mn
Molecular Weight:	54.94 g/mole

Manganese occurs as a brittle silvery metal usually in complex with other metals such as iron. Manganese and its compounds are used in the making of steel alloys, dry-cell batteries, electrical coils, and other metallic fabrication applications. Other manganese uses include use as an oxidizing agent and as a food additive.

FATE AND TRANSPORT

Solubility:

In Water:	Decomposes to ionic forms(1)
In Organics:	Readily dissolves in dilute mineral acids(4)

Specific Gravity: 7.20(1)

HUMAN HEALTH EFFECTS

EPA has established an oral Reference Dose (RfD) for manganese based on central nervous system effects. This oral RfD is based on total dietary intake, and may not be valid if the intake is to occur from drinking water alone.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1): Group D - not classified as a carcinogen

Noncarcinogenic Effects

Oral RfD(1):	5.00×10^{-03} mg/kg/day
Inhalation RfD(1):	1.14×10^{-4} mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

3. Sax, N.I. and R.J. Lewis. Hazardous Chemicals Desk Reference. Van Nostrand Reinhold Company, Inc. New York, New York. 1987.

4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

NICKEL (Soluble Compounds)

INTRODUCTION

Chemical Name:	Nickel (soluble compounds)
Synonyms(1):	Inorganic nickel salts
CAS Number:	7440020
Molecular Formula:	Ni
Molecular Weight:	58.71 g/mole

Nickel is a silvery-white, hard, malleable and ductile metal. Among nickel's uses are alloys, electrical catalyst for hydrogenation of oils, coins, magnet and electrical contacts.

FATE AND TRANSPORT

Density(3):	8.90
BCF(4):	47
Vapor Pressure(3):	1 mm Hg @ 1810°C

HUMAN HEALTH EFFECTS(5)

Nickel has been found to cause dermatitis while ingestion of soluble nickel salts may cause nausea, vomiting, and diarrhea.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(4):	Group A - classified as human carcinogen
Noncarcinogenic Effects	
Oral RfD(2):	$2x10^{-2}$ mg/kg/day

REFERENCES

1. Calabrese, E. and Kenyon, E. Air Toxics and Risk Assessment. Lweis Publishers, Inc. 121 South Main St., Chelsea, Michigan, 48118. 1991.

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PENTACHLOROPHENOL

INTRODUCTION

Chemical Name:	Pentachlorophenol
Synonyms:	Pentachlorophenate, Thompson's Wood Fix
CAS RN:	87865
Molecular Formula:	C_6HCl_5O
Molecular Weight:	266.32

Pentachlorophenol are dark-colored flakes and sublimed needle crystals which have a pungent odor only when hot. Uses of this compound include preservation of wood, wood products, starches, dextrins, glue and algae control in herbicide formulations.

FATE AND TRANSPORT

Density(3):	1.978
Vapor Pressure(3):	40 mm Hg @ 211.2°
Solubility:	Insoluble in water Very soluble in alcohol Soluble in ether and benzene

HUMAN HEALTH EFFECTS

Pentachlorophenol intake causes an increase then decreases respiration, blood pressure, urinary output, fever, increased bowel action, motor weaknesses, and collapse with and convulsions and death. This compound also causes lung, liver, and kidney damage. It also causes contact dermatitis and may be absorbed through skin. This compound becomes more toxic in organic compounds.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B-2 - Probable human carcinogen with sufficient evidence in animals or no evidence in humans
Carcinogenic Effects Oral CSF(1):	0.120 $(mg/kg/day)^{-1}$
NonCarcinogenic Effects Oral RfD(1):	3.00×10^{-2} (mg/kg/day)

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

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4. U.S. EPA. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C. October 1986.

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POLYCHLORINATED BIPHENYLS
(AROCLOR-1248, aroclor-1254, AROCLOR-1260)

INTRODUCTION

Chemical Name:
CAS RN:

Polychlorinated Biphenyls (PCBs) are chemical mixtures comprised of many isomers and compounds which vary from mobile oily liquids to white crystalline solids and hard noncrystalline resins. PCB uses vary. A major use in the past was as the dielectric in electrical transformer.

FATE AND TRANSPORT

BCF: Not significant

HUMAN HEALTH EFFECTS

PCBs cause chloracne. The chlorinated diphenyls have two distinct actions on the body, namely, a skin effect and a toxic action on the liver. The lesion produced in the liver is an acute yellow atrophy. The higher the chlorine content of the diphenyl compound, the more toxic it may be. Oxides of chlorinated diphenyls are more toxic than the unoxidized materials. The skin lesions known as chloracne consist of small pimples and dark pigmentation of the exposes areas, initially. Later, comedones and pustules develop. In persons who have suffered systematic intoxication, the usual signs and symptoms are nausea, vomiting, loss of weight, jaundice, edema and abdominal pain. Where the liver damage has been severe the patient may pass into coma and die.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1): Group B-2 - animal carcinogen

Carcinogenic Effects
Inhalation CSF(1): 7.70 $(mg/kg/day)^{-1}$

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

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1,1,2,2-TETRACHLOROETHANE

INTRODUCTION

Chemical Name:	1,1,2,2-Tetrachloroethane
CAS RN:	79345
Molecular Formula:	$C_2H_2Cl_4$
Molecular Weight:	167.84

Heavy, colorless, mobile liquid, with a chloroform-like odor.

FATE AND TRANSPORT

Solubility: Very sparingly soluble in water. Soluble in some organic solvents.

HUMAN HEALTH EFFECTS

1,1,2,2-Tetrachloroethane is considered to be the most toxic of the common chlorinated hydrocarbons. It is an irritant to the mucous membranes of the upper respiratory tract. The toxic action of this compound is on the liver where it produces acute yellow atrophy and cirrhosis. 1,1,2,2-Tetrachloroethane may also have serious effects on the kidneys, heart, brain and central nervous system. It has been observed to increase the incidence of heptocellular carcinoma in mice.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification: Group C - Possible human carcinogen

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. Sax, N.I., and Lewis, P.J. Chemicals Desk Reference. Van-Nostrand Reinhold Company, inc., New York, NY 1987.

3. Strecher, P., et al. The Merck Index. Eighth Edition, Merck and Company, Inc., Rahway, NJ 1968.

TETRACHLOROETHENE

INTRODUCTION

Chemical Name:	Tetrachloroethene
Synonyms:	1,1,2,2-Tetrachloroethylene, Fetrachoroethylene, Perchloroethylene, Perc, Carbon bichloride, Carbon dichloride, ethylene tetrachloride, Per Perchlor, Perchlorethylene, PerK
CAS Number(1):	127184
Molecular Formula:	C_2Cl_4
Molecular Weight:	165.83 g/mole

Tetrachloroethene is a colorless liquid which exhibits an ethereal odor. This compound's former uses included dry cleaning, degreasing metals and solvents.

FATE AND TRANSPORT

Specific Gravity:	1.62
Vapor Pressure(3):	14 mm Hg @ 20°C
Solubility:	Soluble in water Miscible with ethanol, diethyl ether and oils
BCF:	31

HUMAN HEALTH EFFECTS

Tetrachloroethene exposure causes irritation, lachrymation and buring of the eyes and irritation of the nose and throat. Exposure may cause vomiting, nausea and drowsiness. Exposures can result in either acute or fatal toxicity. This compound also causes dermatitis with skin blistering and opening of skin. Ingestion of this compound may cause irritation of the gastro intestinal tract resulting in nausea, vomiting, diarrhea and bloody stools.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group D - not classifiable as to human carcinogenicity
Carcinogenic Effects	
Oral CSF(5):	5.20×10^{-2} $(mg/kg/day)^{-1}$
Inhalation CSF(5):	2.03×10^{-3} $(mg/kg/day)^{-1}$
Noncarcinogenic Effects:	
Oral RfD(1):	1.00×10^{-2} (mg/kg/day)

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

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4. U.S. EPA. Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, D.C. October 1986.

5. USEPA Region III, Setting Exposure Routes And Contaminants Of Concern By Risk-Based Screening, USEPA Region III, Philadelphia, PA, EPA/903/R-93-001, January, 1993.

6. Stecher, P., et. al. The Merck Index. Eighth Edition, Merck & Co., Inc., Rahway, NJ. 1968.

7. Technical Resources, Inc. Toxicological Profile For Tetrachloroethylene, Oak Ridge National Laboratory, December 1987.

TRICHLOROETHENE

INTRODUCTION

Chemical Name:	Trichloroethylene
Synonyms:	Acetylene trichloride, ethylene trichloride, trichloroethene, vestrol
CAS Number(1):	79016
Molecular Formula:	C_2HCl_3
Molecular Weight:	131.40 g/mole

Trichloroethylene is a clear colorless liquid which exhibits an ethereal, chloroform like, sweet odor. This compound's uses include solvent extraction in industries, solvent for fats, coaxes, resins, oils, and paints; degreasing; dry cleaning and manufacture of organic chemicals and pharmaceuticals.

FATE AND TRANSPORT

Specific Gravity:	1.465
Vapor Pressure(3):	59 mm Hg @ 20°C
Solubility:	Soluble in water
	Miscible with many common organic solvents
BCF:	10.6

HUMAN HEALTH EFFECTS

Trichloroethylene is a strong skin and eye irritant. Inhaling high concentrations causes narcosis and anesthesia. Fatal following severe acute exposure by ventricular fibulation resulting in cardiac failure. Liver and other organ damage caused from chronic exposure's suspected but not definitely established.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group B2 - Probable human carcinogen with sufficient evidence in animals or no evidence in humans.
Carcinogenic Effects	
Oral CSF(2):	1.10×10^{-2} (mg/kg/day)$^{-1}$
Inhalation CSF(5):	6.00×10^{-3} (mg/kg/day)$^{-1}$
Noncarcinogenic Effects:	
Oral RfD(5):	6.00×10^{-3} mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

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7. Technical Resources, Inc. Toxicological Profile For Tetrachloroethylene, Oak Ridge National Laboratory, December 1987.

VANADIUM

INTRODUCTION

Chemical Name:	Vanadium
CAS Number(1):	7440-62-2
Molecular Formula(1):	V
Molecular Weight(1):	50.94 g/mole

Vanadium is a bright, white, soft ductile metal. Vanadium uses include x-rays, manufacture of alloy steels, catalyst for sulfuric acid and synthetic rubber(1).

FATE AND TRANSPORT

Vanadium is capable of being transported in water systems. The extent of transport is dependant upon the chemical species present and by environmental factors determining its solubility and binding to organic materials.

HUMAN HEALTH EFFECTS

Vanadium has not produced carcinogenic, mutagenic, teratogenic, or reproductive effects in humans or animals. Gastrointestinal distress, nausea, vomiting, abdominal pain, cardiac palpitation, tremor, nervous depression, and kidney damage have been linked with industrial exposure. Oral exposure may produce gastrointestinal disturbances and a greenish-black discoloration of the oral mucosa and tongue. Additionally, studies suggest that the liver, adrenals, and bone marrow may be adversely affected by subacute exposure at high concentrations.

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group D - not classified as a carcinogen
Noncarcinogenic Effects	
Oral RfD(1):	$3x10^{-1}$ mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

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ZINC

INTRODUCTION

Chemical Name:	Zinc
Synonyms(1):	Zinc dust; Zinc powder
Trade Names(1,2):	Asarco; Blue powder; CI 77945; JASAD; PASCO
CAS Number(1):	7440-66-6
Molecular Formula(1):	Zn
Molecular Weight(1):	65.38 g/mole

Zinc is a shiny white metal with a bluish-gray luster. Among zincs uses are alloys in brass, bronze, and die-casting alloys; galvanizing iron; as a fungicide; and as a protective coating for other metals.

FATE AND TRANSPORT

Density(1):	7.14
Solubility(1):	
In Water:	Insoluble
In Organics:	Soluble in acetic acid and alkali

Zinc has been found to reduce the serum HDL-cholesterol levels in humans following intermediate oral exposure. The decrease in HDL levels may increase risk of coronary artery disease.

Zinc is essential to maintain one's health. However, ingestion of high levels of zinc present a potential for gastrointestinal disorders in humans and animals such as pancreatic abnormalities and gastrointestinal irritation. Biochemical changes (increased serum amylase levels and hypocalcemia) were evident in humans following ingestion of a zinc chloride solution. Animal studies have shown adverse effects including pancreatic fibrosis and degeneration and necrosis of acinar cells of the pancreas. Zinc has also caused internal bleeding in humans and animals following ingestion of high levels.

Hematological effects in humans and animals following high level acute, intermediate or chronic oral exposure to zinc and zinc compounds consist of anemia which can be exacerbated by gastrointestinal bleeding. These effects occur over a wide range of concentrations depending upon the species(1).

No adverse hepatic effects were reported following intermediate oral exposure to zinc in humans. This indicates that the liver is not a primary target organ for zinc toxicity. Hepatic necrosis was

reported in sheep following acute and intermediate exposure, and enzymatic changes were exhibited in rats exposed following intermediate exposure to zinc.

The only renal effects observed were in laboratory animals following intermediate oral exposure to zinc compounds. No adverse renal effects have occurred in humans(1).

SUMMARY OF TOXICOLOGICAL INDICES

EPA Carcinogenic Classification(1):	Group D - not classified as a carcinogen
Noncarcinogenic Effects Oral RfD(1):	$3x10^{-1}$ mg/kg/day

REFERENCES

1. IRIS. Integrated Risk Information System. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 1993.

2. HEAST. Health Effects Assessments Summary Tables. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. FY-1992.

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CHLORDANE

INTRODUCTION

Chemical Name:	Chlordane
CAS RN:	57-74-9
Molecular Formula:	$C_{10} H_6 CL_8$
Molecular Weight:	409.8

FATE AND TRANSPORT

BCF:	14,000
Solubility:	
In Water:	0.56 mg/l at 20°C
Vapor Pressure:	1.00E-05 mm Hg at 20°C
Specific Gravity:	Not Reported

HUMAN HEALTH EFFECTS

Chlordane is an organochlorine pesticide which has been used as an agricultural and home insecticide (Clayton and Clayton, 1981). As of 1983, the only use for chlordane in the U.S. is for termite control (USEPA, 1991). Chlordane exposure occurs via inhalation, skin adsorption and ingestion (Sittig, 1985). Symptoms of exposure include increased sensitivity to stimuli, tremors, muscular incoordination and convulsions with or without coma (USEPA, 1991).

The toxic effects in rats resulting from daily gastric intubation of chlordane at various doses for 15 days were histologic changes in the liver at all dose levels, and central nervous system effects at higher dose levels (Ambrose et al., 1953). Liver carcinomas were induced in mice of both sexes in two additional studies. Velsicol (1983) reported a significant increase in adenomas of the liver for male rats receiving 25 ppm in a 130 week study carcinogenesis bioassay.

Chlordane has also induced mutagenic, teratogenic, metabolic and biochemical disorders in mice. Systematically, chlordane may act as a cumulative neurotoxin (USEPA, 1984).

Chlordane has been classified by USEPA (1991) in Group B2- Probable Human Carcinogen and has developed an oral and inhalation slope factor of 1.3×10^0 $(mg/kg/day)^{-1}$ and 1.29×10^0 respectively based on two dietary bioassays on mice which resulted in hepatocellular carcinomas (NCI, 1977; Velsicol, 1983). USEPA (1991) has also recommended an oral RfD of 6.0×10^{-5} mg/kg/day for chlordane. An uncertainty factor of 1000 was applied in determining the RfD.

REFERENCES

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National Cancer Institute (NCI). 1977. Bioassay of Chlordane for Possible Carcinogenicity. NCI Carcinogenesis Tech. Rep. Ser. No. 8. U.S. DHEW Publ. No. (NIH) 77-808. Bethesda, Md.

DICHLORODIPHENYLTRICHLOROETHANE (DDT)

INTRODUCTION

Chemical Name:	DDT
CAS RN:	50-29-3
Molecular Formula:	C_{14} H_8 CL_5
Molecular Weight:	355

FATE AND TRANSPORT

BCF:	54,000
Solubility:	
In Water:	5.00E-03 mg/l at 20°C
Vapor Pressure:	5.50E-06 mm/Hg at 20°C
Specific Gravity:	Not Reported

HUMAN HEALTH EFFECTS

DDT, a chlorinated ethane derivative of the organochlorine insecticides, has been widely used in the past for agricultural purposes and in malaria control. DDT, as with other chlorinated insecticides was banned due to its persistence in the environment and tendency to accumulate in biologic and nonbiologic media. DDT is poorly absorbed after dermal exposure, especially when applied in the powder or crystalline form, and is slowly and incompletely absorbed from the gastrointestinal tract. However, DDT is readily absorbed by the lungs. DDT and its degradation product DDD are lipophilic toxicants which distribute and concentrate in adipose tissue where they may remain for years.

Symptoms of acute and subacute exposures to high doses of DDT in humans and experimental animals included paresthesia of the tongue, lips and face, apprehension, hypersusceptibility to stimuli, irritability, dizziness, disturbed equilibrium, tremor and tonic and clonic convulsions. Motor unrest and fine tremors associated with voluntary movements progress to coarse tremors without interruption in moderate to severe poisoning. Symptoms appear several hours after large doses, and in animals poisoned with fatal doses death occurs in 24 to 72 hours. Chronic oral toxicity exposures to experimental animals resulted in tremors, increased mortality and increased liver, kidney and spleen weights with degenerative changes occurring in the liver. No clinical or laboratory evidence of injury to man from occupational, repeated exposures to DDT has been reported although the amount stored in body fat was higher than that found in the general population. Although there have been no reports of teratogenic effects from DDT, with the possible exception of ringtail in rats (Ottoboni, 1969), DDT has consistently resulted in decreased fertility in mice (Keplingler et al., 1968; McLachlan and Dixon, 1972, Schmidt 1973); however, conflicting results have been reported in rats (Fitzhugh and Nelson, 1947; Fitzhugh, 1948; Treon and Cleveland, 1955; Clement and Okey, 1974; Jonsson et al., 1975; Ware and Good, 1967;and Dubey et al., 1971) and dogs (Deichmann et al., 1971; Deichmann and MacDonald, 1971;and Ottoboni et al., 1977). (USEPA, 1980 and 1984; Klaassen et al., 1986;and Clayton and Clayton, 1981).

Although no evidence for the carcinogenicity of DDT exists for humans, extensive accounts of carcinogenicity in a number of experimental animal species have been reported. (USEPA, 1980 and 1984; Klaassen et al., 1986; and Clayton and Clayton, 1981). The USEPA (1991) has recommended an oral reference dose for DDT of $5x10^{-4}$ mg/kg/day based on a rat study in which exposure to 1 ppm in the diet for 27 weeks (0.05 mg/kg/day) resulted in liver lesions. Also, DDT has been classified by the USEPA (1991) as a Group B2 Carcinogen and it has recommended an oral and inhalation slope factor of $3.4x10^{-1}$ $(mg/kg/day)^{-1}$ based on several rat and mouse dietary studies in which liver cancers were observed.

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HEPTACHLOR

INTRODUCTION

Chemical Name:	Heptachlor
CAS RN:	76-44-8
Molecular Formula:	C_{10} H_5 CL_7
Molecular Weight:	373.35

FATE AND TRANSPORT

BCF:	15,700
Solubility:	
In Water:	0.18 mg/l at 20°C
Vapor Pressure:	3.00E-04 mm Hg at 20°C
Specific Gravity:	1.57

HUMAN HEALTH EFFECTS

Heptachlor is a man-made organochlorine insecticide used in the 1960s and 1970s by farmers to kill insects in seed grains and crops and by exterminators to kill termites (ATSDR, 1987). Since 1978, heptachlor uses have gradually declined. In 1987, the only U.S. manufacturer stopped selling the product. Heptachlor can still be used by licensed applicators.

Heptachlor is persistent in the environment. Half-lives in soil for heptachlor and heptachlor epoxide (a heptachlor degradation product) are 2 and 14 years, respectively (ATSDR, 1987). Both compounds bioaccumulate in aquatic organisms.

Data suggest that heptachlor is readily absorbed from the gastrointestinal tract and may be absorbed through the skin. Based on animal data, the liver appears to be the most sensitive target organ of heptachlor toxicity. Increased liver weights and increased levels of serum enzymes indicative of liver damage have been observed following acute and chronic exposures (ATSDR, 1987).

Neurotoxicity has also been observed in animals exposed to heptachlor. Effects include hyperactivity tremors and convulsions and ataxia. In human case studies, neurotoxic effects have included irritability, salvation, lethargy, dizziness, labored breathing, muscle tremors, and convulsions (ATSDR, 1987). Exposures in these studies were to technical-grade chlordane which usually contains 10% heptachlor.

Other toxic effects observed in animals following chronic oral exposure include renal toxicity, adrenotoxicity, and hematologic effects. Humans exposed to mixtures of heptachlor with chlordane have developed leukemia as well as various forms of anemia (ATSDR, 1987).

Epidemiologic data is inadequate to infer a causal association between heptachlor and increased incidence of cancer in humans. Chronic oral exposure in rats and mice, however, has induced and increased liver tumor incidence (ATSDR, 1987). As a result, the USEPA has classified heptachlor/heptachlor epoxide as a Class B2 probable human carcinogen with an oral and

inhalation slope factor of 4.50 and 4.55 ($mg/kg/day^{-1}$) respectively. EPA has also recommended an oral RFD of 5.00 x 104 mg/kg/d.

Heptachlor has tested negative in a variety of assays designed to test the mutagenicity of the compound. It has been postulated that the carcinogenicity of heptachlor is a result of an indirect effect upon cellular DNA (ATSDR, 1987).

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)

HUMAN HEALTH EFFECTS

PAHs occur in the environment as complex mixtures of many components with varying noncarcinogenic and carcinogenic potencies. Only a few components of these mixtures have been adequately characterized, and only limited information is available on the relative potencies of different compounds. The PAHs are often separated into two categories for the purposes of risk assessment: carcinogenic and noncarcinogenic PAHs.

PAH absorption following oral or inhalation exposure is inferred from the demonstrated toxicity of PAHs following ingestion or inhalation (USEPA, 1984a). It has been suggested that simultaneous exposure to carcinogenic PAHs such as benzo[a]pyrene and particulate matter can increase the effective dose of the compound (ATSDR, 1987). PAHs are also absorbed following dermal exposure (Kao et al., 1985). Acute effects from direct contact with PAHs and related materials are limited primarily to phototoxicity, with the principal effect being dermatitis (NIOSH 1977). PAHs have also been shown to cause cytotoxicity in rapidly proliferating cells throughout the body (Santodonato et al., 1981). As a consequence of this, the hematopoietic system, lymphoid system and testes are frequent targets. Some of the noncarcinogenic PAHs have been shown to cause systemic toxicity but these effects are generally seen only at rather high doses (Santodonato et al., 1981). Slight morphological changes in the livers and kidneys of rats have been reported following oral exposure to acenaphthene. Oral administration of naphthalene to rabbits and rats has resulted in cataract formation (USEPA, 1984b). Nonneoplastic lesions are seen in animals exposed to the more potent carcinogenic PAHs only after exposure to levels well above those required to elicit a carcinogenic response. Carcinogenic PAHs are believed to induce tumors both at the site of application and systemically. Neal and Rigdon (1967) reported that the oral administration of benzo[a]pyrene led to forestomach tumors in mice. Thyssen et al. (1981) observed respiratory tract tumors in hamsters exposed to benzo[a]pyrene.

Benzo[a]pyrene and chrysene are representative of the carcinogenic PAHs and is classified by the USEPA as B2 - Probable Human Carcinogen, based on sufficient evidence of carcinogenicity from animal studies and inadequate evidence from human carcinogenicity studies (USEPA, 1991a). The USEPA has recommended slope factors of 7.30E+00 and 7.30E-03 $(mg/kg/day)^{-1}$ for oral exposure and 6.1 and 6.10E-03 $(mg/kg/day)^{-1}$ for inhalation exposure to benzo[a]pyrene and chrysene respectively based on the study by Neal and Rigdon (1967) and Thyssen et al. (1981).

Of the noncarcinogenic PAHs, anthracene, fluoranthrene, naphthalene and pyrene (acenaphthene and fluorene are profiled separately) are the only compounds that have had any systematic toxicity assessment for noncarcinogenic effects. The USEPA (1991) has recommended oral reference doses (RfDs) for these compounds. For anthracene, USEPA (1991) has derived an oral RfD of 0.3 mg/kg/day based its a subchronic study in mice in which there was no LOAEL and therefore no observed effects. An uncertainty factor of 3000 was applied in determining the RfD. For fluoranthrene, a study by USEPA (1991) has derived an oral RfD of 4×10^{-2} mg/kg/day based on a subchronic study in which nephropathy, increased liver weights, hematological alterations and clinical effects were observed at a LOAEL of 250 mg/kg/day in orally exposed mice. Again, an uncertainty factor of 3000 was used to derive the RfD. An oral

RfD of 4 x 10^{-3} mg/kg/day for naphthalene has been derived by USEPA (1991a) from a rat dietary study in which exposure to 10 - 20 mg/day, 6 days/week for 700 days (41 mg/kg/day) resulted in ocular and internal lesions. An uncertainty factor of 10000 was used to determine the RfD. For pyrene, an oral RfD of 3 x 10^{-2} mg/kg/day was determined by USEPA (1991) based on an oral subchronic mouse study in which the LOAEL (125 mg/kg/day) resulted in renal tubular pathology and decreased kidney weights. An uncertainty factor of 3000 was used to derive the RfD. Anthracene and naphthalene have been classified in Group D - Not Classified as to carcinogenicity due to inadequate evidence of carcinogenicity in animals.

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TOLUENE

INTRODUCTION

Chemical Name:	Toluene
CAS RN:	108-88-3
Molecular Formula:	$C_7 A_8$
Molecular Weight:	92

FATE AND TRANSPORT

BCF:	10.7
Solubility:	
In Water:	535 mg/l at 20°C
Vapor Pressure:	28.1 mm Hg at 20°C
Specific Gravity:	0.867

HUMAN HEALTH EFFECTS

Toluene is a homologue of benzene which contains a single methyl group. For humans, the most common routes of exposure to toluene are through the respiratory tract and the skin. Studies in humans show that toluene is absorbed rapidly through the respiratory tract (Astrand et al., 1972 and 1975) and also through the skin. Dutkiewicz and Tyras (1968a, 1968b) measured the absorption rate of liquid toluene into human skin at 23 mg/cm^2/hr. Absorption from the gastrointestinal tract is believed to occur slower than in the respiratory tract, but based on animal studies appears to be fairly complete.

The following toxicological information has been summarized from USEPA (1985) and USEPA (1983). Since human exposure (experimental, occupational or intentional abuse) to toluene typically occurs through inhalation, the effect of greatest concern is dysfunction of the central nervous system (CNS). Acute exposure to toluene at approximately 200 ppm (754 mg/m^3) for eight hours caused fatigue, headache, nausea, muscle weakness, confusion, impaired coordination and paresthesia of the skin (von Oettingen et al., 1942a, 1942b; Carpenter et al., 1944). Chronic exposure at levels of approximately 200 to 800 ppm have been associated primarily with CNS (von Oettingen et al., 1942a, 1942b) and possibly peripheral nervous system effects (Matsushita et al., 1975; Seppalainen et al., 1978). Workers exposed to 200 to 800 ppm for "many years" developed disturbances in memory, thinking, psychomotor skills, visual accuracy and sensorimotor speed (Munchinger, 1964). Chronic abusers of toluene were reported to display toxicities indicative of cerebral and cerebellar dysfunction such as ataxia, tremors, equilibrium disorders, speech, vision and hearing impairment and impaired memory and coordination (Knox and Nelson, 1966; Boor and Hartig, 1977; Sasa et al., 1978). Hepatomegaly and hepatic and renal function changes have been observed in chronic abusers of toluene and occupationally exposed workers (Greenberg et al., 1942; Grabski, 1961; Kroeger et al., 1980; Moss et al., 1980).

Since human exposure in the workplace occurs often and because toluene is an abused substance, many reports on human exposure exist in the literature. None of these reports, however, associates toluene exposure with an increased rate or incidence of cancer. Likewise,

carcinogenicity due to toluene exposure has not been observed in animal studies (USEPA, 1984). USEPA (1991) has derived an oral reference dose of 2 x 10^{-1} mg/kg/day based on a study by NTP (1989) in which changes in liver and kidney weights were observed at a LOAEL of 446 mg/kg/day in rats orally gavaged 5 days/week for 13 weeks. An inhalation reference dose of 1.14E-01 mg/kg/day has been derived by USEPA (1991a) based on human exposure to 151 mg/m^3 with resultant CNS effects and eye and nose irritation (Anderson et al., 1983). Uncertainty factors of 1000 and 100 have been applied when deriving reference doses, respectively.

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ALDRIN

INTRODUCTION

Chemical Name:	Aldrin
CAS RN:	309-00-2
Molecular Formula:	C_{12} H_8 CL_6
Molecular Weight:	364.94

FATE AND TRANSPORT

BCF:	28
Solubility:	
In Water:	0.18 mg/l at 20°C
Vapor Pressure:	6.00E-06 mm Hg at 20°C
Specific Gravity:	Not Reported

HUMAN HEALTH EFFECTS

Aldrin is absorbed following inhalation exposure; between 20-50% of the inhaled vapor is absorbed and retained (Beyermann and Eckrich 1973, Bragt et al. 1984, as cited in Shell 1984). Absorption occurs slowly following ingestion (Farb et al. 1973, Heath and Vandekar 1984, Hunter and Robinson 1967, 1969, Iatropoulos et al. 1975) and also during dermal exposure (Feldmann and Maibach 1974, Sundaram et al. 1978a,b). It is metabolically converted to dieldrin in fatty tissues (ACGIH 1987) and these two insecticides are considered to have similar effects.

Acute symptoms of aldrin intoxication in humans and animals following ingestion or inhalation indicate CNS stimulation manifested primarily as hyperexcitability, muscle twitching and convulsions (with EEG anomalies in humans) (NCI 1978, Hayes 1982, Hoogendam et al. 1962, Jager 1970). Experimental studies indicate that dogs orally exposed for longer periods of time to levels as low as 0.2 mg/kg aldrin developed hepatic toxicity (Fitzhugh et al. 1964, Treon and Cleveland 1955). Several lifetime studies in rats fed aldrin resulted in histologic liver changes and increased liver-to-body weight ratios at doses as low as 0.5 ppm, (Fitzhugh et al. 1964, Treon and Cleveland 1955, Walker et al. 1969 and Deichmann et al. 1970). Aldrin produced fetotoxic and/or teratogenic effects in hamsters fed a single oral dose of 50 mg/kg and in mice fed a single oral dose of 35 mg/kg (Ottolenghi et al. 1974). Other studies with mice (Good and Ware 1969, Deichmann 1971) have associated reduced fertility, reduced litter and/or postnatal mortality with the administration of aldrin. No compelling evidence for genotoxic effects due to aldrin exist in the literature (ATSDR 1987). Chronic aldrin exposure has produced an increase in hepatocellular tumors in mice, but not in rats (ATSDR 1987). Aldrin has been shown to produce liver tumors in both male and female mice following chronic oral exposure (Davis 1965, Davis and Fitzhugh 1962, Epstein 1975, NCI 1978). In contrast, chronic feeding studies with aldrin in rats indicate that oral exposure at levels of up to 250 ppm was associated with nonneoplastic changes in the liver (NCI 1978, Fitzhugh et al. 1964, Deichmann et al. 1967, 1970, Song and Harville 1964, Treon and Cleveland 1955).

USEPA (1991) has classified aldrin as a Group B2 agent - Probable Human Carcinogen and has developed an oral and inhalation slope factor of 1.7 x 10+1 (mg/kg/day)-1. This value is based on several mouse dietary studies in which liver tumors were the effect of concern. USEPA (1991) has derived an oral reference dose (RfD) for aldrin of 3.0 x 10-5 mg/kg/day based on a study in which rats fed 0.025 mg/kg/day (LOAEL) aldrin in the diet for 2 years developed liver lesions (Fitzhugh et al. 1964). An uncertainty factor of 1000 was used to derive the RfD.

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MERCURY

INTRODUCTION

Chemical Name:	Mercury
CAS RN:	7439-97-6
Molecular Formula:	H_9
Molecular Weight:	201

FATE AND TRANSPORT

BCF:	5,500
Solubility:	
In Water:	.081 mg/l at 30°C
Vapor Pressure:	0.002 mm Hg at 20°C
Specific Gravity:	13.59

HUMAN HEALTH EFFECTS

In humans, elemental and inorganic mercury compounds are efficiently absorbed following inhalation exposure but poorly absorbed following oral exposure (USEPA 1984). The occupational exposure of workers to elemental mercury vapors (0.1 to 0.2 mg/m3) has been associated with mental disturbances, tremors and gingivitis (USEPA 1984). The central nervous system is a major target for organic mercury compounds. Adverse effects in humans from exposure to organic mercury compounds have included the destruction of cortical cerebral neurons, damage to Purkinje cells and lesions of the cerebellum. Clinical symptoms following exposure to organic mercury compounds have included paresthesia, loss of sensation in extremities, ataxia, and hearing and visual impairment (WHO, 1976). A primary target organ for inorganic mercurials is the kidney. Human exposure to inorganic mercury compounds has been associated with anuria, polyuria, proteinuria and renal lesions (Hammond and Beliles 1980). Embryotoxic and teratogenic effects, including malformations of the skeletal and genitourinary systems, have been observed in animals exposed to organic mercury (USEPA 1984). Both organic and inorganic compounds are reported to be genotoxic in eukaryotic systems (Leonard et al. 1984).

The USEPA (1991a) has categorized mercury in Group D - Not Classified. This classification applies to those agents for which there is inadequate evidence of carcinogenicity in animals. The USEPA's Health Effects Assessment Summary Tables (1991) recommends an oral reference dose (RfD) for inorganic mercury of 3x10-4 mg/kg/day based on several oral studies in which kidney effects were the effects of concern in exposed rats. USEPA (1991a) has also determined an inhalation reference dose of 8.57x10-5 mg/kg/day based on several human occupational studies in which neurotoxicity was the effect of concern. Throughout this assessment, it will be assumed that all exposures in soil and water are to inorganic mercury. For exposure to biota or sediments under reducing (oxygen deficient) conditions, exposure to the more toxic organic species could become significant.

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VINYL CHLORIDE

INTRODUCTION

Chemical Name:	Vinyl Chloride
CAS RN:	75-01-4
Molecular Formula:	$C_2 H_3 CL$
Molecular Weight:	62.5

FATE AND TRANSPORT

BCF:	1.17
Solubility:	
In Water:	2,670 mg/l at 20°C
Vapor Pressure:	2,660 mm Hg at 20°C
Specific Gravity:	0.9121

HUMAN HEALTH EFFECTS

Vinyl chloride is a gas that is easily liquified and usually handled as a liquid. It is the most important vinyl monomer and the nineteenth highest-volume chemical produced in the United States. Vinyl chloride is an extremely toxic and hazardous material by all avenues of exposure and is a recognized human carcinogen. It is slightly soluble in water and has an extremely high vapor pressure.

Due to the high vapor pressure, volatilization from aquatic and terrestrial systems is the most important transport process for the distribution of vinyl chloride throughout the environment (Clement Associates, Inc., 1985). Under most natural conditions, vinyl chloride should not remain upon release to an aquatic ecosystem. Half-lives in aquatic systems range from several minutes to a few hours. Photooxydation in the troposphere is the dominant environmental fate of vinyl chloride.

Vinyl chloride reacts rapidly with hydroxyl radicals in the air, forming hydrogen chloride or formal chloride. Formyl chloride, if formed, is reported to decompose at ambient temperatures, to carbon monoxide and hydrogen chloride with a half-life of about 20 minutes. As a result, vinyl chloride in the troposphere should be decomposed within a day or two of release (Callahan, et al, 1979). The hydrogen chloride formed is removed from the troposphere during precipitation (Clement Associates, 1985).

Based on the information found, it does not appear that oxidation, hydrolysis and biodegradation are important fate processes for vinyl chloride in aquatic environments. Equally sorption and bioaccumulation do not appear to be important transport processes. However, there is little information pertaining specifically to the rate of adsorption of vinyl chloride to particulate matter. Based on a low log octanol/water partition coefficient, (1.38), vinyl chloride typically travels rapidly through groundwater supplies. At the Fulton Terminals site, for instance, vinyl chloride was detected only in the groundwater, indicating infiltration through the subsoils.

USEPA has recommended oral and inhalation slope factors of 1.90 and 3.00E-01 (mg/kg/day) respectively.

1,2-DICHLOROETHENE (TOTAL)

HUMAN HEALTH EFFECTS

Cis-1,2-dichloroethene is a synthetic chemical which should be absorbed quickly and completely via any exposure route (EPA, 1984). Since it has not been widely used, toxicological information is limited. Unpublished data indicate low to moderate toxicity based on a study by the Dow Chemical Company in which an LD50 of over 2000 mg/kg was determined from rats fed a 60:40 cis-trans mixture. Available data conflict as to whether the difference in the toxicity of the cis- and trans- isomers is significant. According to Smyth (1956), the cis- isomer did not kill or anesthetize rats at a concentration of 8000 ppm for 4 hours. At 16,000 ppm however, they were anesthetized in 8 minutes and killed in 4 hours. Additionally, Smyth (1956) stated that the trans-isomer was twice as toxic and anesthetic as the cis-isomer with narcosis being the major effect of inhalation exposure. Lehmann and Flury (1943) reported the occurrence of equilibrium disturbance and prostration in approximately the same length of time from similar concentrations of the isomers. Slight and deep narcosis both occurred from the cis- isomer at concentrations of about half that of the trans- isomer. Fruendt and Macholz (1978) reported that a single exposure to 200 ppm of either cis- or trans- isomer for 8 hours inhibited mixed-function oxidases in rats with the cis- isomer being more acute than the trans- isomer at high concentrations (EPA 1985; Clayton and Clayton, 1981).

Lehmann and Flury (1943) repeatedly exposed cats and rabbits to vapor concentrations of 0.16 to 0.19 percent 1,2-dichloroethene in air. Animals exposed to the cis- isomer showed loss of appetite, decreased body weight and pathological changes in the lungs, liver and kidney.

Trans-1,2-dichloroethene is a synthetic chemical which is absorbed quickly and completely via any exposure route. The trans- isomer appears to be twice as potent as the cis- isomer in depressing the central nervous system (Albrecht, 1927). At high exposure levels the dichloroethenes possess anesthetic and narcotic properties (Irish, 1963). At lower, yet still acutely toxic, levels the liver and kidneys appear to be the primary target organs (EPA, 1985). Conflicting data exist on the chronic toxicity of 1,2-dichloroethene. Torkelson, as cited in the ACGIH TLV documentation (1979), reported no adverse effects in rats, rabbits, guinea pigs or dogs exposed to 500 or 1000 ppm 7 hours/day, 5 days/week for 6 months of 40% trans- isomer. The parameters studies were growth, mortality, body weight, hematology, clinical chemistry and gross microscopic examination of major organs. Fruendt et al. (1977) reported liver and lung as well as blood chemistry changes in rats exposed 8 hours/day, 5 days/week for 16 weeks to 200 ppm of vapors of the trans- isomer. (EPA, 1985; and Clayton and Clayton, 1981).

An oral reference dose (RfD) of 9.00E-03 mg/kg/day has been recommended by EPA for 1,2 dichloroethene (Total).

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Memorandum to B.Stroud, USEPA Region III, dated September 19, 1994 from J. Dollarhide, Superfund Health Risk Technical Support Center, Oral Systemic and Carcinogenic Toxicity Information.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

MEMORANDUM

DATE: September 19, 1994

SUBJECT: Oral Systemic and Carcinogenic Toxicity Information for Cobalt (CASRN 7440-48-4), Iron (CASRN 7439-89-6), Thallium (CASRN 7440-28-0), Dibenzofuran (CASRN 132-64-9) and 2-Methylnaphthalene (CASRN N/A) (USN Naval Amphibious Base/Little Creek/Norfolk, VA)

FROM: Joan S. Dollarhide
Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Bob Stroud
U.S. EPA
Region III

This memorandum responds to your request for oral systemic and carcinogenic toxicity information for cobalt, iron, thallium, dibenzofuran and 2-methylnaphthalene for use at the USN Naval Amphibious Base/Little Creek.

Attached please find the following information:

Attachment 1 : Risk Assessment Issue Paper for: Provisional RfD for Cobalt (7440-48-4)

Attachment 2: Risk Assessment Issue Paper for: Evaluation of Carcinogenicity of Cobalt (7740-48-4)

Attachment 3: Risk Assessment Issue Paper for: Derivation of a Provisional RfD for Iron (CASRN 7439-89-6)

Attachment 4: Risk Assessment Issue Paper for: Carcinogenicity of Iron (CASRN 7439-89-6)

Attachment 5: Risk Assessment Issue Paper for: Derivation of a Provisional RfD for Dibenzofuran (CASRN 132-64-9)

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Attachment 1

(92-12/11-18-91)

Risk Assessment Issue Paper for:
Provisional RfD for Cobalt (7440-48-4)

Cobalt has been found to stimulate the production of red blood cells in humans and, therefore, has been used as a treatment for anemia. In 12 anemic, anephric patients undergoing dialysis, treatment with 0.18 mg cobalt/kg/day as cobalt chloride for 12 weeks resulted in a significant rise in hemoglobin (Duckham and Lee, 1976). Taylor et al. (1977) reported similar effects in 8 anephric patients treated with 0.16-0.32 mg cobalt/kg/day as cobalt chloride for 12-32 weeks. In both studies, hemoglobin levels returned to pre-treatment levels following the cessation of treatment. Similar effects were reported in nonanemic humans and animals (Davis and Fields, 1958; Krasovskii and Fridlyand, 1971). Reversible polycythemia was reported in 6 normal male subjects following treatment with 1 mg cobalt/kg/day as cobalt chloride for 25 days (Davis and Fields, 1958). In normal rats, treatment with 0.5 mg cobalt/kg/day, but not 0.05 mg/kg/day, as cobalt chloride resulted in polycythemia and an increase in hemoglobin (Krasovskii and Fridlyand, 1971). An increase in hematocrit and hemoglobin levels was not observed, however, in pregnant women treated with 0.5-0.6 mg cobalt/kg/day for 90 days in an attempt to alleviate the anemia often found during pregnancy (Holly, 1955).

Much of the oral data in humans deals with the cardiomyopathy seen in people who drank large quantities of beer containing cobalt chloride (used to stabilize the foam) (Alexander, 1969, 1972; Morin et al., 1971). The people ingested 0.04-0.14 mg cobalt/kg/day (approximately 8-30 pints of beer daily) over a period of years (Alexander, 1969, 1972; Morin et al., 1971). The cardiomyopathy in the beer-drinkers, termed "beer-cobalt cardiomyopathy", was fatal to 43% of the subjects within several years, with approximately 18% of these deaths occurring within the first several days. The beer-cobalt cardiomyopathy appeared to be similar to alcoholic cardiomyopathy and beriberi, but the onset of the beer-cobalt cardiomyopathy was much more abrupt. The practice of adding cobalt to beer to stabilize the foam has been discontinued. It should be noted, however, that the cardiomyopathy may have also been due to the fact that the beer-drinkers had protein-poor diets and may have had prior cardiac and hepatic damage from alcohol abuse. Treatment of both pregnant and nonpregnant anemic patients with comparable or much higher doses of cobalt (0.09-1 mg cobalt/kg/day) did not result in effects on the heart (Duckham and Lee, 1976; Davis and Fields, 1958; Holly, 1955; Taylor et al., 1977).

Cobalt has been found to be a sensitizer in humans. Individuals are sensitized following dermal or inhalation exposure, but flares of dermatitis may be triggered following cobalt ingestion. One study was located that orally challenged cobalt-exposed workers in order to assess sensitization (Veien et al., 1987). In this study, several patients with eczema of the hands were challenged orally with 1 mg cobalt (0.014 mg cobalt/kg/day as cobalt sulfate) in tablet form once per week for 3 weeks and 28/47 patients had a flare of dermatitis

An alternative approach was likewise evaluated based on the hematological effects of cobalt treatment (increase in hemoglobin) in anemic dialysis patients (Duckham and Lee, 1976). The results of this study are supported by a similar study in anephric patients (Taylor et al., 1977). Hematological effects of cobalt were also found in studies in normal humans (Davis and Fields, 1958) and rats (Krasovskii and Fridlyand, 1971) indicating that the effect is not limited to anephric individuals. The data of Davis and Fields (1958) reported hemoglobin increase of 6-11 % over "normal" in "normal" volunteers given 0.96 mg cobalt/kg/day as cobaltous chloride. However, the data of Duckham and Lee (1976) describes a case of refractory anemia in patients with chronic renal failure that upon treatment with 0.18 mg cobalt/kg/day for 12 weeks responded favorably. The patients hemoglobin levels were increased to levels at or near low "normal" clinical levels from levels clinically described as anemic. The anemia recurred following cessation of treatment. Thus, this effect of cobalt administration in the Duckham and Lee (1976) study (and likewise that of Taylor et al., 1977) cannot be termed adverse, but are actually clinically beneficial to patients with renal disease. Consequently, these data cannot be used to derive an oral RfD.

The only known nutritional, but vital function of cobalt is as a cofactor of vitamin B_{12}. In humans, vitamin B_{12} is derived from bacterial synthesis and therefore, cobalt is essential for animal species, such as ruminants, that depend totally on their bacterial flora for vitamin B_{12}. There is no evidence that the intake of cobalt is ever limiting in the human diet, and therefore no RDA is deemed necessary for cobalt (NRC, 1989). It should be noted that the average daily intake of cobalt in humans ranges from approximately 0.002-0.008 mg cobalt/kg/day in adults (0.16-0.58 mg cobalt/day ÷ 70 kg; Tipton et al., 1966; Schroeder et al., 1967) and 0.01-0.06 mg cobalt/kg/day in children (0.3-1.77 mg cobalt/day ÷ 28 kg; NRC, 1989; Murthy et al., 1971). Murthy et al. (1971) indicated that the children in this study ranged in age from 9-12 years. Using the average weight of 28 kg for children aged 7-10 years (NRC, 1989), the average daily intake for the children in this study ranged from 0.01-0.06 mg/kg/day. If the default adult weight of 70 kg is used with the Murthy data, then the range of intake would be from 0.004-0.025 mg/kg/day.

The effects of chronic occupational exposure to cobalt on the respiratory system are well documented. Cobalt has been found to be the etiologic agent in hard metal disease. The observed effects include respiratory irritation, wheezing, asthma, pneumonia and fibrosis and have been found to occur at exposure levels ranging from 0.003 to 0.893 mg cobalt/m^3 over a period of 2-17 years (Davison et al., 1983; Demedts et al., 1984; Kusaka et al., 1986a,b; Raffn et al., 1988; Shirakawa et al., 1988; Sprince et al., 1988).

Studies have implicated cobalt as a sensitizer in humans. Although the minimum exposure level associated with cobalt sensitization has not been determined, work-related asthma was found in hard metal workers who were occupationally exposed (for greater than 3 years) to levels of cobalt ranging from 0.007 to 0.893 mg cobalt/m^3 (Shirakawa et al., 1988). Given the database, the most sensitive indicators of cobalt toxicity by inhalation exposure are the effects on the respiratory system in both humans and animals and allergic responses in cobalt-sensitized individuals.

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Attachment 2

(92-10b/11-08-91)

Risk Assessment Issue Paper for:
Evaluation of Carcinogenicity of Cobalt (7740-48-4)

CARCINOGENICITY

We have reviewed available data on the potential carcinogenicity of cobalt. Cobalt has been the subject of a very recent Health Effects Assessment document (U.S. EPA, 1991) and an ATSDR (1990) document. In the HEA, stable cobalt and compounds were assigned to EPA group D, not classifiable as to human carcinogenicity (U.S. EPA, 1986). The basis for the classification is the lack of carcinogenicity data in humans or animals by oral exposure and inadequate data in humans and animals by inhalation. The EPA concluded that epidemiological data (Morgan, 1983; Mur et al., 1987) were insufficient to determine the carcinogenic potential of low level occupational exposure to cobalt compounds. In addition. no cobalt-related carcinogenicity was observed in a chronic study with hamsters (Wehner et al., 1977, 1979) or in subchronic inhalations studies in rats and mice (NTP, 1990). Cobalt has been associated with induction of injection site tumors in subcutaneous and intramuscular studies (Heath, 1956; Gilman, 1962; Gilman and Ruckerbauer, 1962; Shabaan et al., 1977), however, extrapolation of these data for estimates of oral and inhalation cancer potency factors were considered inappropriate (U.S. EPA, 1991). The ATSDR document did not provide any additional data. The above mentioned studies have been summarized below, as they appear in the HEA, for your information.

Morgan (1983) investigated the health and causes of death of 49 men occupationally exposed to cobalt salts and oxides in a manufacturing plant in South Wales. During the study period, 33 men died, 5 with lung cancer and 3 with cancer at other sites. The expected number of deaths was 0.3 for lung cancer and 4.1 for all cancers based on national statistics, resulting in SMRs of 167 and 73, respectively. The U.S. EPA (1991) concluded that the scope of this study was too limited to demonstrate the carcinogenicity or noncarcinogenicity of occupational exposure to cobalt compounds.

Mur et al. (1987) analyzed the mortality of a cohort of 1143 workers in a plant that refined and processed cobalt and sodium. An increase in deaths resulting from lung cancer was observed in workers (SMR of 4.66; four cases in the exposed group v.s. 1 case in the controls). In a study within the cohort that controlled for age and smoking habits, 44% (four workers) in the exposed group and 17% (three workers) in the control group died of lung cancer. The authors indicated that the differences were not statistically significant and that the workers were exposed to arsenic and nickel in addition to cobalt. The exposure levels of cobalt were not reported.

Wehner et al. (1977, 1979) exposed groups of 51 month old male Syrian golden hamsters by inhalation to cobalt oxide at 0 or 10 mg/m^3, 7 hours/day, 5 days/week for their

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REVIEW OF PERTINENT LITERATURE

While chronic iron toxicity occurs in people with genetic metabolic disorders resulting in excessive iron absorption, with abnormal hemoglobin synthesis, or who receive frequent blood transfusions (Jacobs, 1977; Bothwell et al., 1979), there is a long-standing controversy as to whether a chronic overload due to oral intake is possible in individuals with a normal ability to control iron absorption (Hillman and Finch, 1985). Nevertheless, "the cumulative experience in human subjects suffering from iron overload of various etiologies strongly suggests that iron is noxious to tissues [when]...present in parenchymal cells...for a sufficiently long period of time" (Bothwell et al., 1979).

Looker et al. (1988) made comparisons of dietary iron intake and biochemical indices of iron status based on values taken from the second National Health and Nutrition Examination Survey (NHANES II) data base. NHANES II was a probability sample of the noninstitutionalized U.S. population aged 6 months to 74 years, conducted between 1976 and 1980 by the National Center for Health Statistics. These data suggest that normal intake of iron by men 16-74 years old exceeds the RDAs, and that iron intake is somewhat lower than the RDA for women younger than 51 years. Concomitant with the study of dietary intake, the NHANES II measured the iron status of these populations. The serum ferritin levels, which index total body iron stores, ranged from 23.8 μg/L, for premenopausal women not using iron supplements, to 105.6 μg/L for 45- to 64-year-old supplement users. These values are well within the normal range of 12-300 μg/L (Cook, 1991). (From Taber's Medical Dictionary, ferritin is the form in which iron is stored in the tissues, principally in the reticuloendothelial cells of the liver, spleen, and bone marrow. [It is] an iron-phosphorus-protein complex containing about 23% iron.) The percent serum transferrin saturation, a measure of the residual capacity of the iron transport system to process potential variations in iron from dietary intake or catabolized body stores, ranged from 23.9% saturation for pre- and post-menopausal women not using iron supplements, to 28.9% saturation for male supplement users in the 25- to 44- and 65- to 75-year-old groups. These values are also within the normal range (20-40%), establishing that the intake levels of 0.15-0.27 mg/kg-day consumed by these groups are both sufficient to protect against iron deficiency and insufficient to cause the toxic effects of iron overload (Elinder, 1986; Cook, 1991; Hillman and Finch, 1985). Therefore, 0.15-0.27 mg/kg-day represents a NOEL for chronic dietary iron intake.

Hemosiderosis (or siderosis) and iron overload are increases in tissue iron or a general increase in iron stores without associated tissue damage (Bothwell et al., 1979; Jacobs, 1977). Hemochromatosis describes massive iron overload (15 g of body iron stores or greater) together with cirrhosis and/or other tissue damage attributable to iron. Although focal deposits of iron may occur in any part of the body where red cells are extravasated, the clinical syndrome of hemochromatosis typically involves damage to the hepatic parenchyma (particularly fibrosis), heart (cardiac dysfunction including failure) and endocrine glands (particularly hypogonadism). Pancreatic iron deposition is common, and massive deposits may be associated with fibrosis and diabetes. A number of studies involving chronic oral administration of iron to animals have been designed in an attempt to identify an animal model for hemochromatosis. Most of these studies have been negative (Bothwell et al., 1979;

Ethiopia reportedly has the highest per capita iron intake in the world, with an average daily intake of 471 mg iron/day (range 98-1418 mg/day; 1.4-20.3 mg iron/kg-day assuming 70 kg body weight) (Roe, 1966; Hofvander, 1968). Increased stored iron in the liver and adverse health effects have not been observed due to low bioavailability of the iron in Ethiopian food.

A recent study in Eastern Finnish men suggests that high serum ferritin concentration and high dietary iron intake are risk factors for myocardial infarction (Salonen et al., 1992). Of the 1,931 randomly selected men aged 42-60 years who had no history of coronary heart disease upon entry to the study, 51 experienced an acute myocardial infarction during the average 3-year follow-up. After adjusting via Cox proportional hazards model for age and examination year, cigarette-pack years, ischemic ECG in exercise test, oxygen uptake, systolic blood pressure, blood glucose, serum copper, blood leukocyte count, and concentrations of serum high density lipoprotein cholesterol, apolipoprotein B, and triglyceride, those having serum ferritin at levels $\geq$ 200 μg/L (median value for healthy adult men is 69-140 μg/L) showed increased risk ($p<0.01$) of myocardial infarction compared to those with lower serum ferritin. Use of the same model and covariates indicated dietary iron intake was also significantly ($p<0.05$) associated with disease risk; consumption of red meat had the strongest correlation of all foods with serum ferritin concentration ($r=0.059$). High serum low density lipoprotein (LDL) cholesterol concentrations ($\geq$5.0 mml/L) associated with elevated serum ferritin was also a strong risk factor for acute myocardial infarction; this lends support to the theory that iron overload elevates risk of acute myocardial infarction by promoting oxidation of LDL (Lauffer, 1991; Sullivan, 1992).

The effects of acute oral exposure to iron in humans are well characterized. Acute iron toxicity has most often been observed in small children who accidentally ingested iron supplements, usually in the form of ferrous sulfate, but also as ferrous gluconate, ferrous chloride, ferric chloride or ferric ammonium citrate (Bothwell et al., 1979). The pathogenesis of acute oral iron toxicity consists primarily of gastrointestinal, cardiovascular, metabolic, neurological and hepatic alterations caused by direct corrosive action or the presence of unbound iron in the circulation (Bothwell et al., 1979; Banner and Tong, 1986; Engle et al., 1987; Mann et al., 1989). Gastrointestinal toxicity is due to the direct caustic effect of iron on the mucosa, particularly in the stomach and small intestine, and is characterized initially by vomiting, diarrhea and abdominal pain. These symptoms can progress to gastric and intestinal hemorrhage and/or necrosis and, rarely, 4-6 weeks after ingestion, scarring that may result in stenosis in the stomach outlet and small intestine. Cardiovascular toxicity of iron results from severe hemodynamic alterations characterized by loss of vascular integrity, decreased circulating plasma volume, decreased cardiac output and acidosis, leading to shock and cardiac failure. Neurological effects ranging from lethargy and mild obtundation to coma may occur. Hepatic damage, which can range from cloudy swelling of hepatocytes to necrosis, is a rare complication after ingestion of large quantities of iron in acute overexposure.

Determinations of serum iron concentration and total iron binding capacity (TIBC) in blood 2-4 hours after ingestion may provide reliable laboratory indices of the bioavailability of iron resulting from an acute ingestion (Mann et al., 1989), but are impractical for

was no statistically significant difference ($p>0.05$) in the development of any of the specific symptoms in any of the groups. The prevalence of symptoms generally increased with increasing serum iron levels, but only 20 of the patients had serum iron levels higher than the concentration of 350 μg/dL, generally considered toxic. Symptoms more serious than gastro-intestinal ones (e.g., metabolic, cardiovascular, central nervous system or hepatic effects) did not develop in any of the patients. The results of this study suggest that acute iron ingestions in the range of 20-60 mg/kg are unlikely to be serious in children. Based on this study, the poison center protocol was changed to home management (i.e., ipecac syrup), for iron ingestions of 20-60 mg/kg unless significant symptoms developed, and hospital referral for ingestions 60 mg/kg or greater.

Effects of iron therapy on the upper gastrointestinal tract were evaluated in 14 healthy volunteers [13 women, 1 man; mean age 29 years (range, 24-48 years)] who were instructed to ingest 325 mg tablets of ferrous sulfate (65 mg iron) 3 times/day (before meals) for 2 weeks (Laine et al., 1988). This study was performed to ascertain whether there is a basis for implications that iron therapy may cause false-positive fecal occult blood testing. Evaluation consisted of gastrointestinal symptom survey, qualitative (Hemoccult) and quantitative (HemoQuant; mg mercury/g stool) testing for fecal blood loss, endoscopy of the upper gastrointestinal tract and histological examination of pinch biopsies of the gastric body, antrum and duodenum. In a separate portion of the study, Hemoccult testing was performed on 13 other subjects [12 men, 1 woman; mean age 33 years (range 23-50 years)] who were similarly treated with ferrous sulfate for 1 week. All subjects served as their own controls and ingested no other substances that could potentially damage the upper gastrointestinal tract during their participation in the study. Based on actual average ingestion of 2.5 tablets/day (2-week study) and 2.6 tablets/day (1-week study) and a reference human body weight of 70 kg (U.S. EPA, 1987), the estimated doses consumed by the subjects were 2.3 and 2.4 mg iron/kg-day, respectively, in addition to dietary iron. All subjects had significantly increased ($p<0.05$) dark brown-black stools and symptoms of nausea and vomiting during the treatment period, but not abdominal pain, compared to the 2 weeks prior to treatment. The stool samples of all 27 subjects were Hemoccult-negative prior to iron treatment. Only 1 of 27 stool samples was questionably trace positive after treatment. Hemoglobin levels in stool did not change significantly after iron treatment. Endoscopic examination showed a significant ($p=0.003$) increase in abnormalities in the stomach, but not duodenum, after therapy. These changes consisted of erythema, small areas of subepithelial hemorrhage and solitary antral erosions in nine, six and two subjects, respectively, and were considered only minimally abnormal. Linear regression analysis showed that there was a significant correlation between endoscopy scores and abdominal pain scores ($r=0.64$, $p=0.01$), but not with vomiting ($r=0.5$, $p=0.07$), diarrhea ($r=0.46$, $p=0.1$) or nausea ($r=0.4$, $p=0.16$). No treatment-related histological changes were observed and there was no correlation between the endoscopic and histologic findings, although the investigators noted that the correlation between endoscopic findings and histologic changes in small mucosal pinch biopsies is "notoriously" poor. Although it was speculated that the changes in the stomach could represent a mild form of iron poisoning, the investigators concluded that the treatment caused mild endoscopic abnormalities of uncertain clinical significance in the stomach. Evidence for iron overload (tissue biopsies or hematologic iron status indices) was not examined.

Nonetheless, it is possible to establish a NOEL for chronic iron overload using the values for dietary intake and iron status indices taken from the second National Health and Nutrition Examination Survey (NHANES II) data base. Looker et al. (1988) made comparisons of dietary iron intake and biochemical indices of iron status using data from NHANES II. The average intakes of iron ranged from 0.15 to 0.27 mg/kg-day. The serum ferritin levels and percent serum transferrin saturation were within the normal range. Thus, intake levels of 0.15-0.27 mg/kg-day consumed are both sufficient to protect against iron deficiency and insufficient to cause the toxic effects of iron overload.

Using the NOAEL of 0.27 (representing the upperbound value in the range of mean dietary iron intakes, dietary plus supplemental, taken from the NHANES II data base) and dividing by an uncertainty factor of 1 yields the provisional chronic oral RfD of 0.3 mg/kg-day. An uncertainty factor of 1 is supported by the fact that iron is an essential element. In addition, the information used to derive the oral RfD for iron was derived from intake data from over 20,000 individuals aged 6 months to 74 years and humans exert an efficient homeostatic control over iron such that body burdens are kept constant with variations in diet.

Confidence in the critical study is high; the NHANES II data are derived from a very large sampling of the U.S. population ranging in age from 6 months to 74 years. Overall confidence in the data base is medium; there are insufficient data to determine what chronic dose level is associated with adverse effects in healthy individuals. While a point estimate has been derived in this risk assessment, individual variations in diet, nutritional status, physiology, etc. suggest that a range of values may be more appropriate. Reflecting the high confidence in the critical study and medium confidence in the data base, confidence in the RfD is medium.

NOTE: This RfD supplies adequate levels of iron to meet the nutritional requirements of adults and adolescents over a lifetime. It does not supply the recommended dietary allowance (RDA) to those members of the population that have greater requirements for a short, less-than-lifetime duration such as infants, pre-adolescent children, and pregnant women. For shorter term requirements for these subpopulations, refer to the RDAs (NAS, 1989). Further, this RfD may not be protective of people with inherited disorders of iron metabolism and could be conservative if applied to exposure scenarios involving forms of iron with low bioavailability.

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Attachment 4

(93-24/07-07-93)

Risk Assessment Issue Paper for:
Carcinogenicity of Iron (CASRN 7439-89-6)

INTRODUCTION

Review documents available for iron and compounds include a Reportable Quantity Document for Carcinogenesis from Iron Dextran (U.S. EPA, 1983), a Health Effects Assessment for Iron and Compounds (U.S. EPA, 1984), and journal articles by Stokinger (1984) and Stevens and Kalkwarf (1990). Iron is not listed on the NTP Chemical Status Report (NTP, 1993a). An NTP Results Report (NTP, 1993b) indicates a gavage study has been completed on iron and compounds, but the study does not meet minimum standards (as per telephone conversation with NTP, April, 1993). The following computer searches, performed in April, 1993, were screened to identify additional pertinent studies not discussed in review documents: TOXLINE (oral and inhalation toxicity and cancer from 1983- April, 1993), CANCERLINE (1990 - April, 1993), MEDLINE (1991 - April, 1993), TSCATS, RTECS, and HSDB.

Iron is not listed on IRIS (U.S. EPA, 1994a), the CRAVE Status Report (U.S. EPA, 1994b), Drinking Water Regulations and Health Advisories (U.S. EPA, 1993b), or Table B (Carcinogenicity) of the HEAST (U.S. EPA, 1993a).

REVIEW OF PERTINENT LITERATURE

Carcinogenicity to humans

Overall, the evidence for carcinogenicity in humans due to iron exposure is inadequate. Studies were located in which iron overload (chronic hemochromatosis) from iron ingestion led to iron deposition in the liver, and eventually to cancer of the liver or other organs. Use of these data for risk assessment, however, is compromised by concurrent use of alcohol or by a congenital abnormality that interfered with the normal regulation of gastrointestinal iron absorption. Negative correlations between iron levels in Norwegian municipal water supplies and cancer morbidity were considered of questionable biological significance. There have been several observations of malignancies in people who had previously received injections of iron dextran complex for iron deficiency, but causality was not established. Evidence for lung cancer in humans occupationally exposed to iron is inadequate due to probable concurrent exposure to other known or potential carcinogens. Several studies have reported an increased risk of cancer in individuals with high body iron stores. An association between increased dietary iron consumption and increased risk of cancer has not been established. Thus, these studies are inadequate for assessing the carcinogenic potential of iron following environmental exposure.

The term hemochromatosis describes massive iron overload (≥15 g of body iron stores) together with cirrhosis of the liver with damage to the hepatic parenchyma (particularly fibrosis) and other organs, including the heart, endocrine glands and pancreas. This condition has been observed in people with idiopathic hemochromatosis, a genetic metabolic disorder resulting in abnormal regulation of gastrointestinal absorption, and hence an excessive bioavailability of orally consumed iron (Jacobs, 1977; Bothwell et al., 1979). Liver cancer, usually hepatocellular carcinoma and less often cholangioma, occurs as a late complication of idiopathic hemochromatosis (Bothwell et al., 1979). Approximately one third of patients with hemochromatosis and cirrhosis develop hepatocellular carcinoma; cancer at other sites is not increased; and early treatment to prevent cirrhosis greatly reduces the risk of death due to cancer (Bonkovsky, 1991). Because it is not possible to associate the prevalence of cancer with iron intake (even were the intake known, the anomalous absorption by these patients would prevent extrapolation to the general population), this phenomenon cannot be used to assess risk of liver cancer from oral iron exposure.

Habitual excessive consumption of home-brewed Kaffer beer brewed in iron vessels led to chronic hemochromatosis among the South African Bantu population (Bothwell and Bradlow, 1960; Bothwell et al., 1964). The low pH (3-3.5) of the beer leached iron from the vessels. Bothwell et al. (1964) estimated, based primarily on drinking habits and analyses of beer samples, that Bantu men consumed a daily average of ≈50-100 mg iron/day from this beer. Assuming a reference body weight of 70 kg, iron intake was 0.7-1.4 mg/kg/day. Assimilation of the iron was facilitated by acidity, the presence of iron-complexing ligands, such as fructose, and the alcohol content of the beer, all of which may have contributed to the bioavailability of the iron (Jacobs, 1977; Finch and Monsen, 1972). Histological examinations of livers taken from 129 male and 18 female Bantu that died from traumatic causes revealed hepatic siderosis in 89% of the livers examined, with the degree of severity increasing with age. Histological examination of the spleen of 50 Bantu also showed siderosis and unspecified histological changes (Bothwell and Bradlow, 1960). In another report, the iron concentration of the liver was assayed. Mean hepatic iron concentrations in 85 male Bantu who died of carcinoma of the esophagus between 1959 and 1964 were significantly above ($p<0.05$) those of males who died of other causes (MacPhail et al., 1979). However, not all of the men with esophageal carcinoma had high hepatic iron concentrations (levels were near normal in 13%). Since alcohol consumption has also been associated with esophageal carcinoma, and the source of excessive Bantu iron intake was home-brewed beer, the esophageal carcinoma may have been due to intake of iron, alcohol or related to other factors such as malnutrition (U.S. EPA, 1984).

IARC (1987) reviewed reports of more than 200 local malignancies in patients receiving iron therapy in the form of intramuscular iron dextran injections. In only one case was a causal relationship considered likely. IARC (1987) regarded these data as inadequate evidence for carcinogenicity of iron dextran in humans. The carcinogenicity of iron dextran has been addressed previously by U.S. EPA (1983).

Flaten and Bolviken (1991) assayed finished drinking water from 384 Norwegian municipal waterworks for >15 inorganic substances, including iron, and correlated the results

The relationship between body iron stores and the risk of cancer was investigated in 174,507 people having a multiphasic health checkup (Selby and Friedman, 1988). Body iron stores were assessed by measuring hemoglobin levels and total iron binding capacity (which is inversely related to body iron stores); the subjects were also questioned regarding recent iron use. It was assumed that iron supplements were used for the treatment of anemia. Statistical adjustments for age and smoking status were made. In men, no significant relationships between the risk for lung cancer or all cancer and recent iron use, hemoglobin levels, or total iron binding capacity were found. In women, significant associations between the risk of lung cancer and the indirect measures of body iron stores were found. For other cancers, the relationships were not statistically significant. Recent iron intake, anemia (hemoglobin < 12 g/dl), and increased total iron binding capacity were associated with lower incidences of lung cancer. This study does not specifically examine the risk of excessive administration of iron or excess body iron stores.

Stevens et al. (1988) examined iron status (as measured by serum transferrin levels and total iron-binding capacity) and cancer risk using data from the 1st National Health and Nutrition Examination Survey (NHANES I). Total iron-binding capacity, transferrin saturation, and serum iron were used to assess body iron stores. After adjustments for age and smoking status, this survey of 8722 adults (included adults who remained alive and cancer-free for 4 years after blood collection) showed decreased total iron-binding capacity and increased incidence of transferrin-saturation level in men who had cancer (n = 242), compared to men who did not (n = 3113). The relationship for women was less clear; among 5367 women of whom 203 had cancer, no association between total iron-binding capacity and risk of cancer was seen. Using a statistical model which controlled for smoking and contained age, race, education, alcohol consumption, and body-mass index variables, an association was found only for women having very high transferrin saturation (≥ 36.7%). For men and women, no significant associations between cancer incidence and hemoglobin or dietary iron intake were found. Transferrin saturation was significantly higher in men with cancer of the esophagus, colon, lung, and bladder, as compared to men without cancer. Men with bladder cancer also had significantly lower total iron binding capacities. When the data were broken down by cancer site, significantly decreased hemoglobin levels were found in men with cancer of the esophagus, pancreas, and prostate, as compared to men without cancer. The decrease in hemoglobin levels may be due to excessive bleeding. In men with colon cancer, a significant increase in dietary iron was observed. This study did not control for confounding factors, such as fat and fiber intakes.

Some support for a connection between increased dietary iron and colorectal cancer was reported by Freudenheim et al. (1990), but other factors may be equally important. When iron intake was adjusted for fat intake, the association between iron intake and cancer incidence was no longer statistically significant. Epidemiology studies by both Freudenheim et al. (1990) and Hoff et al. (1986) found an association between intake of high-fat and low-fiber diet with this form of cancer. Graf and Eaton (1985) found evidence in a Scandinavian study that phytate content (ability of fiber to chelate iron) of fiber may be an important etiological factor; studies in mice support this hypothesis (see Nelson et al., 1989, section on CARCINOGENICITY TO ANIMALS). A case-control study of patients with adenomatous or

is that it was concerned only with respiratory tract carcinogenesis and gave no indication that tissues from sites other than the respiratory tract were examined.

Steinhoff et al. (1991) intratracheally injected Sprague-Dawley rats (50/sex/group) with maximum-tolerated total doses of 390 or 1530 mg/kg of 7 types of iron oxides. Doses of 10-40 mg/kg of Bayferrox 920 (95.8% FeOOH), Bayferrox 130 (96.2% cubic α-Fe_2O_3), Bayferrox 306 (93.1% cubic Fe_3O_4), Bayferrox 1352 (99.2% fibrous α-Fe_2O_3), and AC5031 (96.8% α-Fe_2O_3) were administered every 14 days. The total doses at sacrifice (798 study days) was 1530 mg/kg. Rats received 10 mg/kg doses of RBW 07105/SV2 (87.9% fibrous. magnetic iron oxide doped with 1.85% cobalt) or Bayferrox AC5100M (88.5% fibrous, magnetic iron oxide doped with 2.1% cobalt) every 14 days for 18 treatments and every 4 weeks for the remaining 11 treatments. The total dose received during the 920 day treatment period was 390 mg/kg. At sacrifice, histological examination of organs of the respiratory tract, central nervous system, heart, and abdomen revealed only weak traces of a tumorigenic effect. Two squamous cell carcinomas (questionable whether primary or metastases) in females and 1 histiocytic sarcoma (metastasis; primary tumor unknown) in a male were noted in the groups receiving Bayferrox 1352. Intraperitoneal injection of similar groups of rats with a total dose of 600 mg/kg (200 mg/kg doses at 8 week intervals) of the same iron oxides, followed by sacrifice after 790 or 914 days, yielded slight evidence of tumors in the abdominal cavity with exposure to 5 test substances.

No respiratory tract tumors developed in 20 male or 21 female Syrian hamsters intratracheally injected weekly with 3 mg of ferric oxide dust in saline for 15 weeks (Saffiotti et al., 1968). Controls were 100 animals of each sex. The animals were observed for life, with more than 50% surviving at least 1 year. Survival was reduced in the females, but not the males; the difference was attributed to intercurrent disease. Although the focus of this study was on induction of respiratory tumors, tumors at other sites were also reported; incidences of tumors at other sites were not increased by ferric oxide treatment. It is uncertain whether a maximum tolerated dose was achieved.

There have been numerous reports of injection-site tumors (e.g., sarcomas, histiocytomas and fibromas) in rats, mice or rabbits subcutaneously or intramuscularly administered some iron-carbohydrate complexes (such as iron dextran or saccharated iron oxide), but not others (such as iron-sorbitol-citric acid) (U.S. EPA, 1984; IARC, 1987). Both iron and dextran are essential for the carcinogenicity since intramuscular injections of dextran. iron oxide or iron sulfide alone or intrapleural administration of suspended iron are not tumorigenic in rats (Elinder, 1986). These studies do not necessarily indicate that iron dextran will be carcinogenic to humans, since as noted by IARC (1987), although iron dextran accumulates at an injection site in rodents, it is rapidly dispersed after injection into humans. The risk of carcinogenicity due to iron dextran has been addressed previously by U.S. EPA (1983).

Although no animal studies have conclusively shown iron oxide to be carcinogenic, iron oxide particles are co-carcinogenic in the lungs when administered intratracheally with benzo[a]pyrene or dimethylnitrosamine to hamsters (Creasia and Nettesheim, 1974; Stokinger.

On the basis of inadequate evidence for carcinogenicity in humans and animals, iron is classified in U.S. EPA (1986) weight-of-evidence group D: not classifiable as to human carcinogenicity.

DERIVATION OF ORAL SLOPE FACTOR

According to U.S. EPA (1986) guidelines, classification of a chemical in weight-of-evidence Group D precludes quantitative risk assessment.

DERIVATION OF INHALATION UNIT RISK

According to U.S. EPA (1986) guidelines, classification of a chemical in weight-of-evidence Group D precludes quantitative risk assessment.

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Attachment 5

(93-21/4-12-93)

Risk Assessment Issue Paper for:
Derivation of a Provisional RfD for
Dibenzofuran (CASRN 132-64-9)

We have confirmed that no RfD values are listed for unsubstituted dibenzofuran in IRIS (U.S. EPA, 1994a), the HEAST (U.S. EPA, 1994b), or the RfD Work Group Status Report (U.S. EPA, 1994c). A RQ document (U.S. EPA, 1989a) and a HEA document (U.S. EPA, 1987) were retrieved, but neither document derived an oral RfD. Unsubstituted dibenzofuran is not listed in the Drinking Water Regulations and Health Advisories list (U.S. EPA, 1994d). Also, unsubstituted dibenzofuran has not been selected for toxicology studies by NTP (NTP, 1993a,b). Literature searches of TOXLINE (1981-1993, oral RfD strategy), MEDLINE (1988-1993, CAS No. strategy), RTECS, HSDB and TSCATS were performed and screened in March 1993.

As reviewed in the RQ document, the only long-term toxicity data for unsubstituted dibenzofuran is a 200-day subchronic oral feeding study by Thomas et al. (1940). There are no pertinent chronic, carcinogenicity, or reproductive data on unsubstituted dibenzofuran. Unsubstituted dibenzofuran was not found to be mutagenic in reverse mutation assays, and a 2-year bioassay of a structurally related compound (dibenzo-p-dioxin) did not result in treatment-related increases in tumor incidence. A more extensive toxicity data base exists for the polychlorinated and polybrominated dibenzofurans (PCDFs and PBDFs). However, as noted by the Agency (U.S. EPA, 1986a), the biological activity of various halogenated dibenzofurans varies greatly, so that risk assessment by analogy to any of these more widely studied compounds would not be recommended.

In the 200-day subchronic unsubstituted dibenzofuran oral study by Thomas et al., groups of five female rats (strain not specified) were fed diets containing unsubstituted dibenzofuran at concentrations of 0, 0.025, 0.050, 0.100, 0.200, 0.400, or 0.800%. All unsubstituted dibenzofuran concentrations resulted in a decrease in absolute organ weights and a decrease in body length (but not in body weight). A corresponding decrease in body weight did not occur along with the decrease in body length because treated rats had an unusually large amount of abdominal fat. Concentrations of 0.050% and above resulted in kidney abnormalities with an accumulation of brown granules in the epithelial cells. Slight hyperplasia of the Malpighian bodies in the spleen, as well as irregular dilation of the collecting tubules in the kidneys were observed at concentrations of 0.400% and above. Based upon a reference body weight of 0.350 kg and a food factor of 0.05 for rats (U.S. EPA, 1986b), concentrations of 0.025%, 0.050% and 0.400% correspond to dosages of 12.5, 25 and 200 mg/kg/day. The dose level of 25 mg/kg/day represents a LOAEL based on kidney effects; 12.5 mg/kg/day is the NOAEL.

Using this study, a provisional oral RfD can be calculated as follows:

Due to the limited toxicity data base for unsubstituted dibenzofuran, confidence in the provisional oral RfD would be low.

Please note that this provisional RfD is for unsubstituted dibenzofuran only, not chlorinated dibenzofurans. To estimate risks posed by chlorinated dibenzofurans, one should use the toxic equivalency factor approach described in U.S. EPA (1989b).

References:

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Attachment 6

(93-30/07-30-93)

Risk Assessment Issue Paper for:
Feasibility of RfD Derivation for 2-Methylnaphthalene
(CASRN 91-57-6)

INTRODUCTION

The TOXLINE (1981-1991) and TSCATS data bases were examined in October 1991 to identify literature regarding health effects associated with exposure to 2-methylnaphthalene and 1-methylnaphthalene (as a possible surrogate). Update searches of TOXLINE (1991-1993, CAS number and chemical names strategy, all cites), CANCERLINE (1963-1993, CAS number and chemical names strategy, all cites), TSCATS, RTECS, and HSDB were performed and screened in April 1993.

In addition to the literature searches, IRIS (U.S. EPA, 1994a), the RfD/RfC Monthly Status Report (U.S. EPA, 1994b), the Drinking Water Regulations and Health Advisories list (U.S. EPA, 1994c), the HEAST (U.S. EPA, 1994d), the NTP Chemical Status Reports (NTP, 1993a;b) and the OHEA CARA lists (U.S. EPA, 1991, 1993), were used to identify sources of additional information. The ATSDR (1990) Toxicological Profile for Naphthalene and 2-Methylnaphthalene and a report by Buckpitt and Franklin (1989) were also reviewed for pertinent literature.

The U.S. EPA (1994a) has not derived an RfD for 2-methylnaphthalene, nor is this chemical under consideration by the RfD/RfC Work Group (U.S. EPA, 1994b) or listed on the HEAST (U.S. EPA, 1994d). ATSDR (1990) has not derived MRL values.

REVIEW OF PERTINENT LITERATURE

Data were not located regarding effects in humans or animals following inhalation or oral exposure to 2-methylnaphthalene (or 1-methylnaphthalene). Information regarding the health effects of 2-methylnaphthalene is restricted to examinations of cell damage in the bronchiolar epithelium of mice (Griffin et al., 1981; Rasmussen et al., 1986; Buckpitt and Franklin, 1989; Honda et al., 1990) and rats (Dinsdale and Verschoyle, 1987) given intraperitoneal injections of 2-methylnaphthalene, and to studies of mononucleated giant cell formation and proteinosis in pulmonary alveoli of mice dermally exposed over a period of 30 weeks to a mixture of 1- and 2-methylnaphthalene (Murata et al., 1992).

Because no data on 2-methylnaphthalene that are suitable for derivation of the requested provisional oral RfD were located, use of the toxicity data for naphthalene as a surrogate for 2-methylnaphthalene have been considered. Intraperitoneal injections of either naphthalene, 1-methylnaphthalene or 2-methylnaphthalene caused cell damage in the bronchiolar epithelium of mice (Rasmussen et al., 1986). Naphthalene and 2-methylnaphthalene were about equally toxic, but changes associated with 1-

Oral and inhalation toxicity data for 2-methylnaphthalene are lacking, precluding derivation of a provisional oral RfD for 2-methylnaphthalene. The use of toxicity data for naphthalene as a surrogate for 2-methylnaphthalene was considered, but the uncertainties in such an approach appear to be too great to warrant its adoption.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Toxicological Profile for Naphthalene and 2-Methylnaphthalene. U.S. Public Health Service. Atlanta, GA.

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Attachment 7

(93-30/07-30-93)

Risk Assessment Issue Paper for Carcinogenicity of 2-Methylnaphthalene (CASRN 91-57-6)

INTRODUCTION

The TOXLINE (1981-1991) and TSCATS data bases were examined in October 1991 to identify literature regarding health effects associated with exposure to 2-methylnaphthalene and 1-methylnaphthalene (as a possible surrogate). Update searches of TOXLINE (1991-1993, CAS number and chemical names strategy, all cites), CANCERLINE (1963-1993, CAS number and chemical name strategy, all cites), TSCATS, RTECS, and HSDB were performed and screened in April 1993.

In addition to the literature searches, IRIS (U.S. EPA, 1994a), the RfD/RfC and CRAVE Monthly Status Report (U.S. EPA, 1994b), the Drinking Water Regulations and Health Advisories list (U.S. EPA, 1994c), the HEAST (U.S. EPA, 1994d), the NTP Chemical Status Reports (NTP, 1993a,b) and the OHEA CARA lists (U.S. EPA, 1991, 1993), were used to identify sources of additional information. The ATSDR (1990) Toxicological Profile on Naphthalene and 2-Methylnaphthalene and a paper by Buckpitt and Franklin (1989) were also reviewed for pertinent literature.

The U.S. EPA (1994a) has not derived an oral slope factor or inhalation unit risk for 2-methylnaphthalene, nor is this chemical under consideration by the CRAVE Work Group (U.S. EPA, 1994b) or listed on the HEAST (U.S. EPA, 1994d).

REVIEW OF PERTINENT LITERATURE

Data were not located regarding carcinogenicity in humans or animals following inhalation or oral exposure to 2-methylnaphthalene (or 1-methylnaphthalene).

Cancer data in mice exposed to naphthalene are available, and use of these data for naphthalene as a surrogate for 2-methylnaphthalene was considered. An inhalation toxicity and carcinogenicity bioassay in mice exposed to naphthalene (NTP, 1992) found increased incidences of pulmonary alveolar and bronchiolar adenomas in females but not in males. Treatment-related minimal to mild nonneoplastic lesions were also observed in the nose (chronic inflammation, metaplasia of the nasal epithelium and hyperplasia of the respiratory epithelium) and lungs (inflammation, alveolar epithelial hyperplasia and occasional occurrence of multinucleated giant cells). Similarly, pulmonary alveolar epidermal hyperplasia and proteinosis occurred in female mice treated dermally with a mixture of 1- and 2-methylnaphthalene for 30 weeks (Murata et al., 1992). Tumorigenesis was neither studied nor reported in this study; the exposure duration was insufficient to evaluate potential carcinogenicity.

Hermann, 1981; NTP, 1993b). In vitro exposure of human lymphocytes to metabolically activated 2-methylnaphthalene increased the incidence of chromosome aberrations and sister chromatid exchanges, but the increases, while statistically significant, were judged to be biologically nonsignificant by the investigators (Kulka et al., 1988).

WEIGHT OF EVIDENCE CLASSIFICATION

Data regarding the carcinogenic potential of 2-methylnaphthalene in humans or animals were not located. The uncertainties in using naphthalene cancer data as surrogate for 2-methylnaphthalene appear too great to warrant use of this approach. On the basis of inadequate evidence for carcinogenicity in humans and animals, 2-methylnaphthalene is classified in U.S. EPA (1986) weight-of-evidence group D: not classifiable as to human carcinogenicity.

DERIVATION OF ORAL SLOPE FACTOR AND INHALATION UNIT RISK

According to U.S. EPA (1986) guidelines, classification of a chemical in weight-of-evidence Group D precludes quantitative risk assessment.

REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Toxicological Profile for Naphthalene and 2-Methylnaphthalene. U.S. Public Health Service. Atlanta, GA.

Buckpitt, A.R. and R.B. Franklin. 1989. Relationship of naphthalene and 2-methylnaphthalene metabolism to pulmonary bronchiolar epithelial cell necrosis. Pharmac. Ther. 41: 393-410.

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APPENDIX K

CHEMICALS OF CONCERN

CONSTITUENTS DETECTED IN SUBSURFACE SOILS
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations ug/kg	Residential Soil Conc. ug/kg [a]	Potential Concern
VOLATILES				
Acetone	2/16	5j - 7j	0.78	No
Toluene	4/16	1j - 4	1.6	Yes
Tetrachloroethene	2/16	2j - 16	0.012	Yes
SEMI-VOLATILES				
Phenanthrene	1/6	55j	--	No
Di-n-butylphthalate	1/6	970	16000	No
Fluoranthene	1/6	67j	3100	No
Pyrene	1.6	52j	2300	No
Benzo(a)anthracene	1/6	36j	0.88	Yes
Chrysene	1/6	58j	88	Yes
bis(2)ethylhexylphthalate	2/6	43j - 48j	46	No
Benzo(b)fluoranthene	1/6	72j	0.88	Yes
Benzo(k)fluoranthene	1/6	49j	8.8	Yes
Benzo(a)pyrene	1/6	36j	0.088	Yes
PESTICIDES				
Hepthachlor	1/6	0.88j	0.14	Yes
4-4-DDE	1/6	01.7j	1.9	No
4-4-DDD	1/6	1.8j	2.7	No
4-4-DDT	2/6	3.5j - 3.6	1.9	Yes
Alpha Chlordane	4/6	1.8j - 9.1	0.49	Yes
Gamma Chlordane	4/6	1.7j - 9.7	0.49	Yes
INORGANICS				
Aluminum	14/14	390,000 - 21100000	2.30E+07	Yes
Arsenic	14/14	1,200 - 4,600	3.70E+02	Yes
Barium	14/14	1,400 - 52,700	5.50E+05	Yes
Beryllium	14/14	70 - 340	150	Yes
Chromium	14/14	2,100 - 24,000	3.9E+04	Yes
Cobalt	13/14	1,400 - 5,100	4.7+05	Yes
Copper	13/14	3,400 - 7,200	2.9E+05	Yes
Iron	14/14	1,350,000 - 19,000,000	2.3E+06	Yes
Lead	14/14	490 - 11,700		
Manganese	14/14	950 - 57,000	3.90E+04	Yes
Nickel	13/14	2,600 - 12,700	1.60E+05	Yes
Selenium	4/14	660 - 870	3.90E+05	Yes
Vanadium	14/14	2,200 - 29,400	5.50E+04	Yes
Zinc	14/14	3,200 - 19,000	2.30E+6	Yes

CONSTITUENTS DETECTED IN SUBSURFACE SOILS
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations ug/kg	Residential Soil Conc. ug/kg *	Potential Concern

Notes:

a. Federal MCL concentration values represent US Federal Maximum Contaminant Level for potable water supplies.

b. Tap Water Concentration values obtained from October 20, 1995 USEPA Region III Risk-Based Concentration Table except for aluminum which is obtained from the January 7, 1994 RBC table.

c. Health Advisory Concentration values obtained from December 1993 USEPA Office of Water publication "Drinking Water Regulations and Health Advisories."

d. Virginia Water Standards for public water supplies.

* Health risk analysis to be performed will use the Integrated Exposure Uptake biokinetic (IEUBK) Model.

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	30 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Toluene	4.00E-03	25.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	80%	3.41E-08	--	--	--
Tetrachloroethene	7.40E-03	25.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	80%	6.30E-08	5.20E-02	6.50E-02	4.09E-09
Benzo[a]anthracene	3.60E-02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.23E-07	7.30E-01	1.46E+00	1.79E-07
Benzo[b]fluoranthene	7.20E-02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	2.45E-07	7.30E-01	1.46E+00	3.58E-07
Benzo[k]fluoranthene	4.90E-02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.67E-07	7.30E-02	1.46E-01	2.44E-08
Benzo[a]pyrene	3.60E-02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.23E-07	7.30E+00	1.46E+01	1.79E-06
Heptachlor	8.80E-04	6.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.80E-09	4.50E+00	9.00E+00	1.62E-08
4,4'-DDT	3.44E-03	6.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	7.03E-09	3.40E-01	6.80E-01	4.78E-09
alpha-Chlordane	9.10E-03	6.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.86E-08	1.30E+00	2.60E+00	4.83E-08
gamma-Chlordane	9.70E-03	6.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.98E-08	1.30E+00	2.60E+00	5.15E-08
Arsenic	3.62E+00	3.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	95%	3.70E-06	1.50E+00	1.58E+00	5.84E-06
Barium	5.27E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	100%	1.79E-05	--	--	--
Chromium	2.18E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	7.42E-06	--	--	--
Colbalt	5.10E+00	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	1.74E-06	--	--	--
Copper	7.20E+00	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	60%	2.45E-06	--	--	--
Iron	1.90E+04	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	6.47E-03	--	--	--
Lead	1.17E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	3.98E-06	--	--	--
Nickel	9.93E+00	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	4.3%	3.38E-06	--	--	--
Vanadium	3.43E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	2.6%	1.17E-05	--	--	--
											Total Risk =	8.31E-06

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
Toluene	4.00E-03	25.0%	5.80E+03	1.0	70	9.59E-01	80%	7.95E-08	2.00E-01	1.60E-01	4.97E-07
Tetrachloroethene	7.40E-03	25.0%	5.80E+03	1.0	70	9.59E-01	80%	1.47E-07	1.00E-02	8.00E-03	1.84E-05
Benzo[a]anthracene	3.60E-02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	2.86E-07	--	--	--
Benzo[b]fluoranthene	7.20E-02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	5.72E-07	--	--	--
Benzo[k]fluoranthene	4.90E-02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	3.89E-07	--	--	--
Benzo[a]pyrene	3.60E-02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	2.86E-07	--	--	--
Heptachlor	8.80E-04	6.0%	5.80E+03	1.0	70	9.59E-01	50%	4.20E-09	5.00E-04	2.50E-04	1.68E-05
4,4'-DDT	3.44E-03	6.0%	5.80E+03	1.0	70	9.59E-01	50%	1.64E-08	5.00E-04	2.50E-04	6.56E-05
alpha-Chlordane	9.10E-03	6.0%	5.80E+03	1.0	70	9.59E-01	50%	4.34E-08	6.00E-05	3.00E-05	1.45E-03
gamma-Chlordane	9.70E-03	6.0%	5.80E+03	1.0	70	9.59E-01	50%	4.62E-08	6.00E-05	3.00E-05	1.54E-03
Arsenic	3.62E+00	3.0%	5.80E+03	1.0	70	9.59E-01	95%	8.63E-06	3.00E-04	2.85E-04	3.03E-02
Barium	5.27E+01	1.0%	5.80E+03	1.0	70	9.59E-01	100%	4.19E-05	7.00E-02	7.00E-02	5.98E-04
Chromium	2.18E+01	1.0%	5.80E+03	1.0	70	9.59E-01	20%	1.73E-05	5.00E-03	1.00E-03	1.73E-02
Colbalt	5.10E+00	1.0%	5.80E+03	1.0	70	9.59E-01	20%	4.05E-06	6.00E-02	1.20E-02	3.38E-04
Copper	7.20E+00	1.0%	5.80E+03	1.0	70	9.59E-01	60%	5.72E-06	4.00E-02	2.40E-02	2.38E-04
Iron	1.90E+04	1.0%	5.80E+03	1.0	70	9.59E-01	20%	1.51E-02	3.00E-01	6.00E-02	2.52E-01
Lead	1.17E+01	1.0%	5.80E+03	1.0	70	9.59E-01	20%	9.30E-06	--	--	--
Nickel	9.93E+00	1.0%	5.80E+03	1.0	70	9.59E-01	4.3%	7.89E-06	2.00E-02	8.60E-04	9.17E-03
Vanadium	3.43E+01	1.0%	5.80E+03	1.0	70	9.59E-01	2.6%	2.73E-05	7.00E-03	1.82E-04	1.50E-01
										Hazard Index =	4.62E-01

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Toluene	4.00E-03	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	9.97E-09	--	--	--
Tetrachloroethene	7.40E-03	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	1.84E-08	5.20E-02	6.50E-02	1.20E-09
Benzo[a]anthracene	3.60E-02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	3.59E-08	7.30E-01	1.46E+00	5.24E-08
Benzo[b]fluoranthene	7.20E-02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	7.18E-08	7.30E-01	1.46E+00	1.05E-07
Benzo[k]fluoranthene	4.90E-02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	4.89E-08	7.30E-02	1.46E-01	7.13E-09
Benzo[a]pyrene	3.60E-02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	3.59E-08	7.30E+00	1.46E+01	5.24E-07
Heptachlor	8.80E-04	6.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	5.27E-10	4.50E+00	9.00E+00	4.74E-09
4,4'-DDT	3.44E-03	6.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	2.06E-09	3.40E-01	6.80E-01	1.40E-09
alpha-Chlordane	9.10E-03	6.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	5.45E-09	1.30E+00	2.60E+00	1.42E-08
gamma-Chlordane	9.70E-03	6.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	5.80E-09	1.30E+00	2.60E+00	1.51E-08
Arsenic	3.62E+00	3.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	95%	1.08E-06	1.50E+00	1.58E+00	1.71E-06
Barium	5.27E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	100%	5.26E-06	--	--	--
Chromium	2.18E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	2.17E-06	--	--	--
Colbalt	5.10E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	5.09E-07	--	--	--
Copper	7.20E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	60%	7.18E-07	--	--	--
Iron	1.90E+04	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	1.89E-03	--	--	--
Lead	1.17E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	1.17E-06	--	--	--
Nickel	9.93E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	4.3%	9.90E-07	--	--	--
Vanadium	3.43E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	2.6%	3.42E-06	--	--	--
											Total Risk =	2.44E-06

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
Toluene	4.00E-03	25.0%	1.82E+03	1.0	15	9.59E-01	80%	1.16E-07	2.00E-01	1.60E-01	7.27E-07
Tetrachloroethene	7.40E-03	25.0%	1.82E+03	1.0	15	9.59E-01	80%	2.15E-07	1.00E-02	8.00E-03	2.69E-05
Benzo[a]anthracene	3.60E-02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	4.19E-07	--	--	--
Benzo[b]fluoranthene	7.20E-02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	8.38E-07	--	--	--
Benzo[k]fluoranthene	4.90E-02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	5.70E-07	--	--	--
Benzo[a]pyrene	3.60E-02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	4.19E-07	--	--	--
Heptachlor	8.80E-04	6.0%	1.82E+03	1.0	15	9.59E-01	50%	6.14E-09	5.00E-04	2.50E-04	2.46E-05
4,4'-DDT	3.44E-03	6.0%	1.82E+03	1.0	15	9.59E-01	50%	2.40E-08	5.00E-04	2.50E-04	9.61E-05
alpha-Chlordane	9.10E-03	6.0%	1.82E+03	1.0	15	9.59E-01	50%	6.35E-08	6.00E-05	3.00E-05	2.12E-03
gamma-Chlordane	9.70E-03	6.0%	1.82E+03	1.0	15	9.59E-01	50%	6.77E-08	6.00E-05	3.00E-05	2.26E-03
Arsenic	3.62E+00	3.0%	1.82E+03	1.0	15	9.59E-01	95%	1.26E-05	3.00E-04	2.85E-04	4.43E-02
Barium	5.27E+01	1.0%	1.82E+03	1.0	15	9.59E-01	100%	6.13E-05	7.00E-02	7.00E-02	8.76E-04
Chromium	2.18E+01	1.0%	1.82E+03	1.0	15	9.59E-01	20%	2.53E-05	5.00E-03	1.00E-03	2.53E-02
Colbalt	5.10E+00	1.0%	1.82E+03	1.0	15	9.59E-01	20%	5.93E-06	6.00E-02	1.20E-02	4.94E-04
Copper	7.20E+00	1.0%	1.82E+03	1.0	15	9.59E-01	60%	8.38E-06	4.00E-02	2.40E-02	3.49E-04
Iron	1.90E+04	1.0%	1.82E+03	1.0	15	9.59E-01	20%	2.21E-02	3.00E-01	6.00E-02	3.68E-01
Lead	1.17E+01	1.0%	1.82E+03	1.0	15	9.59E-01	20%	1.36E-05	--	--	--
Nickel	9.93E+00	1.0%	1.82E+03	1.0	15	9.59E-01	4.3%	1.16E-05	2.00E-02	8.60E-04	1.34E-02
Vanadium	3.43E+01	1.0%	1.82E+03	1.0	15	9.59E-01	2.6%	3.99E-05	7.00E-03	1.82E-04	2.19E-01
										Hazard Index =	6.77E-01

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 100 mg/day X 1.00 X 1 / 70 kg X 350 days / 365 days X 30 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Bioavailability Factor	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Toluene	4.00E-03	100	1.00	70	9.59E-01	4.29E-01	2.35E-09	--	--
Tetrachloroethene	7.40E-03	100	1.00	70	9.59E-01	4.29E-01	4.34E-09	5.20E-02	2.26E-10
Benzo[a]anthracene	3.60E-02	100	1.00	70	9.59E-01	4.29E-01	2.11E-08	7.30E-01	1.54E-08
Benzo[b]fluoranthene	7.20E-02	100	1.00	70	9.59E-01	4.29E-01	4.23E-08	7.30E-01	3.09E-08
Benzo[k]fluoranthene	4.90E-02	100	1.00	70	9.59E-01	4.29E-01	2.88E-08	7.30E-02	2.10E-09
Benzo[a]pyrene	3.60E-02	100	1.00	70	9.59E-01	4.29E-01	2.11E-08	7.30E+00	1.54E-07
Heptachlor	8.80E-04	100	1.00	70	9.59E-01	4.29E-01	5.17E-10	4.50E+00	2.32E-09
4,4'-DDT	3.44E-03	100	1.00	70	9.59E-01	4.29E-01	2.02E-09	3.40E-01	6.87E-10
alpha-Chlordane	9.10E-03	100	1.00	70	9.59E-01	4.29E-01	5.34E-09	1.30E+00	6.95E-09
gamma-Chlordane	9.70E-03	100	1.00	70	9.59E-01	4.29E-01	5.69E-09	1.30E+00	7.40E-09
Arsenic	3.62E+00	100	1.00	70	9.59E-01	4.29E-01	2.13E-06	1.50E+00	3.19E-06
Barium	5.27E+01	100	1.00	70	9.59E-01	4.29E-01	3.09E-05	--	--
Chromium	2.18E+01	100	1.00	70	9.59E-01	4.29E-01	1.28E-05	--	--
Colbalt	5.10E+00	100	1.00	70	9.59E-01	4.29E-01	2.99E-06	--	--
Copper	7.20E+00	100	1.00	70	9.59E-01	4.29E-01	4.23E-06	--	--
Iron	1.90E+04	100	1.00	70	9.59E-01	4.29E-01	1.12E-02	--	--
Lead	1.17E+01	100	1.00	70	9.59E-01	4.29E-01	6.87E-06	--	--
Nickel	9.93E+00	100	1.00	70	9.59E-01	4.29E-01	5.83E-06	--	--
Vanadium	3.43E+01	100	1.00	70	9.59E-01	4.29E-01	2.01E-05	--	--
								Total Risk =	3.41E-06

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	100 mg/day	X	1.00	X	1 / 70 kg	X	350 days / 365 days	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Bioavailability Factor	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Toluene	4.00E-03	100	1.00	70	9.59E-01	5.48E-09	2.00E-01	2.74E-08
Tetrachloroethene	7.40E-03	100	1.00	70	9.59E-01	1.01E-08	1.00E-02	1.01E-06
Benzo[a]anthracene	3.60E-02	100	1.00	70	9.59E-01	4.93E-08	--	--
Benzo[b]fluoranthene	7.20E-02	100	1.00	70	9.59E-01	9.86E-08	--	--
Benzo[k]fluoranthene	4.90E-02	100	1.00	70	9.59E-01	6.71E-08	--	--
Benzo[a]pyrene	3.60E-02	100	1.00	70	9.59E-01	4.93E-08	--	--
Heptachlor	8.80E-04	100	1.00	70	9.59E-01	1.21E-09	5.00E-04	2.41E-06
4,4'-DDT	3.44E-03	100	1.00	70	9.59E-01	4.71E-09	5.00E-04	9.42E-06
alpha-Chlordane	9.10E-03	100	1.00	70	9.59E-01	1.25E-08	6.00E-05	2.08E-04
gamma-Chlordane	9.70E-03	100	1.00	70	9.59E-01	1.33E-08	6.00E-05	2.21E-04
Arsenic	3.62E+00	100	1.00	70	9.59E-01	4.96E-06	3.00E-04	1.65E-02
Barium	5.27E+01	100	1.00	70	9.59E-01	7.22E-05	7.00E-02	1.03E-03
Chromium	2.18E+01	100	1.00	70	9.59E-01	2.98E-05	5.00E-03	5.97E-03
Colbalt	5.10E+00	100	1.00	70	9.59E-01	6.99E-06	6.00E-02	1.16E-04
Copper	7.20E+00	100	1.00	70	9.59E-01	9.86E-06	4.00E-02	2.47E-04
Iron	1.90E+04	100	1.00	70	9.59E-01	2.60E-02	3.00E-01	8.68E-02
Lead	1.17E+01	100	1.00	70	9.59E-01	1.60E-05	--	--
Nickel	9.93E+00	100	1.00	70	9.59E-01	1.36E-05	2.00E-02	6.80E-04
Vanadium	3.43E+01	100	1.00	70	9.59E-01	4.70E-05	7.00E-03	6.72E-03
							Hazard Index =	1.18E-01

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Soil Intake X Bioavail. Factor X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 200 mg/day X 1.00 X 1 / 15 kg X 350 days / 365 days X 6 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Bioavailability Factor	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Toluene	4.00E-03	200	1.00	15	9.59E-01	8.57E-02	4.38E-09	--	--
Tetrachloroethene	7.40E-03	200	1.00	15	9.59E-01	8.57E-02	8.11E-09	5.20E-02	4.22E-10
Benzo[a]anthracene	3.60E-02	200	1.00	15	9.59E-01	8.57E-02	3.95E-08	7.30E-01	2.88E-08
Benzo[b]fluoranthene	7.20E-02	200	1.00	15	9.59E-01	8.57E-02	7.89E-08	7.30E-01	5.76E-08
Benzo[k]fluoranthene	4.90E-02	200	1.00	15	9.59E-01	8.57E-02	5.37E-08	7.30E-02	3.92E-09
Benzo[a]pyrene	3.60E-02	200	1.00	15	9.59E-01	8.57E-02	3.95E-08	7.30E+00	2.88E-07
Heptachlor	8.80E-04	200	1.00	15	9.59E-01	8.57E-02	9.64E-10	4.50E+00	4.34E-09
4,4'-DDT	3.44E-03	200	1.00	15	9.59E-01	8.57E-02	3.77E-09	3.40E-01	1.28E-09
alpha-Chlordane	9.10E-03	200	1.00	15	9.59E-01	8.57E-02	9.97E-09	1.30E+00	1.30E-08
gamma-Chlordane	9.70E-03	200	1.00	15	9.59E-01	8.57E-02	1.06E-08	1.30E+00	1.38E-08
Arsenic	3.62E+00	200	1.00	15	9.59E-01	8.57E-02	3.97E-06	1.50E+00	5.95E-06
Barium	5.27E+01	200	1.00	15	9.59E-01	8.57E-02	5.78E-05	--	--
Chromium	2.18E+01	200	1.00	15	9.59E-01	8.57E-02	2.39E-05	--	--
Colbalt	5.10E+00	200	1.00	15	9.59E-01	8.57E-02	5.59E-06	--	--
Copper	7.20E+00	200	1.00	15	9.59E-01	8.57E-02	7.89E-06	--	--
Iron	1.90E+04	200	1.00	15	9.59E-01	8.57E-02	2.08E-02	--	--
Lead	1.17E+01	200	1.00	15	9.59E-01	8.57E-02	1.28E-05	--	--
Nickel	9.93E+00	200	1.00	15	9.59E-01	8.57E-02	1.09E-05	--	--
Vanadium	3.43E+01	200	1.00	15	9.59E-01	8.57E-02	3.76E-05	--	--

Total Risk = 6.36E-06

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Soil Intake	X	Bioavail. Factor	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	350 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Bioavailability Factor	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Toluene	4.00E-03	200	1.00	15	9.59E-01	5.11E-08	2.00E-01	2.56E-07
Tetrachloroethene	7.40E-03	200	1.00	15	9.59E-01	9.46E-08	1.00E-02	9.46E-06
Benzo[a]anthracene	3.60E-02	200	1.00	15	9.59E-01	4.60E-07	--	--
Benzo[b]fluoranthene	7.20E-02	200	1.00	15	9.59E-01	9.21E-07	--	--
Benzo[k]fluoranthene	4.90E-02	200	1.00	15	9.59E-01	6.26E-07	--	--
Benzo[a]pyrene	3.60E-02	200	1.00	15	9.59E-01	4.60E-07	--	--
Heptachlor	8.80E-04	200	1.00	15	9.59E-01	1.13E-08	5.00E-04	2.25E-05
4,4'-DDT	3.44E-03	200	1.00	15	9.59E-01	4.40E-08	5.00E-04	8.80E-05
alpha-Chlordane	9.10E-03	200	1.00	15	9.59E-01	1.16E-07	6.00E-05	1.94E-03
gamma-Chlordane	9.70E-03	200	1.00	15	9.59E-01	1.24E-07	6.00E-05	2.07E-03
Arsenic	3.62E+00	200	1.00	15	9.59E-01	4.63E-05	3.00E-04	1.54E-01
Barium	5.27E+01	200	1.00	15	9.59E-01	6.74E-04	7.00E-02	9.63E-03
Chromium	2.18E+01	200	1.00	15	9.59E-01	2.78E-04	5.00E-03	5.57E-02
Colbalt	5.10E+00	200	1.00	15	9.59E-01	6.52E-05	6.00E-02	1.09E-03
Copper	7.20E+00	200	1.00	15	9.59E-01	9.21E-05	4.00E-02	2.30E-03
Iron	1.90E+04	200	1.00	15	9.59E-01	2.43E-01	3.00E-01	8.10E-01
Lead	1.17E+01	200	1.00	15	9.59E-01	1.50E-04	--	--
Nickel	9.93E+00	200	1.00	15	9.59E-01	1.27E-04	2.00E-02	6.35E-03
Vanadium	3.43E+01	200	1.00	15	9.59E-01	4.39E-04	7.00E-03	6.27E-02
							Hazard Index =	1.11E+00

CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations (ug/l)	Federal MCL (ug/l) [a]	Tap Water (ug/l) [b]	Health Advisory (ug/l) [c]	Virginia Ground Water Stds. (ug/l) [d]	Potential Concern
VOLATILES							
1,2-Dichloroethene	2/14	2j - 11000		5.5	70		Yes
(total)	1/14	1j	5.7	0.15	100		Yes
Chloroform	3/14	2j - 2300	5	1.6	300		Yes
Trichloroethene	3/14	2j - 4900	0.8	1.1	5		Yes
Tetrachloroethene	1/14	980		0.019			Yes
Vinyl chloride							
SEMI-VOLATILES							
Phenanthrene	1/10	1.0					No
Fluoranthene	1/10	1.0		1500			Yes
Pyrene	1/10	1.0		1100			Yes
	1/10	0.9 - 1.0		4.8			No
bis(2)ethylhexylphthalate							
PESTICIDES							
Aldrin	1/10	0.015		0.004	0.3		Yes
Heptachlor	1/10	0.038	0.4	0.0023	5.0		Yes
Alpha Chlordane	3/10	0.015 - 0.081	2.0	0.052	6.0		Yes
Gamma Chlordane	2/10	0.046 - 0.05	2.0	0.052	6.0		Yes
INORGANICS							
Aluminum	9/10	11.6 - 117		11000			Yes
Arsenic	1/10	4.3	0.018	0.038	50	50	Yes
Barium	10/10	23.7 - 78.8	2000	260	2000	2000	Yes
Cadmium	1/10	8.1	5.0	18	5	16	Yes
Chromium	4/10	1.6 - 2.8	100	18	100	170	Yes
Cobalt	8/10	2.7 - 9.4		220			Yes
Iron	8/10	275 - 4220				300	Yes
Lead	1/10	43.5			0	15	Yes
Manganese	10/10	112 - 736		18		50	Yes
Nickel	6/10	39 - 122	610	73	100	607	Yes
Vanadium	1/10	2.5		26			Yes
Zinc	9/10	28.1J - 137J		1100		5000	Yes

Notes:

a. Federal MCL concentration values represent US Federal Maximum Contaminant Level for potable water supplies.

b. Tap Water Concentration values obtained from October 20, 1995 USEPA Region III Risk-Based Concentration Table.

c. Health Advisory Concentration values obtained from December 1993 USEPA Office of Water publication "Drinking Water Regulations and Health Advisories."

d. Virginia Water Standards Applicable Statewide.

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake X 1 / Body Wt. ioavailabilit Factor X Days Exposed / Days/Year X Years Exposed / Years Lifetime

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake (mg/day) X 1 / 70 kg 1.0 X 28 days / 365 days X 30 yrs / 70 yrs

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K	Mass ransfer Coef (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	Years Exposed Years Lifetime	CDI (mg/kg-day)	Unit Risk (ug/Cu.m)-1	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	6.36E+02	1.07E-02	2.23E+01	2.93E+00	70	1.0	7.67E-02	4.29E-01	1.38E-03	8.57E-05	3.00E-01	4.13E-04
1,2-Dichloroethene (total)	3.60E+03	3.37E-03	1.70E+01	1.37E+01	70	1.0	7.67E-02	4.29E-01	6.44E-03	--	--	--
Chloroform	1.00E+00	4.35E-03	1.56E+01	3.56E-03	70	1.0	7.67E-02	4.29E-01	1.67E-06	2.30E-05	8.05E-02	1.35E-07
Trichloroethene	3.20E+03	1.03E-03	1.27E+01	9.68E+00	70	1.0	7.67E-02	4.29E-01	4.54E-03	1.71E-06	6.00E-03	2.73E-05
Tetrachloroethene	4.90E+03	1.49E-02	1.38E+01	1.58E+01	70	1.0	7.67E-02	4.29E-01	7.44E-03	5.80E-07	2.03E-03	1.51E-05

Total Risk = 4.55E-04

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake X 1 / Body Wt. ioavailabilit Factor X Days Exposed / Days/Year

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake (mg/day) X 1 / 70 kg 1.0 X 28 days / 365 days

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K	Mass ransfer Coef (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	CDI (mg/kg-day)	RfC (mg/Cu.m)	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	6.36E+02	1.07E-02	2.23E+01	2.93E+00	70	1.0	7.67E-02	3.21E-03	--	--	--
1,2-Dichloroethene (total)	3.60E+03	3.37E-03	1.70E+01	1.37E+01	70	1.0	7.67E-02	1.50E-02	--	--	--
Chloroform	1.00E+00	4.35E-03	1.56E+01	3.56E-03	70	1.0	7.67E-02	3.90E-06	--	--	--
Trichloroethene	3.20E+03	1.03E-03	1.27E+01	9.68E+00	70	1.0	7.67E-02	1.06E-02	--	--	--
Tetrachloroethene	4.90E+03	1.49E-02	1.38E+01	1.58E+01	70	1.0	7.67E-02	1.74E-02	--	--	--

Hazard Index = 0.00E+00

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake X 1 / Body Wt. ioavailabilit Factor X Days Exposed / Days/Year X Years Exposed / Years Lifetime

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake (mg/day) X 1 / 15 kg 1.0 X 14 days / 365 days X 6 yrs / 70 yrs

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K	Mass ransfer Coef (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	Years Exposed Years Lifetime	CDI (mg/kg-day)	Unit Risk (ug/Cu.m)-1	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	6.36E+02	1.07E-02	2.23E+01	2.93E+00	15	1.0	3.84E-02	8.57E-02	6.42E-04	8.57E-05	3.00E-01	1.93E-04
1,2-Dichloroethene (total)	3.60E+03	3.37E-03	1.70E+01	1.37E+01	15	1.0	3.84E-02	8.57E-02	3.01E-03	--	--	--
Chloroform	1.00E+00	4.35E-03	1.56E+01	3.56E-03	15	1.0	3.84E-02	8.57E-02	7.80E-07	2.30E-05	8.05E-02	6.28E-08
Trichloroethene	3.20E+03	1.03E-03	1.27E+01	9.68E+00	15	1.0	3.84E-02	8.57E-02	2.12E-03	1.71E-06	6.00E-03	1.27E-05
Tetrachloroethene	4.90E+03	1.49E-02	1.38E+01	1.58E+01	15	1.0	3.84E-02	8.57E-02	3.47E-03	5.80E-07	2.03E-03	7.05E-06

Total Risk = 2.12E-04

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake X 1 / Body Wt. ioavailabilit Factor X Days Exposed / Days/Year

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminan Intake (mg/day) X 1 / 15 kg 1.0 X 14 days / 365 days

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K	Mass ransfer Coef (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	CDI (mg/kg-day)	RfC (mg/Cu.m)	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	6.36E+02	1.07E-02	2.23E+01	2.93E+00	15	1.0	3.84E-02	7.49E-03	--	--	--
1,2-Dichloroethene (total)	3.60E+03	3.37E-03	1.70E+01	1.37E+01	15	1.0	3.84E-02	3.51E-02	--	--	--
Chloroform	1.00E+00	4.35E-03	1.56E+01	3.56E-03	15	1.0	3.84E-02	9.10E-06	--	--	--
Trichloroethene	3.20E+03	1.03E-03	1.27E+01	9.68E+00	15	1.0	3.84E-02	2.47E-02	--	--	--
Tetrachloroethene	4.90E+03	1.49E-02	1.38E+01	1.58E+01	15	1.0	3.84E-02	4.05E-02	--	--	--

Hazard Index = 0.00E+00

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	cm/hr	0.2 hr/day	1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absoption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Adsorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Vinyl chloride	6.36E-01	23000	0.0073	0.2	70	7.67E-02	4.29E-01	80%	1.00E-05	1.90E+00	2.38E+00	2.38E-05
1,2-Dichloroethene (total)	3.60E+00	23000	0.01	0.2	70	7.67E-02	4.29E-01	80%	7.78E-05	--	--	--
Chloroform	1.00E-03	23000	0.13	0.2	70	7.67E-02	4.29E-01	80%	2.81E-07	6.10E-03	7.63E-03	2.14E-09
Trichloroethene	2.30E+00	23000	0.23	0.2	70	7.67E-02	4.29E-01	80%	1.14E-03	1.10E-02	1.38E-02	1.57E-05
Tetrachloroethene	4.90E+00	23000	0.37	0.2	70	7.67E-02	4.29E-01	80%	3.92E-03	5.20E-02	6.50E-02	2.55E-04
Aldrin	1.50E-05	23000	0.0016	0.2	70	7.67E-02	4.29E-01	50%	5.19E-11	1.70E+01	3.40E+01	1.76E-09
Heptachlor	2.50E-05	23000	0.011	0.2	70	7.67E-02	4.29E-01	50%	5.94E-10	4.50E+00	9.00E+00	5.35E-09
alpha-Chlordane	4.96E-05	23000	0.046	0.2	70	7.67E-02	4.29E-01	50%	4.93E-09	1.30E+00	2.60E+00	1.28E-08
gamma-Chlordane	3.54E-05	23000	0.046	0.2	70	7.67E-02	4.29E-01	50%	3.52E-09	1.30E+00	2.60E+00	9.15E-09
Aluminum	1.17E-01	23000	0.001	0.2	70	7.67E-02	4.29E-01	20%	2.53E-07	--	--	--
Arsenic	4.30E-03	23000	0.001	0.2	70	7.67E-02	4.29E-01	95%	9.29E-09	1.50E+00	1.58E+00	1.47E-08
Barium	6.02E-02	23000	0.001	0.2	70	7.67E-02	4.29E-01	100%	1.30E-07	--	--	--
Cadmium	3.40E-03	23000	0.001	0.2	70	7.67E-02	4.29E-01	5%	7.35E-09	--	--	--
Chromium	1.92E-03	23000	0.001	0.2	70	7.67E-02	4.29E-01	20%	4.15E-09	--	--	--
Cobalt	9.40E-03	23000	0.001	0.2	70	7.67E-02	4.29E-01	20%	2.03E-08	--	--	--
Iron	4.22E+00	23000	0.001	0.2	70	7.67E-02	4.29E-01	20%	9.12E-06	--	--	--
Lead	1.73E-02	23000	0.001	0.2	70	7.67E-02	4.29E-01	20%	3.73E-08	--	--	--
Manganese	6.50E-01	23000	0.001	0.2	70	7.67E-02	4.29E-01	5%	1.40E-06	--	--	--
Nickel	1.01E-02	23000	0.001	0.2	70	7.67E-02	4.29E-01	4.3%	2.17E-08	--	--	--
Vanadium	1.42E-03	23000	0.001	0.2	70	7.67E-02	4.29E-01	2.6%	3.07E-09	--	--	--
Zinc	8.84E-02	23000	0.0006	0.2	70	7.67E-02	4.29E-01	25%	1.15E-07	--	--	--
											Total Risk =	2.94E-04

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	cm/hr	0.2 hr/day	1 / 70 kg	28 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absoption Factor	CDI	RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted Rf
Vinyl chloride	6.36E-01	23000	0.0073	0.2	70	7.67E-02	80%	2.34E-05	--	--	--
1,2-Dichloroethene (total)	3.60E+00	23000	0.01	0.2	70	7.67E-02	80%	1.82E-04	9.00E-03	7.20E-03	2.52E-02
Chloroform	1.00E-03	23000	0.13	0.2	70	7.67E-02	80%	6.55E-07	1.00E-02	8.00E-03	8.19E-05
Trichloroethene	2.30E+00	23000	0.23	0.2	70	7.67E-02	80%	2.67E-03	6.00E-03	4.80E-03	5.56E-01
Tetrachloroethene	4.90E+00	23000	0.37	0.2	70	7.67E-02	80%	9.14E-03	1.00E-02	8.00E-03	1.14E+00
Aldrin	1.50E-05	23000	0.0016	0.2	70	7.67E-02	50%	1.21E-10	3.00E-05	1.50E-05	8.07E-06
Heptachlor	2.50E-05	23000	0.011	0.2	70	7.67E-02	50%	1.39E-09	5.00E-04	2.50E-04	5.55E-06
alpha-Chlordane	4.96E-05	23000	0.046	0.2	70	7.67E-02	50%	1.15E-08	6.00E-05	3.00E-05	3.83E-04
gamma-Chlordane	3.54E-05	23000	0.046	0.2	70	7.67E-02	50%	8.21E-09	6.00E-05	3.00E-05	2.74E-04
Aluminum	1.17E-01	23000	0.001	0.2	70	7.67E-02	20%	5.90E-07	1.00E+00	2.00E-01	2.95E-06
Arsenic	4.30E-03	23000	0.001	0.2	70	7.67E-02	95%	2.17E-08	3.00E-04	2.85E-04	7.61E-05
Barium	6.02E-02	23000	0.001	0.2	70	7.67E-02	100%	3.04E-07	7.00E-02	7.00E-02	4.34E-06
Cadmium	3.40E-03	23000	0.001	0.2	70	7.67E-02	5%	1.71E-08	5.00E-04	2.50E-05	6.86E-04
Chromium	1.92E-03	23000	0.001	0.2	70	7.67E-02	20%	9.68E-09	5.00E-03	1.00E-03	9.68E-06
Cobalt	9.40E-03	23000	0.001	0.2	70	7.67E-02	20%	4.74E-08	6.00E-02	1.20E-02	3.95E-06
Iron	4.22E+00	23000	0.001	0.2	70	7.67E-02	20%	2.13E-05	3.00E-01	6.00E-02	3.55E-04
Lead	1.73E-02	23000	0.001	0.2	70	7.67E-02	20%	8.70E-08	--	--	--
Manganese	6.50E-01	23000	0.001	0.2	70	7.67E-02	5%	3.28E-06	1.40E-01	7.00E-03	4.68E-04
Nickel	1.01E-02	23000	0.001	0.2	70	7.67E-02	4.3%	5.07E-08	2.00E-02	8.60E-04	5.90E-05
Vanadium	1.42E-03	23000	0.001	0.2	70	7.67E-02	2.6%	7.16E-09	7.00E-03	1.82E-04	3.93E-05
Zinc	8.84E-02	23000	0.0006	0.2	70	7.67E-02	25%	2.67E-07	3.00E-01	7.50E-02	3.56E-06
										Hazard Index =	1.73E+00

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	cm/hr	0.2 hr/day	1 / 15 kg	14 days / 365 days	6 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absoption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Adsorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Vinyl chloride	6.36E-01	7280	0.0073	0.2	15	3.84E-02	8.57E-02	80%	1.48E-06	1.90E+00	2.38E+00	3.52E-06
1,2-Dichloroethene (total)	3.60E+00	7280	0.01	0.2	15	3.84E-02	8.57E-02	80%	1.15E-05	--	--	--
Chloroform	1.00E-03	7280	0.13	0.2	15	3.84E-02	8.57E-02	80%	4.15E-08	6.10E-03	7.63E-03	3.16E-10
Trichloroethene	2.30E+00	7280	0.23	0.2	15	3.84E-02	8.57E-02	80%	1.69E-04	1.10E-02	1.38E-02	2.32E-06
Tetrachloroethene	4.90E+00	7280	0.37	0.2	15	3.84E-02	8.57E-02	80%	5.79E-04	5.20E-02	6.50E-02	3.76E-05
Aldrin	1.50E-05	7280	0.0016	0.2	15	3.84E-02	8.57E-02	50%	7.66E-12	1.70E+01	3.40E+01	2.60E-10
Heptachlor	2.50E-05	7280	0.011	0.2	15	3.84E-02	8.57E-02	50%	8.78E-11	4.50E+00	9.00E+00	7.90E-10
alpha-Chlordane	4.96E-05	7280	0.046	0.2	15	3.84E-02	8.57E-02	50%	7.28E-10	1.30E+00	2.60E+00	1.89E-09
gamma-Chlordane	3.54E-05	7280	0.046	0.2	15	3.84E-02	8.57E-02	50%	5.20E-10	1.30E+00	2.60E+00	1.35E-09
Aluminum	1.17E-01	7280	0.001	0.2	15	3.84E-02	8.57E-02	20%	3.73E-08	--	--	--
Arsenic	4.30E-03	7280	0.001	0.2	15	3.84E-02	8.57E-02	95%	1.37E-09	1.50E+00	1.58E+00	2.17E-09
Barium	6.02E-02	7280	0.001	0.2	15	3.84E-02	8.57E-02	100%	1.92E-08	--	--	--
Cadmium	3.40E-03	7280	0.001	0.2	15	3.84E-02	8.57E-02	5%	1.09E-09	--	--	--
Chromium	1.92E-03	7280	0.001	0.2	15	3.84E-02	8.57E-02	20%	6.13E-10	--	--	--
Cobalt	9.40E-03	7280	0.001	0.2	15	3.84E-02	8.57E-02	20%	3.00E-09	--	--	--
Iron	4.22E+00	7280	0.001	0.2	15	3.84E-02	8.57E-02	20%	1.35E-06	--	--	--
Lead	1.73E-02	7280	0.001	0.2	15	3.84E-02	8.57E-02	20%	5.50E-09	--	--	--
Manganese	6.50E-01	7280	0.001	0.2	15	3.84E-02	8.57E-02	5%	2.08E-07	--	--	--
Nickel	1.01E-02	7280	0.001	0.2	15	3.84E-02	8.57E-02	4.3%	3.21E-09	--	--	--
Vanadium	1.42E-03	7280	0.001	0.2	15	3.84E-02	8.57E-02	2.6%	4.53E-10	--	--	--
Zinc	8.84E-02	7280	0.0006	0.2	15	3.84E-02	8.57E-02	25%	1.69E-08	--	--	--
											Total Risk =	4.35E-05

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	cm/hr	0.2 hr/day	1 / 15 kg	14 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absoption Factor	CDI	RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted Rf
Vinyl chloride	6.36E-01	7280	0.0073	0.2	15	3.84E-02	80%	1.73E-05	--	--	--
1,2-Dichloroethene (total)	3.60E+00	7280	0.01	0.2	15	3.84E-02	80%	1.34E-04	9.00E-03	7.20E-03	1.86E-02
Chloroform	1.00E-03	7280	0.13	0.2	15	3.84E-02	80%	4.84E-07	1.00E-02	8.00E-03	6.05E-05
Trichloroethene	2.30E+00	7280	0.23	0.2	15	3.84E-02	80%	1.97E-03	6.00E-03	4.80E-03	4.10E-01
Tetrachloroethene	4.90E+00	7280	0.37	0.2	15	3.84E-02	80%	6.75E-03	1.00E-02	8.00E-03	8.44E-01
Aldrin	1.50E-05	7280	0.0016	0.2	15	3.84E-02	50%	8.94E-11	3.00E-05	1.50E-05	5.96E-06
Heptachlor	2.50E-05	7280	0.011	0.2	15	3.84E-02	50%	1.02E-09	5.00E-04	2.50E-04	4.10E-06
alpha-Chlordane	4.96E-05	7280	0.046	0.2	15	3.84E-02	50%	8.49E-09	6.00E-05	3.00E-05	2.83E-04
gamma-Chlordane	3.54E-05	7280	0.046	0.2	15	3.84E-02	50%	6.06E-09	6.00E-05	3.00E-05	2.02E-04
Aluminum	1.17E-01	7280	0.001	0.2	15	3.84E-02	20%	4.36E-07	1.00E+00	2.00E-01	2.18E-06
Arsenic	4.30E-03	7280	0.001	0.2	15	3.84E-02	95%	1.60E-08	3.00E-04	2.85E-04	5.62E-05
Barium	6.02E-02	7280	0.001	0.2	15	3.84E-02	100%	2.24E-07	7.00E-02	7.00E-02	3.20E-06
Cadmium	3.40E-03	7280	0.001	0.2	15	3.84E-02	5%	1.27E-08	5.00E-04	2.50E-05	5.06E-04
Chromium	1.92E-03	7280	0.001	0.2	15	3.84E-02	20%	7.15E-09	5.00E-03	1.00E-03	7.15E-06
Cobalt	9.40E-03	7280	0.001	0.2	15	3.84E-02	20%	3.50E-08	6.00E-02	1.20E-02	2.92E-06
Iron	4.22E+00	7280	0.001	0.2	15	3.84E-02	20%	1.57E-05	3.00E-01	6.00E-02	2.62E-04
Lead	1.73E-02	7280	0.001	0.2	15	3.84E-02	20%	6.42E-08	--	--	--
Manganese	6.50E-01	7280	0.001	0.2	15	3.84E-02	5%	2.42E-06	1.40E-01	7.00E-03	3.46E-04
Nickel	1.01E-02	7280	0.001	0.2	15	3.84E-02	4.3%	3.75E-08	2.00E-02	8.60E-04	4.36E-05
Vanadium	1.42E-03	7280	0.001	0.2	15	3.84E-02	2.6%	5.29E-09	7.00E-03	1.82E-04	2.90E-05
Zinc	8.84E-02	7280	0.0006	0.2	15	3.84E-02	25%	1.97E-07	3.00E-01	7.50E-02	2.63E-06
										Hazard Index =	1.27E+00

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 70 kg	X	28 days / 365 days	X	30 yrs / 70 yrs	

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	6.36E-01	2.0	70	7.67E-02	4.29E-01	5.97E-04	1.90E+00	1.13E-03
1,2-Dichloroethene (total)	3.60E+00	2.0	70	7.67E-02	4.29E-01	3.38E-03	--	--
Chloroform	1.00E-03	2.0	70	7.67E-02	4.29E-01	9.39E-07	6.10E-03	5.73E-09
Trichloroethene	2.30E+00	2.0	70	7.67E-02	4.29E-01	2.16E-03	1.10E-02	2.38E-05
Tetrachloroethene	4.90E+00	2.0	70	7.67E-02	4.29E-01	4.60E-03	5.20E-02	2.39E-04
Aldrin	1.50E-05	2.0	70	7.67E-02	4.29E-01	1.41E-08	1.70E+01	2.40E-07
Heptachlor	2.50E-05	2.0	70	7.67E-02	4.29E-01	2.35E-08	4.50E+00	1.06E-07
alpha-Chlordane	4.96E-05	2.0	70	7.67E-02	4.29E-01	4.66E-08	1.30E+00	6.06E-08
gamma-Chlordane	3.54E-05	2.0	70	7.67E-02	4.29E-01	3.33E-08	1.30E+00	4.32E-08
Aluminum	1.17E-01	2.0	70	7.67E-02	4.29E-01	1.10E-04	--	--
Arsenic	4.30E-03	2.0	70	7.67E-02	4.29E-01	4.04E-06	1.50E+00	6.06E-06
Barium	6.02E-02	2.0	70	7.67E-02	4.29E-01	5.66E-05	--	--
Cadmium	3.40E-03	2.0	70	7.67E-02	4.29E-01	3.19E-06	--	--
Chromium	1.92E-03	2.0	70	7.67E-02	4.29E-01	1.80E-06	--	--
Cobalt	9.40E-03	2.0	70	7.67E-02	4.29E-01	8.83E-06	--	--
Iron	4.22E+00	2.0	70	7.67E-02	4.29E-01	3.96E-03	--	--
Lead	1.73E-02	2.0	70	7.67E-02	4.29E-01	1.62E-05	--	--
Manganese	6.50E-01	2.0	70	7.67E-02	4.29E-01	6.11E-04	--	--
Nickel	1.01E-02	2.0	70	7.67E-02	4.29E-01	9.45E-06	--	--
Vanadium	1.42E-03	2.0	70	7.67E-02	4.29E-01	1.33E-06	--	--
Zinc	8.84E-02	2.0	70	7.67E-02	4.29E-01	8.30E-05	--	--
							Total Risk =	1.40E-03

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = Water Conc X Consumption Rate X 1 / Body Wt. X Days Exposed/Year / Days/Year
(mg/kg-day)

Chronic Daily Intake = mg/L X 2.0 L/day X 1 / 70 kg X 28 days / 365 days
(mg/kg-day)

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	6.36E-01	2.0	70	7.67E-02	1.39E-03	--	--
1,2-Dichloroethene (total)	3.60E+00	2.0	70	7.67E-02	7.89E-03	9.00E-03	8.77E-01
Chloroform	1.00E-03	2.0	70	7.67E-02	2.19E-06	1.00E-02	2.19E-04
Trichloroethene	2.30E+00	2.0	70	7.67E-02	5.04E-03	6.00E-03	8.40E-01
Tetrachloroethene	4.90E+00	2.0	70	7.67E-02	1.07E-02	1.00E-02	1.07E+00
Aldrin	1.50E-05	2.0	70	7.67E-02	3.29E-08	3.00E-05	1.10E-03
Heptachlor	2.50E-05	2.0	70	7.67E-02	5.48E-08	5.00E-04	1.10E-04
alpha-Chlordane	4.96E-05	2.0	70	7.67E-02	1.09E-07	6.00E-05	1.81E-03
gamma-Chlordane	3.54E-05	2.0	70	7.67E-02	7.76E-08	6.00E-05	1.29E-03
Aluminum	1.17E-01	2.0	70	7.67E-02	2.56E-04	1.00E+00	2.56E-04
Arsenic	4.30E-03	2.0	70	7.67E-02	9.42E-06	3.00E-04	3.14E-02
Barium	6.02E-02	2.0	70	7.67E-02	1.32E-04	7.00E-02	1.89E-03
Cadmium	3.40E-03	2.0	70	7.67E-02	7.45E-06	5.00E-04	1.49E-02
Chromium	1.92E-03	2.0	70	7.67E-02	4.21E-06	5.00E-03	8.42E-04
Cobalt	9.40E-03	2.0	70	7.67E-02	2.06E-05	6.00E-02	3.43E-04
Iron	4.22E+00	2.0	70	7.67E-02	9.25E-03	3.00E-01	3.08E-02
Lead	1.73E-02	2.0	70	7.67E-02	3.78E-05	--	--
Manganese	6.50E-01	2.0	70	7.67E-02	1.43E-03	1.40E-01	1.02E-02
Nickel	1.01E-02	2.0	70	7.67E-02	2.20E-05	2.00E-02	1.10E-03
Vanadium	1.42E-03	2.0	70	7.67E-02	3.11E-06	7.00E-03	4.45E-04
Zinc	8.84E-02	2.0	70	7.67E-02	1.94E-04	3.00E-01	6.46E-04
						Hazard Index =	2.89E+00

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime		
Chronic Daily Intake = (mg/kg-day)	mg/L	X	1.0 L/day	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs		

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	6.36E-01	1.0	15	3.84E-02	8.57E-02	1.39E-04	1.90E+00	2.65E-04
1,2-Dichloroethene (total)	3.60E+00	1.0	15	3.84E-02	8.57E-02	7.89E-04	--	--
Chloroform	1.00E-03	1.0	15	3.84E-02	8.57E-02	2.19E-07	6.10E-03	1.34E-09
Trichloroethene	2.30E+00	1.0	15	3.84E-02	8.57E-02	5.04E-04	1.10E-02	5.55E-06
Tetrachloroethene	4.90E+00	1.0	15	3.84E-02	8.57E-02	1.07E-03	5.20E-02	5.58E-05
Aldrin	1.50E-05	1.0	15	3.84E-02	8.57E-02	3.29E-09	1.70E+01	5.59E-08
Heptachlor	2.50E-05	1.0	15	3.84E-02	8.57E-02	5.48E-09	4.50E+00	2.47E-08
alpha-Chlordane	4.96E-05	1.0	15	3.84E-02	8.57E-02	1.09E-08	1.30E+00	1.41E-08
gamma-Chlordane	3.54E-05	1.0	15	3.84E-02	8.57E-02	7.76E-09	1.30E+00	1.01E-08
Aluminum	1.17E-01	1.0	15	3.84E-02	8.57E-02	2.56E-05	--	--
Arsenic	4.30E-03	1.0	15	3.84E-02	8.57E-02	9.42E-07	1.50E+00	1.41E-06
Barium	6.02E-02	1.0	15	3.84E-02	8.57E-02	1.32E-05	--	--
Cadmium	3.40E-03	1.0	15	3.84E-02	8.57E-02	7.45E-07	--	--
Chromium	1.92E-03	1.0	15	3.84E-02	8.57E-02	4.21E-07	--	--
Cobalt	9.40E-03	1.0	15	3.84E-02	8.57E-02	2.06E-06	--	--
Iron	4.22E+00	1.0	15	3.84E-02	8.57E-02	9.25E-04	--	--
Lead	1.73E-02	1.0	15	3.84E-02	8.57E-02	3.78E-06	--	--
Manganese	6.50E-01	1.0	15	3.84E-02	8.57E-02	1.43E-04	--	--
Nickel	1.01E-02	1.0	15	3.84E-02	8.57E-02	2.20E-06	--	--
Vanadium	1.42E-03	1.0	15	3.84E-02	8.57E-02	3.11E-07	--	--
Zinc	8.84E-02	1.0	15	3.84E-02	8.57E-02	1.94E-05	--	--
							Total Risk =	3.28E-04

CONSTITUENTS DETECTED IN SEDIMENTS
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations ug/l	Residential Soil Conc. ug/kg [a]	Potential Concern
VOLATILES				
Acetone	5/9	8j - 82j	0.78	No
Chlorobenzene	1/9	2j	1600	No
1,2-Dichloroethene (total)	2/9	2j - 14j	0.07	Yes
Trichloroethene	2/9	2j - 19j	0.058	Yes
Tetrachloroethene	2/9	6j - 15j	0.012	Yes
Toluene	1/9	5j	1.6	Yes
Xylene (total)	1/9	4j	1600	No
INORGANICS				
Aluminum	9/9	974000 - 11700000	2.30E+07	Yes
Arsenic (b)	6/9	640 b - 7500 b	3.70E+02	Yes
Barium (b)	9/9	3700 b - 72000 b	5.50E+05	Yes
Beryllium	2/9	130 - 28000	150	Yes
Cadmium (b)	1/4	1200 b	3.90E+04	No
Calcium	4/4	72500 b - 3E+06 b		Yes
Chromium	9/9	1300 b - 20600	3.90E+04	Yes
Cobalt (b)	3/9	1300 b - 4800 b	4.70E+05	Yes
Copper	9/9	1500 - 36000	2.90E+05	Yes
Iron	9/9	1220000 - 12900000		Yes
Lead	9/9	3800 - 110000		Yes*
Magnesium	9/9	83600 b - 2E+06 b		No
Manganese	9/9	3700 - 144000	3.90E+04	Yes
Mercury	1/9	280	2.30E+03	Yes
Nickel (b)	8/9	1400 - 13800 b	1.60E+05	Yes
Potassium	1/4	45800 b - 1E+06 b		No
Sodium	1/4	346000 b		No
Vanadium	9/9	1900 b - 26900 b	5.50E+04	Yes
Zinc	9/9	6100 - 383000	2.30+06	Yes

Notes:

a. Residential Soil Concentration values obtained from October 20, 1995 USEPA Risk-Based Concentration Table except for aluminum which is obtained from the January 11 1994 RBC table using a target hazard quotient of 0.1 and a target cancer risk of 1e-06.

b. Constituent concentration is five times greater than the maximum detected in blank (b).

* Health risk analysis to be performed will use the Integrated Exposure Uptake Biokinetic (IEUBK) Model.

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Yea / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / #########	25 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	8.70E-09	--	--	--
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	8.68E-09	1.10E-02	1.38E-02	1.19E-10
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	7.03E-09	5.20E-02	6.50E-02	4.57E-10
Toluene	5.00E-03	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	3.41E-09	--	--	--
Aluminum	6.96E+03	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	1.90E-04	--	--	--
Arsenic	7.50E+00	3.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	95%	6.13E-07	1.50E+00	1.58E+00	9.69E-07
Barium	5.14E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	100%	1.40E-06	--	--	--
Beryllium	2.80E-01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	1%	7.63E-09	4.30E+00	4.30E+02	3.28E-06
Cadmium	1.20E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	2.5%	3.27E-08	--	--	--
Chromium	1.23E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	3.36E-07	--	--	--
Cobalt	2.75E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	7.50E-08	--	--	--
Copper	3.30E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	60%	8.99E-07	--	--	--
Iron	7.53E+03	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	2.05E-04	--	--	--
Lead	1.10E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	3.00E-06	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	5%	2.92E-06	--	--	--
Mercury	1.70E-01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	15%	4.63E-09	--	--	--
Nickel	7.63E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	4.3%	2.08E-07	--	--	--
Vanadium	1.85E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	2.6%	5.05E-07	--	--	--
Zinc	3.83E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	25%	1.04E-05	--	--	--

Total Risk = 4.25E-06

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Yea / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / #########	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	2.03E-08	9.00E-03	7.20E-03	2.82E-06
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	2.02E-08	6.00E-03	4.80E-03	4.21E-06
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	1.64E-08	1.00E-02	8.00E-03	2.05E-06
Toluene	5.00E-03	25.0%	5.80E+03	1.0	70	7.67E-02	80%	7.94E-09	2.00E-01	1.60E-01	4.96E-08
Aluminum	6.96E+03	1.0%	5.80E+03	1.0	70	7.67E-02	20%	4.43E-04	1.00E+00	2.00E-01	2.21E-03
Arsenic	7.50E+00	3.0%	5.80E+03	1.0	70	7.67E-02	95%	1.43E-06	3.00E-04	2.85E-04	5.02E-03
Barium	5.14E+01	1.0%	5.80E+03	1.0	70	7.67E-02	100%	3.26E-06	7.00E-02	7.00E-02	4.66E-05
Beryllium	2.80E-01	1.0%	5.80E+03	1.0	70	7.67E-02	1%	1.78E-08	5.00E-03	5.00E-05	3.56E-04
Cadmium	1.20E+00	1.0%	5.80E+03	1.0	70	7.67E-02	2.5%	7.63E-08	5.00E-04	1.25E-05	6.10E-03
Chromium	1.23E+01	1.0%	5.80E+03	1.0	70	7.67E-02	20%	7.84E-07	5.00E-03	1.00E-03	7.84E-04
Cobalt	2.75E+00	1.0%	5.80E+03	1.0	70	7.67E-02	20%	1.75E-07	6.00E-02	1.20E-02	1.46E-05
Copper	3.30E+01	1.0%	5.80E+03	1.0	70	7.67E-02	60%	2.10E-06	4.00E-02	2.40E-02	8.73E-05
Iron	7.53E+03	1.0%	5.80E+03	1.0	70	7.67E-02	20%	4.78E-04	3.00E-01	6.00E-02	7.97E-03
Lead	1.10E+02	1.0%	5.80E+03	1.0	70	7.67E-02	20%	6.99E-06	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.0	70	7.67E-02	5%	6.81E-06	1.40E-01	7.00E-03	9.72E-04
Mercury	1.70E-01	1.0%	5.80E+03	1.0	70	7.67E-02	15%	1.08E-08	3.00E-04	4.50E-05	2.40E-04
Nickel	7.63E+00	1.0%	5.80E+03	1.0	70	7.67E-02	4.3%	4.85E-07	2.00E-02	8.60E-04	5.64E-04
Vanadium	1.85E+01	1.0%	5.80E+03	1.0	70	7.67E-02	2.6%	1.18E-06	7.00E-03	1.82E-04	6.47E-03
Zinc	3.83E+02	1.0%	5.80E+03	1.0	70	7.67E-02	25%	2.43E-05	3.00E-01	7.50E-02	3.25E-04
										Hazard Index =	3.12E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	ears Expose / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	######### / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	3.18E-08	--	--	--
Trichloroethene	1.27E-02	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	3.17E-08	1.10E-02	1.38E-02	4.36E-10
Tetrachloroethene	1.03E-02	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	2.57E-08	5.20E-02	6.50E-02	1.67E-09
Toluene	5.00E-03	25.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	80%	1.25E-08	--	--	--
Aluminum	6.96E+03	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	6.95E-04	--	--	--
Arsenic	7.50E+00	3.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	95%	2.24E-06	1.50E+00	1.58E+00	3.54E-06
Barium	5.14E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	100%	5.12E-06	--	--	--
Beryllium	2.80E-01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	1%	2.79E-08	4.30E+00	4.30E+02	1.20E-05
Cadmium	1.20E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	2.5%	1.20E-07	--	--	--
Chromium	1.23E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	1.23E-06	--	--	--
Cobalt	2.75E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	2.74E-07	--	--	--
Copper	3.30E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	60%	3.29E-06	--	--	--
Iron	7.53E+03	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	7.50E-04	--	--	--
Lead	1.10E+02	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	1.10E-05	--	--	--
Manganese	1.07E+02	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	5%	1.07E-05	--	--	--
Mercury	1.70E-01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	15%	1.70E-08	--	--	--
Nickel	7.63E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	4.3%	7.61E-07	--	--	--
Vanadium	1.85E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	2.6%	1.85E-06	--	--	--
Zinc	3.83E+02	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	25%	3.82E-05	--	--	--

Total Risk = 1.56E-05

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	######### / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	1.82E+03	1.0	15	9.59E-01	80%	3.71E-07	9.00E-03	7.20E-03	5.16E-05
Trichloroethene	1.27E-02	25.0%	1.82E+03	1.0	15	9.59E-01	80%	3.70E-07	6.00E-03	4.80E-03	7.71E-05
Tetrachloroethene	1.03E-02	25.0%	1.82E+03	1.0	15	9.59E-01	80%	3.00E-07	1.00E-02	8.00E-03	3.75E-05
Toluene	5.00E-03	25.0%	1.82E+03	1.0	15	9.59E-01	80%	1.45E-07	2.00E-01	1.60E-01	9.09E-07
Aluminum	6.96E+03	1.0%	1.82E+03	1.0	15	9.59E-01	20%	8.10E-03	1.00E+00	2.00E-01	4.05E-02
Arsenic	7.50E+00	3.0%	1.82E+03	1.0	15	9.59E-01	95%	2.62E-05	3.00E-04	2.85E-04	9.19E-02
Barium	5.14E+01	1.0%	1.82E+03	1.0	15	9.59E-01	100%	5.98E-05	7.00E-02	7.00E-02	8.54E-04
Beryllium	2.80E-01	1.0%	1.82E+03	1.0	15	9.59E-01	1%	3.26E-07	5.00E-03	5.00E-05	6.52E-03
Cadmium	1.20E+00	1.0%	1.82E+03	1.0	15	9.59E-01	2.5%	1.40E-06	5.00E-04	1.25E-05	1.12E-01
Chromium	1.23E+01	1.0%	1.82E+03	1.0	15	9.59E-01	20%	1.43E-05	5.00E-03	1.00E-03	1.43E-02
Cobalt	2.75E+00	1.0%	1.82E+03	1.0	15	9.59E-01	20%	3.20E-06	6.00E-02	1.20E-02	2.67E-04
Copper	3.30E+01	1.0%	1.82E+03	1.0	15	9.59E-01	60%	3.84E-05	4.00E-02	2.40E-02	1.60E-03
Iron	7.53E+03	1.0%	1.82E+03	1.0	15	9.59E-01	20%	8.76E-03	3.00E-01	6.00E-02	1.46E-01
Lead	1.10E+02	1.0%	1.82E+03	1.0	15	9.59E-01	20%	1.28E-04	--	--	--
Manganese	1.07E+02	1.0%	1.82E+03	1.0	15	9.59E-01	5%	1.25E-04	1.40E-01	7.00E-03	1.78E-02
Mercury	1.70E-01	1.0%	1.82E+03	1.0	15	9.59E-01	15%	1.98E-07	3.00E-04	4.50E-05	4.40E-03
Nickel	7.63E+00	1.0%	1.82E+03	1.0	15	9.59E-01	4.3%	8.88E-06	2.00E-02	8.60E-04	1.03E-02
Vanadium	1.85E+01	1.0%	1.82E+03	1.0	15	9.59E-01	2.6%	2.16E-05	7.00E-03	1.82E-04	1.18E-01
Zinc	3.83E+02	1.0%	1.82E+03	1.0	15	9.59E-01	25%	4.46E-04	3.00E-01	7.50E-02	5.94E-03
										Hazard Index =	5.71E-01

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	ears Expose / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / 365 days/yr	25 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	8.70E-09	--	--	--
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	8.68E-09	1.10E-02	1.38E-02	1.19E-10
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	7.03E-09	5.20E-02	6.50E-02	4.57E-10
Toluene	5.00E-03	25.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	80%	3.41E-09	--	--	--
Aluminum	6.96E+03	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	1.90E-04	--	--	--
Arsenic	7.50E+00	3.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	95%	6.13E-07	1.50E+00	1.58E+00	9.69E-07
Barium	5.14E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	100%	1.40E-06	--	--	--
Beryllium	2.80E-01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	1%	7.63E-09	4.30E+00	4.30E+02	3.28E-06
Cadmium	1.20E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	2.5%	3.27E-08	--	--	--
Chromium	1.23E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	3.36E-07	--	--	--
Cobalt	2.75E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	7.50E-08	--	--	--
Copper	3.30E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	60%	8.99E-07	--	--	--
Iron	7.53E+03	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	2.05E-04	--	--	--
Lead	1.10E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	20%	3.00E-06	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	5%	2.92E-06	--	--	--
Mercury	1.70E-01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	15%	4.63E-09	--	--	--
Nickel	7.63E+00	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	4.3%	2.08E-07	--	--	--
Vanadium	1.85E+01	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	2.6%	5.05E-07	--	--	--
Zinc	3.83E+02	1.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	25%	1.04E-05	--	--	--

Total Risk = 4.25E-06

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	2.03E-08	9.00E-03	7.20E-03	2.82E-06
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	2.02E-08	6.00E-03	4.80E-03	4.21E-06
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.0	70	7.67E-02	80%	1.64E-08	1.00E-02	8.00E-03	2.05E-06
Toluene	5.00E-03	25.0%	5.80E+03	1.0	70	7.67E-02	80%	7.94E-09	2.00E-01	1.60E-01	4.96E-08
Aluminum	6.96E+03	1.0%	5.80E+03	1.0	70	7.67E-02	20%	4.43E-04	1.00E+00	2.00E-01	2.21E-03
Arsenic	7.50E+00	3.0%	5.80E+03	1.0	70	7.67E-02	95%	1.43E-06	3.00E-04	2.85E-04	5.02E-03
Barium	5.14E+01	1.0%	5.80E+03	1.0	70	7.67E-02	100%	3.26E-06	7.00E-02	7.00E-02	4.66E-05
Beryllium	2.80E-01	1.0%	5.80E+03	1.0	70	7.67E-02	1%	1.78E-08	5.00E-03	5.00E-05	3.56E-04
Cadmium	1.20E+00	1.0%	5.80E+03	1.0	70	7.67E-02	2.5%	7.63E-08	5.00E-04	1.25E-05	6.10E-03
Chromium	1.23E+01	1.0%	5.80E+03	1.0	70	7.67E-02	20%	7.84E-07	5.00E-03	1.00E-03	7.84E-04
Cobalt	2.75E+00	1.0%	5.80E+03	1.0	70	7.67E-02	20%	1.75E-07	6.00E-02	1.20E-02	1.46E-05
Copper	3.30E+01	1.0%	5.80E+03	1.0	70	7.67E-02	60%	2.10E-06	4.00E-02	2.40E-02	8.73E-05
Iron	7.53E+03	1.0%	5.80E+03	1.0	70	7.67E-02	20%	4.78E-04	3.00E-01	6.00E-02	7.97E-03
Lead	1.10E+02	1.0%	5.80E+03	1.0	70	7.67E-02	20%	6.99E-06	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.0	70	7.67E-02	5%	6.81E-06	1.40E-01	7.00E-03	9.72E-04
Mercury	1.70E-01	1.0%	5.80E+03	1.0	70	7.67E-02	15%	1.08E-08	3.00E-04	4.50E-05	2.40E-04
Nickel	7.63E+00	1.0%	5.80E+03	1.0	70	7.67E-02	4.3%	4.85E-07	2.00E-02	8.60E-04	5.64E-04
Vanadium	1.85E+01	1.0%	5.80E+03	1.0	70	7.67E-02	2.6%	1.18E-06	7.00E-03	1.82E-04	6.47E-03
Zinc	3.83E+02	1.0%	5.80E+03	1.0	70	7.67E-02	25%	2.43E-05	3.00E-01	7.50E-02	3.25E-04
										Hazard Index =	3.12E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	ears Expose / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	80%	1.27E-09	--	--	--
Trichloroethene	1.27E-02	25.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	80%	1.27E-09	1.10E-02	1.38E-02	1.75E-11
Tetrachloroethene	1.03E-02	25.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	80%	1.03E-09	5.20E-02	6.50E-02	6.69E-11
Toluene	5.00E-03	25.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	80%	4.99E-10	--	--	--
Aluminum	6.96E+03	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	20%	2.78E-05	--	--	--
Arsenic	7.50E+00	3.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	95%	8.98E-08	1.50E+00	1.58E+00	1.42E-07
Barium	5.14E+01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	100%	2.05E-07	--	--	--
Beryllium	2.80E-01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	1%	1.12E-09	4.30E+00	4.30E+02	4.80E-07
Cadmium	1.20E+00	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	2.5%	4.79E-09	--	--	--
Chromium	1.23E+01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	20%	4.92E-08	--	--	--
Cobalt	2.75E+00	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	20%	1.10E-08	--	--	--
Copper	3.30E+01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	60%	1.32E-07	--	--	--
Iron	7.53E+03	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	20%	3.00E-05	--	--	--
Lead	1.10E+02	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	20%	4.39E-07	--	--	--
Manganese	1.07E+02	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	5%	4.27E-07	--	--	--
Mercury	1.70E-01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	15%	6.78E-10	--	--	--
Nickel	7.63E+00	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	4.3%	3.04E-08	--	--	--
Vanadium	1.85E+01	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	2.6%	7.39E-08	--	--	--
Zinc	3.83E+02	1.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	25%	1.53E-06	--	--	--

Total Risk = 6.22E-07

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	1.82E+03	1.0	15	3.84E-02	80%	1.49E-08	9.00E-03	7.20E-03	2.06E-06
Trichloroethene	1.27E-02	25.0%	1.82E+03	1.0	15	3.84E-02	80%	1.48E-08	6.00E-03	4.80E-03	3.09E-06
Tetrachloroethene	1.03E-02	25.0%	1.82E+03	1.0	15	3.84E-02	80%	1.20E-08	1.00E-02	8.00E-03	1.50E-06
Toluene	5.00E-03	25.0%	1.82E+03	1.0	15	3.84E-02	80%	5.82E-09	2.00E-01	1.60E-01	3.64E-08
Aluminum	6.96E+03	1.0%	1.82E+03	1.0	15	3.84E-02	20%	3.24E-04	1.00E+00	2.00E-01	1.62E-03
Arsenic	7.50E+00	3.0%	1.82E+03	1.0	15	3.84E-02	95%	1.05E-06	3.00E-04	2.85E-04	3.67E-03
Barium	5.14E+01	1.0%	1.82E+03	1.0	15	3.84E-02	100%	2.39E-06	7.00E-02	7.00E-02	3.42E-05
Beryllium	2.80E-01	1.0%	1.82E+03	1.0	15	3.84E-02	1%	1.30E-08	5.00E-03	5.00E-05	2.61E-04
Cadmium	1.20E+00	1.0%	1.82E+03	1.0	15	3.84E-02	2.5%	5.58E-08	5.00E-04	1.25E-05	4.47E-03
Chromium	1.23E+01	1.0%	1.82E+03	1.0	15	3.84E-02	20%	5.74E-07	5.00E-03	1.00E-03	5.74E-04
Cobalt	2.75E+00	1.0%	1.82E+03	1.0	15	3.84E-02	20%	1.28E-07	6.00E-02	1.20E-02	1.07E-05
Copper	3.30E+01	1.0%	1.82E+03	1.0	15	3.84E-02	60%	1.53E-06	4.00E-02	2.40E-02	6.40E-05
Iron	7.53E+03	1.0%	1.82E+03	1.0	15	3.84E-02	20%	3.50E-04	3.00E-01	6.00E-02	5.84E-03
Lead	1.10E+02	1.0%	1.82E+03	1.0	15	3.84E-02	20%	5.12E-06	--	--	--
Manganese	1.07E+02	1.0%	1.82E+03	1.0	15	3.84E-02	5%	4.98E-06	1.40E-01	7.00E-03	7.12E-04
Mercury	1.70E-01	1.0%	1.82E+03	1.0	15	3.84E-02	15%	7.91E-09	3.00E-04	4.50E-05	1.76E-04
Nickel	7.63E+00	1.0%	1.82E+03	1.0	15	3.84E-02	4.3%	3.55E-07	2.00E-02	8.60E-04	4.13E-04
Vanadium	1.85E+01	1.0%	1.82E+03	1.0	15	3.84E-02	2.6%	8.62E-07	7.00E-03	1.82E-04	4.74E-03
Zinc	3.83E+02	1.0%	1.82E+03	1.0	15	3.84E-02	25%	1.78E-05	3.00E-01	7.50E-02	2.38E-04
										Hazard Index =	2.28E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	########## / 365 days/yr	25 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	80%	6.47E-08	--	--	--
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	80%	6.45E-08	1.10E-02	1.38E-02	8.87E-10
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	80%	5.23E-08	5.20E-02	6.50E-02	3.40E-09
Toluene	5.00E-03	25.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	80%	2.53E-08	--	--	--
Aluminum	6.96E+03	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	20%	1.41E-03	--	--	--
Arsenic	7.50E+00	3.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	95%	4.56E-06	1.50E+00	1.58E+00	7.20E-06
Barium	5.14E+01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	100%	1.04E-05	--	--	--
Beryllium	2.80E-01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	1%	5.68E-08	4.30E+00	4.30E+02	2.44E-05
Cadmium	1.20E+00	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	2.5%	2.43E-07	--	--	--
Chromium	1.23E+01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	20%	2.50E-06	--	--	--
Cobalt	2.75E+00	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	20%	5.57E-07	--	--	--
Copper	3.30E+01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	60%	6.68E-06	--	--	--
Iron	7.53E+03	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	20%	1.53E-03	--	--	--
Lead	1.10E+02	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	20%	2.23E-05	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	5%	2.17E-05	--	--	--
Mercury	1.70E-01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	15%	3.45E-08	--	--	--
Nickel	7.63E+00	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	4.3%	1.55E-06	--	--	--
Vanadium	1.85E+01	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	2.6%	3.76E-06	--	--	--
Zinc	3.83E+02	1.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	25%	7.76E-05	--	--	--

Total Risk = 3.16E-05

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	########## / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.0	70	6.85E-01	80%	1.81E-07	9.00E-03	7.20E-03	2.52E-05
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.0	70	6.85E-01	80%	1.81E-07	6.00E-03	4.80E-03	3.76E-05
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.0	70	6.85E-01	80%	1.46E-07	1.00E-02	8.00E-03	1.83E-05
Toluene	5.00E-03	25.0%	5.80E+03	1.0	70	6.85E-01	80%	7.09E-08	2.00E-01	1.60E-01	4.43E-07
Aluminum	6.96E+03	1.0%	5.80E+03	1.0	70	6.85E-01	20%	3.95E-03	1.00E+00	2.00E-01	1.98E-02
Arsenic	7.50E+00	3.0%	5.80E+03	1.0	70	6.85E-01	95%	1.28E-05	3.00E-04	2.85E-04	4.48E-02
Barium	5.14E+01	1.0%	5.80E+03	1.0	70	6.85E-01	100%	2.92E-05	7.00E-02	7.00E-02	4.16E-04
Beryllium	2.80E-01	1.0%	5.80E+03	1.0	70	6.85E-01	1%	1.59E-07	5.00E-03	5.00E-05	3.18E-03
Cadmium	1.20E+00	1.0%	5.80E+03	1.0	70	6.85E-01	2.5%	6.81E-07	5.00E-04	1.25E-05	5.45E-02
Chromium	1.23E+01	1.0%	5.80E+03	1.0	70	6.85E-01	20%	7.00E-06	5.00E-03	1.00E-03	7.00E-03
Cobalt	2.75E+00	1.0%	5.80E+03	1.0	70	6.85E-01	20%	1.56E-06	6.00E-02	1.20E-02	1.30E-04
Copper	3.30E+01	1.0%	5.80E+03	1.0	70	6.85E-01	60%	1.87E-05	4.00E-02	2.40E-02	7.80E-04
Iron	7.53E+03	1.0%	5.80E+03	1.0	70	6.85E-01	20%	4.27E-03	3.00E-01	6.00E-02	7.12E-02
Lead	1.10E+02	1.0%	5.80E+03	1.0	70	6.85E-01	20%	6.24E-05	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.0	70	6.85E-01	5%	6.08E-05	1.40E-01	7.00E-03	8.68E-03
Mercury	1.70E-01	1.0%	5.80E+03	1.0	70	6.85E-01	15%	9.65E-08	3.00E-04	4.50E-05	2.14E-03
Nickel	7.63E+00	1.0%	5.80E+03	1.0	70	6.85E-01	4.3%	4.33E-06	2.00E-02	8.60E-04	5.04E-03
Vanadium	1.85E+01	1.0%	5.80E+03	1.0	70	6.85E-01	2.6%	1.05E-05	7.00E-03	1.82E-04	5.78E-02
Zinc	3.83E+02	1.0%	5.80E+03	1.0	70	6.85E-01	25%	2.17E-04	3.00E-01	7.50E-02	2.90E-03
										Hazard Index =	2.78E-01

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	33 mg/day	X	1.00	X	1 / 70 kg	X	28 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	33	1.00	70	7.67E-02	4.62E-10	9.00E-03	5.13E-08
Trichloroethene	1.27E-02	33	1.00	70	7.67E-02	4.60E-10	6.00E-03	7.67E-08
Tetrachloroethene	1.03E-02	33	1.00	70	7.67E-02	3.73E-10	1.00E-02	3.73E-08
Toluene	5.00E-03	33	1.00	70	7.67E-02	1.81E-10	2.00E-01	9.04E-10
Aluminum	6.96E+03	33	1.00	70	7.67E-02	2.52E-04	1.00E+00	2.52E-04
Arsenic	7.50E+00	33	1.00	70	7.67E-02	2.71E-07	3.00E-04	9.04E-04
Barium	5.14E+01	33	1.00	70	7.67E-02	1.86E-06	7.00E-02	2.65E-05
Beryllium	2.80E-01	33	1.00	70	7.67E-02	1.01E-08	5.00E-03	2.03E-06
Cadmium	1.20E+00	33	1.00	70	7.67E-02	4.34E-08	5.00E-04	8.68E-05
Chromium	1.23E+01	33	1.00	70	7.67E-02	4.46E-07	5.00E-03	8.92E-05
Cobalt	2.75E+00	33	1.00	70	7.67E-02	9.95E-08	6.00E-02	1.66E-06
Copper	3.30E+01	33	1.00	70	7.67E-02	1.19E-06	4.00E-02	2.98E-05
Iron	7.53E+03	33	1.00	70	7.67E-02	2.72E-04	3.00E-01	9.07E-04
Lead	1.10E+02	33	1.00	70	7.67E-02	3.98E-06	--	--
Manganese	1.07E+02	33	1.00	70	7.67E-02	3.87E-06	1.40E-01	2.77E-05
Mercury	1.70E-01	33	1.00	70	7.67E-02	6.15E-09	3.00E-04	2.05E-05
Nickel	7.63E+00	33	1.00	70	7.67E-02	2.76E-07	2.00E-02	1.38E-05
Vanadium	1.85E+01	33	1.00	70	7.67E-02	6.70E-07	7.00E-03	9.57E-05
Zinc	3.83E+02	33	1.00	70	7.67E-02	1.39E-05	3.00E-01	4.62E-05
							Hazard Index =	2.50E-03

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	67 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	67	1.00	15	3.84E-02	8.57E-02	1.88E-10	--	--
Trichloroethene	1.27E-02	67	1.00	15	3.84E-02	8.57E-02	1.87E-10	1.10E-02	2.06E-12
Tetrachloroethene	1.03E-02	67	1.00	15	3.84E-02	8.57E-02	1.52E-10	5.20E-02	7.88E-12
Toluene	5.00E-03	67	1.00	15	3.84E-02	8.57E-02	7.34E-11	--	--
Aluminum	6.96E+03	67	1.00	15	3.84E-02	8.57E-02	1.02E-04	--	--
Arsenic	7.50E+00	67	1.00	15	3.84E-02	8.57E-02	1.10E-07	1.50E+00	1.65E-07
Barium	5.14E+01	67	1.00	15	3.84E-02	8.57E-02	7.54E-07	--	--
Beryllium	2.80E-01	67	1.00	15	3.84E-02	8.57E-02	4.11E-09	4.30E+00	1.77E-08
Cadmium	1.20E+00	67	1.00	15	3.84E-02	8.57E-02	1.76E-08	--	--
Chromium	1.23E+01	67	1.00	15	3.84E-02	8.57E-02	1.81E-07	--	--
Cobalt	2.75E+00	67	1.00	15	3.84E-02	8.57E-02	4.04E-08	--	--
Copper	3.30E+01	67	1.00	15	3.84E-02	8.57E-02	4.84E-07	--	--
Iron	7.53E+03	67	1.00	15	3.84E-02	8.57E-02	1.11E-04	--	--
Lead	1.10E+02	67	1.00	15	3.84E-02	8.57E-02	1.62E-06	--	--
Manganese	1.07E+02	67	1.00	15	3.84E-02	8.57E-02	1.57E-06	--	--
Mercury	1.70E-01	67	1.00	15	3.84E-02	8.57E-02	2.50E-09	--	--
Nickel	7.63E+00	67	1.00	15	3.84E-02	8.57E-02	1.12E-07	--	--
Vanadium	1.85E+01	67	1.00	15	3.84E-02	8.57E-02	2.72E-07	--	--
Zinc	3.83E+02	67	1.00	15	3.84E-02	8.57E-02	5.62E-06	--	--
								Total Risk =	1.83E-07

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 67\text{ mg/day} \times 1.00 \times \frac{1}{15\text{ kg}} \times \frac{14\text{ days}}{365\text{ days}} \times \frac{6\text{ yrs}}{70\text{ yrs}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	67	1.00	15	3.84E-02	8.57E-02	1.88E-10	--	--
Trichloroethene	1.27E-02	67	1.00	15	3.84E-02	8.57E-02	1.87E-10	1.10E-02	2.06E-12
Tetrachloroethene	1.03E-02	67	1.00	15	3.84E-02	8.57E-02	1.52E-10	5.20E-02	7.88E-12
Toluene	5.00E-03	67	1.00	15	3.84E-02	8.57E-02	7.34E-11	--	--
Aluminum	6.96E+03	67	1.00	15	3.84E-02	8.57E-02	1.02E-04	--	--
Arsenic	7.50E+00	67	1.00	15	3.84E-02	8.57E-02	1.10E-07	1.50E+00	1.65E-07
Barium	5.14E+01	67	1.00	15	3.84E-02	8.57E-02	7.54E-07	--	--
Beryllium	2.80E-01	67	1.00	15	3.84E-02	8.57E-02	4.11E-09	4.30E+00	1.77E-08
Cadmium	1.20E+00	67	1.00	15	3.84E-02	8.57E-02	1.76E-08	--	--
Chromium	1.23E+01	67	1.00	15	3.84E-02	8.57E-02	1.81E-07	--	--
Cobalt	2.75E+00	67	1.00	15	3.84E-02	8.57E-02	4.04E-08	--	--
Copper	3.30E+01	67	1.00	15	3.84E-02	8.57E-02	4.84E-07	--	--
Iron	7.53E+03	67	1.00	15	3.84E-02	8.57E-02	1.11E-04	--	--
Lead	1.10E+02	67	1.00	15	3.84E-02	8.57E-02	1.62E-06	--	--
Manganese	1.07E+02	67	1.00	15	3.84E-02	8.57E-02	1.57E-06	--	--
Mercury	1.70E-01	67	1.00	15	3.84E-02	8.57E-02	2.50E-09	--	--
Nickel	7.63E+00	67	1.00	15	3.84E-02	8.57E-02	1.12E-07	--	--
Vanadium	1.85E+01	67	1.00	15	3.84E-02	8.57E-02	2.72E-07	--	--
Zinc	3.83E+02	67	1.00	15	3.84E-02	8.57E-02	5.62E-06	--	--
								Total Risk =	1.83E-07

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	67 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	67	1.00	15	3.84E-02	2.19E-09	9.00E-03	2.43E-07
Trichloroethene	1.27E-02	67	1.00	15	3.84E-02	2.18E-09	6.00E-03	3.63E-07
Tetrachloroethene	1.03E-02	67	1.00	15	3.84E-02	1.77E-09	1.00E-02	1.77E-07
Toluene	5.00E-03	67	1.00	15	3.84E-02	8.57E-10	2.00E-01	4.28E-09
Aluminum	6.96E+03	67	1.00	15	3.84E-02	1.19E-03	1.00E+00	1.19E-03
Arsenic	7.50E+00	67	1.00	15	3.84E-02	1.28E-06	3.00E-04	4.28E-03
Barium	5.14E+01	67	1.00	15	3.84E-02	8.80E-06	7.00E-02	1.26E-04
Beryllium	2.80E-01	67	1.00	15	3.84E-02	4.80E-08	5.00E-03	9.59E-06
Cadmium	1.20E+00	67	1.00	15	3.84E-02	2.06E-07	5.00E-04	4.11E-04
Chromium	1.23E+01	67	1.00	15	3.84E-02	2.11E-06	5.00E-03	4.22E-04
Cobalt	2.75E+00	67	1.00	15	3.84E-02	4.71E-07	6.00E-02	7.85E-06
Copper	3.30E+01	67	1.00	15	3.84E-02	5.65E-06	4.00E-02	1.41E-04
Iron	7.53E+03	67	1.00	15	3.84E-02	1.29E-03	3.00E-01	4.30E-03
Lead	1.10E+02	67	1.00	15	3.84E-02	1.88E-05	--	--
Manganese	1.07E+02	67	1.00	15	3.84E-02	1.83E-05	1.40E-01	1.31E-04
Mercury	1.70E-01	67	1.00	15	3.84E-02	2.91E-08	3.00E-04	9.71E-05
Nickel	7.63E+00	67	1.00	15	3.84E-02	1.31E-06	2.00E-02	6.54E-05
Vanadium	1.85E+01	67	1.00	15	3.84E-02	3.17E-06	7.00E-03	4.54E-04
Zinc	3.83E+02	67	1.00	15	3.84E-02	6.56E-05	3.00E-01	2.19E-04
							Hazard Index =	1.19E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	200	1.00	15	3.84E-02	8.57E-02	5.60E-10	--	--
Trichloroethene	1.27E-02	200	1.00	15	3.84E-02	8.57E-02	5.58E-10	1.10E-02	6.14E-12
Tetrachloroethene	1.03E-02	200	1.00	15	3.84E-02	8.57E-02	4.52E-10	5.20E-02	2.35E-11
Toluene	5.00E-03	200	1.00	15	3.84E-02	8.57E-02	2.19E-10	--	--
Aluminum	6.96E+03	200	1.00	15	3.84E-02	8.57E-02	3.05E-04	--	--
Arsenic	7.50E+00	200	1.00	15	3.84E-02	8.57E-02	3.29E-07	1.50E+00	4.93E-07
Barium	5.14E+01	200	1.00	15	3.84E-02	8.57E-02	2.25E-06	--	--
Beryllium	2.80E-01	200	1.00	15	3.84E-02	8.57E-02	1.23E-08	4.30E+00	5.28E-08
Cadmium	1.20E+00	200	1.00	15	3.84E-02	8.57E-02	5.26E-08	--	--
Chromium	1.23E+01	200	1.00	15	3.84E-02	8.57E-02	5.40E-07	--	--
Cobalt	2.75E+00	200	1.00	15	3.84E-02	8.57E-02	1.21E-07	--	--
Copper	3.30E+01	200	1.00	15	3.84E-02	8.57E-02	1.45E-06	--	--
Iron	7.53E+03	200	1.00	15	3.84E-02	8.57E-02	3.30E-04	--	--
Lead	1.10E+02	200	1.00	15	3.84E-02	8.57E-02	4.82E-06	--	--
Manganese	1.07E+02	200	1.00	15	3.84E-02	8.57E-02	4.69E-06	--	--
Mercury	1.70E-01	200	1.00	15	3.84E-02	8.57E-02	7.45E-09	--	--
Nickel	7.63E+00	200	1.00	15	3.84E-02	8.57E-02	3.34E-07	--	--
Vanadium	1.85E+01	200	1.00	15	3.84E-02	8.57E-02	8.12E-07	--	--
Zinc	3.83E+02	200	1.00	15	3.84E-02	8.57E-02	1.68E-05	--	--
								Total Risk =	5.46E-07

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	200	1.00	15	3.84E-02	6.53E-09	9.00E-03	7.26E-07
Trichloroethene	1.27E-02	200	1.00	15	3.84E-02	6.51E-09	6.00E-03	1.09E-06
Tetrachloroethene	1.03E-02	200	1.00	15	3.84E-02	5.28E-09	1.00E-02	5.28E-07
Toluene	5.00E-03	200	1.00	15	3.84E-02	2.56E-09	2.00E-01	1.28E-08
Aluminum	6.96E+03	200	1.00	15	3.84E-02	3.56E-03	1.00E+00	3.56E-03
Arsenic	7.50E+00	200	1.00	15	3.84E-02	3.84E-06	3.00E-04	1.28E-02
Barium	5.14E+01	200	1.00	15	3.84E-02	2.63E-05	7.00E-02	3.75E-04
Beryllium	2.80E-01	200	1.00	15	3.84E-02	1.43E-07	5.00E-03	2.86E-05
Cadmium	1.20E+00	200	1.00	15	3.84E-02	6.14E-07	5.00E-04	1.23E-03
Chromium	1.23E+01	200	1.00	15	3.84E-02	6.31E-06	5.00E-03	1.26E-03
Cobalt	2.75E+00	200	1.00	15	3.84E-02	1.41E-06	6.00E-02	2.34E-05
Copper	3.30E+01	200	1.00	15	3.84E-02	1.69E-05	4.00E-02	4.22E-04
Iron	7.53E+03	200	1.00	15	3.84E-02	3.85E-03	3.00E-01	1.28E-02
Lead	1.10E+02	200	1.00	15	3.84E-02	5.63E-05	--	--
Manganese	1.07E+02	200	1.00	15	3.84E-02	5.48E-05	1.40E-01	3.91E-04
Mercury	1.70E-01	200	1.00	15	3.84E-02	8.69E-08	3.00E-04	2.90E-04
Nickel	7.63E+00	200	1.00	15	3.84E-02	3.90E-06	2.00E-02	1.95E-04
Vanadium	1.85E+01	200	1.00	15	3.84E-02	9.48E-06	7.00E-03	1.35E-03
Zinc	3.83E+02	200	1.00	15	3.84E-02	1.96E-04	3.00E-01	6.53E-04
							Hazard Index =	3.54E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	50 mg/day	X	1.00	X	1 / 70 kg	X	250 days / 365 days	X	25 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	50	1.00	70	6.85E-01	3.57E-01	2.23E-09	--	--
Trichloroethene	1.27E-02	50	1.00	70	6.85E-01	3.57E-01	2.22E-09	1.10E-02	2.45E-11
Tetrachloroethene	1.03E-02	50	1.00	70	6.85E-01	3.57E-01	1.80E-09	5.20E-02	9.38E-11
Toluene	5.00E-03	50	1.00	70	6.85E-01	3.57E-01	8.74E-10	--	--
Aluminum	6.96E+03	50	1.00	70	6.85E-01	3.57E-01	1.22E-03	--	--
Arsenic	7.50E+00	50	1.00	70	6.85E-01	3.57E-01	1.31E-06	1.50E+00	1.97E-06
Barium	5.14E+01	50	1.00	70	6.85E-01	3.57E-01	8.98E-06	--	--
Beryllium	2.80E-01	50	1.00	70	6.85E-01	3.57E-01	4.89E-08	4.30E+00	2.10E-07
Cadmium	1.20E+00	50	1.00	70	6.85E-01	3.57E-01	2.10E-07	--	--
Chromium	1.23E+01	50	1.00	70	6.85E-01	3.57E-01	2.15E-06	--	--
Cobalt	2.75E+00	50	1.00	70	6.85E-01	3.57E-01	4.81E-07	--	--
Copper	3.30E+01	50	1.00	70	6.85E-01	3.57E-01	5.76E-06	--	--
Iron	7.53E+03	50	1.00	70	6.85E-01	3.57E-01	1.31E-03	--	--
Lead	1.10E+02	50	1.00	70	6.85E-01	3.57E-01	1.92E-05	--	--
Manganese	1.07E+02	50	1.00	70	6.85E-01	3.57E-01	1.87E-05	--	--
Mercury	1.70E-01	50	1.00	70	6.85E-01	3.57E-01	2.97E-08	--	--
Nickel	7.63E+00	50	1.00	70	6.85E-01	3.57E-01	1.33E-06	--	--
Vanadium	1.85E+01	50	1.00	70	6.85E-01	3.57E-01	3.24E-06	--	--
Zinc	3.83E+02	50	1.00	70	6.85E-01	3.57E-01	6.69E-05	--	--
								Total Risk =	2.18E-06

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 50 mg/day X 1.00 X 1 / 70 kg X 250 days / 365 days X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	50	1.00	70	6.85E-01	6.25E-09	9.00E-03	6.94E-07
Trichloroethene	1.27E-02	50	1.00	70	6.85E-01	6.23E-09	6.00E-03	1.04E-06
Tetrachloroethene	1.03E-02	50	1.00	70	6.85E-01	5.05E-09	1.00E-02	5.05E-07
Toluene	5.00E-03	50	1.00	70	6.85E-01	2.45E-09	2.00E-01	1.22E-08
Aluminum	6.96E+03	50	1.00	70	6.85E-01	3.41E-03	1.00E+00	3.41E-03
Arsenic	7.50E+00	50	1.00	70	6.85E-01	3.67E-06	3.00E-04	1.22E-02
Barium	5.14E+01	50	1.00	70	6.85E-01	2.51E-05	7.00E-02	3.59E-04
Beryllium	2.80E-01	50	1.00	70	6.85E-01	1.37E-07	5.00E-03	2.74E-05
Cadmium	1.20E+00	50	1.00	70	6.85E-01	5.87E-07	5.00E-04	1.17E-03
Chromium	1.23E+01	50	1.00	70	6.85E-01	6.03E-06	5.00E-03	1.21E-03
Cobalt	2.75E+00	50	1.00	70	6.85E-01	1.35E-06	6.00E-02	2.24E-05
Copper	3.30E+01	50	1.00	70	6.85E-01	1.61E-05	4.00E-02	4.03E-04
Iron	7.53E+03	50	1.00	70	6.85E-01	3.68E-03	3.00E-01	1.23E-02
Lead	1.10E+02	50	1.00	70	6.85E-01	5.38E-05	--	--
Manganese	1.07E+02	50	1.00	70	6.85E-01	5.24E-05	1.40E-01	3.74E-04
Mercury	1.70E-01	50	1.00	70	6.85E-01	8.32E-08	3.00E-04	2.77E-04
Nickel	7.63E+00	50	1.00	70	6.85E-01	3.73E-06	2.00E-02	1.87E-04
Vanadium	1.85E+01	50	1.00	70	6.85E-01	9.07E-06	7.00E-03	1.30E-03
Zinc	3.83E+02	50	1.00	70	6.85E-01	1.87E-04	3.00E-01	6.25E-04
							Hazard Index =	3.39E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Expose / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / 365 days/yr	25 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	80%	1.08E-07	--	--	--
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	80%	1.08E-07	1.10E-02	1.38E-02	1.48E-09
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	80%	8.72E-08	5.20E-02	6.50E-02	5.67E-09
Toluene	5.00E-03	25.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	80%	4.23E-08	--	--	--
Aluminum	6.96E+03	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	20%	2.35E-03	--	--	--
Arsenic	7.50E+00	3.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	95%	7.61E-06	1.50E+00	1.58E+00	1.20E-05
Barium	5.14E+01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	100%	1.74E-05	--	--	--
Beryllium	2.80E-01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	1%	9.47E-08	4.30E+00	4.30E+02	4.07E-05
Cadmium	1.20E+00	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	2.5%	4.06E-07	--	--	--
Chromium	1.23E+01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	20%	4.17E-06	--	--	--
Cobalt	2.75E+00	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	20%	9.30E-07	--	--	--
Copper	3.30E+01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	60%	1.11E-05	--	--	--
Iron	7.53E+03	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	20%	2.54E-03	--	--	--
Lead	1.10E+02	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	20%	3.72E-05	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	5%	3.62E-05	--	--	--
Mercury	1.70E-01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	15%	5.75E-08	--	--	--
Nickel	7.63E+00	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	4.3%	2.58E-06	--	--	--
Vanadium	1.85E+01	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	2.6%	6.26E-06	--	--	--
Zinc	3.83E+02	1.0%	5.80E+03	1.00	70	9.51E-01	4.29E-01	25%	1.29E-04	--	--	--

Total Risk = 5.27E-05

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	######### / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
1,2-Dichloroethene	1.28E-02	25.0%	5.80E+03	1.0	70	9.51E-01	80%	2.52E-07	9.00E-03	7.20E-03	3.49E-05
Trichloroethene	1.27E-02	25.0%	5.80E+03	1.0	70	9.51E-01	80%	2.51E-07	6.00E-03	4.80E-03	5.22E-05
Tetrachloroethene	1.03E-02	25.0%	5.80E+03	1.0	70	9.51E-01	80%	2.03E-07	1.00E-02	8.00E-03	2.54E-05
Toluene	5.00E-03	25.0%	5.80E+03	1.0	70	9.51E-01	80%	9.85E-08	2.00E-01	1.60E-01	6.16E-07
Aluminum	6.96E+03	1.0%	5.80E+03	1.0	70	9.51E-01	20%	5.49E-03	1.00E+00	2.00E-01	2.74E-02
Arsenic	7.50E+00	3.0%	5.80E+03	1.0	70	9.51E-01	95%	1.77E-05	3.00E-04	2.85E-04	6.22E-02
Barium	5.14E+01	1.0%	5.80E+03	1.0	70	9.51E-01	100%	4.05E-05	7.00E-02	7.00E-02	5.78E-04
Beryllium	2.80E-01	1.0%	5.80E+03	1.0	70	9.51E-01	1%	2.21E-07	5.00E-03	5.00E-05	4.41E-03
Cadmium	1.20E+00	1.0%	5.80E+03	1.0	70	9.51E-01	2.5%	9.46E-07	5.00E-04	1.25E-05	7.56E-02
Chromium	1.23E+01	1.0%	5.80E+03	1.0	70	9.51E-01	20%	9.72E-06	5.00E-03	1.00E-03	9.72E-03
Cobalt	2.75E+00	1.0%	5.80E+03	1.0	70	9.51E-01	20%	2.17E-06	6.00E-02	1.20E-02	1.81E-04
Copper	3.30E+01	1.0%	5.80E+03	1.0	70	9.51E-01	60%	2.60E-05	4.00E-02	2.40E-02	1.08E-03
Iron	7.53E+03	1.0%	5.80E+03	1.0	70	9.51E-01	20%	5.93E-03	3.00E-01	6.00E-02	9.88E-02
Lead	1.10E+02	1.0%	5.80E+03	1.0	70	9.51E-01	20%	8.67E-05	--	--	--
Manganese	1.07E+02	1.0%	5.80E+03	1.0	70	9.51E-01	5%	8.44E-05	1.40E-01	7.00E-03	1.21E-02
Mercury	1.70E-01	1.0%	5.80E+03	1.0	70	9.51E-01	15%	1.34E-07	3.00E-04	4.50E-05	2.98E-03
Nickel	7.63E+00	1.0%	5.80E+03	1.0	70	9.51E-01	4.3%	6.01E-06	2.00E-02	8.60E-04	6.99E-03
Vanadium	1.85E+01	1.0%	5.80E+03	1.0	70	9.51E-01	2.6%	1.46E-05	7.00E-03	1.82E-04	8.02E-02
Zinc	3.83E+02	1.0%	5.80E+03	1.0	70	9.51E-01	25%	3.02E-04	3.00E-01	7.50E-02	4.02E-03
										Hazard Index =	3.86E-01

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	100 mg/day	X	1.00	X	1 / 70 kg	X	350 days / 365 days	X	30 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	100	1.00	70	9.59E-01	4.29E-01	7.50E-09	--	--
Trichloroethene	1.27E-02	100	1.00	70	9.59E-01	4.29E-01	7.47E-09	1.10E-02	8.22E-11
Tetrachloroethene	1.03E-02	100	1.00	70	9.59E-01	4.29E-01	6.06E-09	5.20E-02	3.15E-10
Toluene	5.00E-03	100	1.00	70	9.59E-01	4.29E-01	2.94E-09	--	--
Aluminum	6.96E+03	100	1.00	70	9.59E-01	4.29E-01	4.09E-03	--	--
Arsenic	7.50E+00	100	1.00	70	9.59E-01	4.29E-01	4.40E-06	1.50E+00	6.60E-06
Barium	5.14E+01	100	1.00	70	9.59E-01	4.29E-01	3.02E-05	--	--
Beryllium	2.80E-01	100	1.00	70	9.59E-01	4.29E-01	1.64E-07	4.30E+00	7.07E-07
Cadmium	1.20E+00	100	1.00	70	9.59E-01	4.29E-01	7.05E-07	--	--
Chromium	1.23E+01	100	1.00	70	9.59E-01	4.29E-01	7.24E-06	--	--
Cobalt	2.75E+00	100	1.00	70	9.59E-01	4.29E-01	1.61E-06	--	--
Copper	3.30E+01	100	1.00	70	9.59E-01	4.29E-01	1.94E-05	--	--
Iron	7.53E+03	100	1.00	70	9.59E-01	4.29E-01	4.42E-03	--	--
Lead	1.10E+02	100	1.00	70	9.59E-01	4.29E-01	6.46E-05	--	--
Manganese	1.07E+02	100	1.00	70	9.59E-01	4.29E-01	6.29E-05	--	--
Mercury	1.70E-01	100	1.00	70	9.59E-01	4.29E-01	9.98E-08	--	--
Nickel	7.63E+00	100	1.00	70	9.59E-01	4.29E-01	4.48E-06	--	--
Vanadium	1.85E+01	100	1.00	70	9.59E-01	4.29E-01	1.09E-05	--	--
Zinc	3.83E+02	100	1.00	70	9.59E-01	4.29E-01	2.25E-04	--	--
								Total Risk =	7.31E-06

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 100\text{ mg/day} \times 1.00 \times \frac{1}{70\text{ kg}} \times \frac{350\text{ days}}{365\text{ days}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	100	1.00	70	9.59E-01	1.75E-08	9.00E-03	1.94E-06
Trichloroethene	1.27E-02	100	1.00	70	9.59E-01	1.74E-08	6.00E-03	2.91E-06
Tetrachloroethene	1.03E-02	100	1.00	70	9.59E-01	1.41E-08	1.00E-02	1.41E-06
Toluene	5.00E-03	100	1.00	70	9.59E-01	6.85E-09	2.00E-01	3.42E-08
Aluminum	6.96E+03	100	1.00	70	9.59E-01	9.54E-03	1.00E+00	9.54E-03
Arsenic	7.50E+00	100	1.00	70	9.59E-01	1.03E-05	3.00E-04	3.42E-02
Barium	5.14E+01	100	1.00	70	9.59E-01	7.04E-05	7.00E-02	1.01E-03
Beryllium	2.80E-01	100	1.00	70	9.59E-01	3.84E-07	5.00E-03	7.67E-05
Cadmium	1.20E+00	100	1.00	70	9.59E-01	1.64E-06	5.00E-04	3.29E-03
Chromium	1.23E+01	100	1.00	70	9.59E-01	1.69E-05	5.00E-03	3.38E-03
Cobalt	2.75E+00	100	1.00	70	9.59E-01	3.77E-06	6.00E-02	6.28E-05
Copper	3.30E+01	100	1.00	70	9.59E-01	4.52E-05	4.00E-02	1.13E-03
Iron	7.53E+03	100	1.00	70	9.59E-01	1.03E-02	3.00E-01	3.44E-02
Lead	1.10E+02	100	1.00	70	9.59E-01	1.51E-04	--	--
Manganese	1.07E+02	100	1.00	70	9.59E-01	1.47E-04	1.40E-01	1.05E-03
Mercury	1.70E-01	100	1.00	70	9.59E-01	2.33E-07	3.00E-04	7.76E-04
Nickel	7.63E+00	100	1.00	70	9.59E-01	1.05E-05	2.00E-02	5.23E-04
Vanadium	1.85E+01	100	1.00	70	9.59E-01	2.54E-05	7.00E-03	3.63E-03
Zinc	3.83E+02	100	1.00	70	9.59E-01	5.25E-04	3.00E-01	1.75E-03
							Hazard Index =	9.48E-02

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 200 mg/day X 1.00 X 1 / 15 kg X 350 days / 365 days X 6 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	1.28E-02	200	1.00	15	9.59E-01	8.57E-02	1.40E-08	--	--
Trichloroethene	1.27E-02	200	1.00	15	9.59E-01	8.57E-02	1.40E-08	1.10E-02	1.53E-10
Tetrachloroethene	1.03E-02	200	1.00	15	9.59E-01	8.57E-02	1.13E-08	5.20E-02	5.88E-10
Toluene	5.00E-03	200	1.00	15	9.59E-01	8.57E-02	5.48E-09	--	--
Aluminum	6.96E+03	200	1.00	15	9.59E-01	8.57E-02	7.63E-03	--	--
Arsenic	7.50E+00	200	1.00	15	9.59E-01	8.57E-02	8.22E-06	1.50E+00	1.23E-05
Barium	5.14E+01	200	1.00	15	9.59E-01	8.57E-02	5.63E-05	--	--
Beryllium	2.80E-01	200	1.00	15	9.59E-01	8.57E-02	3.07E-07	4.30E+00	1.32E-06
Cadmium	1.20E+00	200	1.00	15	9.59E-01	8.57E-02	1.32E-06	--	--
Chromium	1.23E+01	200	1.00	15	9.59E-01	8.57E-02	1.35E-05	--	--
Cobalt	2.75E+00	200	1.00	15	9.59E-01	8.57E-02	3.01E-06	--	--
Copper	3.30E+01	200	1.00	15	9.59E-01	8.57E-02	3.61E-05	--	--
Iron	7.53E+03	200	1.00	15	9.59E-01	8.57E-02	8.25E-03	--	--
Lead	1.10E+02	200	1.00	15	9.59E-01	8.57E-02	1.21E-04	--	--
Manganese	1.07E+02	200	1.00	15	9.59E-01	8.57E-02	1.17E-04	--	--
Mercury	1.70E-01	200	1.00	15	9.59E-01	8.57E-02	1.86E-07	--	--
Nickel	7.63E+00	200	1.00	15	9.59E-01	8.57E-02	8.36E-06	--	--
Vanadium	1.85E+01	200	1.00	15	9.59E-01	8.57E-02	2.03E-05	--	--
Zinc	3.83E+02	200	1.00	15	9.59E-01	8.57E-02	4.20E-04	--	--

Total Risk = 1.36E-05

TABLE
SEDIMENT EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 200 mg/day X 1.00 X 1 / 15 kg X 350 days / 365 days X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	1.28E-02	200	1.00	15	9.59E-01	1.63E-07	9.00E-03	1.81E-05
Trichloroethene	1.27E-02	200	1.00	15	9.59E-01	1.63E-07	6.00E-03	2.71E-05
Tetrachloroethene	1.03E-02	200	1.00	15	9.59E-01	1.32E-07	1.00E-02	1.32E-05
Toluene	5.00E-03	200	1.00	15	9.59E-01	6.39E-08	2.00E-01	3.20E-07
Aluminum	6.96E+03	200	1.00	15	9.59E-01	8.90E-02	1.00E+00	8.90E-02
Arsenic	7.50E+00	200	1.00	15	9.59E-01	9.59E-05	3.00E-04	3.20E-01
Barium	5.14E+01	200	1.00	15	9.59E-01	6.57E-04	7.00E-02	9.38E-03
Beryllium	2.80E-01	200	1.00	15	9.59E-01	3.58E-06	5.00E-03	7.16E-04
Cadmium	1.20E+00	200	1.00	15	9.59E-01	1.53E-05	5.00E-04	3.07E-02
Chromium	1.23E+01	200	1.00	15	9.59E-01	1.58E-04	5.00E-03	3.15E-02
Cobalt	2.75E+00	200	1.00	15	9.59E-01	3.52E-05	6.00E-02	5.86E-04
Copper	3.30E+01	200	1.00	15	9.59E-01	4.22E-04	4.00E-02	1.05E-02
Iron	7.53E+03	200	1.00	15	9.59E-01	9.62E-02	3.00E-01	3.21E-01
Lead	1.10E+02	200	1.00	15	9.59E-01	1.41E-03	--	--
Manganese	1.07E+02	200	1.00	15	9.59E-01	1.37E-03	1.40E-01	9.78E-03
Mercury	1.70E-01	200	1.00	15	9.59E-01	2.17E-06	3.00E-04	7.25E-03
Nickel	7.63E+00	200	1.00	15	9.59E-01	9.76E-05	2.00E-02	4.88E-03
Vanadium	1.85E+01	200	1.00	15	9.59E-01	2.37E-04	7.00E-03	3.38E-02
Zinc	3.83E+02	200	1.00	15	9.59E-01	4.90E-03	3.00E-01	1.63E-02
							Hazard Index =	8.85E-01

CONSTITUENTS DETECTED IN SURFACE WATER
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations (ug/l)	Federal MCL (ug/l) [a]	Tap Water (ug/l) [b]	Health Advisory (ug/l) [c]	Virginia Ground Water Stds. (ug/l) [d]	Potential Concern
VOLATILES							
Acetone	5/9	13j - 50		370			No
1,2-Dichloroethene	1/9	11		5.5	70		Yes
(total)	1/9	36					No
2-Butanone	1/9	3j	5	1.6	300	27	Yes
Trichloroethene	1/9	3j	0.8	1.1	5	318	Yes
Tetrachlorethene	3/9	2j - 58	6800	750	1000	6800	No
Toluene							
INORGANICS							
Aluminum	9/9	153j - 81800j		11000			Yes
Arsenic	6/9	1.8 - 23.4j	0.018	0.038	50	50	Yes
Barium	9/9	8.1 - 669j	2000	260	2000	2000	Yes
Beryllium	2/9	0.73 - 3.1j	4.0	0.016	4		Yes
Cadmium	2/9	1.7 - 7.5j	5.0	18	5	16	Yes
Calcium	4/9	15600j - 84500j					No
Chromium	3/9	2.6 - 148j	100	18	100	170	Yes
Cobalt	1/9	64j		220			Yes
Copper	8/9	3.3 - 305j		140	1300	1300	Yes
Iron	9/9	951 - 94800j				300	Yes
Lead	5/9	1.75 - 312j			0	15	Yes*
Magnesium	4/9	5150j - 26600j					No
Manganese	9/9	103 - 1240j		18		50	Yes
Mercury	1/9	0.79j	0.14	1.1	2	0.144	Yes
Nickel	2/9	3.7 - 143j	610	73	100	607	Yes
Potassium	4/9	2800j - 21300j					No
Sodium	4/9	13300j - 262000j					No
Vanadium	4/9	1.7 - 162j		26			Yes
Zinc	9/9	18.2 - 3800j		1100		5000	Yes

Notes:

a. Federal MCL concentration values represent US Federal Maximum Contaminant Level for potable water supplies.

b. Tap Water Concentration values obtained from July 11, 1994 USEPA Region III Risk-Based Concentration Table except for aluminum which is obtained from the January 7, 1994 RBC table.

c. Health Advisory Concentration values obtained from December 1993 USEPA Office of Water publication "Drinking Water Regulations and Health Advisories."

d. Virginia Water Standards for public water supplies.

* Health risk analysis to be performed will use the Integrated Exposure Uptake Biokinetic (IEUBK) Model.

CONSTITUENTS CONCENTRATION IN FISH
SITE 12
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Maximum Detected Concentrations		Bioconcentration Factor* (l/kg)	Fish Concentration (mg/kg)	Fish** Stds. (mg/kg)	Potential Concern
	(ug/l)	(mg/l)				
VOLATILES						
1,2-Dichloroethene (total)	11	1.10E-02	1.6	1.76E-02	1.20E+00	No
Trichloroethene	3j	3.00E-03j	10.6	3.18E-02	2.90E-01	No
Tetrachloroethene	3j	3.00E-03j	31	9.30E-02	6.10E-02	Yes
INORGANICS						
Aluminum	81800j	8.18E+01j	--	--	--	***
Arsenic	23.4j	2.34E-02j	44	1.03E+00	1.80E-02	Yes
Barium	669j	6.69E-01j	--	--	--	***
Beryllium	3.1j	3.10E-03j	19	5.89E-02	7.30E-04	Yes
Cadmium	7.5j	7.50E-03j	81	6.07E-01	6.80E-01	No
Chromium	148j	1.48E-01j	16	2.37E+00	6.80E+00	No
Cobalt	64j	6.40E-02j	--	--	--	***
Copper	305j	3.05E-01j	200	6.10E+01	500E+01	Yes
Iron	94800j	9.48E+01j	--	--	--	***
Lead	312j	3.12E-01j	49	1.53E+01	5.00E+01	No
Manganese	1240j	1.24E+00j	--	--	--	***
Mercury	0.79j	7.90E-04j	5500	4.34E+00	4.10E-01	Yes
Nickel	143j	1.43E-01j	47	6.72E+00	2.70E+01	No
Vanadium	162j	1.62E-01j	--	--	--	***
Zinc	3800j	3.80E+00j	47	1.79E+02	4.10E+01	Yes

* Source: USEPA Superfund Public Health Evaluation Manual, EPA/540/1-86/060, October 1986
** Fish Concentration values obtained from July 11, 1994 USEPA Region III Risk-Based Concentration Table.
*** Not evaluated due to unavailable bioconcentration factor.

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	7.67E-02	4.29E-01	80%	1.90E-06	--	--	--
Trichloroethene	3.00E-03	23000	0.23	2.6	70	7.67E-02	4.29E-01	80%	1.94E-05	1.10E-02	1.38E-02	2.66E-07
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	7.67E-02	4.29E-01	80%	3.12E-05	5.20E-02	6.50E-02	2.03E-06
Aluminum	8.18E+01	23000	0.001	2.6	70	7.67E-02	4.29E-01	20%	2.30E-03	--	--	--
Arsenic	1.09E-02	23000	0.001	2.6	70	7.67E-02	4.29E-01	95%	3.05E-07	1.50E+00	1.58E+00	4.81E-07
Barium	4.74E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	100%	1.33E-05	--	--	--
Beryllium	2.13E-03	23000	0.001	2.6	70	7.67E-02	4.29E-01	1%	5.98E-08	4.30E+00	4.30E+02	2.57E-05
Cadmium	4.59E-03	23000	0.001	2.6	70	7.67E-02	4.29E-01	5%	1.29E-07	--	--	--
Chromium	1.24E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	20%	3.49E-06	--	--	--
Cobalt	2.68E-02	23000	0.001	2.6	70	7.67E-02	4.29E-01	20%	7.54E-07	--	--	--
Copper	3.05E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	60%	8.57E-06	--	--	--
Iron	9.48E+01	23000	0.001	2.6	70	7.67E-02	4.29E-01	20%	2.66E-03	--	--	--
Lead	3.12E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	20%	8.76E-06	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	5%	2.76E-05	--	--	--
Mercury	3.10E-04	23000	0.001	2.6	70	7.67E-02	4.29E-01	15%	8.71E-09	--	--	--
Nickel	1.10E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	4.3%	3.10E-06	--	--	--
Vanadium	1.62E-01	23000	0.001	2.6	70	7.67E-02	4.29E-01	2.6%	4.55E-06	--	--	--
Zinc	3.80E+00	23000	0.0006	2.6	70	7.67E-02	4.29E-01	25%	6.40E-05	--	--	--
											Total Risk =	2.85E-05

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Water Conc × Skin Surface Area × Permeability Constant × Exposure Time × 1 / Body Wt × Days Exposed/Year / Days/Year × 1 L / 10^3 cm^3

Chronic Daily Intake = (mg/kg-day) = mg/L × 23000 cm^2 × cm/hr × 2.6 hr/day × 1 / 70 kg × 28 days / 365 days × 1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	7.67E-02	80%	4.44E-06	9.00E-03	7.20E-03	6.17E-04
Trichloroethene	3.00E-03	23000	0.23	2.6	70	7.67E-02	80%	4.52E-05	6.00E-03	4.80E-03	9.42E-03
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	7.67E-02	80%	7.27E-05	1.00E-02	8.00E-03	9.09E-03
Aluminum	8.18E+01	23000	0.001	2.6	70	7.67E-02	20%	5.36E-03	1.00E+00	2.00E-01	2.68E-02
Arsenic	1.09E-02	23000	0.001	2.6	70	7.67E-02	95%	7.11E-07	3.00E-04	2.85E-04	2.49E-03
Barium	4.74E-01	23000	0.001	2.6	70	7.67E-02	100%	3.11E-05	7.00E-02	7.00E-02	4.44E-04
Beryllium	2.13E-03	23000	0.001	2.6	70	7.67E-02	1%	1.40E-07	5.00E-03	5.00E-05	2.79E-03
Cadmium	4.59E-03	23000	0.001	2.6	70	7.67E-02	5%	3.01E-07	5.00E-04	2.50E-05	1.20E-02
Chromium	1.24E-01	23000	0.001	2.6	70	7.67E-02	20%	8.15E-06	5.00E-03	1.00E-03	8.15E-03
Cobalt	2.68E-02	23000	0.001	2.6	70	7.67E-02	20%	1.76E-06	6.00E-02	1.20E-02	1.47E-04
Copper	3.05E-01	23000	0.001	2.6	70	7.67E-02	60%	2.00E-05	4.00E-02	2.40E-02	8.33E-04
Iron	9.48E+01	23000	0.001	2.6	70	7.67E-02	20%	6.21E-03	3.00E-01	6.00E-02	1.04E-01
Lead	3.12E-01	23000	0.001	2.6	70	7.67E-02	20%	2.04E-05	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	7.67E-02	5%	6.44E-05	1.40E-01	7.00E-03	9.20E-03
Mercury	3.10E-04	23000	0.001	2.6	70	7.67E-02	15%	2.03E-08	3.00E-04	4.50E-05	4.51E-04
Nickel	1.10E-01	23000	0.001	2.6	70	7.67E-02	4.3%	7.23E-06	2.00E-02	8.60E-04	8.41E-03
Vanadium	1.62E-01	23000	0.001	2.6	70	7.67E-02	2.6%	1.06E-05	7.00E-03	1.82E-04	5.83E-02
Zinc	3.80E+00	23000	0.0006	2.6	70	7.67E-02	25%	1.49E-04	3.00E-01	7.50E-02	1.99E-03
										Hazard Index =	2.55E-01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3		
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 15 kg	350 days / 365 days	6 yrs / 70 yrs	1 L / 10^3 cm^3		

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	9.59E-01	8.57E-02	80%	7.03E-06	--	--	--
Trichloroethene	3.00E-03	7280	0.23	2.6	15	9.59E-01	8.57E-02	80%	7.16E-05	1.10E-02	1.38E-02	9.84E-07
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	9.59E-01	8.57E-02	80%	1.15E-04	5.20E-02	6.50E-02	7.48E-06
Aluminum	8.18E+01	7280	0.001	2.6	15	9.59E-01	8.57E-02	20%	8.48E-03	--	--	--
Arsenic	1.09E-02	7280	0.001	2.6	15	9.59E-01	8.57E-02	95%	1.13E-06	1.50E+00	1.58E+00	1.78E-06
Barium	4.74E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	100%	4.92E-05	--	--	--
Beryllium	2.13E-03	7280	0.001	2.6	15	9.59E-01	8.57E-02	1%	2.21E-07	4.30E+00	4.30E+02	9.50E-05
Cadmium	4.59E-03	7280	0.001	2.6	15	9.59E-01	8.57E-02	5%	4.76E-07	--	--	--
Chromium	1.24E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	20%	1.29E-05	--	--	--
Cobalt	2.68E-02	7280	0.001	2.6	15	9.59E-01	8.57E-02	20%	2.78E-06	--	--	--
Copper	3.05E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	60%	3.16E-05	--	--	--
Iron	9.48E+01	7280	0.001	2.6	15	9.59E-01	8.57E-02	20%	9.83E-03	--	--	--
Lead	3.12E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	20%	3.24E-05	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	5%	1.02E-04	--	--	--
Mercury	3.10E-04	7280	0.001	2.6	15	9.59E-01	8.57E-02	15%	3.22E-08	--	--	--
Nickel	1.10E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	4.3%	1.14E-05	--	--	--
Vanadium	1.62E-01	7280	0.001	2.6	15	9.59E-01	8.57E-02	2.6%	1.68E-05	--	--	--
Zinc	3.80E+00	7280	0.0006	2.6	15	9.59E-01	8.57E-02	25%	2.36E-04	--	--	--
											Total Risk =	1.05E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X	1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	X	1 / 15 kg	350 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	9.59E-01	80%	8.20E-05	9.00E-03	7.20E-03	1.14E-02
Trichloroethene	3.00E-03	7280	0.23	2.6	15	9.59E-01	80%	8.35E-04	6.00E-03	4.80E-03	1.74E-01
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	9.59E-01	80%	1.34E-03	1.00E-02	8.00E-03	1.68E-01
Aluminum	8.18E+01	7280	0.001	2.6	15	9.59E-01	20%	9.90E-02	1.00E+00	2.00E-01	4.95E-01
Arsenic	1.09E-02	7280	0.001	2.6	15	9.59E-01	95%	1.31E-05	3.00E-04	2.85E-04	4.61E-02
Barium	4.74E-01	7280	0.001	2.6	15	9.59E-01	100%	5.74E-04	7.00E-02	7.00E-02	8.20E-03
Beryllium	2.13E-03	7280	0.001	2.6	15	9.59E-01	1%	2.58E-06	5.00E-03	5.00E-05	5.16E-02
Cadmium	4.59E-03	7280	0.001	2.6	15	9.59E-01	5%	5.55E-06	5.00E-04	2.50E-05	2.22E-01
Chromium	1.24E-01	7280	0.001	2.6	15	9.59E-01	20%	1.51E-04	5.00E-03	1.00E-03	1.51E-01
Cobalt	2.68E-02	7280	0.001	2.6	15	9.59E-01	20%	3.25E-05	6.00E-02	1.20E-02	2.71E-03
Copper	3.05E-01	7280	0.001	2.6	15	9.59E-01	60%	3.69E-04	4.00E-02	2.40E-02	1.54E-02
Iron	9.48E+01	7280	0.001	2.6	15	9.59E-01	20%	1.15E-01	3.00E-01	6.00E-02	1.91E+00
Lead	3.12E-01	7280	0.001	2.6	15	9.59E-01	20%	3.78E-04	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	9.59E-01	5%	1.19E-03	1.40E-01	7.00E-03	1.70E-01
Mercury	3.10E-04	7280	0.001	2.6	15	9.59E-01	15%	3.75E-07	3.00E-04	4.50E-05	8.34E-03
Nickel	1.10E-01	7280	0.001	2.6	15	9.59E-01	4.3%	1.33E-04	2.00E-02	8.60E-04	1.55E-01
Vanadium	1.62E-01	7280	0.001	2.6	15	9.59E-01	2.6%	1.96E-04	7.00E-03	1.82E-04	1.08E+00
Zinc	3.80E+00	7280	0.0006	2.6	15	9.59E-01	25%	2.76E-03	3.00E-01	7.50E-02	3.68E-02
										Hazard Index =	4.70E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{350\ \text{days}}{365\ \text{days}} \times \frac{30\ \text{yrs}}{70\ \text{yrs}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	70	9.59E-01	4.29E-01	7.96E-05	--	--
Trichloroethene	3.00E-03	2.0	70	9.59E-01	4.29E-01	3.52E-05	1.10E-02	3.87E-07
Tetrachloroethene	3.00E-03	2.0	70	9.59E-01	4.29E-01	3.52E-05	5.20E-02	1.83E-06
Aluminum	8.18E+01	2.0	70	9.59E-01	4.29E-01	9.60E-01	--	--
Arsenic	1.09E-02	2.0	70	9.59E-01	4.29E-01	1.27E-04	1.50E+00	1.91E-04
Barium	4.74E-01	2.0	70	9.59E-01	4.29E-01	5.57E-03	--	--
Beryllium	2.13E-03	2.0	70	9.59E-01	4.29E-01	2.50E-05	4.30E+00	1.08E-04
Cadmium	4.59E-03	2.0	70	9.59E-01	4.29E-01	5.39E-05	--	--
Chromium	1.24E-01	2.0	70	9.59E-01	4.29E-01	1.46E-03	--	--
Cobalt	2.68E-02	2.0	70	9.59E-01	4.29E-01	3.15E-04	--	--
Copper	3.05E-01	2.0	70	9.59E-01	4.29E-01	3.58E-03	--	--
Iron	9.48E+01	2.0	70	9.59E-01	4.29E-01	1.11E+00	--	--
Lead	3.12E-01	2.0	70	9.59E-01	4.29E-01	3.66E-03	--	--
Manganese	9.83E-01	2.0	70	9.59E-01	4.29E-01	1.15E-02	--	--
Mercury	3.10E-04	2.0	70	9.59E-01	4.29E-01	3.64E-06	--	--
Nickel	1.10E-01	2.0	70	9.59E-01	4.29E-01	1.30E-03	--	--
Vanadium	1.62E-01	2.0	70	9.59E-01	4.29E-01	1.90E-03	--	--
Zinc	3.80E+00	2.0	70	9.59E-01	4.29E-01	4.46E-02	--	--
							Total Risk =	3.01E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{350\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	70	9.59E-01	1.86E-04	9.00E-03	2.06E-02
Trichloroethene	3.00E-03	2.0	70	9.59E-01	8.22E-05	6.00E-03	1.37E-02
Tetrachloroethene	3.00E-03	2.0	70	9.59E-01	8.22E-05	1.00E-02	8.22E-03
Aluminum	8.18E+01	2.0	70	9.59E-01	2.24E+00	1.00E+00	2.24E+00
Arsenic	1.09E-02	2.0	70	9.59E-01	2.97E-04	3.00E-04	9.91E-01
Barium	4.74E-01	2.0	70	9.59E-01	1.30E-02	7.00E-02	1.86E-01
Beryllium	2.13E-03	2.0	70	9.59E-01	5.84E-05	5.00E-03	1.17E-02
Cadmium	4.59E-03	2.0	70	9.59E-01	1.26E-04	5.00E-04	2.52E-01
Chromium	1.24E-01	2.0	70	9.59E-01	3.41E-03	5.00E-03	6.82E-01
Cobalt	2.68E-02	2.0	70	9.59E-01	7.35E-04	6.00E-02	1.23E-02
Copper	3.05E-01	2.0	70	9.59E-01	8.36E-03	4.00E-02	2.09E-01
Iron	9.48E+01	2.0	70	9.59E-01	2.60E+00	3.00E-01	8.66E+00
Lead	3.12E-01	2.0	70	9.59E-01	8.55E-03	--	--
Manganese	9.83E-01	2.0	70	9.59E-01	2.69E-02	1.40E-01	1.92E-01
Mercury	3.10E-04	2.0	70	9.59E-01	8.49E-06	3.00E-04	2.83E-02
Nickel	1.10E-01	2.0	70	9.59E-01	3.02E-03	2.00E-02	1.51E-01
Vanadium	1.62E-01	2.0	70	9.59E-01	4.44E-03	7.00E-03	6.34E-01
Zinc	3.80E+00	2.0	70	9.59E-01	1.04E-01	3.00E-01	3.47E-01
						Hazard Index =	1.46E+01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime			
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 15 kg	X	350 days / 365 days	X	6 yrs / 70 yrs			

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	15	9.59E-01	8.57E-02	7.43E-05	--	--
Trichloroethene	3.00E-03	2.0	15	9.59E-01	8.57E-02	3.29E-05	1.10E-02	3.62E-07
Tetrachloroethene	3.00E-03	2.0	15	9.59E-01	8.57E-02	3.29E-05	5.20E-02	1.71E-06
Aluminum	8.18E+01	2.0	15	9.59E-01	8.57E-02	8.96E-01	--	--
Arsenic	1.09E-02	2.0	15	9.59E-01	8.57E-02	1.19E-04	1.50E+00	1.78E-04
Barium	4.74E-01	2.0	15	9.59E-01	8.57E-02	5.20E-03	--	--
Beryllium	2.13E-03	2.0	15	9.59E-01	8.57E-02	2.33E-05	4.30E+00	1.00E-04
Cadmium	4.59E-03	2.0	15	9.59E-01	8.57E-02	5.03E-05	--	--
Chromium	1.24E-01	2.0	15	9.59E-01	8.57E-02	1.36E-03	--	--
Cobalt	2.68E-02	2.0	15	9.59E-01	8.57E-02	2.94E-04	--	--
Copper	3.05E-01	2.0	15	9.59E-01	8.57E-02	3.34E-03	--	--
Iron	9.48E+01	2.0	15	9.59E-01	8.57E-02	1.04E+00	--	--
Lead	3.12E-01	2.0	15	9.59E-01	8.57E-02	3.42E-03	--	--
Manganese	9.83E-01	2.0	15	9.59E-01	8.57E-02	1.08E-02	--	--
Mercury	3.10E-04	2.0	15	9.59E-01	8.57E-02	3.40E-06	--	--
Nickel	1.10E-01	2.0	15	9.59E-01	8.57E-02	1.21E-03	--	--
Vanadium	1.62E-01	2.0	15	9.59E-01	8.57E-02	1.78E-03	--	--
Zinc	3.80E+00	2.0	15	9.59E-01	8.57E-02	4.16E-02	--	--
							Total Risk =	2.81E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\text{ L/day} \times \frac{1}{15\text{ kg}} \times \frac{350\text{ days}}{365\text{ days}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	15	9.59E-01	8.67E-04	9.00E-03	9.63E-02
Trichloroethene	3.00E-03	2.0	15	9.59E-01	3.84E-04	6.00E-03	6.39E-02
Tetrachloroethene	3.00E-03	2.0	15	9.59E-01	3.84E-04	1.00E-02	3.84E-02
Aluminum	8.18E+01	2.0	15	9.59E-01	1.05E+01	1.00E+00	1.05E+01
Arsenic	1.09E-02	2.0	15	9.59E-01	1.39E-03	3.00E-04	4.62E+00
Barium	4.74E-01	2.0	15	9.59E-01	6.06E-02	7.00E-02	8.66E-01
Beryllium	2.13E-03	2.0	15	9.59E-01	2.72E-04	5.00E-03	5.45E-02
Cadmium	4.59E-03	2.0	15	9.59E-01	5.87E-04	5.00E-04	1.17E+00
Chromium	1.24E-01	2.0	15	9.59E-01	1.59E-02	5.00E-03	3.18E+00
Cobalt	2.68E-02	2.0	15	9.59E-01	3.43E-03	6.00E-02	5.72E-02
Copper	3.05E-01	2.0	15	9.59E-01	3.90E-02	4.00E-02	9.75E-01
Iron	9.48E+01	2.0	15	9.59E-01	1.21E+01	3.00E-01	4.04E+01
Lead	3.12E-01	2.0	15	9.59E-01	3.99E-02	--	--
Manganese	9.83E-01	2.0	15	9.59E-01	1.26E-01	1.40E-01	8.98E-01
Mercury	3.10E-04	2.0	15	9.59E-01	3.96E-05	3.00E-04	1.32E-01
Nickel	1.10E-01	2.0	15	9.59E-01	1.41E-02	2.00E-02	7.05E-01
Vanadium	1.62E-01	2.0	15	9.59E-01	2.07E-02	7.00E-03	2.96E+00
Zinc	3.80E+00	2.0	15	9.59E-01	4.86E-01	3.00E-01	1.62E+00
						Hazard Index =	6.83E+01

CONSTITUENTS DETECTED IN SURFACE SOIL SAMPLES
SITE 13
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations (ug/l)	Residential Soil Conc. (ug/kg) [a]	Potential Concern
VOLATILES				
Acetone	4/6	8 - 19	7.80E+05	No
Toluene	3/6	2 - 3j	1.60E+06	No
SEMI-VOLATILES				
2-Methyl naphthalene	1/6	410j		No
Acenaphthene	1/6	950j	4.70E+05	No
Dibenzofuran	1/6	870j		No
Fluorene	1/6	1300j	3.10E+05	No
Pentachlorophenol	4/6	520 - 13000	5.30E+03	Yes
Phenanthrene	4/6	81 - 7900		Yes
Anthracene	1/6	1800j	2.30E+06	No
Fluoranthene	5/6	120 - 9800	3.10E+05	No
Carbazole	1/6	1200 j	3.20E+04	No
Pyrene	5/6	410 - 21000	2.30E+05	No
Butylbenzyl phthalate	2/6	38 - 44j	1.60E+06	No
Benzo(a)anthracene	5/6	110 - 10000	8.80E+02	Yes
Chrysene	5/6	120 - 10000	8.80E+04	No
Bis(2)ethylhexylphthalate	4/6	230 - 630j	4.60E+03	No
Benzo(b)fluoranthene	6/6	140 - 13000	8.80E+02	Yes
Benzo(k)fluoranthene	5/6	81 - 3400j	8.80E+03	No
Benzo(a)pyrene	5/6	100 - 6400	8.80E+01	Yes
Indeno (1,2,3-cd)pyrene	4/6	200 - 4000j	8.88E+02	Yes
Dibenzo(a,h)anthracene	1/6	700j	8.80E+01	No
Benzo(g,h,i)perylene	3/6	190 - 3600j		Yes

Notes:

a. Residential Soil Concentration values obtained from July 11, 1994 USEPA Region III Risk-Based Concentration Table using a target hazard quotient of 0.1 and a target cancer risk of 1e-06.

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1 0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	30 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Naphthalene	8.50E-02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	2.89E-07	--	--	--
Pentachlorophenol	2.11E+02	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	7.17E-04	1.20E-01	2.40E-01	1.72E-04
Antimony	3.50E+00	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	1.19E-06	--	--	--
Arsenic	4.00E+00	3.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	95%	4.09E-06	1.50E+00	1.58E+00	6.45E-06
Barium	5.27E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	100%	1.79E-05	--	--	--
Beryllium	3.30E-01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	1%	1.12E-07	4.30E+00	4.30E+02	4.83E-05
Chromium	2.12E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	7.22E-06	--	--	--
Lead	9.40E+00	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	20%	3.20E-06	--	--	--
Manganese	3.99E+01	1.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	5%	1.36E-05	--	--	--
											Total Risk =	2.27E-04

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
Naphthalene	8.50E-02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	6.75E-07	4.00E-02	2.00E-02	3.38E-05
Pentachlorophenol	2.11E+02	10.0%	5.80E+03	1.0	70	9.59E-01	50%	1.67E-03	3.00E-02	1.50E-02	1.12E-01
Antimony	3.50E+00	1.0%	5.80E+03	1.0	70	9.59E-01	20%	2.78E-06	4.00E-04	8.00E-05	3.48E-02
Arsenic	4.00E+00	3.0%	5.80E+03	1.0	70	9.59E-01	95%	9.53E-06	3.00E-04	2.85E-04	3.35E-02
Barium	5.27E+01	1.0%	5.80E+03	1.0	70	9.59E-01	100%	4.19E-05	7.00E-02	7.00E-02	5.98E-04
Beryllium	3.30E-01	1.0%	5.80E+03	1.0	70	9.59E-01	1%	2.62E-07	5.00E-03	5.00E-05	5.24E-03
Chromium	2.12E+01	1.0%	5.80E+03	1.0	70	9.59E-01	20%	1.68E-05	5.00E-03	1.00E-03	1.68E-02
Lead	9.40E+00	1.0%	5.80E+03	1.0	70	9.59E-01	20%	7.47E-06	--	--	--
Manganese	3.99E+01	1.0%	5.80E+03	1.0	70	9.59E-01	5%	3.17E-05	1.40E-01	7.00E-03	4.53E-03
										Hazard Index =	2.07E-01

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Naphthalene	8.50E-02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	8.48E-08	--	--	--
Pentachlorophenol	2.11E+02	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	2.10E-04	1.20E-01	2.40E-01	5.04E-05
Antimony	3.50E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	3.49E-07	--	--	--
Arsenic	4.00E+00	3.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	95%	1.20E-06	1.50E+00	1.58E+00	1.89E-06
Barium	5.27E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	100%	5.26E-06	--	--	--
Beryllium	3.30E-01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	1%	3.29E-08	4.30E+00	4.30E+02	1.42E-05
Chromium	2.12E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	2.11E-06	--	--	--
Lead	9.40E+00	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	20%	9.37E-07	--	--	--
Manganese	3.99E+01	1.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	5%	3.98E-06	--	--	--
											Total Risk =	6.65E-05

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
Naphthalene	8.50E-02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	9.89E-07	4.00E-02	2.00E-02	4.94E-05
Pentachlorophenol	2.11E+02	10.0%	1.82E+03	1.0	15	9.59E-01	50%	2.45E-03	3.00E-02	1.50E-02	1.63E-01
Antimony	3.50E+00	1.0%	1.82E+03	1.0	15	9.59E-01	20%	4.07E-06	4.00E-04	8.00E-05	5.09E-02
Arsenic	4.00E+00	3.0%	1.82E+03	1.0	15	9.59E-01	95%	1.40E-05	3.00E-04	2.85E-04	4.90E-02
Barium	5.27E+01	1.0%	1.82E+03	1.0	15	9.59E-01	100%	6.13E-05	7.00E-02	7.00E-02	8.76E-04
Beryllium	3.30E-01	1.0%	1.82E+03	1.0	15	9.59E-01	1%	3.84E-07	5.00E-03	5.00E-05	7.68E-03
Chromium	2.12E+01	1.0%	1.82E+03	1.0	15	9.59E-01	20%	2.47E-05	5.00E-03	1.00E-03	2.47E-02
Lead	9.40E+00	1.0%	1.82E+03	1.0	15	9.59E-01	20%	1.09E-05	--	--	--
Manganese	3.99E+01	1.0%	1.82E+03	1.0	15	9.59E-01	5%	4.64E-05	1.40E-01	7.00E-03	6.63E-03
										Hazard Index =	3.03E-01

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 100\text{ mg/day} \times 1.00 \times \frac{1}{70\text{ kg}} \times \frac{350\text{ days}}{365\text{ days}} \times \frac{30\text{ yrs}}{70\text{ yrs}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Naphthalene	8.50E-02	100	1.00	70	9.59E-01	4.29E-01	4.99E-08	--	--
Pentachlorophenol	2.11E+02	100	1.00	70	9.59E-01	4.29E-01	1.24E-04	1.20E-01	1.48E-05
Antimony	3.50E+00	100	1.00	70	9.59E-01	4.29E-01	2.05E-06	--	--
Arsenic	4.00E+00	100	1.00	70	9.59E-01	4.29E-01	2.35E-06	1.50E+00	3.52E-06
Barium	5.27E+01	100	1.00	70	9.59E-01	4.29E-01	3.09E-05	--	--
Beryllium	3.30E-01	100	1.00	70	9.59E-01	4.29E-01	1.94E-07	4.30E+00	8.33E-07
Chromium	2.12E+01	100	1.00	70	9.59E-01	4.29E-01	1.24E-05	--	--
Lead	9.40E+00	100	1.00	70	9.59E-01	4.29E-01	5.52E-06	--	--
Manganese	3.99E+01	100	1.00	70	9.59E-01	4.29E-01	2.34E-05	--	--
								Total Risk =	1.92E-05

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	100 mg/day	X	1.00	X	1 / 70 kg	X	350 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Naphthalene	8.50E-02	100	1.00	70	9.59E-01	1.16E-07	4.00E-02	2.91E-06
Pentachlorophenol	2.11E+02	100	1.00	70	9.59E-01	2.89E-04	3.00E-02	9.62E-03
Antimony	3.50E+00	100	1.00	70	9.59E-01	4.79E-06	4.00E-04	1.20E-02
Arsenic	4.00E+00	100	1.00	70	9.59E-01	5.48E-06	3.00E-04	1.83E-02
Barium	5.27E+01	100	1.00	70	9.59E-01	7.22E-05	7.00E-02	1.03E-03
Beryllium	3.30E-01	100	1.00	70	9.59E-01	4.52E-07	5.00E-03	9.04E-05
Chromium	2.12E+01	100	1.00	70	9.59E-01	2.90E-05	5.00E-03	5.81E-03
Lead	9.40E+00	100	1.00	70	9.59E-01	1.29E-05	--	--
Manganese	3.99E+01	100	1.00	70	9.59E-01	5.47E-05	1.40E-01	3.90E-04
							Hazard Index =	4.72E-02

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 200 mg/day X 1.00 X 1 / 15 kg X 350 days / 365 days X 6 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Naphthalene	8.50E-02	200	1.00	15	9.59E-01	8.57E-02	9.32E-08	--	--
Pentachlorophenol	2.11E+02	200	1.00	15	9.59E-01	8.57E-02	2.31E-04	1.20E-01	2.77E-05
Antimony	3.50E+00	200	1.00	15	9.59E-01	8.57E-02	3.84E-06	--	--
Arsenic	4.00E+00	200	1.00	15	9.59E-01	8.57E-02	4.38E-06	1.50E+00	6.58E-06
Barium	5.27E+01	200	1.00	15	9.59E-01	8.57E-02	5.78E-05	--	--
Beryllium	3.30E-01	200	1.00	15	9.59E-01	8.57E-02	3.62E-07	4.30E+00	1.56E-06
Chromium	2.12E+01	200	1.00	15	9.59E-01	8.57E-02	2.32E-05	--	--
Lead	9.40E+00	200	1.00	15	9.59E-01	8.57E-02	1.03E-05	--	--
Manganese	3.99E+01	200	1.00	15	9.59E-01	8.57E-02	4.37E-05	--	--

Total Risk = 3.58E-05

TABLE
SUBSURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	350 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Naphthalene	8.50E-02	200	1.00	15	9.59E-01	1.09E-06	4.00E-02	2.72E-05
Pentachlorophenol	2.11E+02	200	1.00	15	9.59E-01	2.69E-03	3.00E-02	8.98E-02
Antimony	3.50E+00	200	1.00	15	9.59E-01	4.47E-05	4.00E-04	1.12E-01
Arsenic	4.00E+00	200	1.00	15	9.59E-01	5.11E-05	3.00E-04	1.70E-01
Barium	5.27E+01	200	1.00	15	9.59E-01	6.74E-04	7.00E-02	9.63E-03
Beryllium	3.30E-01	200	1.00	15	9.59E-01	4.22E-06	5.00E-03	8.44E-04
Chromium	2.12E+01	200	1.00	15	9.59E-01	2.71E-04	5.00E-03	5.42E-02
Lead	9.40E+00	200	1.00	15	9.59E-01	1.20E-04	--	--
Manganese	3.99E+01	200	1.00	15	9.59E-01	5.10E-04	1.40E-01	3.64E-03
							Hazard Index =	4.40E-01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3		
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	1 / 15 kg	14 days / 365 days	6 yrs / 70 yrs	1 L / 10^3 cm^3		

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	3.84E-02	8.57E-02	80%	2.81E-07	--	--	--
Trichloroethene	3.00E-03	7280	0.23	2.6	15	3.84E-02	8.57E-02	80%	2.86E-06	1.10E-02	1.38E-02	3.94E-08
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	3.84E-02	8.57E-02	80%	4.60E-06	5.20E-02	6.50E-02	2.99E-07
Aluminum	8.18E+01	7280	0.001	2.6	15	3.84E-02	8.57E-02	20%	3.39E-04	--	--	--
Arsenic	1.09E-02	7280	0.001	2.6	15	3.84E-02	8.57E-02	95%	4.50E-08	1.50E+00	1.58E+00	7.11E-08
Barium	4.74E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	100%	1.97E-06	--	--	--
Beryllium	2.13E-03	7280	0.001	2.6	15	3.84E-02	8.57E-02	1%	8.84E-09	4.30E+00	4.30E+02	3.80E-06
Cadmium	4.59E-03	7280	0.001	2.6	15	3.84E-02	8.57E-02	5%	1.90E-08	--	--	--
Chromium	1.24E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	20%	5.16E-07	--	--	--
Cobalt	2.68E-02	7280	0.001	2.6	15	3.84E-02	8.57E-02	20%	1.11E-07	--	--	--
Copper	3.05E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	60%	1.27E-06	--	--	--
Iron	9.48E+01	7280	0.001	2.6	15	3.84E-02	8.57E-02	20%	3.93E-04	--	--	--
Lead	3.12E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	20%	1.29E-06	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	5%	4.08E-06	--	--	--
Mercury	3.10E-04	7280	0.001	2.6	15	3.84E-02	8.57E-02	15%	1.29E-09	--	--	--
Nickel	1.10E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	4.3%	4.58E-07	--	--	--
Vanadium	1.62E-01	7280	0.001	2.6	15	3.84E-02	8.57E-02	2.6%	6.72E-07	--	--	--
Zinc	3.80E+00	7280	0.0006	2.6	15	3.84E-02	8.57E-02	25%	9.46E-06	--	--	--
											Total Risk =	4.21E-06

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3		
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 15 kg	14 days / 365 days	1 L / 10^3 cm^3		

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	3.84E-02	80%	3.28E-06	9.00E-03	7.20E-03	4.56E-04
Trichloroethene	3.00E-03	7280	0.23	2.6	15	3.84E-02	80%	3.34E-05	6.00E-03	4.80E-03	6.96E-03
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	3.84E-02	80%	5.37E-05	1.00E-02	8.00E-03	6.72E-03
Aluminum	8.18E+01	7280	0.001	2.6	15	3.84E-02	20%	3.96E-03	1.00E+00	2.00E-01	1.98E-02
Arsenic	1.09E-02	7280	0.001	2.6	15	3.84E-02	95%	5.25E-07	3.00E-04	2.85E-04	1.84E-03
Barium	4.74E-01	7280	0.001	2.6	15	3.84E-02	100%	2.30E-05	7.00E-02	7.00E-02	3.28E-04
Beryllium	2.13E-03	7280	0.001	2.6	15	3.84E-02	1%	1.03E-07	5.00E-03	5.00E-05	2.06E-03
Cadmium	4.59E-03	7280	0.001	2.6	15	3.84E-02	5%	2.22E-07	5.00E-04	2.50E-05	8.89E-03
Chromium	1.24E-01	7280	0.001	2.6	15	3.84E-02	20%	6.02E-06	5.00E-03	1.00E-03	6.02E-03
Cobalt	2.68E-02	7280	0.001	2.6	15	3.84E-02	20%	1.30E-06	6.00E-02	1.20E-02	1.08E-04
Copper	3.05E-01	7280	0.001	2.6	15	3.84E-02	60%	1.48E-05	4.00E-02	2.40E-02	6.15E-04
Iron	9.48E+01	7280	0.001	2.6	15	3.84E-02	20%	4.59E-03	3.00E-01	6.00E-02	7.65E-02
Lead	3.12E-01	7280	0.001	2.6	15	3.84E-02	20%	1.51E-05	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	3.84E-02	5%	4.76E-05	1.40E-01	7.00E-03	6.80E-03
Mercury	3.10E-04	7280	0.001	2.6	15	3.84E-02	15%	1.50E-08	3.00E-04	4.50E-05	3.33E-04
Nickel	1.10E-01	7280	0.001	2.6	15	3.84E-02	4.3%	5.34E-06	2.00E-02	8.60E-04	6.21E-03
Vanadium	1.62E-01	7280	0.001	2.6	15	3.84E-02	2.6%	7.84E-06	7.00E-03	1.82E-04	4.31E-02
Zinc	3.80E+00	7280	0.0006	2.6	15	3.84E-02	25%	1.10E-04	3.00E-01	7.50E-02	1.47E-03
										Hazard Index =	1.88E-01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	9.59E-01	4.29E-01	80%	2.38E-05	--	--	--
Trichloroethene	3.00E-03	23000	0.23	2.6	70	9.59E-01	4.29E-01	80%	2.43E-04	1.10E-02	1.38E-02	3.33E-06
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	9.59E-01	4.29E-01	80%	3.90E-04	5.20E-02	6.50E-02	2.54E-05
Aluminum	8.18E+01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	2.87E-02	--	--	--
Arsenic	1.09E-02	23000	0.001	2.6	70	9.59E-01	4.29E-01	95%	3.81E-06	1.50E+00	1.58E+00	6.02E-06
Barium	4.74E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	100%	1.67E-04	--	--	--
Beryllium	2.13E-03	23000	0.001	2.6	70	9.59E-01	4.29E-01	1%	7.49E-07	4.30E+00	4.30E+02	3.22E-04
Cadmium	4.59E-03	23000	0.001	2.6	70	9.59E-01	4.29E-01	5%	1.61E-06	--	--	--
Chromium	1.24E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	4.37E-05	--	--	--
Cobalt	2.68E-02	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	9.43E-06	--	--	--
Copper	3.05E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	60%	1.07E-04	--	--	--
Iron	9.48E+01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	3.33E-02	--	--	--
Lead	3.12E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	1.10E-04	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	5%	3.46E-04	--	--	--
Mercury	3.10E-04	23000	0.001	2.6	70	9.59E-01	4.29E-01	15%	1.09E-07	--	--	--
Nickel	1.10E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	4.3%	3.88E-05	--	--	--
Vanadium	1.62E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	2.6%	5.69E-05	--	--	--
Zinc	3.80E+00	23000	0.0006	2.6	70	9.59E-01	4.29E-01	25%	8.01E-04	--	--	--
											Total Risk =	3.57E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	9.59E-01	80%	5.55E-05	9.00E-03	7.20E-03	7.71E-03
Trichloroethene	3.00E-03	23000	0.23	2.6	70	9.59E-01	80%	5.65E-04	6.00E-03	4.80E-03	1.18E-01
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	9.59E-01	80%	9.09E-04	1.00E-02	8.00E-03	1.14E-01
Aluminum	8.18E+01	23000	0.001	2.6	70	9.59E-01	20%	6.70E-02	1.00E+00	2.00E-01	3.35E-01
Arsenic	1.09E-02	23000	0.001	2.6	70	9.59E-01	95%	8.89E-06	3.00E-04	2.85E-04	3.12E-02
Barium	4.74E-01	23000	0.001	2.6	70	9.59E-01	100%	3.89E-04	7.00E-02	7.00E-02	5.55E-03
Beryllium	2.13E-03	23000	0.001	2.6	70	9.59E-01	1%	1.75E-06	5.00E-03	5.00E-05	3.49E-02
Cadmium	4.59E-03	23000	0.001	2.6	70	9.59E-01	5%	3.76E-06	5.00E-04	2.50E-05	1.50E-01
Chromium	1.24E-01	23000	0.001	2.6	70	9.59E-01	20%	1.02E-04	5.00E-03	1.00E-03	1.02E-01
Cobalt	2.68E-02	23000	0.001	2.6	70	9.59E-01	20%	2.20E-05	6.00E-02	1.20E-02	1.83E-03
Copper	3.05E-01	23000	0.001	2.6	70	9.59E-01	60%	2.50E-04	4.00E-02	2.40E-02	1.04E-02
Iron	9.48E+01	23000	0.001	2.6	70	9.59E-01	20%	7.77E-02	3.00E-01	6.00E-02	1.29E+00
Lead	3.12E-01	23000	0.001	2.6	70	9.59E-01	20%	2.56E-04	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	9.59E-01	5%	8.05E-04	1.40E-01	7.00E-03	1.15E-01
Mercury	3.10E-04	23000	0.001	2.6	70	9.59E-01	15%	2.54E-07	3.00E-04	4.50E-05	5.64E-03
Nickel	1.10E-01	23000	0.001	2.6	70	9.59E-01	4.3%	9.04E-05	2.00E-02	8.60E-04	1.05E-01
Vanadium	1.62E-01	23000	0.001	2.6	70	9.59E-01	2.6%	1.33E-04	7.00E-03	1.82E-04	7.29E-01
Zinc	3.80E+00	23000	0.0006	2.6	70	9.59E-01	25%	1.87E-03	3.00E-01	7.50E-02	2.49E-02
										Hazard Index =	3.18E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 15 kg	350 days / 365 days	6 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	9.59E-01	4.29E-01	80%	3.52E-05	--	--	--
Trichloroethene	3.00E-03	7280	0.23	2.6	15	9.59E-01	4.29E-01	80%	3.58E-04	1.10E-02	1.38E-02	4.93E-06
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	9.59E-01	4.29E-01	80%	5.76E-04	5.20E-02	6.50E-02	3.75E-05
Aluminum	8.18E+01	7280	0.001	2.6	15	9.59E-01	4.29E-01	20%	4.25E-02	--	--	--
Arsenic	1.09E-02	7280	0.001	2.6	15	9.59E-01	4.29E-01	95%	5.63E-06	1.50E+00	1.58E+00	8.89E-06
Barium	4.74E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	100%	2.46E-04	--	--	--
Beryllium	2.13E-03	7280	0.001	2.6	15	9.59E-01	4.29E-01	1%	1.11E-06	4.30E+00	4.30E+02	4.75E-04
Cadmium	4.59E-03	7280	0.001	2.6	15	9.59E-01	4.29E-01	5%	2.38E-06	--	--	--
Chromium	1.24E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	20%	6.46E-05	--	--	--
Cobalt	2.68E-02	7280	0.001	2.6	15	9.59E-01	4.29E-01	20%	1.39E-05	--	--	--
Copper	3.05E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	60%	1.58E-04	--	--	--
Iron	9.48E+01	7280	0.001	2.6	15	9.59E-01	4.29E-01	20%	4.92E-02	--	--	--
Lead	3.12E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	20%	1.62E-04	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	5%	5.10E-04	--	--	--
Mercury	3.10E-04	7280	0.001	2.6	15	9.59E-01	4.29E-01	15%	1.61E-07	--	--	--
Nickel	1.10E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	4.3%	5.73E-05	--	--	--
Vanadium	1.62E-01	7280	0.001	2.6	15	9.59E-01	4.29E-01	2.6%	8.41E-05	--	--	--
Zinc	3.80E+00	7280	0.0006	2.6	15	9.59E-01	4.29E-01	25%	1.18E-03	--	--	--
											Total Risk =	5.27E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 15 kg	350 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	7280	0.01	2.6	15	9.59E-01	80%	8.20E-05	9.00E-03	7.20E-03	1.14E-02
Trichloroethene	3.00E-03	7280	0.23	2.6	15	9.59E-01	80%	8.35E-04	6.00E-03	4.80E-03	1.74E-01
Tetrachloroethene	3.00E-03	7280	0.37	2.6	15	9.59E-01	80%	1.34E-03	1.00E-02	8.00E-03	1.68E-01
Aluminum	8.18E+01	7280	0.001	2.6	15	9.59E-01	20%	9.90E-02	1.00E+00	2.00E-01	4.95E-01
Arsenic	1.09E-02	7280	0.001	2.6	15	9.59E-01	95%	1.31E-05	3.00E-04	2.85E-04	4.61E-02
Barium	4.74E-01	7280	0.001	2.6	15	9.59E-01	100%	5.74E-04	7.00E-02	7.00E-02	8.20E-03
Beryllium	2.13E-03	7280	0.001	2.6	15	9.59E-01	1%	2.58E-06	5.00E-03	5.00E-05	5.16E-02
Cadmium	4.59E-03	7280	0.001	2.6	15	9.59E-01	5%	5.55E-06	5.00E-04	2.50E-05	2.22E-01
Chromium	1.24E-01	7280	0.001	2.6	15	9.59E-01	20%	1.51E-04	5.00E-03	1.00E-03	1.51E-01
Cobalt	2.68E-02	7280	0.001	2.6	15	9.59E-01	20%	3.25E-05	6.00E-02	1.20E-02	2.71E-03
Copper	3.05E-01	7280	0.001	2.6	15	9.59E-01	60%	3.69E-04	4.00E-02	2.40E-02	1.54E-02
Iron	9.48E+01	7280	0.001	2.6	15	9.59E-01	20%	1.15E-01	3.00E-01	6.00E-02	1.91E+00
Lead	3.12E-01	7280	0.001	2.6	15	9.59E-01	20%	3.78E-04	--	--	--
Manganese	9.83E-01	7280	0.001	2.6	15	9.59E-01	5%	1.19E-03	1.40E-01	7.00E-03	1.70E-01
Mercury	3.10E-04	7280	0.001	2.6	15	9.59E-01	15%	3.75E-07	3.00E-04	4.50E-05	8.34E-03
Nickel	1.10E-01	7280	0.001	2.6	15	9.59E-01	4.3%	1.33E-04	2.00E-02	8.60E-04	1.55E-01
Vanadium	1.62E-01	7280	0.001	2.6	15	9.59E-01	2.6%	1.96E-04	7.00E-03	1.82E-04	1.08E+00
Zinc	3.80E+00	7280	0.0006	2.6	15	9.59E-01	25%	2.76E-03	3.00E-01	7.50E-02	3.68E-02
										Hazard Index =	4.70E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3					
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3					
Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	6.85E-01	3.57E-01	80%	1.42E-05	--	--	--
Trichloroethene	3.00E-03	23000	0.23	2.6	70	6.85E-01	3.57E-01	80%	1.44E-04	1.10E-02	1.38E-02	1.98E-06
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	6.85E-01	3.57E-01	80%	2.32E-04	5.20E-02	6.50E-02	1.51E-05
Aluminum	8.18E+01	23000	0.001	2.6	70	6.85E-01	3.57E-01	20%	1.71E-02	--	--	--
Arsenic	1.09E-02	23000	0.001	2.6	70	6.85E-01	3.57E-01	95%	2.27E-06	1.50E+00	1.58E+00	3.58E-06
Barium	4.74E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	100%	9.91E-05	--	--	--
Beryllium	2.13E-03	23000	0.001	2.6	70	6.85E-01	3.57E-01	1%	4.45E-07	4.30E+00	4.30E+02	1.91E-04
Cadmium	4.59E-03	23000	0.001	2.6	70	6.85E-01	3.57E-01	5%	9.59E-07	--	--	--
Chromium	1.24E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	20%	2.60E-05	--	--	--
Cobalt	2.68E-02	23000	0.001	2.6	70	6.85E-01	3.57E-01	20%	5.61E-06	--	--	--
Copper	3.05E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	60%	6.37E-05	--	--	--
Iron	9.48E+01	23000	0.001	2.6	70	6.85E-01	3.57E-01	20%	1.98E-02	--	--	--
Lead	3.12E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	20%	6.52E-05	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	5%	2.05E-04	--	--	--
Mercury	3.10E-04	23000	0.001	2.6	70	6.85E-01	3.57E-01	15%	6.48E-08	--	--	--
Nickel	1.10E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	4.3%	2.30E-05	--	--	--
Vanadium	1.62E-01	23000	0.001	2.6	70	6.85E-01	3.57E-01	2.6%	3.38E-05	--	--	--
Zinc	3.80E+00	23000	0.0006	2.6	70	6.85E-01	3.57E-01	25%	4.76E-04	--	--	--
											Total Risk =	2.12E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	6.85E-01	80%	3.97E-05	9.00E-03	7.20E-03	5.51E-03
Trichloroethene	3.00E-03	23000	0.23	2.6	70	6.85E-01	80%	4.04E-04	6.00E-03	4.80E-03	8.41E-02
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	6.85E-01	80%	6.50E-04	1.00E-02	8.00E-03	8.12E-02
Aluminum	8.18E+01	23000	0.001	2.6	70	6.85E-01	20%	4.79E-02	1.00E+00	2.00E-01	2.39E-01
Arsenic	1.09E-02	23000	0.001	2.6	70	6.85E-01	95%	6.35E-06	3.00E-04	2.85E-04	2.23E-02
Barium	4.74E-01	23000	0.001	2.6	70	6.85E-01	100%	2.78E-04	7.00E-02	7.00E-02	3.96E-03
Beryllium	2.13E-03	23000	0.001	2.6	70	6.85E-01	1%	1.25E-06	5.00E-03	5.00E-05	2.49E-02
Cadmium	4.59E-03	23000	0.001	2.6	70	6.85E-01	5%	2.69E-06	5.00E-04	2.50E-05	1.07E-01
Chromium	1.24E-01	23000	0.001	2.6	70	6.85E-01	20%	7.28E-05	5.00E-03	1.00E-03	7.28E-02
Cobalt	2.68E-02	23000	0.001	2.6	70	6.85E-01	20%	1.57E-05	6.00E-02	1.20E-02	1.31E-03
Copper	3.05E-01	23000	0.001	2.6	70	6.85E-01	60%	1.78E-04	4.00E-02	2.40E-02	7.44E-03
Iron	9.48E+01	23000	0.001	2.6	70	6.85E-01	20%	5.55E-02	3.00E-01	6.00E-02	9.25E-01
Lead	3.12E-01	23000	0.001	2.6	70	6.85E-01	20%	1.83E-04	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	6.85E-01	5%	5.75E-04	1.40E-01	7.00E-03	8.22E-02
Mercury	3.10E-04	23000	0.001	2.6	70	6.85E-01	15%	1.81E-07	3.00E-04	4.50E-05	4.03E-03
Nickel	1.10E-01	23000	0.001	2.6	70	6.85E-01	4.3%	6.45E-05	2.00E-02	8.60E-04	7.51E-02
Vanadium	1.62E-01	23000	0.001	2.6	70	6.85E-01	2.6%	9.48E-05	7.00E-03	1.82E-04	5.21E-01
Zinc	3.80E+00	23000	0.0006	2.6	70	6.85E-01	25%	1.33E-03	3.00E-01	7.50E-02	1.78E-02
										Hazard Index =	2.27E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 70 kg	X	28 days / 365 days	X	30 yrs / 70 yrs

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	70	7.67E-02	4.29E-01	6.37E-06	--	--
Trichloroethene	3.00E-03	2.0	70	7.67E-02	4.29E-01	2.82E-06	1.10E-02	3.10E-08
Tetrachloroethene	3.00E-03	2.0	70	7.67E-02	4.29E-01	2.82E-06	5.20E-02	1.47E-07
Aluminum	8.18E+01	2.0	70	7.67E-02	4.29E-01	7.68E-02	--	--
Arsenic	1.09E-02	2.0	70	7.67E-02	4.29E-01	1.02E-05	1.50E+00	1.53E-05
Barium	4.74E-01	2.0	70	7.67E-02	4.29E-01	4.45E-04	--	--
Beryllium	2.13E-03	2.0	70	7.67E-02	4.29E-01	2.00E-06	4.30E+00	8.60E-06
Cadmium	4.59E-03	2.0	70	7.67E-02	4.29E-01	4.31E-06	--	--
Chromium	1.24E-01	2.0	70	7.67E-02	4.29E-01	1.17E-04	--	--
Cobalt	2.68E-02	2.0	70	7.67E-02	4.29E-01	2.52E-05	--	--
Copper	3.05E-01	2.0	70	7.67E-02	4.29E-01	2.86E-04	--	--
Iron	9.48E+01	2.0	70	7.67E-02	4.29E-01	8.90E-02	--	--
Lead	3.12E-01	2.0	70	7.67E-02	4.29E-01	2.93E-04	--	--
Manganese	9.83E-01	2.0	70	7.67E-02	4.29E-01	9.23E-04	--	--
Mercury	3.10E-04	2.0	70	7.67E-02	4.29E-01	2.91E-07	--	--
Nickel	1.10E-01	2.0	70	7.67E-02	4.29E-01	1.04E-04	--	--
Vanadium	1.62E-01	2.0	70	7.67E-02	4.29E-01	1.52E-04	--	--
Zinc	3.80E+00	2.0	70	7.67E-02	4.29E-01	3.57E-03	--	--
							Total Risk =	2.41E-05

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{28\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	70	7.67E-02	1.49E-05	9.00E-03	1.65E-03
Trichloroethene	3.00E-03	2.0	70	7.67E-02	6.58E-06	6.00E-03	1.10E-03
Tetrachloroethene	3.00E-03	2.0	70	7.67E-02	6.58E-06	1.00E-02	6.58E-04
Aluminum	8.18E+01	2.0	70	7.67E-02	1.79E-01	1.00E+00	1.79E-01
Arsenic	1.09E-02	2.0	70	7.67E-02	2.38E-05	3.00E-04	7.93E-02
Barium	4.74E-01	2.0	70	7.67E-02	1.04E-03	7.00E-02	1.48E-02
Beryllium	2.13E-03	2.0	70	7.67E-02	4.67E-06	5.00E-03	9.34E-04
Cadmium	4.59E-03	2.0	70	7.67E-02	1.01E-05	5.00E-04	2.01E-02
Chromium	1.24E-01	2.0	70	7.67E-02	2.73E-04	5.00E-03	5.45E-02
Cobalt	2.68E-02	2.0	70	7.67E-02	5.88E-05	6.00E-02	9.80E-04
Copper	3.05E-01	2.0	70	7.67E-02	6.68E-04	4.00E-02	1.67E-02
Iron	9.48E+01	2.0	70	7.67E-02	2.08E-01	3.00E-01	6.93E-01
Lead	3.12E-01	2.0	70	7.67E-02	6.84E-04	--	--
Manganese	9.83E-01	2.0	70	7.67E-02	2.15E-03	1.40E-01	1.54E-02
Mercury	3.10E-04	2.0	70	7.67E-02	6.79E-07	3.00E-04	2.26E-03
Nickel	1.10E-01	2.0	70	7.67E-02	2.42E-04	2.00E-02	1.21E-02
Vanadium	1.62E-01	2.0	70	7.67E-02	3.55E-04	7.00E-03	5.07E-02
Zinc	3.80E+00	2.0	70	7.67E-02	8.33E-03	3.00E-01	2.78E-02
						Hazard Index =	1.17E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	15	3.84E-02	8.57E-02	2.97E-06	--	--
Trichloroethene	3.00E-03	2.0	15	3.84E-02	8.57E-02	1.32E-06	1.10E-02	1.45E-08
Tetrachloroethene	3.00E-03	2.0	15	3.84E-02	8.57E-02	1.32E-06	5.20E-02	6.84E-08
Aluminum	8.18E+01	2.0	15	3.84E-02	8.57E-02	3.59E-02	--	--
Arsenic	1.09E-02	2.0	15	3.84E-02	8.57E-02	4.76E-06	1.50E+00	7.13E-06
Barium	4.74E-01	2.0	15	3.84E-02	8.57E-02	2.08E-04	--	--
Beryllium	2.13E-03	2.0	15	3.84E-02	8.57E-02	9.34E-07	4.30E+00	4.01E-06
Cadmium	4.59E-03	2.0	15	3.84E-02	8.57E-02	2.01E-06	--	--
Chromium	1.24E-01	2.0	15	3.84E-02	8.57E-02	5.45E-05	--	--
Cobalt	2.68E-02	2.0	15	3.84E-02	8.57E-02	1.18E-05	--	--
Copper	3.05E-01	2.0	15	3.84E-02	8.57E-02	1.34E-04	--	--
Iron	9.48E+01	2.0	15	3.84E-02	8.57E-02	4.16E-02	--	--
Lead	3.12E-01	2.0	15	3.84E-02	8.57E-02	1.37E-04	--	--
Manganese	9.83E-01	2.0	15	3.84E-02	8.57E-02	4.31E-04	--	--
Mercury	3.10E-04	2.0	15	3.84E-02	8.57E-02	1.36E-07	--	--
Nickel	1.10E-01	2.0	15	3.84E-02	8.57E-02	4.84E-05	--	--
Vanadium	1.62E-01	2.0	15	3.84E-02	8.57E-02	7.10E-05	--	--
Zinc	3.80E+00	2.0	15	3.84E-02	8.57E-02	1.67E-03	--	--
							Total Risk =	1.12E-05

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - RECREATIONAL CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{15\ \text{kg}} \times \frac{14\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	15	3.84E-02	3.47E-05	9.00E-03	3.85E-03
Trichloroethene	3.00E-03	2.0	15	3.84E-02	1.53E-05	6.00E-03	2.56E-03
Tetrachloroethene	3.00E-03	2.0	15	3.84E-02	1.53E-05	1.00E-02	1.53E-03
Aluminum	8.18E+01	2.0	15	3.84E-02	4.18E-01	1.00E+00	4.18E-01
Arsenic	1.09E-02	2.0	15	3.84E-02	5.55E-05	3.00E-04	1.85E-01
Barium	4.74E-01	2.0	15	3.84E-02	2.43E-03	7.00E-02	3.46E-02
Beryllium	2.13E-03	2.0	15	3.84E-02	1.09E-05	5.00E-03	2.18E-03
Cadmium	4.59E-03	2.0	15	3.84E-02	2.35E-05	5.00E-04	4.69E-02
Chromium	1.24E-01	2.0	15	3.84E-02	6.36E-04	5.00E-03	1.27E-01
Cobalt	2.68E-02	2.0	15	3.84E-02	1.37E-04	6.00E-02	2.29E-03
Copper	3.05E-01	2.0	15	3.84E-02	1.56E-03	4.00E-02	3.90E-02
Iron	9.48E+01	2.0	15	3.84E-02	4.85E-01	3.00E-01	1.62E+00
Lead	3.12E-01	2.0	15	3.84E-02	1.60E-03	--	--
Manganese	9.83E-01	2.0	15	3.84E-02	5.03E-03	1.40E-01	3.59E-02
Mercury	3.10E-04	2.0	15	3.84E-02	1.59E-06	3.00E-04	5.28E-03
Nickel	1.10E-01	2.0	15	3.84E-02	5.64E-04	2.00E-02	2.82E-02
Vanadium	1.62E-01	2.0	15	3.84E-02	8.28E-04	7.00E-03	1.18E-01
Zinc	3.80E+00	2.0	15	3.84E-02	1.94E-02	3.00E-01	6.48E-02
						Hazard Index =	2.73E+00

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 70 kg	X	350 days / 365 days	X	30 yrs / 70 yrs	

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	70	9.59E-01	4.29E-01	7.96E-05	--	--
Trichloroethene	3.00E-03	2.0	70	9.59E-01	4.29E-01	3.52E-05	1.10E-02	3.87E-07
Tetrachloroethene	3.00E-03	2.0	70	9.59E-01	4.29E-01	3.52E-05	5.20E-02	1.83E-06
Aluminum	8.18E+01	2.0	70	9.59E-01	4.29E-01	9.60E-01	--	--
Arsenic	1.09E-02	2.0	70	9.59E-01	4.29E-01	1.27E-04	1.50E+00	1.91E-04
Barium	4.74E-01	2.0	70	9.59E-01	4.29E-01	5.57E-03	--	--
Beryllium	2.13E-03	2.0	70	9.59E-01	4.29E-01	2.50E-05	4.30E+00	1.08E-04
Cadmium	4.59E-03	2.0	70	9.59E-01	4.29E-01	5.39E-05	--	--
Chromium	1.24E-01	2.0	70	9.59E-01	4.29E-01	1.46E-03	--	--
Cobalt	2.68E-02	2.0	70	9.59E-01	4.29E-01	3.15E-04	--	--
Copper	3.05E-01	2.0	70	9.59E-01	4.29E-01	3.58E-03	--	--
Iron	9.48E+01	2.0	70	9.59E-01	4.29E-01	1.11E+00	--	--
Lead	3.12E-01	2.0	70	9.59E-01	4.29E-01	3.66E-03	--	--
Manganese	9.83E-01	2.0	70	9.59E-01	4.29E-01	1.15E-02	--	--
Mercury	3.10E-04	2.0	70	9.59E-01	4.29E-01	3.64E-06	--	--
Nickel	1.10E-01	2.0	70	9.59E-01	4.29E-01	1.30E-03	--	--
Vanadium	1.62E-01	2.0	70	9.59E-01	4.29E-01	1.90E-03	--	--
Zinc	3.80E+00	2.0	70	9.59E-01	4.29E-01	4.46E-02	--	--
							Total Risk =	3.01E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{350\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	70	9.59E-01	1.86E-04	9.00E-03	2.06E-02
Trichloroethene	3.00E-03	2.0	70	9.59E-01	8.22E-05	6.00E-03	1.37E-02
Tetrachloroethene	3.00E-03	2.0	70	9.59E-01	8.22E-05	1.00E-02	8.22E-03
Aluminum	8.18E+01	2.0	70	9.59E-01	2.24E+00	1.00E+00	2.24E+00
Arsenic	1.09E-02	2.0	70	9.59E-01	2.97E-04	3.00E-04	9.91E-01
Barium	4.74E-01	2.0	70	9.59E-01	1.30E-02	7.00E-02	1.86E-01
Beryllium	2.13E-03	2.0	70	9.59E-01	5.84E-05	5.00E-03	1.17E-02
Cadmium	4.59E-03	2.0	70	9.59E-01	1.26E-04	5.00E-04	2.52E-01
Chromium	1.24E-01	2.0	70	9.59E-01	3.41E-03	5.00E-03	6.82E-01
Cobalt	2.68E-02	2.0	70	9.59E-01	7.35E-04	6.00E-02	1.23E-02
Copper	3.05E-01	2.0	70	9.59E-01	8.36E-03	4.00E-02	2.09E-01
Iron	9.48E+01	2.0	70	9.59E-01	2.60E+00	3.00E-01	8.66E+00
Lead	3.12E-01	2.0	70	9.59E-01	8.55E-03	--	--
Manganese	9.83E-01	2.0	70	9.59E-01	2.69E-02	1.40E-01	1.92E-01
Mercury	3.10E-04	2.0	70	9.59E-01	8.49E-06	3.00E-04	2.83E-02
Nickel	1.10E-01	2.0	70	9.59E-01	3.02E-03	2.00E-02	1.51E-01
Vanadium	1.62E-01	2.0	70	9.59E-01	4.44E-03	7.00E-03	6.34E-01
Zinc	3.80E+00	2.0	70	9.59E-01	1.04E-01	3.00E-01	3.47E-01
						Hazard Index =	1.46E+01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime
Chronic Daily Intake = (mg/kg-day)	mg/L	X	2.0 L/day	X	1 / 15 kg	X	350 days / 365 days	X	6 yrs / 70 yrs

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	15	9.59E-01	8.57E-02	7.43E-05	--	--
Trichloroethene	3.00E-03	2.0	15	9.59E-01	8.57E-02	3.29E-05	1.10E-02	3.62E-07
Tetrachloroethene	3.00E-03	2.0	15	9.59E-01	8.57E-02	3.29E-05	5.20E-02	1.71E-06
Aluminum	8.18E+01	2.0	15	9.59E-01	8.57E-02	8.96E-01	--	--
Arsenic	1.09E-02	2.0	15	9.59E-01	8.57E-02	1.19E-04	1.50E+00	1.78E-04
Barium	4.74E-01	2.0	15	9.59E-01	8.57E-02	5.20E-03	--	--
Beryllium	2.13E-03	2.0	15	9.59E-01	8.57E-02	2.33E-05	4.30E+00	1.00E-04
Cadmium	4.59E-03	2.0	15	9.59E-01	8.57E-02	5.03E-05	--	--
Chromium	1.24E-01	2.0	15	9.59E-01	8.57E-02	1.36E-03	--	--
Cobalt	2.68E-02	2.0	15	9.59E-01	8.57E-02	2.94E-04	--	--
Copper	3.05E-01	2.0	15	9.59E-01	8.57E-02	3.34E-03	--	--
Iron	9.48E+01	2.0	15	9.59E-01	8.57E-02	1.04E+00	--	--
Lead	3.12E-01	2.0	15	9.59E-01	8.57E-02	3.42E-03	--	--
Manganese	9.83E-01	2.0	15	9.59E-01	8.57E-02	1.08E-02	--	--
Mercury	3.10E-04	2.0	15	9.59E-01	8.57E-02	3.40E-06	--	--
Nickel	1.10E-01	2.0	15	9.59E-01	8.57E-02	1.21E-03	--	--
Vanadium	1.62E-01	2.0	15	9.59E-01	8.57E-02	1.78E-03	--	--
Zinc	3.80E+00	2.0	15	9.59E-01	8.57E-02	4.16E-02	--	--
							Total Risk =	2.81E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{15\ \text{kg}} \times \frac{350\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	15	9.59E-01	8.67E-04	9.00E-03	9.63E-02
Trichloroethene	3.00E-03	2.0	15	9.59E-01	3.84E-04	6.00E-03	6.39E-02
Tetrachloroethene	3.00E-03	2.0	15	9.59E-01	3.84E-04	1.00E-02	3.84E-02
Aluminum	8.18E+01	2.0	15	9.59E-01	1.05E+01	1.00E+00	1.05E+01
Arsenic	1.09E-02	2.0	15	9.59E-01	1.39E-03	3.00E-04	4.62E+00
Barium	4.74E-01	2.0	15	9.59E-01	6.06E-02	7.00E-02	8.66E-01
Beryllium	2.13E-03	2.0	15	9.59E-01	2.72E-04	5.00E-03	5.45E-02
Cadmium	4.59E-03	2.0	15	9.59E-01	5.87E-04	5.00E-04	1.17E+00
Chromium	1.24E-01	2.0	15	9.59E-01	1.59E-02	5.00E-03	3.18E+00
Cobalt	2.68E-02	2.0	15	9.59E-01	3.43E-03	6.00E-02	5.72E-02
Copper	3.05E-01	2.0	15	9.59E-01	3.90E-02	4.00E-02	9.75E-01
Iron	9.48E+01	2.0	15	9.59E-01	1.21E+01	3.00E-01	4.04E+01
Lead	3.12E-01	2.0	15	9.59E-01	3.99E-02	--	--
Manganese	9.83E-01	2.0	15	9.59E-01	1.26E-01	1.40E-01	8.98E-01
Mercury	3.10E-04	2.0	15	9.59E-01	3.96E-05	3.00E-04	1.32E-01
Nickel	1.10E-01	2.0	15	9.59E-01	1.41E-02	2.00E-02	7.05E-01
Vanadium	1.62E-01	2.0	15	9.59E-01	2.07E-02	7.00E-03	2.96E+00
Zinc	3.80E+00	2.0	15	9.59E-01	4.86E-01	3.00E-01	1.62E+00
						Hazard Index =	6.83E+01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{250\ \text{days}}{365\ \text{days}} \times \frac{25\ \text{yrs}}{70\ \text{yrs}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
1,2-Dichloroethene	6.78E-03	2.0	70	6.85E-01	3.57E-01	4.74E-05	--	--
Trichloroethene	3.00E-03	2.0	70	6.85E-01	3.57E-01	2.10E-05	1.10E-02	2.31E-07
Tetrachloroethene	3.00E-03	2.0	70	6.85E-01	3.57E-01	2.10E-05	5.20E-02	1.09E-06
Aluminum	8.18E+01	2.0	70	6.85E-01	3.57E-01	5.72E-01	--	--
Arsenic	1.09E-02	2.0	70	6.85E-01	3.57E-01	7.58E-05	1.50E+00	1.14E-04
Barium	4.74E-01	2.0	70	6.85E-01	3.57E-01	3.31E-03	--	--
Beryllium	2.13E-03	2.0	70	6.85E-01	3.57E-01	1.49E-05	4.30E+00	6.40E-05
Cadmium	4.59E-03	2.0	70	6.85E-01	3.57E-01	3.21E-05	--	--
Chromium	1.24E-01	2.0	70	6.85E-01	3.57E-01	8.69E-04	--	--
Cobalt	2.68E-02	2.0	70	6.85E-01	3.57E-01	1.88E-04	--	--
Copper	3.05E-01	2.0	70	6.85E-01	3.57E-01	2.13E-03	--	--
Iron	9.48E+01	2.0	70	6.85E-01	3.57E-01	6.63E-01	--	--
Lead	3.12E-01	2.0	70	6.85E-01	3.57E-01	2.18E-03	--	--
Manganese	9.83E-01	2.0	70	6.85E-01	3.57E-01	6.87E-03	--	--
Mercury	3.10E-04	2.0	70	6.85E-01	3.57E-01	2.17E-06	--	--
Nickel	1.10E-01	2.0	70	6.85E-01	3.57E-01	7.71E-04	--	--
Vanadium	1.62E-01	2.0	70	6.85E-01	3.57E-01	1.13E-03	--	--
Zinc	3.80E+00	2.0	70	6.85E-01	3.57E-01	2.66E-02	--	--
							Total Risk =	1.79E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{250\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
1,2-Dichloroethene	6.78E-03	2.0	70	6.85E-01	1.33E-04	9.00E-03	1.47E-02
Trichloroethene	3.00E-03	2.0	70	6.85E-01	5.87E-05	6.00E-03	9.78E-03
Tetrachloroethene	3.00E-03	2.0	70	6.85E-01	5.87E-05	1.00E-02	5.87E-03
Aluminum	8.18E+01	2.0	70	6.85E-01	1.60E+00	1.00E+00	1.60E+00
Arsenic	1.09E-02	2.0	70	6.85E-01	2.12E-04	3.00E-04	7.08E-01
Barium	4.74E-01	2.0	70	6.85E-01	9.28E-03	7.00E-02	1.33E-01
Beryllium	2.13E-03	2.0	70	6.85E-01	4.17E-05	5.00E-03	8.34E-03
Cadmium	4.59E-03	2.0	70	6.85E-01	8.98E-05	5.00E-04	1.80E-01
Chromium	1.24E-01	2.0	70	6.85E-01	2.43E-03	5.00E-03	4.87E-01
Cobalt	2.68E-02	2.0	70	6.85E-01	5.25E-04	6.00E-02	8.75E-03
Copper	3.05E-01	2.0	70	6.85E-01	5.97E-03	4.00E-02	1.49E-01
Iron	9.48E+01	2.0	70	6.85E-01	1.86E+00	3.00E-01	6.18E+00
Lead	3.12E-01	2.0	70	6.85E-01	6.11E-03	--	--
Manganese	9.83E-01	2.0	70	6.85E-01	1.92E-02	1.40E-01	1.37E-01
Mercury	3.10E-04	2.0	70	6.85E-01	6.07E-06	3.00E-04	2.02E-02
Nickel	1.10E-01	2.0	70	6.85E-01	2.16E-03	2.00E-02	1.08E-01
Vanadium	1.62E-01	2.0	70	6.85E-01	3.17E-03	7.00E-03	4.53E-01
Zinc	3.80E+00	2.0	70	6.85E-01	7.44E-02	3.00E-01	2.48E-01
						Hazard Index =	1.05E+01

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3				
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3				

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	9.59E-01	4.29E-01	80%	2.38E-05	--	--	--
Trichloroethene	3.00E-03	23000	0.23	2.6	70	9.59E-01	4.29E-01	80%	2.42E-04	1.10E-02	1.38E-02	3.33E-06
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	9.59E-01	4.29E-01	80%	3.90E-04	5.20E-02	6.50E-02	2.53E-05
Aluminum	8.18E+01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	2.87E-02	--	--	--
Arsenic	1.09E-02	23000	0.001	2.6	70	9.59E-01	4.29E-01	95%	3.81E-06	1.50E+00	1.58E+00	6.02E-06
Barium	4.74E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	100%	1.67E-04	--	--	--
Beryllium	2.13E-03	23000	0.001	2.6	70	9.59E-01	4.29E-01	1%	7.48E-07	4.30E+00	4.30E+02	3.22E-04
Cadmium	4.59E-03	23000	0.001	2.6	70	9.59E-01	4.29E-01	5%	1.61E-06	--	--	--
Chromium	1.24E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	4.37E-05	--	--	--
Cobalt	2.68E-02	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	9.42E-06	--	--	--
Copper	3.05E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	60%	1.07E-04	--	--	--
Iron	9.48E+01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	3.33E-02	--	--	--
Lead	3.12E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	20%	1.10E-04	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	5%	3.45E-04	--	--	--
Mercury	3.10E-04	23000	0.001	2.6	70	9.59E-01	4.29E-01	15%	1.09E-07	--	--	--
Nickel	1.10E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	4.3%	3.87E-05	--	--	--
Vanadium	1.62E-01	23000	0.001	2.6	70	9.59E-01	4.29E-01	2.6%	5.69E-05	--	--	--
Zinc	3.80E+00	23000	0.0006	2.6	70	9.59E-01	4.29E-01	25%	8.01E-04	--	--	--
											Total Risk =	3.56E-04

TABLE
SURFACE WATER EXPOSURE PATHWAY RISK - SITE 12
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	X Permeability Constant	X Exposure Time	X 1 / Body Wt	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	X cm/hr	X 2.6 hr/day	X 1 / 70 kg	28 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted RfD
1,2-Dichloroethene	6.78E-03	23000	0.01	2.6	70	9.59E-01	80%	5.55E-05	9.00E-03	7.20E-03	7.71E-03
Trichloroethene	3.00E-03	23000	0.23	2.6	70	9.59E-01	80%	5.65E-04	6.00E-03	4.80E-03	1.18E-01
Tetrachloroethene	3.00E-03	23000	0.37	2.6	70	9.59E-01	80%	9.09E-04	1.00E-02	8.00E-03	1.14E-01
Aluminum	8.18E+01	23000	0.001	2.6	70	9.59E-01	20%	6.70E-02	1.00E+00	2.00E-01	3.35E-01
Arsenic	1.09E-02	23000	0.001	2.6	70	9.59E-01	95%	8.89E-06	3.00E-04	2.85E-04	3.12E-02
Barium	4.74E-01	23000	0.001	2.6	70	9.59E-01	100%	3.89E-04	7.00E-02	7.00E-02	5.55E-03
Beryllium	2.13E-03	23000	0.001	2.6	70	9.59E-01	1%	1.75E-06	5.00E-03	5.00E-05	3.49E-02
Cadmium	4.59E-03	23000	0.001	2.6	70	9.59E-01	5%	3.76E-06	5.00E-04	2.50E-05	1.50E-01
Chromium	1.24E-01	23000	0.001	2.6	70	9.59E-01	20%	1.02E-04	5.00E-03	1.00E-03	1.02E-01
Cobalt	2.68E-02	23000	0.001	2.6	70	9.59E-01	20%	2.20E-05	6.00E-02	1.20E-02	1.83E-03
Copper	3.05E-01	23000	0.001	2.6	70	9.59E-01	60%	2.50E-04	4.00E-02	2.40E-02	1.04E-02
Iron	9.48E+01	23000	0.001	2.6	70	9.59E-01	20%	7.77E-02	3.00E-01	6.00E-02	1.29E+00
Lead	3.12E-01	23000	0.001	2.6	70	9.59E-01	20%	2.56E-04	--	--	--
Manganese	9.83E-01	23000	0.001	2.6	70	9.59E-01	5%	8.05E-04	1.40E-01	7.00E-03	1.15E-01
Mercury	3.10E-04	23000	0.001	2.6	70	9.59E-01	15%	2.54E-07	3.00E-04	4.50E-05	5.64E-03
Nickel	1.10E-01	23000	0.001	2.6	70	9.59E-01	4.3%	9.04E-05	2.00E-02	8.60E-04	1.05E-01
Vanadium	1.62E-01	23000	0.001	2.6	70	9.59E-01	2.6%	1.33E-04	7.00E-03	1.82E-04	7.29E-01
Zinc	3.80E+00	23000	0.0006	2.6	70	9.59E-01	25%	1.87E-03	3.00E-01	7.50E-02	2.49E-02
										Hazard Index =	3.18E+00

CONSTITUENTS DETECTED IN SUBSURFACE SOIL SAMPLES
SITE 13
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detection (ug/l)	Residential Soil Concentration (ug/kg)[a]	Threat to Groundwater (ug/kg)[a]	Potential Concern
VOLATILES					
Acetone	2/19	29j - 130j	7.8E+05	8,000	No
Ethylbenzene	1/19	17j	7.8E+05		No
Xylene	2/19	120-190	1.6E+07	7.4E+04	No
1,1,1-Trichloroethane	3/19	9-21	7.0E+06	900	No
Benzene	2/19	3j - 5j	22,000	20	No
Toluene	6/19	1j - 4j	16,000	500	No
SEMI-VOLATILES					
Naphthalene	1/19	85	3,100	30	Yes
2-methylnaphthalene	3/19	120 - 6,300			No
Pentachlorophenol	3/19	30,000 - 890,000	5,300	7,900	Yes
bis(2)ethylhexylphthalate	9/19	45j - 570	46,000	11,000	No
di-n-butylphthalate	4/19	42-58			No
PESTICIDES					
4-4 DDE	1/3	2.4j	1900	500	No
4-4 DDD	1/3	1.5	2700	700	No
INORGANICS					
Aluminum	3/3	13,300 - 18,400	7.8E+07		No
Antimony	1/3	3,500j	31,000		Yes
Arsenic	3/3	2,600 - 4,000	23,000	15,000	Yes
Barium	3/3	45,000 - 52,700	5,500,000	32,000	Yes
Beryllium	3/3	310 - 330	150	180,000	Yes
Chromium	3/3	13,800 - 21,000	390,000	19,000	Yes
Cobalt	3/3	2,500 - 3,500	4.7E+06		No
Copper	3/3	3,400 - 5,400	3.1E+06		No
Lead	3/3	7,500 - 9,400			Yes*
Manganese	3/3	37,900 - 39,900	3.9E+05		Yes
Nickel	3/3	5,800 - 8,400	1.6E+06	21,000	No
Vanadium	3/3	19,400 - 28,600	5.5E+05		No
Zinc	3/3	12,200 - 36,900	2.3E+07	4.2E+07	No

Notes:

a. Residential and threat to groundwater soil concentration values obtained from October 20, 1995 USEPA Risk-Based Concentration Table except for aluminum which is obtained from January 11, 1995 RBC table.

* Health Risk Analysis to be performed will use the Integrated Exposure Uptake Biokinetic (IEUBK) model.

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	28 events/yr / 365 days/yr	30 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.12E-07	--	--	--
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	2.37E-07	--	--	--
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	3.54E-06	1.20E-01	2.40E-01	8.50E-07
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	84%	2.15E-06	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	2.72E-06	7.30E-01	1.46E+00	3.98E-06
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	3.54E-06	7.30E-01	1.46E+00	5.17E-06
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.74E-06	7.30E+00	1.46E+01	2.55E-05
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.09E-06	7.30E-01	1.46E+00	1.59E-06
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	9.81E-07	1.55E-01	3.10E-01	3.04E-07
											Total Risk =	3.73E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	28 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.61E-07	4.00E-02	2.00E-02	1.30E-05
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	5.53E-07	4.00E-03	2.00E-03	2.76E-04
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	8.26E-06	3.00E-02	1.50E-02	5.51E-04
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.0	70	7.67E-02	84%	5.02E-06	2.90E-02	2.44E-02	2.06E-04
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	6.36E-06	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	8.26E-06	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	4.07E-06	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.54E-06	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.29E-06	--	--	--
										Hazard Index =	1.05E-03

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.64E-08	--	--	--
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	3.47E-08	--	--	--
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	5.19E-07	1.20E-01	2.40E-01	1.24E-07
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	84%	3.15E-07	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	3.99E-07	7.30E-01	1.46E+00	5.82E-07
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	5.19E-07	7.30E-01	1.46E+00	7.57E-07
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	2.55E-07	7.30E+00	1.46E+01	3.73E-06
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.60E-07	7.30E-01	1.46E+00	2.33E-07
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.44E-07	1.55E-01	3.10E-01	4.45E-08
											Total Risk =	5.47E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1 0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.91E-07	4.00E-02	2.00E-02	9.54E-06
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	4.05E-07	4.00E-03	2 00E-03	2.02E-04
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	6.05E-06	3.00E-02	1.50E-02	4.03E-04
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.0	15	3.84E-02	84%	3.68E-06	2.90E-02	2.44E-02	1.51E-04
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	4.65E-06	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	6.05E-06	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	2.98E-06	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.86E-06	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.68E-06	--	--	--
										Hazard Index =	7.66E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	28 events/yr / 365 days/yr	30 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.12E-07	--	--	--
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	2.37E-07	--	--	--
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	3.54E-06	1.20E-01	2.40E-01	8.50E-07
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	84%	2.15E-06	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	2.72E-06	7.30E-01	1.46E+00	3.98E-06
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	3.54E-06	7.30E-01	1.46E+00	5.17E-06
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.74E-06	7.30E+00	1.46E+01	2.55E-05
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	1.09E-06	7.30E-01	1.46E+00	1.59E-06
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.00	70	7.67E-02	4.29E-01	50%	9.81E-07	1.55E-01	3.10E-01	3.04E-07
											Total Risk =	3.73E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	28 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.61E-07	4.00E-02	2.00E-02	1.30E-05
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	5.53E-07	4.00E-03	2.00E-03	2.76E-04
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	8.26E-06	3.00E-02	1.50E-02	5.51E-04
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.0	70	7.67E-02	84%	5.02E-06	2.90E-02	2.44E-02	2.06E-04
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	6.36E-06	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.0	70	7.67E-02	50%	8.26E-06	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	4.07E-06	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.54E-06	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.0	70	7.67E-02	50%	2.29E-06	--	--	--
										Hazard Index =	1.05E-03

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.64E-08	--	--	--
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	3.47E-08	--	--	--
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	5.19E-07	1.20E-01	2.40E-01	1.24E-07
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	84%	3.15E-07	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	3.99E-07	7.30E-01	1.46E+00	5.82E-07
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	5.19E-07	7.30E-01	1.46E+00	7.57E-07
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	2.55E-07	7.30E+00	1.46E+01	3.73E-06
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.60E-07	7.30E-01	1.46E+00	2.33E-07
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.00	15	3.84E-02	8.57E-02	50%	1.44E-07	1.55E-01	3.10E-01	4.45E-08
											Total Risk =	5.47E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	14 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.91E-07	4.00E-02	2.00E-02	9.54E-06
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	4.05E-07	4.00E-03	2.00E-03	2.02E-04
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	6.05E-06	3.00E-02	1.50E-02	4.03E-04
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.0	15	3.84E-02	84%	3.68E-06	2.90E-02	2.44E-02	1.51E-04
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	4.65E-06	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.0	15	3.84E-02	50%	6.05E-06	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	2.98E-06	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.86E-06	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.0	15	3.84E-02	50%	1.68E-06	--	--	--
										Hazard Index =	7.66E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	250 events/yr / 365 days/yr	25 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	8.31E-07	--	--	--
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	1.76E-06	--	--	--
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	2.63E-05	1.20E-01	2.40E-01	6.32E-06
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	84%	1.60E-05	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	2.03E-05	7.30E-01	1.46E+00	2.96E-05
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	2.63E-05	7.30E-01	1.46E+00	3.85E-05
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	1.30E-05	7.30E+00	1.46E+01	1.89E-04
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	8.11E-06	7.30E-01	1.46E+00	1.18E-05
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.00	70	6.85E-01	3.57E-01	50%	7.30E-06	1.55E-01	3.10E-01	2.26E-06
											Total Risk =	2.78E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	250 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.0	70	6.85E-01	50%	2.33E-06	4.00E-02	2.00E-02	1.16E-04
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.0	70	6.85E-01	50%	4.94E-06	4.00E-03	2.00E-03	2.47E-03
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.0	70	6.85E-01	50%	7.38E-05	3.00E-02	1.50E-02	4.92E-03
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.0	70	6.85E-01	84%	4.48E-05	2.90E-02	2.44E-02	1.84E-03
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.0	70	6.85E-01	50%	5.68E-05	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.0	70	6.85E-01	50%	7.38E-05	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.0	70	6.85E-01	50%	3.63E-05	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.0	70	6.85E-01	50%	2.27E-05	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.0	70	6.85E-01	50%	2.04E-05	--	--	--
										Hazard Index =	9.34E-03

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	33 mg/day	X	1.00	X	1 / 70 kg	X	28 days / 365 days	X	30 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	33	1.00	70	7.67E-02	4.29E-01	6.35E-09	--	--
Dibenzofuran	8.70E-01	33	1.00	70	7.67E-02	4.29E-01	1.35E-08	--	--
Pentachlorophenol	1.30E+01	33	1.00	70	7.67E-02	4.29E-01	2.01E-07	1.20E-01	2.42E-08
Phenanthrene	7.90E+00	33	1.00	70	7.67E-02	4.29E-01	1.22E-07	--	--
Benzo[a]anthracene	1.00E+01	33	1.00	70	7.67E-02	4.29E-01	1.55E-07	7.30E-01	1.13E-07
Benzo[b]fluoranthene	1.30E+01	33	1.00	70	7.67E-02	4.29E-01	2.01E-07	7.30E-01	1.47E-07
Benzo[a]pyrene	6.40E+00	33	1.00	70	7.67E-02	4.29E-01	9.92E-08	7.30E+00	7.24E-07
Indeno[1,2,3-cd]pyrene	4.00E+00	33	1.00	70	7.67E-02	4.29E-01	6.20E-08	7.30E-01	4.53E-08
Benzo[g,h,i]perlyene	3.60E+00	33	1.00	70	7.67E-02	4.29E-01	5.58E-08	1.55E-01	8.65E-09
								Total Risk =	1.06E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 33\text{ mg/day} \times 1.00 \times \frac{1}{70\text{ kg}} \times \frac{28\text{ days}}{365\text{ days}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	33	1.00	70	7.67E-02	1.48E-08	4.00E-02	3.71E-07
Dibenzofuran	8.70E-01	33	1.00	70	7.67E-02	3.15E-08	4.00E-03	7.87E-06
Pentachlorophenol	1.30E+01	33	1.00	70	7.67E-02	4.70E-07	3.00E-02	1.57E-05
Phenanthrene	7.90E+00	33	1.00	70	7.67E-02	2.86E-07	2.90E-02	9.85E-06
Benzo[a]anthracene	1.00E+01	33	1.00	70	7.67E-02	3.62E-07	--	--
Benzo[b]fluoranthene	1.30E+01	33	1.00	70	7.67E-02	4.70E-07	--	--
Benzo[a]pyrene	6.40E+00	33	1.00	70	7.67E-02	2.31E-07	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	33	1.00	70	7.67E-02	1.45E-07	--	--
Benzo[g,h,i]perlyene	3.60E+00	33	1.00	70	7.67E-02	1.30E-07	--	--
							Hazard Index =	3.38E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	67 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	67	1.00	15	3.84E-02	8.57E-02	6.02E-09	--	--
Dibenzofuran	8.70E-01	67	1.00	15	3.84E-02	8.57E-02	1.28E-08	--	--
Pentachlorophenol	1.30E+01	67	1.00	15	3.84E-02	8.57E-02	1.91E-07	1.20E-01	2.29E-08
Phenanthrene	7.90E+00	67	1.00	15	3.84E-02	8.57E-02	1.16E-07	--	--
Benzo[a]anthracene	1.00E+01	67	1.00	15	3.84E-02	8.57E-02	1.47E-07	7.30E-01	1.07E-07
Benzo[b]fluoranthene	1.30E+01	67	1.00	15	3.84E-02	8.57E-02	1.91E-07	7.30E-01	1.39E-07
Benzo[a]pyrene	6.40E+00	67	1.00	15	3.84E-02	8.57E-02	9.40E-08	7.30E+00	6.86E-07
Indeno[1,2,3-cd]pyrene	4.00E+00	67	1.00	15	3.84E-02	8.57E-02	5.87E-08	7.30E-01	4.29E-08
Benzo[g,h,i]perlyene	3.60E+00	67	1.00	15	3.84E-02	8.57E-02	5.29E-08	1.55E-01	8.19E-09
								Total Risk =	1.01E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - RECREATIONAL CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 67\text{ mg/day} \times 1.00 \times \frac{1}{15\text{ kg}} \times \frac{14\text{ days}}{365\text{ days}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	67	1.00	15	3.84E-02	7.02E-08	4.00E-02	1.76E-06
Dibenzofuran	8.70E-01	67	1.00	15	3.84E-02	1.49E-07	4.00E-03	3.73E-05
Pentachlorophenol	1.30E+01	67	1.00	15	3.84E-02	2.23E-06	3.00E-02	7.42E-05
Phenanthrene	7.90E+00	67	1.00	15	3.84E-02	1.35E-06	2.90E-02	4.67E-05
Benzo[a]anthracene	1.00E+01	67	1.00	15	3.84E-02	1.71E-06	--	--
Benzo[b]fluoranthene	1.30E+01	67	1.00	15	3.84E-02	2.23E-06	--	--
Benzo[a]pyrene	6.40E+00	67	1.00	15	3.84E-02	1.10E-06	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	67	1.00	15	3.84E-02	6.85E-07	--	--
Benzo[g,h,i]perlyene	3.60E+00	67	1.00	15	3.84E-02	6.17E-07	--	--
							Hazard Index =	1.60E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 100 mg/day X 1.00 X 1 / 70 kg X 28 days / 365 days X 30 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	100	1.00	70	7.67E-02	4.29E-01	1.93E-08	--	--
Dibenzofuran	8.70E-01	100	1.00	70	7.67E-02	4.29E-01	4.09E-08	--	--
Pentachlorophenol	1.30E+01	100	1.00	70	7.67E-02	4.29E-01	6.11E-07	1.20E-01	7.33E-08
Phenanthrene	7.90E+00	100	1.00	70	7.67E-02	4.29E-01	3.71E-07	--	--
Benzo[a]anthracene	1.00E+01	100	1.00	70	7.67E-02	4.29E-01	4.70E-07	7.30E-01	3.43E-07
Benzo[b]fluoranthene	1.30E+01	100	1.00	70	7.67E-02	4.29E-01	6.11E-07	7.30E-01	4.46E-07
Benzo[a]pyrene	6.40E+00	100	1.00	70	7.67E-02	4.29E-01	3.01E-07	7.30E+00	2.19E-06
Indeno[1,2,3-cd]pyrene	4.00E+00	100	1.00	70	7.67E-02	4.29E-01	1.88E-07	7.30E-01	1.37E-07
Benzo[g,h,i]perlyene	3.60E+00	100	1.00	70	7.67E-02	4.29E-01	1.69E-07	1.55E-01	2.62E-08
								Total Risk =	3.22E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	100 mg/day	X	1.00	X	1 / 70 kg	X	28 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	100	1.00	70	7.67E-02	4.49E-08	4.00E-02	1.12E-06
Dibenzofuran	8.70E-01	100	1.00	70	7.67E-02	9.53E-08	4.00E-03	2.38E-05
Pentachlorophenol	1.30E+01	100	1.00	70	7.67E-02	1.42E-06	3.00E-02	4.75E-05
Phenanthrene	7.90E+00	100	1.00	70	7.67E-02	8.66E-07	2.90E-02	2.99E-05
Benzo[a]anthracene	1.00E+01	100	1.00	70	7.67E-02	1.10E-06	--	--
Benzo[b]fluoranthene	1.30E+01	100	1.00	70	7.67E-02	1.42E-06	--	--
Benzo[a]pyrene	6.40E+00	100	1.00	70	7.67E-02	7.01E-07	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	100	1.00	70	7.67E-02	4.38E-07	--	--
Benzo[g,h,i]perlyene	3.60E+00	100	1.00	70	7.67E-02	3.95E-07	--	--
							Hazard Index =	1.02E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	200	1.00	15	3.84E-02	8.57E-02	1.80E-08	--	--
Dibenzofuran	8.70E-01	200	1.00	15	3.84E-02	8.57E-02	3.81E-08	--	--
Pentachlorophenol	1.30E+01	200	1.00	15	3.84E-02	8.57E-02	5.70E-07	1.20E-01	6.84E-08
Phenanthrene	7.90E+00	200	1.00	15	3.84E-02	8.57E-02	3.46E-07	--	--
Benzo[a]anthracene	1.00E+01	200	1.00	15	3.84E-02	8.57E-02	4.38E-07	7.30E-01	3.20E-07
Benzo[b]fluoranthene	1.30E+01	200	1.00	15	3.84E-02	8.57E-02	5.70E-07	7.30E-01	4.16E-07
Benzo[a]pyrene	6.40E+00	200	1.00	15	3.84E-02	8.57E-02	2.81E-07	7.30E+00	2.05E-06
Indeno[1,2,3-cd]pyrene	4.00E+00	200	1.00	15	3.84E-02	8.57E-02	1.75E-07	7.30E-01	1.28E-07
Benzo[g,h,i]perlyene	3.60E+00	200	1.00	15	3.84E-02	8.57E-02	1.58E-07	1.55E-01	2.45E-08
								Total Risk =	3.00E-06

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - TRESPASSER CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Soil Conc} \times \text{Ingestion Rate} \times \text{Fraction Ingested} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/kg} \times 200\text{ mg/day} \times 1.00 \times \frac{1}{15\text{ kg}} \times \frac{14\text{ days}}{365\text{ days}} \times \frac{1\text{kg}}{10^6\text{ mg}}$$

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	200	1.00	15	3.84E-02	2.10E-07	4.00E-02	5.24E-06
Dibenzofuran	8.70E-01	200	1.00	15	3.84E-02	4.45E-07	4.00E-03	1.11E-04
Pentachlorophenol	1.30E+01	200	1.00	15	3.84E-02	6.65E-06	3.00E-02	2.22E-04
Phenanthrene	7.90E+00	200	1.00	15	3.84E-02	4.04E-06	2.90E-02	1.39E-04
Benzo[a]anthracene	1.00E+01	200	1.00	15	3.84E-02	5.11E-06	--	--
Benzo[b]fluoranthene	1.30E+01	200	1.00	15	3.84E-02	6.65E-06	--	--
Benzo[a]pyrene	6.40E+00	200	1.00	15	3.84E-02	3.27E-06	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	200	1.00	15	3.84E-02	2.05E-06	--	--
Benzo[g,h,i]perlyene	3.60E+00	200	1.00	15	3.84E-02	1.84E-06	--	--
							Hazard Index =	4.77E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - WORKER ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg	
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	50 mg/day	X	1.00	X	1 / 70 kg	X	250 days / 365 days	X	25 yrs / 70 yrs	X	1kg / 10^6 mg	

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	50	1.00	70	6.85E-01	3.57E-01	7.16E-08	--	--
Dibenzofuran	8.70E-01	50	1.00	70	6.85E-01	3.57E-01	1.52E-07	--	--
Pentachlorophenol	1.30E+01	50	1.00	70	6.85E-01	3.57E-01	2.27E-06	1.20E-01	2.73E-07
Phenanthrene	7.90E+00	50	1.00	70	6.85E-01	3.57E-01	1.38E-06	--	--
Benzo[a]anthracene	1.00E+01	50	1.00	70	6.85E-01	3.57E-01	1.75E-06	7.30E-01	1.28E-06
Benzo[b]fluoranthene	1.30E+01	50	1.00	70	6.85E-01	3.57E-01	2.27E-06	7.30E-01	1.66E-06
Benzo[a]pyrene	6.40E+00	50	1.00	70	6.85E-01	3.57E-01	1.12E-06	7.30E+00	8.16E-06
Indeno[1,2,3-cd]pyrene	4.00E+00	50	1.00	70	6.85E-01	3.57E-01	6.99E-07	7.30E-01	5.10E-07
Benzo[g,h,i]perlyene	3.60E+00	50	1.00	70	6.85E-01	3.57E-01	6.29E-07	1.55E-01	9.75E-08
								Total Risk =	1.20E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
CURRENT SCENARIO - WORKER ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	50 mg/day	X	1.00	X	1 / 70 kg	X	250 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Intake (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	50	1.00	70	6.85E-01	2.01E-07	4.00E-02	5.01E-06
Dibenzofuran	8.70E-01	50	1.00	70	6.85E-01	4.26E-07	4.00E-03	1.06E-04
Pentachlorophenol	1.30E+01	50	1.00	70	6.85E-01	6.36E-06	3.00E-02	2.12E-04
Phenanthrene	7.90E+00	50	1.00	70	6.85E-01	3.86E-06	2.90E-02	1.33E-04
Benzo[a]anthracene	1.00E+01	50	1.00	70	6.85E-01	4.89E-06	--	--
Benzo[b]fluoranthene	1.30E+01	50	1.00	70	6.85E-01	6.36E-06	--	--
Benzo[a]pyrene	6.40E+00	50	1.00	70	6.85E-01	3.13E-06	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	50	1.00	70	6.85E-01	1.96E-06	--	--
Benzo[g,h,i]perlyene	3.60E+00	50	1.00	70	6.85E-01	1.76E-06	--	--
							Hazard Index =	4.57E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	30 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.40E-06	--	--	--
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	2.96E-06	--	--	--
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	4.43E-05	1.20E-01	2.40E-01	1.06E-05
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	84%	2.69E-05	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	3.41E-05	7.30E-01	1.46E+00	4.97E-05
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	4.43E-05	7.30E-01	1.46E+00	6.46E-05
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	2.18E-05	7.30E+00	1.46E+01	3.18E-04
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.36E-05	7.30E-01	1.46E+00	1.99E-05
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.00	70	9.59E-01	4.29E-01	50%	1.23E-05	1.55E-01	3.10E-01	3.80E-06
											Total Risk =	4.67E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	5.80E+03 cm^2	1.0 mg/cm^2-event	1 / 70 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	5.80E+03	1.0	70	9.59E-01	50%	3.26E-06	4.00E-02	2.00E-02	1.63E-04
Dibenzofuran	8.70E-01	10.0%	5.80E+03	1.0	70	9.59E-01	50%	6.91E-06	4.00E-03	2.00E-03	3.46E-03
Pentachlorophenol	1.30E+01	10.0%	5.80E+03	1.0	70	9.59E-01	50%	1.03E-04	3.00E-02	1.50E-02	6.89E-03
Phenanthrene	7.90E+00	10.0%	5.80E+03	1.0	70	9.59E-01	84%	6.28E-05	2.90E-02	2.44E-02	2.58E-03
Benzo[a]anthracene	1.00E+01	10.0%	5.80E+03	1.0	70	9.59E-01	50%	7.95E-05	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	5.80E+03	1.0	70	9.59E-01	50%	1.03E-04	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	5.80E+03	1.0	70	9.59E-01	50%	5.08E-05	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	5.80E+03	1.0	70	9.59E-01	50%	3.18E-05	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	5.80E+03	1.0	70	9.59E-01	50%	2.86E-05	--	--	--
										Hazard Index =	1.31E-02

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	Years Exposed / Years Lifetime	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	6 yrs / 70 yrs	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr Days/Yr	Years Exposed Years Lifetime	GI Absorption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF SF/GI Absorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	4.09E-07	--	--	--
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	8.68E-07	--	--	--
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	1.30E-05	1.20E-01	2.40E-01	3.11E-06
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	84%	7.88E-06	--	--	--
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	9.97E-06	7.30E-01	1.46E+00	1.46E-05
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	1.30E-05	7.30E-01	1.46E+00	1.89E-05
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	6.38E-06	7.30E+00	1.46E+01	9.32E-05
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	3.99E-06	7.30E-01	1.46E+00	5.82E-06
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.00	15	9.59E-01	8.57E-02	50%	3.59E-06	1.55E-01	3.10E-01	1.11E-06
											Total Risk =	1.37E-04

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	Absorbance Factor	Skin Surface Area	Adherence Factor	1 / Body Wt	Events/Year / Days/Year	1 kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	%	1.82E+03 cm^2	1.0 mg/cm^2-event	1 / 15 kg	350 events/yr / 365 days/yr	1 kg / 10^6 mg

Compound	Soil Conc (mg/kg)	Absorbance Factor (%)	Skin Surface Area (cm^2)	Adherence Factor (mg/cm^2-event)	Body Wt (kg)	Events/Yr / Days/Yr	GI Absorption Factor	CDI	Oral RfD (mg/kg-day)	Adjusted RfD RfD*GI Adsorption Factor (mg/kg-day)	Hazard Factor CDI/Adjusted RfD
2-Methylnaphthalene	4.10E-01	10.0%	1.82E+03	1.0	15	9.59E-01	50%	4.77E-06	4.00E-02	2.00E-02	2.39E-04
Dibenzofuran	8.70E-01	10.0%	1.82E+03	1.0	15	9.59E-01	50%	1.01E-05	4.00E-03	2.00E-03	5.06E-03
Pentachlorophenol	1.30E+01	10.0%	1.82E+03	1.0	15	9.59E-01	50%	1.51E-04	3.00E-02	1.50E-02	1.01E-02
Phenanthrene	7.90E+00	10.0%	1.82E+03	1.0	15	9.59E-01	84%	9.19E-05	2.90E-02	2.44E-02	3.77E-03
Benzo[a]anthracene	1.00E+01	10.0%	1.82E+03	1.0	15	9.59E-01	50%	1.16E-04	--	--	--
Benzo[b]fluoranthene	1.30E+01	10.0%	1.82E+03	1.0	15	9.59E-01	50%	1.51E-04	--	--	--
Benzo[a]pyrene	6.40E+00	10.0%	1.82E+03	1.0	15	9.59E-01	50%	7.45E-05	--	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	10.0%	1.82E+03	1.0	15	9.59E-01	50%	4.65E-05	--	--	--
Benzo[g,h,i]perlyene	3.60E+00	10.0%	1.82E+03	1.0	15	9.59E-01	50%	4.19E-05	--	--	--
										Hazard Index =	1.92E-02

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day) = Soil Conc X Ingestion Rate X Fraction Ingested X 1 / Body Wt. X Days Exposed/Year / Days/Year X Years Exposed / Years Lifetime X 1kg / 10^6 mg

Chronic Daily Intake = (mg/kg-day) = mg/kg X 100 mg/day X 1.00 X 1 / 70 kg X 350 days / 365 days X 30 yrs / 70 yrs X 1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	100	1.00	70	9.59E-01	4.29E-01	2.41E-07	--	--
Dibenzofuran	8.70E-01	100	1.00	70	9.59E-01	4.29E-01	5.11E-07	--	--
Pentachlorophenol	1.30E+01	100	1.00	70	9.59E-01	4.29E-01	7.63E-06	1.20E-01	9.16E-07
Phenanthrene	7.90E+00	100	1.00	70	9.59E-01	4.29E-01	4.64E-06	--	--
Benzo[a]anthracene	1.00E+01	100	1.00	70	9.59E-01	4.29E-01	5.87E-06	7.30E-01	4.29E-06
Benzo[b]fluoranthene	1.30E+01	100	1.00	70	9.59E-01	4.29E-01	7.63E-06	7.30E-01	5.57E-06
Benzo[a]pyrene	6.40E+00	100	1.00	70	9.59E-01	4.29E-01	3.76E-06	7.30E+00	2.74E-05
Indeno[1,2,3-cd]pyrene	4.00E+00	100	1.00	70	9.59E-01	4.29E-01	2.35E-06	7.30E-01	1.71E-06
Benzo[g,h,i]perlyene	3.60E+00	100	1.00	70	9.59E-01	4.29E-01	2.11E-06	1.55E-01	3.28E-07
								Total Risk =	4.02E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	100 mg/day	X	1.00	X	1 / 70 kg	X	350 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr / Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	100	1.00	70	9.59E-01	5.62E-07	4.00E-02	1.40E-05
Dibenzofuran	8.70E-01	100	1.00	70	9.59E-01	1.19E-06	4.00E-03	2.98E-04
Pentachlorophenol	1.30E+01	100	1.00	70	9.59E-01	1.78E-05	3.00E-02	5.94E-04
Phenanthrene	7.90E+00	100	1.00	70	9.59E-01	1.08E-05	2.90E-02	3.73E-04
Benzo[a]anthracene	1.00E+01	100	1.00	70	9.59E-01	1.37E-05	--	--
Benzo[b]fluoranthene	1.30E+01	100	1.00	70	9.59E-01	1.78E-05	--	--
Benzo[a]pyrene	6.40E+00	100	1.00	70	9.59E-01	8.77E-06	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	100	1.00	70	9.59E-01	5.48E-06	--	--
Benzo[g,h,i]perlyene	3.60E+00	100	1.00	70	9.59E-01	4.93E-06	--	--
							Hazard Index =	1.28E-03

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	350 days / 365 days	X	6 yrs / 70 yrs	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
2-Methylnaphthalene	4.10E-01	200	1.00	15	9.59E-01	8.57E-02	4.49E-07	--	--
Dibenzofuran	8.70E-01	200	1.00	15	9.59E-01	8.57E-02	9.53E-07	--	--
Pentachlorophenol	1.30E+01	200	1.00	15	9.59E-01	8.57E-02	1.42E-05	1.20E-01	1.71E-06
Phenanthrene	7.90E+00	200	1.00	15	9.59E-01	8.57E-02	8.66E-06	--	--
Benzo[a]anthracene	1.00E+01	200	1.00	15	9.59E-01	8.57E-02	1.10E-05	7.30E-01	8.00E-06
Benzo[b]fluoranthene	1.30E+01	200	1.00	15	9.59E-01	8.57E-02	1.42E-05	7.30E-01	1.04E-05
Benzo[a]pyrene	6.40E+00	200	1.00	15	9.59E-01	8.57E-02	7.01E-06	7.30E+00	5.12E-05
Indeno[1,2,3-cd]pyrene	4.00E+00	200	1.00	15	9.59E-01	8.57E-02	4.38E-06	7.30E-01	3.20E-06
Benzo[g,h,i]perlyene	3.60E+00	200	1.00	15	9.59E-01	8.57E-02	3.95E-06	1.55E-01	6.12E-07
								Total Risk =	7.51E-05

TABLE
SURFACE SOIL EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Soil Conc	X	Ingestion Rate	X	Fraction Ingested	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	1kg / 10^6 mg
Chronic Daily Intake = (mg/kg-day)	mg/kg	X	200 mg/day	X	1.00	X	1 / 15 kg	X	350 days / 365 days	X	1kg / 10^6 mg

Compound	Soil Conc. (mg/kg)	Rate (mg/day)	Fraction Ingested	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
2-Methylnaphthalene	4.10E-01	200	1.00	15	9.59E-01	5.24E-06	4.00E-02	1.31E-04
Dibenzofuran	8.70E-01	200	1.00	15	9.59E-01	1.11E-05	4.00E-03	2.78E-03
Pentachlorophenol	1.30E+01	200	1.00	15	9.59E-01	1.66E-04	3.00E-02	5.54E-03
Phenanthrene	7.90E+00	200	1.00	15	9.59E-01	1.01E-04	2.90E-02	3.48E-03
Benzo[a]anthracene	1.00E+01	200	1.00	15	9.59E-01	1.28E-04	--	--
Benzo[b]fluoranthene	1.30E+01	200	1.00	15	9.59E-01	1.66E-04	--	--
Benzo[a]pyrene	6.40E+00	200	1.00	15	9.59E-01	8.18E-05	--	--
Indeno[1,2,3-cd]pyrene	4.00E+00	200	1.00	15	9.59E-01	5.11E-05	--	--
Benzo[g,h,i]perlyene	3.60E+00	200	1.00	15	9.59E-01	4.60E-05	--	--
							Hazard Index =	1.19E-02

CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES
SITE 13
NAVAL AMPHIBIOUS BASE - LITTLE CREEK
VIRGINIA BEACH, VIRGINIA

Constituent	Frequency of Detection	Range of Detected Concentrations (ug/l)	Federal MCL (ug/l) [a]	Tap Water (ug/l) [b]	Health Advisory (ug/l) [c]	Virginia Ground Water Stds. (ug/l) [d]	Potential Concern
VOLATILES							
Vinyl chloride	2/21	4j - 200.0	2.0	0.019	2		Yes
Carbon Disulfide	1/21	2j		2.1			No
1,1-Dichloroethane	1/21	2 - 7j		81			No
1,2-Dichloroethene	10/21	2 - 530		5.5	70		Yes
(total)	13/21	1j - 570	2.7	1.6	5		Yes
Trichloroethene	10/21	2j - 1200	0.8	1.1	5		Yes
Tetrachlorethene	1/21	55	0.17	0.052			Yes
1,1,2,2-	4/21	1j - 2j	6800	75	1000		No
Tetrachloroethane	3/21	1j - 110	680	3.9			Yes
Toluene	5/21	3j - 15	3100	130	700		No
Chlorobenzene	5/21	5j - 77		1200	10000		No
Ethylbenzene							
Xylene							
SEMI-VOLATILES							
1,4-Dichlorobenzene	1/6	1j	400	0.44	75		No
Naphthalene	5/18	3j - 96j		150			No
2-Methylnaphthalene	3/18	2j - 170j					No
Acenaphthene	1/18	1j		220			No
Dibenzofuran	1/18	2j					No
Fluorene	2/18	1j - 30	1300	150			No
Pentachlorophenol	10/18	20j - 2300	0.28	0.56	1		Yes
Phenanthrene	1/18	3j					No
PESTICIDES							
4-4 DDD	1/4	0.053j		0.28			No
Alpha chlordane	1/4	0.044j	2.0	0.052	60		No
Gamma chlordane	1/4	0.044j	2.0	0.052	60		No
METALS							
Aluminum	4/3	17.5 - 31.8		11000			No
Barium	4/4	40.8 - 73.9	2000	260	2000	2000	No
Cadmium	1/4	1.7	5.0	18	5	16	No
Iron	4/4	11.2 - 106				300	No
Manganese	4/4	109 - 844		18		50	Yes
Zinc	4/4	22.3 - 50		1100		5000	No

Notes:
a. Federal MCL concentration values represent US Federal Maximum Contaminant Level for potable water supplies.
b. Tap Water Concentration values obtained from July 11, 1994 USEPA Region III Risk-Based Concentration Table using a target hazard quotient of 0.1.
c. Health Advisory Concentration values obtained from December 1993 USEPA Office of Water publication "Drinking Water Regulations and Health Advisories."
d. Virginia Water Standards Applicable Statewide.

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

CARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) = Contaminant Intake X 1 / Body Wt. X Bioavailabilit Factor X Days Exposed / Days/Year X Years Exposed / Years Lifetime

Chronic Daily Intake (CDI) = (mg/kg-day) = Contaminant Intake (mg/day) X 1 / 70 kg X 1.0 X 28 days / 365 days X 30 yrs / 70 yrs

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K)	Mass Transfer Coeff (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed / Days/Year	Years Exposed / Years Lifetime	CDI (mg/kg-day	Unit Risk (ug/Cu.m)-1	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	5.89E+01	1.07E-02	2.23E+01	2.71E-01	70	1.0	7.67E-02	4.29E-01	1.27E-04	8.57E-05	3.00E-01	3.82E-05
1,2-DCE (total)	2.29E+02	3.37E-03	1.70E+01	8.74E-01	70	1.0	7.67E-02	4.29E-01	4.10E-04	--	--	--
TCE	5.70E+02	1.03E-03	1.27E+01	1.72E+00	70	1.0	7.67E-02	4.29E-01	8.09E-04	1.71E-06	6.00E-03	4.86E-06
PCE	1.20E+03	1.49E-02	1.38E+01	3.88E+00	70	1.0	7.67E-02	4.29E-01	1.82E-03	5.80E-07	2.03E-03	3.70E-06
1,1,2,2-PCA	5.50E+01	3.81E-04	8.45E+00	1.19E-01	70	1.0	7.67E-02	4.29E-01	5.57E-05	5.80E-05	2.03E-01	1.13E-05
Chlorobenzene	1.10E+02	3.45E-03	1.58E-03	3.97E-01	70	1.0	7.67E-02	4.29E-01	1.86E-04	--	--	--
Napthalene	1.90E+01	4.60E-04	1.03E+01	4.84E-02	70	1.0	7.67E-02	4.29E-01	2.27E-05	--	--	--
Pentachlorophenol	1.17E+03	2.75E-06	1.20E-01	4.10E-02	70	1.0	7.67E-02	4.29E-01	1.93E-05	--	--	--
											Total Risk =	5.81E-05

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT ADULT

NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminant Intake X 1 / Body Wt. X Bioavailabilit Factor X Days Exposed / Days/Year

Chronic Daily Intake (CDI) = (mg/kg-day) Contaminant Intake (mg/day) X 1 / 70 kg X 1.0 X 28 days / 365 days

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K)	Mass Transfer Coeff (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	CDI (mg/kg-day)	RfC (mg/Cu.m)	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	5.89E+01	1.07E-02	2.23E+01	2.71E-01	70	1.0	7.67E-02	2.97E-04	--	--	--
1,2-DCE (total)	2.29E+02	3.37E-03	1.70E+01	8.74E-01	70	1.0	7.67E-02	9.58E-04	--	--	--
TCE	5.70E+02	1.03E-03	1.27E+01	1.72E+00	70	1.0	7.67E-02	1.89E-03	--	--	--
PCE	1.20E+03	1.49E-02	1.38E+01	3.88E+00	70	1.0	7.67E-02	4.25E-03	--	--	--
1,1,2,2-PCA	5.50E+01	3.81E-04	8.45E+00	1.19E-01	70	1.0	7.67E-02	1.30E-04	--	--	--
Chlorobenzene	1.10E+02	3.45E-03	1.58E-03	3.97E-01	70	1.0	7.67E-02	4.35E-04	2.00E-02	5.71E-03	7.61E-02
Napthalene	1.90E+01	4.60E-04	1.03E+01	4.84E-02	70	1.0	7.67E-02	5.30E-05	--	--	--
Pentachlorophenol	1.17E+03	2.75E-06	1.20E-01	4.10E-02	70	1.0	7.67E-02	4.49E-05	--	--	--

Hazard Index = 7.61E-02

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

CARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \text{Contaminant Intake} \times \frac{1}{\text{Body Wt.}} \times \text{Bioavailabilit Factor} \times \frac{\text{Days Exposed}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}}$$

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \text{Contaminant Intake (mg/day)} \times \frac{1}{15\text{ kg}} \times 1.0 \times \frac{14\text{ days}}{365\text{ days}} \times \frac{6\text{ yrs}}{70\text{ yrs}}$$

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K)	Mass Transfer Coeff (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	Years Exposed Years Lifetime	CDI (mg/kg-day	Unit Risk (ug/Cu.m)-1	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	5.89E+01	1.07E-02	2.23E+01	2.71E-01	15	1.0	3.84E-02	8.57E-02	5.94E-05	8.57E-05	3.00E-01	1.78E-05
1,2-DCE (total)	2.29E+02	3.37E-03	1.70E+01	8.74E-01	15	1.0	3.84E-02	8.57E-02	1.92E-04	--	--	--
TCE	5.70E+02	1.03E-03	1.27E+01	1.72E+00	15	1.0	3.84E-02	8.57E-02	3.78E-04	1.71E-06	6.00E-03	2.27E-06
PCE	1.20E+03	1.49E-02	1.38E+01	3.88E+00	15	1.0	3.84E-02	8.57E-02	8.51E-04	5.80E-07	2.03E-03	1.73E-06
1,1,2,2-PCA	5.50E+01	3.81E-04	8.45E+00	1.19E-01	15	1.0	3.84E-02	8.57E-02	2.60E-05	5.80E-05	2.03E-01	5.28E-06
Chlorobenzene	1.10E+02	3.45E-03	1.58E-03	3.97E-01	15	1.0	3.84E-02	8.57E-02	8.69E-05	--	--	--
Napthalene	1.90E+01	4.60E-04	1.03E+01	4.84E-02	15	1.0	3.84E-02	8.57E-02	1.06E-05	--	--	--
Pentachlorophenol	1.17E+03	2.75E-06	1.20E-01	4.10E-02	15	1.0	3.84E-02	8.57E-02	8.99E-06	--	--	--
											Total Risk =	2.71E-05

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT CHILD

NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE WHILE SHOWERING

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \text{Contaminant Intake} \times \frac{1}{\text{Body Wt.}} \times \text{Bioavailabilit Factor} \times \frac{\text{Days Exposed}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \text{Contaminant Intake (mg/day)} \times \frac{1}{15\text{ kg}} \times 1.0 \times \frac{14\text{ days}}{365\text{ days}}$$

Chemical Name	Concentration in Water (ug/L)	Henry's Law Coeff (atm-m^3/mol-K)	Mass Transfer Coeff (cm/hr)	Contaminant Intake (mg/day)	Body Wt. (kg)	Bioavailability Factor	Days Exposed Days/Year	CDI (mg/kg-day)	RfC (mg/Cu.m)	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	5.89E+01	1.07E-02	2.23E+01	2.71E-01	15	1.0	3.84E-02	6.93E-04	--	--	--
1,2-DCE (total)	2.29E+02	3.37E-03	1.70E+01	8.74E-01	15	1.0	3.84E-02	2.23E-03	--	--	--
TCE	5.70E+02	1.03E-03	1.27E+01	1.72E+00	15	1.0	3.84E-02	4.41E-03	--	--	--
PCE	1.20E+03	1.49E-02	1.38E+01	3.88E+00	15	1.0	3.84E-02	9.93E-03	--	--	--
1,1,2,2-PCA	5.50E+01	3.81E-04	8.45E+00	1.19E-01	15	1.0	3.84E-02	3.03E-04	--	--	--
Chlorobenzene	1.10E+02	3.45E-03	1.58E-03	3.97E-01	15	1.0	3.84E-02	1.01E-03	2.00E-02	5.71E-03	1.78E-01
Napthalene	1.90E+01	4.60E-04	1.03E+01	4.84E-02	15	1.0	3.84E-02	1.24E-04	--	--	--
Pentachlorophenol	1.17E+03	2.75E-06	1.20E-01	4.10E-02	15	1.0	3.84E-02	1.05E-04	--	--	--

Hazard Index = 1.78E-01

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	cm/hr	0.2 hr/day	1 / 70 kg	28 days / 365 days	30 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	GI Absoption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Adsorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Vinyl chloride	5.89E-02	23000	0.0073	0.2	70	7.67E-02	4.29E-01	80%	9.29E-07	1.90E+00	2.38E+00	2.21E-06
1,2-Dichloroethene (total)	2.29E-01	23000	0.01	0.2	70	7.67E-02	4.29E-01	80%	4.96E-06	--	--	--
Trichloroethene	5.70E-01	23000	0.23	0.2	70	7.67E-02	4.29E-01	80%	2.83E-04	1.10E-02	1.38E-02	3.89E-06
Tetrachloroethene	1.20E+00	23000	0.37	0.2	70	7.67E-02	4.29E-01	80%	9.59E-04	5.20E-02	6.50E-02	6.24E-05
1,1,2,2-Tetrachloroethane	5.50E-02	23000	0.009	0.2	70	7.67E-02	4.29E-01	80%	1.07E-06	2.00E-01	2.50E-01	2.67E-07
Chlorobenzene	1.10E-01	23000	0.0410	0.2	70	7.67E-02	4.29E-01	30%	9.74E-06	--	--	--
Naphthalene	1.90E-02	23000	0.069	0.2	70	7.67E-02	4.29E-01	50%	2.82E-06	--	--	--
Pentachlorophenol	1.17E+00	23000	0.650	0.2	70	7.67E-02	4.29E-01	50%	1.64E-03	1.20E-01	2.40E-01	3.94E-04
Manganese	8.44E-01	23000	0.001	0.2	70	7.67E-02	4.29E-01	5%	1.82E-06	--	--	--
											Total Risk =	4.62E-04

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	23000 cm^2	cm/hr	0.2 hr/day	1 / 70 kg	28 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	GI Absoption Factor	CDI	RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted Rf
Vinyl chloride	5.89E-02	23000	0.0073	0.2	70	7.67E-02	80%	2.17E-06	--	--	--
1,2-Dichloroethene (total)	2.29E-01	23000	0.01	0.2	70	7.67E-02	80%	1.16E-05	9.00E-03	7.20E-03	1.61E-03
Trichloroethene	5.70E-01	23000	0.23	0.2	70	7.67E-02	80%	6.61E-04	6.00E-03	4.80E-03	1.38E-01
Tetrachloroethene	1.20E+00	23000	0.37	0.2	70	7.67E-02	80%	2.24E-03	1.00E-02	8.00E-03	2.80E-01
1,1,2,2-Tetrachloroethane	5.50E-02	23000	0.009	0.2	70	7.67E-02	80%	2.50E-06	--	--	--
Chlorobenzene	1.10E-01	23000	0.0410	0.2	70	7.67E-02	30%	2.27E-05	2.00E-02	6.00E-03	3.79E-03
Naphthalene	1.90E-02	23000	0.069	0.2	70	7.67E-02	50%	6.59E-06	4.00E-02	2.00E-02	3.30E-04
Pentachlorophenol	1.17E+00	23000	0.650	0.2	70	7.67E-02	50%	3.83E-03	3.00E-02	1.50E-02	2.55E-01
Manganese	8.44E-01	23000	0.001	0.2	70	7.67E-02	5%	4.25E-06	1.40E-01	7.00E-03	6.08E-04
										Hazard Index =	6.79E-01

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

CARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	Years Exposed / Years Lifetime	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	cm/hr	0.2 hr/day	1 / 15 kg	14 days / 365 days	6 yrs / 70 yrs	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	GI Absoption Factor	CDI	Oral SF (mg/kg-day)-1	Adjusted SF Oral SF/GI Adsorption Factor (mg/kg-day)-1	RISK Adjusted SF*CDI
Vinyl chloride	5.89E-02	7280	0.0073	0.2	15	3.84E-02	8.57E-02	80%	1.37E-07	1.90E+00	2.38E+00	3.26E-07
1,2-Dichloroethene (total)	2.29E-01	7280	0.01	0.2	15	3.84E-02	8.57E-02	80%	7.32E-07	--	--	--
Trichloroethene	5.70E-01	7280	0.23	0.2	15	3.84E-02	8.57E-02	80%	4.18E-05	1.10E-02	1.38E-02	5.75E-07
Tetrachloroethene	1.20E+00	7280	0.37	0.2	15	3.84E-02	8.57E-02	80%	1.42E-04	5.20E-02	6.50E-02	9.21E-06
1,1,2,2-Tetrachloroethane	5.50E-02	7280	0.009	0.2	15	3.84E-02	8.57E-02	80%	1.58E-07	2.00E-01	2.50E-01	3.95E-08
Chlorobenzene	1.10E-01	7280	0.041	0.2	15	3.84E-02	8.57E-02	30%	1.44E-06	--	--	--
Naphthalene	1.90E-02	7280	0.069	0.2	15	3.84E-02	8.57E-02	50%	4.17E-07	--	--	--
Pentachlorophenol	1.17E+00	7280	0.65	0.2	15	3.84E-02	8.57E-02	50%	2.42E-04	1.20E-01	2.40E-01	5.82E-05
Manganese	8.44E-01	7280	0.001	0.2	15	3.84E-02	8.57E-02	5%	2.69E-07	--	--	--
											Total Risk =	6.83E-05

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

NONCARCINOGENIC EFFECTS - DERMAL CONTACT EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	Skin Surface Area	Permeability Constant	Exposure Time	1 / Body Wt.	Days Exposed/Year / Days/Year	1 L / 10^3 cm^3
Chronic Daily Intake = (mg/kg-day)	mg/L	7280 cm^2	cm/hr	0.2 hr/day	1 / 15 kg	14 days / 365 days	1 L / 10^3 cm^3

Compound	Water Conc. (mg/L)	Surface Area (cm^2)	Perm. Const. (cm/hr)	Exposure Time (hr/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	GI Absoption Factor	CDI	RfD (mg/kg-day)	Adjusted RfD Oral RfD*GI Absorption Factor (mg/kg-day)	CDI/Adjusted Rf
Vinyl chloride	5.89E-02	7280	0.0073	0.2	15	3.84E-02	80%	1.60E-06	--	--	--
1,2-Dichloroethene (total)	2.29E-01	7280	0.01	0.2	15	3.84E-02	80%	8.54E-06	9.00E-03	7.20E-03	1.19E-03
Trichloroethene	5.70E-01	7280	0.23	0.2	15	3.84E-02	80%	4.88E-04	6.00E-03	4.80E-03	1.02E-01
Tetrachloroethene	1.20E+00	7280	0.37	0.2	15	3.84E-02	80%	1.65E-03	1.00E-02	8.00E-03	2.07E-01
1,1,2,2-Tetrachloroethane	5.50E-02	7280	0.009	0.2	15	3.84E-02	80%	1.84E-06	--	--	--
Chlorobenzene	1.10E-01	7280	0.041	0.2	15	3.84E-02	30%	1.68E-05	2.00E-02	6.00E-03	2.80E-03
Naphthalene	1.90E-02	7280	0.069	0.2	15	3.84E-02	50%	4.87E-06	4.00E-02	2.00E-02	2.43E-04
Pentachlorophenol	1.17E+00	7280	0.65	0.2	15	3.84E-02	50%	2.83E-03	3.00E-02	1.50E-02	1.88E-01
Manganese	8.44E-01	7280	0.001	0.2	15	3.84E-02	5%	3.14E-06	1.40E-01	7.00E-03	4.49E-04
										Hazard Index =	5.01E-01

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}} \times \frac{\text{Years Exposed}}{\text{Years Lifetime}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{28\ \text{days}}{365\ \text{days}} \times \frac{30\ \text{yrs}}{70\ \text{yrs}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr / Days/Yr	Years Exposed / Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	5.89E-02	2.0	70	7.67E-02	4.29E-01	5.53E-05	1.90E+00	1.05E-04
1,2-Dichloroethene (total)	2.29E-01	2.0	70	7.67E-02	4.29E-01	2.16E-04	--	--
Trichloroethene	5.70E-01	2.0	70	7.67E-02	4.29E-01	5.35E-04	1.10E-02	5.89E-06
Tetrachloroethene	1.20E+00	2.0	70	7.67E-02	4.29E-01	1.13E-03	5.20E-02	5.86E-05
1,1,2,2-Tetrachloroethane	5.50E-02	2.0	70	7.67E-02	4.29E-01	5.17E-05	2.00E-01	1.03E-05
Chlorobenzene	1.10E-01	2.0	70	7.67E-02	4.29E-01	1.03E-04	--	--
Naphthalene	1.90E-02	2.0	70	7.67E-02	4.29E-01	1.78E-05	--	--
Pentachlorophenol	1.17E+00	2.0	70	7.67E-02	4.29E-01	1.10E-03	1.20E-01	1.32E-04
Manganese	8.44E-01	2.0	70	7.67E-02	4.29E-01	7.93E-04	--	--

Total Risk = 3.12E-04

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) ADULT

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times 2.0\ \text{L/day} \times \frac{1}{70\ \text{kg}} \times \frac{28\ \text{days}}{365\ \text{days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	5.89E-02	2.0	70	7.67E-02	1.29E-04	--	--
1,2-Dichloroethene (total)	2.29E-01	2.0	70	7.67E-02	5.03E-04	9.00E-03	5.59E-02
Trichloroethene	5.70E-01	2.0	70	7.67E-02	1.25E-03	6.00E-03	2.08E-01
Tetrachloroethene	1.20E+00	2.0	70	7.67E-02	2.63E-03	1.00E-02	2.63E-01
1,1,2,2-Tetrachloroethane	5.50E-02	2.0	70	7.67E-02	1.21E-04	--	--
Chlorobenzene	1.10E-01	2.0	70	7.67E-02	2.41E-04	2.00E-02	1.21E-02
Naphthalene	1.90E-02	2.0	70	7.67E-02	4.15E-05	4.00E-02	1.04E-03
Pentachlorophenol	1.17E+00	2.0	70	7.67E-02	2.56E-03	3.00E-02	8.53E-02
Manganese	8.44E-01	2.0	70	7.67E-02	1.85E-03	1.40E-01	1.32E-02
						Hazard Index =	6.39E-01

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

CARCINOGENIC EFFECTS - INGESTION EXPOSURE

Chronic Daily Intake = (mg/kg-day)	Water Conc	X	Consumption Rate	X	1 / Body Wt.	X	Days Exposed/Year / Days/Year	X	Years Exposed / Years Lifetime	
Chronic Daily Intake = (mg/kg-day)	mg/L	X	1.0 L/day	X	1 / 15 kg	X	14 days / 365 days	X	6 yrs / 70 yrs	

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	Years Exposed Years Lifetime	CDI	SF (mg/kg-day)-1	RISK SF*CDI
Vinyl chloride	5.89E-02	1.0	15	3.84E-02	8.57E-02	1.29E-05	1.90E+00	2.45E-05
1,2-Dichloroethene (total)	2.29E-01	1.0	15	3.84E-02	8.57E-02	5.03E-05	--	--
Trichloroethene	5.70E-01	1.0	15	3.84E-02	8.57E-02	1.25E-04	1.10E-02	1.37E-06
Tetrachloroethene	1.20E+00	1.0	15	3.84E-02	8.57E-02	2.63E-04	5.20E-02	1.37E-05
1,1,2,2-Tetrachloroethane	5.50E-02	1.0	15	3.84E-02	8.57E-02	1.21E-05	2.00E-01	2.41E-06
Chlorobenzene	1.10E-01	1.0	15	3.84E-02	8.57E-02	2.41E-05	--	--
Naphthalene	1.90E-02	1.0	15	3.84E-02	8.57E-02	4.15E-06	--	--
Pentachlorophenol	1.17E+00	1.0	15	3.84E-02	8.57E-02	2.56E-04	1.20E-01	3.07E-05
Manganese	8.44E-01	1.0	15	3.84E-02	8.57E-02	1.85E-04	--	--
							Total Risk =	7.27E-05

TABLE
GROUNDWATER EXPOSURE PATHWAY RISK - SITE 13
FUTURE SCENARIO - RESIDENT (EXPOSED AS TRESPASSER/RECREATIONAL) CHILD

NONCARCINOGENIC EFFECTS - INGESTION EXPOSURE

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{Water Conc} \times \text{Consumption Rate} \times \frac{1}{\text{Body Wt.}} \times \frac{\text{Days Exposed/Year}}{\text{Days/Year}}$$

$$\text{Chronic Daily Intake (mg/kg-day)} = \text{mg/L} \times \text{1.0 L/day} \times \frac{1}{\text{15 kg}} \times \frac{\text{14 days}}{\text{365 days}}$$

Compound	Water Conc. (mg/L)	Rate (L/day)	Body Wt (kg)	Days Exposed/Yr Days/Yr	CDI	RfD (mg/kg-day)	CDI/RfD
Vinyl chloride	5.89E-02	1.0	15	3.84E-02	1.51E-04	--	--
1,2-Dichloroethene (total)	2.29E-01	1.0	15	3.84E-02	5.87E-04	9.00E-03	6.52E-02
Trichloroethene	5.70E-01	1.0	15	3.84E-02	1.46E-03	6.00E-03	2.43E-01
Tetrachloroethene	1.20E+00	1.0	15	3.84E-02	3.07E-03	1.00E-02	3.07E-01
1,1,2,2-Tetrachloroethane	5.50E-02	1.0	15	3.84E-02	1.41E-04	--	--
Chlorobenzene	1.10E-01	1.0	15	3.84E-02	2.81E-04	2.00E-02	1.41E-02
Naphthalene	1.90E-02	1.0	15	3.84E-02	4.85E-05	4.00E-02	1.21E-03
Pentachlorophenol	1.17E+00	1.0	15	3.84F-02	2.99E-03	3.00E-02	9.96E-02
Manganese	8.44E-01	1.0	15	3.84E-02	2.16E-03	1.40E-01	1.54E-02
						Hazard Index =	7.45E-01