
**SUPPLEMENT TO THE REVISED
BASELINE HEALTH RISK ASSESSMENT
FOR THE UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA
SEPTEMBER 1992**

 **DAMES & MOORE**

 **DAMES & MOORE**

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September 14, 1992

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Attention: Mr. James L. Tjosvold, P.E., Chief
Sacramento Responsible Party Unit
Site Mitigation Program

Re: Transmittal of Report
Supplement to the Revised
Baseline Health Risk Assessment
Union Pacific Railroad Yard
Sacramento, California
Project No. 00173-072-044

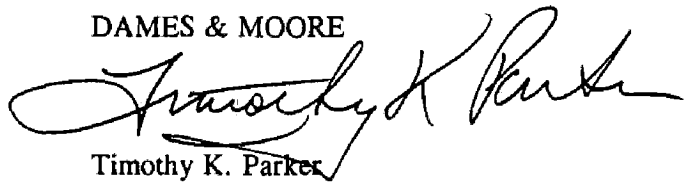
Dear Mr. Tjosvold:

Union Pacific Railroad Company (UPRR) has requested that Dames & Moore transmit the above-referenced report. Presented in the report are modifications to the Revised Baseline Health Risk Assessment (Dames & Moore, November 1991), based on comments received from the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) via correspondence and at a meeting of March 17, 1992.

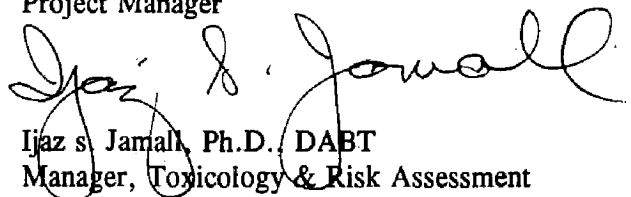
If you have any questions or require further clarification, please contact either of the undersigned.

Sincerely,

DAMES & MOORE



Timothy K. Parker
Project Manager



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**SUPPLEMENT TO THE REVISED
BASELINE HEALTH RISK ASSESSMENT
FOR THE UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA**

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**SUPPLEMENT TO THE REVISED
BASELINE HEALTH RISK ASSESSMENT
FOR THE UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA**

1.0 INTRODUCTION

This document is a Supplement to the Revised Baseline Health Risk Assessment (Appendix J of the Addendum Remedial Investigation/Feasibility Study (RI/FS) Report, Dames & Moore, 1991) dated November 1991 for the Union Pacific Railroad Yard, Sacramento, California. This document presents modifications to the Revised Baseline Health Risk Assessment (BHRA), based on comments from a March 17, 1992 meeting with the California Environmental Protection Agency (Cal EPA) Department of Toxic Substances Control (DTSC), and to various correspondence from DTSC. Except when noted, the methodology is based on the risk calculations performed in the November 1991 BHRA. Chemical concentrations and other site-specific data are based on information collected from Dames & Moore (1991).

2.0 REVISED BASELINE HEALTH RISK ESTIMATES

These recalculations involve the reevaluation of the carcinogenicity of 1,1-dichloroethene (1,1-DCE) (Section 2.1) and the replacement of selected exposure factors used in the November 1991 BHRA with default exposure factors (Section 2.3). Only chemicals that contributed a significant (as defined in Section 2.2) amount to health risks in the BHRA were examined.

2.1 CARCINOGENICITY OF 1,1-DICHLOROETHENE (1,1-DCE)

Based on a review of regulatory guidance and the available literature, 1,1-DCE was not considered to be carcinogenic in the recalculation of risks. The following information is summarized from USEPA Region IX guidance (EPA, 1990) to support the statement that 1,1-DCE not be evaluated as a carcinogen.

One study by Maltoni (EPA, 1990), which examined the inhalation of 1,1-DCE by mice, indicated that 1,1-DCE is a carcinogen. Since 1,1-DCE is mutagenic and structurally similar to vinyl chloride, a known human carcinogen, EPA classified 1,1-DCE as a group C (possible human) carcinogen. However, the Maltoni study did not unequivocally show a carcinogenic dose-response relationship, which is an important factor in judging the potential carcinogenicity of a chemical. A similar study by the same group of investigators did not produce cancer in rats, even though doses up to six-fold greater were administered. Furthermore, several other animal studies with 1,1-DCE yielded negative results for carcinogenic effects (according to the IRIS profile for 1,1-DCE, dated January 20, 1992). EPA Region IX notes that five oral carcinogenicity studies on 1,1-DCE, including a lifetime study by the National Cancer Institute and the National Toxicology Program, yielded negative results. Out of eleven inhalation studies on 1,1-DCE, only the early Maltoni study indicated a carcinogenic potential. Thus, the evidence supporting the classification of 1,1-DCE as a "carcinogen" is especially weak (EPA, 1990).

To address the risks associated with 1,1-DCE, EPA Region IX recommends the use of a modified-reference dose (RfD) approach (as opposed to using the cancer slope factor for this chemical). Although RfDs are intended to address non-carcinogenic effects, the Region IX guidance suggests applying an additional 10-fold safety factor to the published RfD for this chemical to account for the potential carcinogenic or unknown effects of this chemical. The carcinogenic risks of 1,1-DCE exposure

were not quantitatively evaluated. Therefore, in the chemical screening procedure described below, cancer risks associated with 1,1-DCE exposure were omitted from the total cancer risks calculated in the BHRA. The 10-fold safety factor was applied to the RfD and used to recalculate the non-carcinogenic effects of 1,1-DCE.

2.2 IDENTIFICATION OF CHEMICALS OF CONCERN

Only those compounds that provided a significant (as described below) contribution to risk in the BHRA were examined in this supplement. The Risk Assessment Guidance for Superfund (EPA, 1989) suggests that reducing the numbers of chemicals is appropriate as long as significant pathways and chemicals are included. Carcinogens were considered significant contributors if their individual contribution to cumulative cancer risk for a given exposure scenario was greater than or equal to (\geq), one percent of the total cancer risk for that scenario. Any chemical having an individual cancer risk of less than one percent of the cumulative risk was omitted from further evaluation; those contributing greater than one percent to total risk were retained for the risk recalculation procedure (*i.e.*, chemicals were included if: (risk of specific chemical \geq (total cancer risk from baseline risk assessment - risk of 1,1-DCE) x 1%). A similar procedure was followed in examining non-carcinogens; chemicals with hazard quotients less than or equal to 0.001 were not considered to contribute significantly to total risk from the site. This value is 0.1% of a hazard quotient of 1. Any chemical with a hazard quotient greater than 0.001 was retained for the risk recalculation procedure (*i.e.*, chemicals were included if the hazard quotient of specified chemical \geq 0.001).

Based on the above screening procedure, the following chemicals were chosen as chemicals of concern for risk recalculation in this Supplement:

Metals	PAHs	Pesticides	VOCs
Antimony	Anthracene	Aldrin	1,1,1-Trichloroethane
Arsenic	Benzo(a)anthracene		1,1,2-Trichloroethane
Barium	Benzo(a)pyrene		1,1-Dichloroethane
Beryllium	Benzo(b)fluoranthene		1,1-Dichloroethene
Cadmium	Benzo(ghi)perylene		1,2-Dichloroethane
Chromium	Benzo(k)fluoranthene		Benzene
Copper	Chrysene		Carbon tetrachloride
Nickel	Dibenzo(ah)anthracene		Chloroform
Silver	Fluoranthene		Ethylbenzene
Thallium	Indeno(1,2,3-cd)pyrene		Tetrachloroethene
Vanadium	Naphthalene		Toluene
Zinc	Phenanthrene		Trichloroethene
	Pyrene		Xylenes

PAHs were grouped in some instances on the basis of carcinogenic or noncarcinogenic effects; please refer to the BHRA (Dames & Moore 1991) for the rationale used in evaluating PAHs.

2.3 SELECTION OF EXPOSURE PARAMETERS

The exposure parameters used in the BHRA (Dames & Moore 1991) were replaced with EPA standard default exposure factors, which are less conservative (*i.e.*, intake estimates are likely to be lower). Replacement of these factors resulted in different chemical intake values, and hence, different risks due to chemical exposure. The following Table summarizes the changes in exposure factors for this supplement:

Exposure Parameter	Exposure Population	Pathway	Values Used	
			Baseline Health Risk Assessment	Revised Calculation
Exposure duration	Resident	All	70 years	30 years
	Trespasser		70 years	8 years
Averaging time - non-carcinogens	All	All	70 years	Period of exposure

Exposure Parameter	Exposure Population	Pathway	Values Used	
			Baseline Health Risk Assessment	Revised Calculation
Exposure frequency	Trespassers	All	350 days/year	104 day/year
Groundwater ingestion rate	Residents - children	Groundwater ingestion	1.2 L/day	1.4 L/day
Exposure time	Residents		16 hour/day	24 hour/day
	Trespassers		16 hour/day	8 hour/day
Skin surface area	Residents - adults	Dermal contact with soil	3,120 cm ²	4,300 cm ²
Skin surface area	Residents - children	Bathing	3,910 cm ²	8,760 cm ²
Skin surface area	Trespassers	Dermal contact with soil	3,120 cm ²	4,100 cm ²

The exposure scenarios and pathways examined, and the exposure concentrations are the same as those used in the BHRA. The toxicity criteria remained the same except that a RfD for arsenic of 0.003 mg/kg/day was used (in response to DTSC comments) to compute noncancer effects of this element, and the slope factor for 1,1-DCE was corrected. The exposure factors used in the revised calculations are presented in Table 2-1. Of particular note are the changes in the averaging time and exposure duration parameters. The Draft Scientific and Technical Standards for Hazardous Waste Sites, Volume 2: Exposure Assessment (DTSC, 1990) suggests that the exposure duration be considered equivalent to the averaging time; therefore, an exposure duration and averaging time of 70 years each for both adult and child receptors were used in the BHRA. The EPA suggests that the averaging time for noncarcinogenic effects be made equivalent to the period of exposure which is referred to as the exposure duration. EPA (1991) notes the default residential exposure duration as 30 years (24 years for adults, and 6 years for children). Therefore, averaging times of 30 years (equivalent to summed exposure duration) for non-carcinogenic effects and 70 years (equivalent to lifetime) for carcinogenic effects were used in this Supplement.

2.4 RISK RECALCULATION RESULTS

Tables 2-2 to 2-22 present the exposure calculations based on the revised exposure parameters. Summaries of the hazard quotients and hazard indices (using a screening approach, summing all chemicals and all pathways) are presented in Tables 2-23 to 2-30. Carcinogenic risks for each chemical and each pathway are summarized in Tables 2-31 to 2-38. Because hazard indices, using the screening approach, exceeded unity for several pathways, hazard indices were summed according to critical effect or common target organ (please see Table 2-39).

The summary of cancer risks and hazard indices is presented in Table 2-40. Arsenic was a common contributor to cancer risk in all scenarios; however, the background level of arsenic in soil samples collected in the vicinity (8 mg/kg) would also produce risks in excess of 1×10^{-6} . Therefore, part of the contribution of arsenic to total risk is due to background concentrations. Hazard indices based on hepatotoxicity (liver toxicity) exceeded one for the future on-site and off-site residential scenarios.

REFERENCES

- Dames & Moore. 1991. Addendum Remedial Investigation/Feasibility Study Report, Union Pacific Railroad Yard, Sacramento, California, dated November 1991.
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- Wester, R.C., H.I. Maibach, L. Sedik, J. Melendres, S. Dizio, I. Jamall and M. Wade. 1991. *In-vitro* percutaneous absorption of cadmium from water and soil into human skin. Toxicologist 11:289.2

TABLES

TABLE 2-1
SUMMARY OF VALUES USED TO ESTIMATE INTAKE
UNION PACIFIC RAILROAD SITE

GENERAL PARAMETERS		
PARAMETER	VALUE	SOURCE/RATIONALE
Lifetime Average Daily Dose (LADD) or Average Daily Dose (ADD)	mg/kg/day	Calculated
Soil Concentrations (C _s) Groundwater Concentrations (C _w) Particulate Concentrations (C _p) Vapor Concentrations (C _v)	mg/kg mg/L mg/m ³ mg/m ³	Representative concentrations based on samples from appropriate area on-site Estimated concentrations at receptor well using fate and transport modeling Concentration based on the product of soil concentration fraction containing chemical, and California Air Resources Board measurements in area Based on modeling results
Fraction from Contaminated Soil (F) Resident Trespasser	1 1	Default value Default value
Exposure Frequency (EF) Resident Trespasser	350 days/year 104 days/year	EPA (1991) Professional judgment; trespasser assumed to be on-site 2 days/week
Exposure Duration (ED) Resident Adult Child Trespasser	24 years 6 years 8 years	Default value Default value Professional judgment, maximum time for youths 9 - 17 years old
Body Weight (BW) Adult Child Trespasser	70 kg 15.1 kg 50.6 kg	Default value Default value Median bodyweight of child 9 - 17 years old
Averaging Time (AT) Carcinogens Non-carcinogens Adult Child Trespasser	70 years 24 years 6 years 8 years	Lifetime (EPA, 1991) EPA (1991) EPA (1991) See Exposure Duration
Conversion Factors	365 10 ⁻⁶	Days per year Kg per mg

TABLE 2-1 (CONTINUED)

PATHWAY SPECIFIC PARAMETERS		
PARAMETER	VALUE	SOURCE/RATIONALE
Dermal Contact with Soil		
Skin Surface Area (SA)		
Adult	4,300 cm ²	Exposed hands, forearms, and head of adult males (EPA, 1988)
Child	3,910 cm ²	Surface area of hands, arms, and legs averaged over the ages of 6-7 years (EPA, 1989)
Trespasser	4,100 cm ²	Median surface area of hands, arms and head of children between the ages of 9 - 17 years (EPA, 1989).
Soil to Skin Adherence Factor (AF)	1.45 mg/cm ² /day	EPA (1989)
Absorption Factor (ABS)		
Metals	0.0007	Based on analogy to cadmium, Wester, <i>et al.</i> (1991)
PNAs	0.13	Wester, <i>et al.</i> (1990)
SVOCs	0.10	Professional judgment
VOCs	0.10	Professional judgment
Soil Ingestion		
Soil Ingestion Rate (Is)		
Adult	100 mg/day	EPA (1991)
Child	200 mg/day	EPA (1991)
Trespasser	100 mg/day	Assumed equivalent to adult
Particulate Inhalation		
Particulate Deposition to Lung (Pd)	1	Maximum
Inhalation Rate (IR)		
Adult	0.83 m ³ /hour	Based on breathing rate of 20 m ³ /day (EPA, 1991)
Child	0.80 m ³ /hour	Estimated accounting for activity levels of children (EPA, 1990)
Trespasser	0.83 m ³ /hour	Based on breathing rate of 20 m ³ /day (EPA, 1991)
Exposure Time (ET)		
Residents	24 hours/day	Based on EPA (1991b) default value for breathing rate of 20 m ³ /day.
Trespassers	8 hours/day	Professional judgment
Groundwater Ingestion		
Ingestion Rate (IR)		
Adult	2 L/day	EPA (1991)
Child	1.4 L/day	Professional judgment; Based on average intake for adults (EPA, 1990)

TABLE 2-1 (CONTINUED)

PATHWAY SPECIFIC PARAMETERS		
PARAMETER	VALUE	SOURCE/RATIONALE
Dermal Contact with Groundwater (during Showering/Bathing)		
Skin Surface Area (SA) Adult Child	19,400 cm ² 8,760 cm ²	EPA (1990) 95 th percentile value for males 3-6 years, EPA (1990)
Exposure Time (ET) Adult Child	0.25 hours/day 0.25 hours/day	Average showering time of 15 minutes (EPA, 1988) Average bathing time of 15 minutes (EPA, 1988)
Inhalation of Vapors during Showering		
Inhalation Rate (IR) Adult Child	0.63 m ³ /hour NA	EPA (1991) Professional judgement; children assumed to bathe instead of shower
Exposure Time (ET) Adult	0.25 hours/day	Average showering time of 12 minutes (EPA, 1989)

Table 2-2

**TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE
CURRENT ON-SITE TRESPASSER SCENARIO**

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Dermal Contact:							
Metals							
Antimony	31.77	7.44E-07	4.00E-04	1.86E-03	8.51E-08	NA	NA
Arsenic	45.91	1.08E-06	3.00E-04	3.59E-03	1.23E-07	1.75E+00	2.15E-07
Barium	297.66	6.98E-06	1.00E-02	6.98E-04	7.97E-07	NA	NA
Beryllium	2.72	6.37E-08	5.00E-03	1.27E-05	7.28E-09	4.30E+00	3.13E-08
Thallium	36.3	8.51E-07	7.00E-05	1.22E-02	9.72E-08	NA	NA
PAHs							
Anthracene	2.55	1.11E-05	5.70E-04	1.95E-02	1.27E-06	NA	NA
Carcinogenic PAHs	4.28	1.86E-05	5.70E-04	3.27E-02	2.13E-06	4.00E-01	8.51E-07
Fluoranthene	0.91	3.96E-06	5.70E-04	6.95E-03	4.53E-07	NA	NA
Naphthalene	10.61	4.62E-05	5.70E-04	8.10E-02	5.28E-06	NA	NA
Phenanthrene	2.69	1.17E-05	5.70E-04	2.05E-02	1.34E-06	NA	NA
Pyrene	0.93	4.05E-06	5.70E-04	7.10E-03	4.63E-07	NA	NA
				HAZARD INDEX:	0.19		
						TOTAL RISK:	1 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-3

**TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE
CURRENT ON-SITE TRESPASSER SCENARIO**

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Soil Ingestion							
Metals							
Antimony	31.77	1.79E-05	4.00E-04	4.47E-02	2.04E-06	NA	NA
Arsenic	45.91	2.59E-05	3.00E-04	8.62E-02	2.95E-06	1.75E+00	5.17E-06
Barium	297.66	1.68E-04	1.00E-02	1.68E-02	1.92E-05	NA	NA
Beryllium	2.72	1.53E-06	5.00E-03	3.06E-04	1.75E-07	4.30E+00	7.53E-07
Thallium	36.3	2.04E-05	7.00E-05	2.92E-01	2.34E-06	NA	NA
PAHs							
Anthracene	2.55	1.44E-06	5.70E-04	2.52E-03	1.64E-07	NA	NA
Carcinogenic PAHs	4.28	2.41E-06	5.70E-04	4.23E-03	2.75E-07	4.00E-01	1.10E-07
Fluoranthene	0.91	5.12E-07	5.70E-04	8.99E-04	5.86E-08	NA	NA
Naphthalene	10.61	5.97E-06	5.70E-04	1.05E-02	6.83E-07	NA	NA
Phenanthrene	2.69	1.51E-06	5.70E-04	2.66E-03	1.73E-07	NA	NA
Pyrene	0.93	5.24E-07	5.70E-04	9.19E-04	5.99E-08	NA	NA

HAZARD INDEX: 0.46

TOTAL RISK: 6 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RfD (or AAL)

Table 2-4

**TOTAL INTAKE AND RISKS FROM INHALATION OF OUTDOOR AIR IN THE
CURRENT ON-SITE TRESPASSER SCENARIO**

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Inhalation							
Metals							
Antimony	4.00E-06	1.50E-07	4.00E-04	3.74E-04	1.71E-08	NA	NA
Arsenic	3.10E-05	1.16E-06	3.00E-04	3.86E-03	1.32E-07	1.50E+01	1.99E-06
Barium	3.70E-05	1.38E-06	1.43E-03	9.67E-04	1.58E-07	NA	NA
Beryllium	4.40E-07	1.65E-08	5.00E-03	3.29E-06	1.88E-09	8.40E+00	1.58E-08
Thallium	4.00E-06	1.50E-07	7.00E-05	2.14E-03	1.71E-08	NA	NA
PAHs							
Non-Carcinogenic PAHs	7.90E-05	2.95E-06	5.70E-04	5.18E-03	3.38E-07	NA	NA

HAZARD INDEX: 0.013

TOTAL RISK: 2 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-5

TOTAL INTAKE AND RISKS FROM INHALATION OF OUTDOOR AIR IN THE
CURRENT OFF-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Inhalation							
VOCs							
1,1-Dichloroethane	1.95E-05	4.26E-06	1.00E-01	4.26E-05	1.82E-06	NA	NA
Metals							
Arsenic	3.10E-05	6.77E-06	3.00E-04	2.26E-02	2.90E-06	1.50E+01	4.35E-05
Beryllium	4.38E-07	9.56E-08	5.00E-03	1.91E-05	4.10E-08	8.40E+00	3.44E-07
Cadmium	2.13E-07	4.65E-08	5.00E-04	9.30E-05	1.99E-08	6.10E+00	1.22E-07
Thallium	4.00E-06	8.73E-07	7.00E-05	1.25E-02	3.74E-07	NA	NA
PAHs							
Non-Carcinogenic PAHs	7.90E-05	1.72E-05	5.70E-04	3.03E-02	7.39E-06	NA	NA
				HAZARD INDEX:	0.065		
						TOTAL RISK:	4 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RID = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-6

**TOTAL INTAKE AND RISKS FROM INHALATION OF OUTDOOR AIR IN THE
CURRENT OFF-SITE RESIDENT -CHILD- SCENARIO**

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Inhalation							
VOCs							
1,1-Dichloroethane	1.95E-05	4.76E-06	1.00E-01	4.76E-05	2.04E-06	NA	NA
Metals							
Arsenic	3.10E-05	7.56E-06	3.00E-04	2.52E-02	3.24E-06	1.50E+01	4.86E-05
Beryllium	4.38E-07	1.07E-07	5.00E-03	2.14E-05	4.58E-08	8.40E+00	3.85E-07
Cadmium	2.13E-07	5.19E-08	5.00E-04	1.04E-04	2.23E-08	6.10E+00	1.36E-07
Thallium	4.00E-06	9.75E-07	7.00E-05	1.39E-02	4.18E-07	NA	NA
PAHs							
Non-Carcinogenic PAHs	7.90E-05	1.93E-05	5.70E-04	3.38E-02	8.26E-06	NA	NA

HAZARD INDEX: 0.073

TOTAL RISK: 5 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RfD (or AAL)

Table 2-7

TOTAL INTAKE AND RISKS FROM INHALATION OF OUTDOOR AIR IN THE
FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Inhalation							
Metals							
Arsenic	3.10E-05	6.77E-06	3.00E-04	2.26E-02	2.90E-06	1.50E+01	4.35E-05
Thallium	4.00E-06	8.73E-07	7.00E-05	1.25E-02	3.74E-07	NA	NA
PAHs							
Non-Carcinogenic PAHs	7.90E-05	1.72E-05	5.70E-04	3.03E-02	7.39E-06	NA	NA

HAZARD INDEX: 0.065

TOTAL RISK: 4 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RID = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-8

TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH GROUNDWATER IN THE FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Dermal contact (showering)							
VOCs							
1,1,1-Trichloroethane	3.79E-03	2.03E-04	8.57E-03	2.37E-02	8.72E-05	NA	NA
1,1-Dichloroethane	8.20E-03	4.40E-04	1.00E-01	4.40E-03	1.89E-04	NA	NA
1,1-Dichloroethene	4.10E-02	2.20E-03	9.00E-04	2.45E+00	9.43E-04	NA	NA
1,2-Dichloroethane	4.90E-03	2.63E-04	NA	NA	1.13E-04	9.10E-02	1.03E-05
Carbon tetrachloride	1.03E-03	5.53E-05	7.00E-04	7.90E-02	2.37E-05	1.30E-01	3.08E-06
Trichloroethene	1.10E-03	5.91E-05	2.00E-04	2.95E-01	2.53E-05	1.10E-02	2.78E-07

HAZARD INDEX: 2.85

TOTAL RISK: 1 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-9

TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE
FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Groundwater Ingestion							
VOCs							
1,1,1-Trichloroethane	3.79E-03	8.31E-05	8.57E-03	9.69E-03	3.56E-05	NA	NA
1,1-Dichloroethane	8.20E-03	1.80E-04	1.00E-01	1.80E-03	7.70E-05	NA	NA
1,1-Dichloroethene	4.10E-02	8.99E-04	9.00E-04	9.98E-01	3.85E-04	NA	NA
1,2-Dichloroethane	4.90E-03	1.07E-04	NA	NA	4.60E-05	9.10E-02	4.19E-06
Carbon tetrachloride	1.03E-03	2.26E-05	7.00E-04	3.23E-02	9.68E-06	1.30E-01	1.26E-06
Trichloroethene	1.10E-03	2.41E-05	2.00E-04	1.21E-01	1.03E-05	1.10E-02	1.14E-07

HAZARD INDEX: 1.16

TOTAL RISK: 6 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-10

TOTAL INTAKE AND RISKS FROM VAPOR INHALATION OF GROUNDWATER IN THE FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Vapor Inhalation (showering)							
VOCs							
1,1,1-Trichloroethane	1.18E-01	2.04E-04	8.57E-02	2.38E-03	8.73E-05	NA	NA
1,1-Dichloroethane	2.83E-01	4.88E-04	1.00E-01	4.88E-03	2.09E-04	NA	NA
1,1-Dichloroethene	1.46E+00	2.52E-03	9.00E-04	2.80E+00	1.08E-03	NA	NA
1,2-Dichloroethane	1.47E-01	NA	NA	NA	1.09E-04	9.10E-02	9.90E-06
Carbon tetrachloride	3.10E-02	5.35E-05	7.00E-04	7.64E-02	2.29E-05	1.30E-01	2.98E-06
Trichloroethene	3.50E-02	6.04E-05	2.00E-03	3.02E-02	2.59E-05	1.70E-02	4.40E-07

HAZARD INDEX: 2.91

TOTAL RISK: 1 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
 RfD = Reference Dose
 AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
 SF = Carcinogenic Slope Factor
 RISK = LADD x SF

NA = Not Applicable, no criteria.
 1E-6 = 1/1,000,000
 Hazard Ratio = ADD / RfD (or AAL)

Table 2-11

TOTAL INTAKE AND RISKS FROM INHALATION OF OUTDOOR AIR IN THE
FUTURE OFF-SITE RESIDENT -CHILD- SCENARIO

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Inhalation							
Metals							
Arsenic	3.10E-05	7.56E-06	3.00E-04	2.52E-02	3.24E-06	1.50E+01	4.86E-05
Beryllium	4.38E-07	1.07E-07	1.00E-04	1.07E-03	4.58E-08	8.40E+00	3.85E-07
Cadmium	2.13E-07	5.19E-08	5.00E-04	1.04E-04	2.23E-08	6.10E+00	1.36E-07
Thallium	4.00E-06	9.75E-07	7.00E-05	1.39E-02	4.18E-07	NA	NA
PAHs							
Non-Carcinogenic	7.90E-05	1.93E-05	4.00E-03	4.82E-03	8.26E-06	NA	NA

HAZARD INDEX: 0.045

TOTAL RISK: 5 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-12

TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH GROUNDWATER IN THE
FUTURE OFF-SITE RESIDENT -CHILD- SCENARIO

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Dermal contact (bathing)							
VOCs							
1,1,1-Trichloroethane	3.79E-03	1.06E-04	8.57E-03	1.24E-02	4.56E-05	NA	NA
1,1-Dichloroethane	8.20E-03	2.30E-04	1.00E-01	2.30E-03	9.87E-05	NA	NA
1,1-Dichloroethene	4.10E-02	1.15E-03	9.00E-04	1.28E+00	4.94E-04	NA	NA
1,2-Dichloroethane	4.90E-03	1.38E-04	NA	NA	5.90E-05	9.10E-02	5.37E-06
Carbon tetrachloride	1.03E-03	2.89E-05	7.00E-04	4.13E-02	1.24E-05	1.30E-01	1.61E-06
Chloroform	1.47E-03	4.13E-05	1.00E-02	4.13E-03	1.77E-05	6.10E-03	1.08E-07
Trichloroethene	1.10E-03	3.09E-05	2.00E-04	1.55E-01	1.32E-05	1.10E-02	1.46E-07
Tetrachloroethene	5.40E-04	1.52E-05	1.00E-02	1.52E-03	6.50E-06	5.10E-02	3.32E-07

HAZARD INDEX: 1.50

TOTAL RISK: 8 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RfD (or AAL)

Table 2-13

TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE FUTURE OFF-SITE RESIDENT -CHILD- SCENARIO

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Groundwater Ingestion							
VOCs							
1,1,1-Trichloroethane	3.79E-03	6.74E-05	8.57E-03	7.86E-03	2.89E-05	NA	NA
1,1-Dichloroethane	8.20E-03	1.46E-04	1.00E-01	1.46E-03	6.25E-05	NA	NA
1,1-Dichloroethene	4.10E-02	7.29E-04	9.00E-04	8.10E-01	3.12E-04	NA	NA
1,2-Dichloroethane	4.90E-03	8.71E-05	NA	NA	3.73E-05	9.10E-02	3.40E-06
Carbon tetrachloride	1.03E-03	1.83E-05	7.00E-04	2.62E-02	7.85E-06	1.30E-01	1.02E-06
Chloroform	1.47E-03	2.61E-05	1.00E-02	2.61E-03	1.12E-05	6.10E-03	6.83E-08
Trichloroethene	1.10E-03	1.96E-05	2.00E-04	9.78E-02	8.38E-06	1.10E-02	9.22E-08
Tetrachloroethene	5.40E-04	9.60E-06	1.00E-02	9.60E-04	4.12E-06	5.10E-02	2.10E-07

HAZARD INDEX: 0.95

TOTAL RISK: 5 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
 RID = Reference Dose
 AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
 SF = Carcinogenic Slope Factor
 RISK = LADD x SF

NA = Not Applicable, no-criteria.
 1E-6 = 1/1,000,000
 Hazard Ratio = ADD / RID (or AAL)

Table 2-14

**TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO**

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Dermal Contact							
Metals							
Antimony	31.77	1.52E-06	4.00E-04	3.80E-03	6.51E-07	NA	NA
Arsenic	45.91	2.20E-06	3.00E-04	7.32E-03	9.41E-07	1.75E+00	1.65E-06
Barium	297.66	1.42E-05	1.00E-02	1.42E-03	6.10E-06	NA	NA
Beryllium	2.72	1.30E-07	5.00E-03	2.60E-05	5.58E-08	4.30E+00	2.40E-07
Cadmium	1.32	6.31E-08	5.00E-04	1.26E-04	2.71E-08	NA	NA
Chromium	39.41	1.88E-06	1.43E+00	1.32E-06	8.08E-07	NA	NA
Nickel	40.24	1.92E-06	1.14E-02	1.68E-04	8.25E-07	NA	NA
Silver	1.31	6.27E-08	5.71E-03	1.10E-05	2.69E-08	NA	NA
Thallium	36.3	1.74E-06	7.00E-05	2.48E-02	7.44E-07	NA	NA
Vanadium	39.86	1.91E-06	7.00E-03	2.72E-04	8.17E-07	NA	NA
PAHs							
Carcinogenic PAHs	4.28	3.80E-05	5.70E-04	6.67E-02	1.63E-05	4.00E-01	6.52E-06
Fluoranthene	0.91	8.08E-06	5.70E-04	1.42E-02	3.46E-06	NA	NA
Naphthalene	10.61	9.42E-05	5.70E-04	1.65E-01	4.04E-05	NA	NA
Phenanthrene	2.69	2.39E-05	5.70E-04	4.19E-02	1.02E-05	NA	NA
Pyrene	0.93	8.26E-06	5.70E-04	1.45E-02	3.54E-06	NA	NA
VOCs							
Toluene	0.16	1.09E-06	5.71E-02	1.91E-05	4.69E-07	NA	NA
HAZARD INDEX:				0.34	TOTAL RISK:		8 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RID = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-15

**TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO**

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Soil Ingestion							
Metals							
Antimony	31.77	3.48E-05	4.00E-04	8.70E-02	1.49E-05	NA	NA
Arsenic	45.91	5.03E-05	3.00E-04	1.68E-01	2.16E-05	1.75E+00	3.77E-05
Barium	297.66	3.26E-04	1.00E-02	3.26E-02	1.40E-04	NA	NA
Beryllium	2.72	2.98E-06	5.00E-03	5.96E-04	1.28E-06	4.30E+00	5.49E-06
Cadmium	1.32	1.45E-06	5.00E-04	2.89E-03	6.20E-07	NA	NA
Chromium	39.41	4.32E-05	1.43E+00	3.02E-05	1.85E-05	NA	NA
Nickel	40.24	4.41E-05	1.14E-02	3.86E-03	1.89E-05	NA	NA
Silver	1.31	1.44E-06	5.71E-03	2.51E-04	6.15E-07	NA	NA
Thallium	36.3	3.98E-05	7.00E-05	5.68E-01	1.70E-05	NA	NA
Vanadium	39.86	4.37E-05	7.00E-03	6.24E-03	1.87E-05	NA	NA
PAHs							
Carcinogenic PAHs	4.28	4.69E-06	5.70E-04	8.23E-03	2.01E-06	4.00E-01	8.04E-07
Fluoranthene	0.91	9.97E-07	5.70E-04	1.75E-03	4.27E-07	NA	NA
Naphthalene	10.61	1.16E-05	5.70E-04	2.04E-02	4.98E-06	NA	NA
Phenanthrene	2.69	2.95E-06	5.70E-04	5.17E-03	1.26E-06	NA	NA
Pyrene	0.93	1.02E-06	5.70E-04	1.79E-03	4.37E-07	NA	NA
VOCs							
Toluene	0.16	1.75E-07	5.71E-02	3.07E-06	7.51E-08	NA	NA
HAZARD INDEX:				0.91	TOTAL RISK:		4 E-05

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RID = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-16

**TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH GROUNDWATER IN THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO**

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RfD (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK	
Dermal contact (showering)								
Metals								
Arsenic	7.37E-03	NA	NA	NA	NA	NA	NA	
Barium	1.91E-01	NA	NA	NA	NA	NA	NA	
Beryllium	1.14E-03	NA	NA	NA	NA	NA	NA	
Cadmium	1.69E-04	NA	NA	NA	NA	NA	NA	
Chromium	3.02E-02	NA	NA	NA	NA	NA	NA	
Nickel	9.22E-02	NA	NA	NA	NA	NA	NA	
Silver	2.27E-03	NA	NA	NA	NA	NA	NA	
Vanadium	2.63E-02	NA	NA	NA	NA	NA	NA	
VOCs								
1,1,1-Trichloroethane	6.20E-03	3.33E-04	8.57E-03	3.88E-02	1.43E-04	NA	NA	
1,1-Dichloroethane	5.86E-02	3.15E-03	9.00E-04	3.50E+00	1.35E-03	NA	NA	
Benzene	6.62E-01	3.55E-02	NA	NA	1.52E-02	2.90E-02	4.42E-04	
Carbon tetrachloride	9.10E-04	4.89E-05	7.00E-04	6.98E-02	2.09E-05	1.30E-01	2.72E-06	
Ethylbenzene	4.66E-02	2.50E-03	1.00E-01	2.50E-02	1.07E-03	NA	NA	
Toluene	4.16E-02	2.23E-03	5.71E-02	3.91E-02	9.57E-04	NA	NA	
Xylenes	9.95E-02	5.34E-03	5.70E-02	9.37E-02	2.29E-03	NA	NA	
Pesticides								
Aldrin	3.00E-05	NA	3.00E-05	NA	NA	1.70E+01	NA	
HAZARD INDEX:				3.76	TOTAL RISK:			4 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

Note: In accordance with the 1991 BHRA, dermal contact with metals was not evaluated.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RfD (or AAL)

Table 2-17

TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Groundwater Ingestion							
Metals							
Arsenic	7.37E-03	1.62E-04	3.00E-04	5.38E-01	6.92E-05	1.75E+00	1.21E-04
Barium	1.91E-01	4.19E-03	1.00E-02	4.19E-01	1.79E-03	NA	NA
Beryllium	1.14E-03	2.50E-05	5.00E-03	5.00E-03	1.07E-05	4.30E+00	4.60E-05
Cadmium	1.69E-04	3.70E-06	5.00E-04	7.41E-03	1.59E-06	NA	NA
Chromium	3.02E-02	6.62E-04	1.43E+00	4.63E-04	2.84E-04	NA	NA
Nickel	9.22E-02	2.02E-03	1.14E-02	1.77E-01	8.66E-04	NA	NA
Silver	2.27E-03	4.98E-05	5.71E-03	8.71E-03	2.13E-05	NA	NA
Vanadium	2.63E-02	5.76E-04	7.00E-03	8.23E-02	2.47E-04	NA	NA
VOCs							
1,1,1-Trichloroethane	6.20E-03	1.36E-04	8.57E-03	1.59E-02	5.82E-05	NA	NA
1,1-Dichloroethene	5.86E-02	1.28E-03	9.00E-04	1.43E+00	5.51E-04	NA	NA
Benzene	6.62E-01	1.45E-02	NA	NA	6.22E-03	2.90E-02	1.80E-04
Carbon tetrachloride	9.10E-04	1.99E-05	7.00E-04	2.85E-02	8.55E-06	1.30E-01	1.11E-06
Ethylbenzene	4.66E-02	1.02E-03	1.00E-01	1.02E-02	4.38E-04	NA	NA
Toluene	4.16E-02	9.12E-04	5.71E-02	1.60E-02	3.91E-04	NA	NA
Xylenes	9.95E-02	2.18E-03	5.70E-02	3.83E-02	9.35E-04	NA	NA
Pesticides							
Aldrin	3.00E-05	6.58E-07	3.00E-05	2.19E-02	2.82E-07	1.70E+01	4.79E-06
				HAZARD INDEX:	2.80		
						TOTAL RISK:	4 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RfD = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RfD (or AAL)

Table 2-18

**TOTAL INTAKE AND RISKS FROM VAPOR INHALATION OF GROUNDWATER IN THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO**

CHEMICAL	Concentration (mg/m ³)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK	
Vapor Inhalation (showering)								
Metals								
Arsenic	NA	NA	NA	NA	NA	NA	NA	
Barium	NA	NA	NA	NA	NA	NA	NA	
Beryllium	NA	NA	NA	NA	NA	NA	NA	
Cadmium	NA	NA	NA	NA	NA	NA	NA	
Chromium	NA	NA	NA	NA	NA	NA	NA	
Nickel	NA	NA	NA	NA	NA	NA	NA	
Silver	NA	NA	NA	NA	NA	NA	NA	
Vanadium	NA	NA	NA	NA	NA	NA	NA	
VOCs								
1,1,1-Trichloroethane	0.192	3.31E-04	8.57E-02	3.87E-03	1.42E-04	NA	NA	
1,1-Dichloroethene	2.087	3.60E-03	9.00E-04	4.00E+00	1.54E-03	NA	NA	
Benzene	24.82	4.28E-02	NA	NA	1.84E-02	2.90E-02	5.32E-04	
Carbon tetrachloride	0.027	4.66E-05	7.00E-04	6.66E-02	2.00E-05	1.30E-01	2.60E-06	
Ethylbenzene	1.58	2.73E-03	1.00E-01	2.73E-02	1.17E-03	NA	NA	
Toluene	1.47	2.54E-03	5.71E-02	4.44E-02	1.09E-03	NA	NA	
Xylenes	3.33	5.75E-03	1.14E-01	5.04E-02	2.46E-03	NA	NA	
Pesticides								
Aldrin	NA	NA	NA	NA	NA	NA	NA	
HAZARD INDEX:				4.20	TOTAL RISK:			5 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RID = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-19

**TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH SOIL IN THE
FUTURE ON-SITE RESIDENT CHILD SCENARIO**

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK	
Dermal Contact								
Metals								
Antimony	31.77	1.60E-06	4.00E-04	4.00E-03	6.86E-07	NA	NA	
Arsenic	45.91	2.31E-06	3.00E-04	7.71E-03	9.92E-07	1.75E+00	1.74E-06	
Barium	297.66	1.50E-05	1.00E-02	1.50E-03	6.43E-06	NA	NA	
Beryllium	2.72	1.37E-07	5.00E-03	2.74E-05	5.88E-08	4.30E+00	2.53E-07	
Cadmium	1.32	6.65E-08	5.00E-04	1.33E-04	2.85E-08	NA	NA	
Chromium	39.41	1.99E-06	1.43E+00	1.39E-06	8.51E-07	NA	NA	
Copper	429.29	2.16E-05	1.14E-01	1.90E-04	9.27E-06	NA	NA	
Nickel	40.24	2.03E-06	1.14E-02	1.77E-04	8.69E-07	NA	NA	
Silver	1.31	6.60E-08	5.71E-03	1.16E-05	2.83E-08	NA	NA	
Thallium	36.3	1.83E-06	7.00E-05	2.61E-02	7.84E-07	NA	NA	
Vanadium	39.86	2.01E-06	7.00E-03	2.87E-04	8.61E-07	NA	NA	
Zinc	698.36	3.52E-05	2.29E-01	1.54E-04	1.51E-05	NA	NA	
PAHs								
Carcinogenic PAHs	4.28	4.01E-05	5.70E-04	7.03E-02	1.72E-05	4.00E-01	6.87E-06	
Anthracene	2.55	2.39E-05	5.70E-04	4.19E-02	1.02E-05	NA	NA	
Benzo(g,h,i)Perylene	0.35	3.28E-06	5.70E-04	5.75E-03	1.40E-06	NA	NA	
Fluoranthene	0.91	8.52E-06	5.70E-04	1.49E-02	3.65E-06	NA	NA	
Naphthalene	10.61	9.93E-05	5.70E-04	1.74E-01	4.26E-05	NA	NA	
Phenanthrene	2.69	2.52E-05	5.70E-04	4.42E-02	1.08E-05	NA	NA	
Pyrene	0.93	8.71E-06	5.70E-04	1.53E-02	3.73E-06	NA	NA	
VOCs								
Toluene	0.16	1.15E-06	5.71E-02	2.02E-05	4.94E-07	NA	NA	
HAZARD INDEX:				0.41	TOTAL RISK:			9 E-06

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-20

TOTAL INTAKE AND RISKS FROM INGESTION OF SOIL IN THE
FUTURE ON-SITE RESIDENT -CHILD- SCENARIO

CHEMICAL	Concentration (mg/kg)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Soil Ingestion							
Metals							
Antimony	31.77	8.07E-05	4.00E-04	2.02E-01	3.46E-05	NA	NA
Arsenic	45.91	1.17E-04	3.00E-04	3.89E-01	5.00E-05	1.75E+00	8.75E-05
Barium	297.66	7.56E-04	1.00E-02	7.56E-02	3.24E-04	NA	NA
Beryllium	2.72	6.91E-06	5.00E-03	1.38E-03	2.96E-06	4.30E+00	1.27E-05
Cadmium	1.32	3.35E-06	5.00E-04	6.71E-03	1.44E-06	NA	NA
Chromium	39.41	1.00E-04	1.43E+00	7.01E-05	4.29E-05	NA	NA
Copper	429.29	1.09E-03	1.14E-01	9.57E-03	4.67E-04	NA	NA
Nickel	40.24	1.02E-04	1.14E-02	8.94E-03	4.38E-05	NA	NA
Silver	1.31	3.33E-06	5.71E-03	5.83E-04	1.43E-06	NA	NA
Thallium	36.3	9.22E-05	7.00E-05	1.32E+00	3.95E-05	NA	NA
Vanadium	39.86	1.01E-04	7.00E-03	1.45E-02	4.34E-05	NA	NA
Zinc	698.36	1.77E-03	2.29E-01	7.75E-03	7.60E-04	NA	NA
PAHs							
Carcinogenic PAHs	4.28	1.09E-05	5.70E-04	1.91E-02	4.66E-06	4.00E-01	1.86E-06
Anthracene	2.55	6.48E-06	5.70E-04	1.14E-02	2.78E-06	NA	NA
Benzo(g,h,i)Perylene	0.35	8.89E-07	5.70E-04	1.56E-03	3.81E-07	NA	NA
Fluoranthene	0.91	2.31E-06	5.70E-04	4.06E-03	9.91E-07	NA	NA
Naphthalene	10.61	2.70E-05	5.70E-04	4.73E-02	1.16E-05	NA	NA
Phenanthrene	2.69	6.83E-06	5.70E-04	1.20E-02	2.93E-06	NA	NA
Pyrene	0.93	2.36E-06	5.70E-04	4.14E-03	1.01E-06	NA	NA
VOCs							
Toluene	0.16	4.06E-07	5.71E-02	7.11E-06	1.74E-07	NA	NA

HAZARD INDEX: 2.13

TOTAL RISK: 1 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-21

**TOTAL INTAKE AND RISKS FROM DERMAL CONTACT WITH GROUNDWATER IN THE
FUTURE ON-SITE RESIDENT -CHILD- SCENARIO**

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK
Dermal contact (bathing)							
Metals							
Arsenic	7.37E-03	NA	NA	NA	NA	NA	NA
Barium	1.91E-01	NA	NA	NA	NA	NA	NA
Beryllium	1.14E-03	NA	NA	NA	NA	NA	NA
Cadmium	1.69E-04	NA	NA	NA	NA	NA	NA
Chromium	3.02E-02	NA	NA	NA	NA	NA	NA
Copper	1.08E-02	NA	NA	NA	NA	NA	NA
Nickel	9.22E-02	NA	NA	NA	NA	NA	NA
Silver	2.27E-03	NA	NA	NA	NA	NA	NA
Vanadium	2.63E-02	NA	NA	NA	NA	NA	NA
Zinc	3.87E-02	NA	NA	NA	NA	NA	NA
VOCs							
1,1,1-Trichloroethane	6.20E-03	1.74E-04	8.57E-03	2.03E-02	7.46E-05	NA	NA
1,1,2-Trichloroethane	9.00E-04	2.53E-05	4.00E-03	6.32E-03	1.08E-05	5.70E-02	6.18E-07
1,1-Dichloroethane	5.47E-03	1.54E-04	1.00E-01	1.54E-03	6.59E-05	NA	NA
1,1-Dichloroethene	5.86E-02	1.65E-03	9.00E-04	1.83E+00	7.06E-04	NA	NA
1,2-Dichloroethane	1.75E-02	4.92E-04	NA	NA	2.11E-04	9.10E-02	1.92E-05
Benzene	6.62E-01	1.86E-02	NA	NA	7.97E-03	2.90E-02	2.31E-04
Carbon tetrachloride	9.10E-04	2.56E-05	7.00E-04	3.65E-02	1.10E-05	1.30E-01	1.42E-06
Chloroform	2.18E-03	6.12E-05	1.00E-02	6.12E-03	2.62E-05	6.10E-03	1.60E-07
Ethylbenzene	4.66E-02	1.31E-03	1.00E-01	1.31E-02	5.61E-04	NA	NA
Toluene	4.16E-02	1.17E-03	5.71E-02	2.05E-02	5.01E-04	NA	NA
Xylenes	9.95E-02	2.80E-03	5.70E-02	4.90E-02	1.20E-03	NA	NA
Pesticides							
Aldrin	3.00E-05	NA	3.00E-05	NA	NA	1.70E+01	NA
HAZARD INDEX:				1.98	TOTAL RISK:		3 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

Note: In accordance with the 1991 BHRA, dermal contact of metals was not evaluated.

ADD = Average Daily Dose

RID = Reference Dose

AAL = Applied Action Level

LADD = Lifetime Average Daily Dose

SF = Carcinogenic Slope Factor

RISK = LADD x SF

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

Hazard Ratio = ADD / RID (or AAL)

Table 2-22

**TOTAL INTAKE AND RISKS FROM INGESTION OF GROUNDWATER IN THE
FUTURE ON-SITE RESIDENT CHILD SCENARIO**

CHEMICAL	Concentration (mg/L)	ADD (mg/kg/day)	AAL or RID (mg/kg/day)	HAZARD QUOTIENT	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	CARCINOGENIC RISK	
Groundwater Ingestion								
Metals								
Arsenic	7.37E-03	1.31E-04	3.00E-04	4.37E-01	5.62E-05	1.75E+00	9.83E-05	
Barium	1.91E-01	3.40E-03	1.00E-02	3.40E-01	1.46E-03	NA	NA	
Beryllium	1.14E-03	2.03E-05	5.00E-03	4.05E-03	8.69E-06	4.30E+00	3.74E-05	
Cadmium	1.69E-04	3.00E-06	5.00E-04	6.01E-03	1.29E-06	NA	NA	
Chromium	3.02E-02	5.37E-04	1.43E+00	3.76E-04	2.30E-04	NA	NA	
Copper	1.08E-02	1.92E-04	1.14E-01	1.68E-03	8.21E-05	NA	NA	
Nickel	9.22E-02	1.64E-03	1.14E-02	1.43E-01	7.02E-04	NA	NA	
Silver	2.27E-03	4.04E-05	5.71E-03	7.07E-03	1.73E-05	NA	NA	
Vanadium	2.63E-02	4.68E-04	7.00E-03	6.68E-02	2.00E-04	NA	NA	
Zinc	3.87E-02	6.88E-04	2.29E-01	3.00E-03	2.95E-04	NA	NA	
VOCs								
1,1,1-Trichloroethane	6.20E-03	1.10E-04	8.57E-03	1.29E-02	4.72E-05	NA	NA	
1,1,2-Trichloroethane	9.00E-04	1.60E-05	4.00E-03	4.00E-03	6.86E-06	5.70E-02	3.91E-07	
1,1-Dichloroethane	5.47E-03	9.73E-05	1.00E-01	9.73E-04	4.17E-05	NA	NA	
1,1-Dichloroethene	5.86E-02	1.04E-03	9.00E-04	1.16E+00	4.47E-04	NA	NA	
1,2-Dichloroethane	1.75E-02	3.12E-04	NA	NA	1.34E-04	9.10E-02	1.21E-05	
Benzene	6.62E-01	1.18E-02	NA	NA	5.04E-03	2.90E-02	1.46E-04	
Carbon tetrachloride	9.10E-04	1.62E-05	7.00E-04	2.31E-02	6.93E-06	1.30E-01	9.01E-07	
Chloroform	2.18E-03	3.88E-05	1.00E-02	3.88E-03	1.66E-05	6.10E-03	1.01E-07	
Ethylbenzene	4.66E-02	8.29E-04	1.00E-01	8.29E-03	3.55E-04	NA	NA	
Toluene	4.16E-02	7.40E-04	5.71E-02	1.29E-02	3.17E-04	NA	NA	
Xylenes	9.95E-02	1.77E-03	5.70E-02	3.10E-02	7.58E-04	NA	NA	
Pesticides								
Aldrin	3.00E-05	5.33E-07	3.00E-05	1.78E-02	2.29E-07	1.70E+01	3.89E-06	
HAZARD INDEX:				2.28	TOTAL RISK:			3 E-04

Note: All chemical concentrations obtained from November 1991 BHRA.

ADD = Average Daily Dose
RfD = Reference Dose
AAL = Applied Action Level

LADD = Lifetime Average Daily Dose
SF = Carcinogenic Slope Factor
RISK = LADD x SF

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
Hazard Ratio = ADD / RID (or AAL)

Table 2-23
 SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
 CURRENT ON-SITE TRESPASSER SCENARIO

Chemical	Hazard Quotient			Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Inhalation of Outdoor Air	
Metals				
Antimony	0.0019	0.0447	0.00037	0.0470
Arsenic	0.0036	0.0862	0.0039	0.0936
Barium	0.0007	0.0168	0.00097	0.0184
Beryllium	0.000013	0.0003	0.0000033	0.0003
Thallium	0.0122	0.2920	0.0021	0.3063
PAHs				
Anthracene	0.0195	0.0025	NA	0.0220
Carcinogenic PAHs	0.0327	0.0042	NA	0.0369
Fluoranthene	0.0069	0.0009	NA	0.0078
Naphthalene	0.0810	0.0105	NA	0.0915
Non-carcinogenic PAHs	NA	NA	0.0052	0.0052
Phenanthrene	0.0205	0.0027	NA	0.0232
Pyrene	0.0071	0.0009	NA	0.0080
Total for Pathway	0.186	0.462	0.0125	
Total for Scenario				0.66

Table 2-24

SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
CURRENT OFF-SITE RESIDENT -ADULT AND CHILD- SCENARIOS

Chemical	Hazard Quotient		Summed Hazard Quotient	Total For Chemical
	Adult Inhalation	Child Inhalation	Inhalation of Outdoor Air	
Metals				
Arsenic	0.0226	0.0252	0.0478	0.0478
Beryllium	0.0000191	0.0000214	0.00004048	0.00004048
Cadmium	0.0000930	0.000104	0.00019688	0.00019688
Thallium	0.0125	0.0139	0.0264	0.0264
PAHs				
Non-Carcinogenic PAHs	0.0303	0.0338	0.0641	0.0641
VOCs				
1,1-Dichloroethane	0.0000426	0.0000476	0.00009012	0.0000901
Total for Pathway	0.0654	0.0731	0.138	
Total for Scenario				0.14

Table 2-25
SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

Chemical	Hazard Quotient				Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact (Showering)	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals					
Arsenic	0.0226	NA	NA	NA	0.0226
Thallium	0.0125	NA	NA	NA	0.0125
PAHs					
Non-Carcinogenic PAHs	0.0303	NA	NA	NA	0.0303
VOCs					
1,1,1-Trichloroethane	NA	0.02	0.0097	0.0024	0.036
1,1-Dichloroethane	NA	0.0044	0.0018	0.0049	0.01
1,1-Dichloroethene	NA	2.45	1.00	2.80	6.25
Carbon tetrachloride	NA	0.08	0.03	0.076	0.19
Trichloroethene	NA	0.30	0.12	0.030	0.45
Total for Pathway	0.065	2.9	1.2	2.9	
<i>Total for Scenario</i>					7.0

Table 2-26
 SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
 FUTURE OFF-SITE RESIDENT -CHILD- SCENARIO

Chemical	Hazard Quotient			Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact (Bathing)	Groundwater Ingestion	
Metals				
Arsenic	0.0252	NA	NA	0.0252
Beryllium	0.001068	NA	NA	0.001068
Cadmium	0.000104	NA	NA	0.000104
Thallium	0.0139	NA	NA	0.0139
PAHs				
Non-Carcinogenic PAHs	0.0048	NA	NA	0.0048
VOCs				
1,1,1-Trichloroethane	NA	0.01	0.0079	0.02
1,1-Dichloroethane	NA	0.0023	0.0015	0.0038
1,1-Dichloroethene	NA	1.28	0.81	2.09
Carbon tetrachloride	NA	0.04	0.03	0.07
Chloroform	NA	0.0041	0.0026	0.0067
Trichloroethene	NA	0.15	0.10	0.25
Tetrachloroethene	NA	0.0015	0.0010	0.0025
Total for Pathway	0.045	1.5	0.95	
Total for Scenario				2.5

Table 2-27

SUMMARY OF COMBINED NON-CARCINOGENIC RISKS FOR THE
FUTURE OFF-SITE RESIDENT -ADULT AND CHILD- SCENARIOS

Chemical	Summed Hazard Quotient				Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact with Groundwater	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals					
Arsenic	0.048	NA	NA	NA	0.048
Beryllium	0.001068	NA	NA	NA	0.001068
Cadmium	0.000104	NA	NA	NA	0.000104
Thallium	0.026	NA	NA	NA	0.026
PAHs					
Non-Carcinogenic PAHs	0.035	NA	NA	NA	0.035
VOCs					
1,1,1-Trichloroethane	NA	0.04	0.02	0.002	0.06
1,1-Dichloroethane	NA	0.007	0.003	0.005	0.01
1,1-Dichloroethene	NA	3.73	1.81	2.80	8.34
Carbon tetrachloride	NA	0.12	0.06	0.08	0.26
Chloroform	NA	0.004	0.003	NA	0.007
Trichloroethene	NA	0.45	0.22	0.03	0.70
Tetrachloroethene	NA	0.002	0.0010	NA	0.002
Total for Pathway	0.110	4.3	2.1	2.9	
Total for Scenario					9.5

Table 2-28

SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO

Chemical	Hazard Quotient					Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Showering)	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals						
Antimony	0.004	0.09	NA	NA	NA	0.09
Arsenic	0.007	0.17	NA	0.54	NA	0.71
Barium	0.001	0.03	NA	0.42	NA	0.45
Beryllium	0.000026	0.0006	NA	0.005	NA	0.006
Cadmium	0.0001	0.003	NA	0.007	NA	0.01
Chromium	0.000001	0.000030	NA	0.0005	NA	0.0005
Nickel	0.0002	0.004	NA	0.18	NA	0.18
Silver	0.000011	0.0003	NA	0.009	NA	0.009
Thallium	0.02	0.57	NA	NA	NA	0.59
Vanadium	0.0003	0.006	NA	0.08	NA	0.09
PAHs						
Carcinogenic PAHs	0.02	0.008	NA	NA	NA	0.03
Fluoranthene	0.005	0.002	NA	NA	NA	0.007
Naphthalene	0.06	0.02	NA	NA	NA	0.08
Phenanthrene	0.01	0.005	NA	NA	NA	0.02
Pyrene	0.005	0.002	NA	NA	NA	0.007
Pesticides						
Aldrin	NA	NA	NA	0.02	NA	0.02
VOCs						
1,1,1-Trichloroethane	NA	NA	0.04	0.02	0.004	0.06
1,1-Dichloroethene	NA	NA	3.50	1.43	4.00	8.93
Carbon tetrachloride	NA	NA	0.07	0.03	0.07	0.16
Ethylbenzene	NA	NA	0.03	0.01	0.03	0.06
Toluene	0.000007	0.000003	0.04	0.02	0.04	0.10
Xylenes	NA	NA	0.09	0.04	0.05	0.18

Table 2-28

**SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO**

Chemical	Hazard Quotient				Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Showering)	Groundwater Ingestion	
(Continued)					
Total for Pathway	0.14	0.91	3.8	2.8	4.2
					<hr/> <i>Total for Scenario</i> 12

Table 2-29
SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -CHILD- SCENARIO

Chemical	Hazard Quotient				Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Bathing)	Groundwater Ingestion	
Metals					
Antimony	0.004	0.20	NA	NA	0.21
Arsenic	0.008	0.39	NA	0.44	0.83
Barium	0.002	0.08	NA	0.34	0.42
Beryllium	0.000027	0.001	NA	0.004	0.005
Cadmium	0.0001	0.007	NA	0.006	0.01
Chromium	0.000001	0.000070	NA	0.0004	0.0004
Copper	0.0002	0.010	NA	0.002	0.01
Nickel	0.0002	0.009	NA	0.14	0.15
Silver	0.000012	0.0006	NA	0.007	0.008
Thallium	0.03	1.32	NA	NA	1.34
Vanadium	0.0003	0.01	NA	0.07	0.08
Zinc	0.0002	0.008	NA	0.003	0.01
PAHs					
Carcinogenic PAHs	0.02	0.02	NA	NA	0.04
Anthracene	0.01	0.01	NA	NA	0.03
Benzo(g,h,i)Perylene	0.002	0.002	NA	NA	0.004
Fluoranthene	0.005	0.004	NA	NA	0.009
Naphthalene	0.06	0.05	NA	NA	0.11
Phenanthrene	0.02	0.01	NA	NA	0.03
Pyrene	0.005	0.004	NA	NA	0.009
Pesticides					
Aldrin	NA	NA	NA	0.02	0.02
VOCs					
1,1,1-Trichloroethane	NA	NA	0.02	0.01	0.03
1,1,2-Trichloroethane	NA	NA	0.006	0.004	0.01
1,1-Dichloroethane	NA	NA	0.002	0.0010	0.003
1,1-Dichloroethene	NA	NA	1.83	1.16	2.99

Table 2-29
 SUMMARY OF NON-CARCINOGENIC RISKS FOR THE
 FUTURE ON-SITE RESIDENT -CHILD- SCENARIO

Chemical	Hazard Quotient				Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Bathing)	Groundwater Ingestion	
(Continued)					
Carbon tetrachloride	NA	NA	0.04	0.02	0.06
Chloroform	NA	NA	0.006	0.004	0.01
Ethylbenzene	NA	NA	0.01	0.008	0.02
Toluene	0.000007	0.000007	0.02	0.01	0.03
Xylenes	NA	NA	0.05	0.03	0.08
Total for Pathway	0.17	2.1	2.0	2.3	
				<i>Total for Scenario</i>	6.6

Table 2-30
SUMMARY OF COMBINED NON-CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -ADULT AND CHILD- SCENARIOS

Chemical	Summed Hazard Index					Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact with Groundwater	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals						
Antimony	0.008	0.29	NA	NA	NA	0.30
Arsenic	0.02	0.56	NA	0.98	NA	1.55
Barium	0.003	0.11	NA	0.76	NA	0.87
Beryllium	0.000053	0.002	NA	0.009	NA	0.01
Cadmium	0.0003	0.010	NA	0.01	NA	0.02
Chromium	0.000003	0.0001	NA	0.0008	NA	0.0009
Copper	0.0002	0.010	NA	0.002	NA	0.01
Nickel	0.0003	0.01	NA	0.32	NA	0.33
Silver	0.000023	0.0008	NA	0.02	NA	0.02
Thallium	0.05	1.89	NA	NA	NA	1.94
Vanadium	0.0006	0.02	NA	0.15	NA	0.17
Zinc	0.0002	0.008	NA	0.003	NA	0.01
PAHs						
Carcinogenic PAHs	0.05	0.03	NA	NA	NA	0.07
Anthracene	0.01	0.01	NA	NA	NA	0.03
Benzo(g,h,i)Perylene	0.0020	0.0016	NA	NA	NA	0.004
Fluoranthene	0.01	0.0058	NA	NA	NA	0.02
Naphthalene	0.12	0.07	NA	NA	NA	0.18
Phenanthrene	0.03	0.02	NA	NA	NA	0.05
Pyrene	0.01	0.0059	NA	NA	NA	0.02
Pesticides						
Aldrin	NA	NA	NA	0.04	NA	0.04
VOCs						
1,1,1-Trichloroethane	NA	NA	0.06	0.03	0.0039	0.09
1,1,2-Trichloroethane	NA	NA	0.0063	0.0040	NA	0.01
1,1-Dichloroethane	NA	NA	0.0015	0.0010	NA	0.003
1,1-Dichloroethene	NA	NA	5.33	2.59	4.00	11.92

Table 2-30
**SUMMARY OF COMBINED NON-CARCINOGENIC RISKS FOR THE
 FUTURE ON-SITE RESIDENT -ADULT AND CHILD- SCENARIOS**

Chemical	Summed Hazard Index					Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact with Groundwater	Groundwater Ingestion	Vapor Inhalation (Showering)	
(Continued)						
Carbon tetrachloride	NA	NA	0.11	0.05	0.07	0.22
Chloroform	NA	NA	0.0061	0.0039	NA	0.01
Ethylbenzene	NA	NA	0.04	0.02	0.03	0.08
Toluene	0.00001	0.00001	0.06	0.03	0.04	0.13
Xylenes	NA	NA	0.14	0.07	0.05	0.26
Total for Pathway	0.31	3.0	5.7	5.1	4.2	
					Total for Scenario 18	

Table 2-31
 SUMMARY OF CARCINOGENIC RISKS FOR THE
 CURRENT ON-SITE TRESPASSER SCENARIO

Chemical	Cancer Risk			Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Inhalation of Outdoor Air	
Metals				
Arsenic	2.15E-07	5.17E-06	1.99E-06	7.37E-06
Beryllium	3.13E-08	7.53E-07	1.58E-08	8.00E-07
PAHs				
Carcinogenic PAHs	8.51E-07	1.10E-07	NA	9.61E-07
Total for Pathway	1.10E-06	6.03E-06	2.00E-06	
			Total for Scenario	9E-06

Table 2-32
**SUMMARY OF CARCINOGENIC RISKS FOR THE
 CURRENT OFF-SITE RESIDENT -ADULT AND CHILD- SCENARIOS**

Chemical	Cancer Risk		Summed Cancer Risk	Total For Chemical
	Adult Inhalation	Child Inhalation	Inhalation of Outdoor Air	
Metals				
Arsenic	4.35E-05	4.86E-05	9.21E-05	9.21E-05
Beryllium	3.44E-07	3.85E-07	7.29E-07	7.29E-07
Cadmium	1.22E-07	1.36E-07	2.57E-07	2.57E-07
Total for Pathway	4.40E-05	4.91E-05	9.31E-05	
<i>Total for Scenario</i>				9 E-05

Table 2-33

SUMMARY OF CARCINOGENIC RISKS FOR THE
FUTURE OFF-SITE RESIDENT -ADULT- SCENARIO

Chemical	Cancer Risk				Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact (Showering)	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals					
Arsenic	4.35E-05	NA	NA	NA	4.35E-05
VOCs					
1,2-Dichloroethane	NA	1.03E-05	4.19E-06	9.90E-06	2.43E-05
Carbon tetrachloride	NA	3.08E-06	1.26E-06	2.98E-06	7.32E-06
Trichloroethene	NA	2.78E-07	1.14E-07	4.40E-07	8.32E-07
Total for Pathway	4.35E-05	1.36E-05	5.56E-06	1.33E-05	
Total for Scenario					8 E-05

Table 2-34
 SUMMARY OF CARCINOGENIC RISKS FOR THE
 FUTURE OFF-SITE RESIDENT -CHILD- SCENARIO

Chemical	Cancer Risk			Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact (Bathing)	Groundwater Ingestion	
Metals				
Arsenic	4.86E-05	NA	NA	4.86E-05
Beryllium	3.85E-07	NA	NA	3.85E-07
Cadmium	1.36E-07	NA	NA	1.36E-07
VOCs				
1,2-Dichloroethane	NA	5.37E-06	3.40E-06	8.77E-06
Carbon tetrachloride	NA	1.61E-06	1.02E-06	2.63E-06
Chloroform	NA	1.08E-07	6.83E-08	1.76E-07
Trichloroethene	NA	1.46E-07	9.22E-08	2.38E-07
Tetrachloroethene	NA	3.32E-07	2.10E-07	5.42E-07
Total for Pathway	4.91E-05	7.57E-06	4.79E-06	
			Total for Scenario	6E-05

Table 2-35

SUMMARY OF COMBINED CARCINOGENIC RISKS FOR THE
FUTURE OFF-SITE RESIDENT -ADULT AND CHILD- SCENARIOS

Chemical	Summed Cancer Risk				Total for Chemical
	Inhalation of Outdoor Air	Dermal Contact with Groundwater	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals					
Arsenic	9.21E-05	NA	NA	NA	9.21E-05
Beryllium	3.85E-07	NA	NA	NA	3.85E-07
Cadmium	1.36E-07	NA	NA	NA	1.36E-07
VOCs					
1,2-Dichloroethane	NA	1.56E-05	7.59E-06	9.90E-06	3.31E-05
Carbon tetrachloride	NA	4.69E-06	2.28E-06	2.98E-06	9.95E-06
Chloroform	NA	1.08E-07	6.83E-08	NA	1.76E-07
Trichloroethene	NA	4.24E-07	2.06E-07	4.40E-07	1.07E-06
Tetrachloroethene	NA	3.32E-07	2.10E-07	NA	5.42E-07
Total for Pathway	9.26E-05	2.12E-05	1.03E-05	1.33E-05	
<i>Total for Scenario</i>					1E-04

Table 2-36

SUMMARY OF CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -ADULT- SCENARIO

Chemical	Cancer Risk					Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Showering)	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals						
Arsenic	1.65E-06	3.77E-05	NA	1.21E-04	NA	1.61E-04
Beryllium	2.40E-07	5.49E-06	NA	4.60E-05	NA	5.18E-05
PAHs						
Carcinogenic PAHs	2.25E-06	8.04E-07	NA	NA	NA	3.05E-06
Pesticides						
Aldrin	NA	NA	NA	4.79E-06	NA	4.79E-06
VOCs						
Benzene	NA	NA	4.42E-04	1.80E-04	5.32E-04	1.15E-03
Carbon tetrachloride	NA	NA	2.72E-06	1.11E-06	2.60E-06	6.43E-06
Total for Pathway	4.14E-06	4.40E-05	4.44E-04	3.53E-04	5.35E-04	
Total for Scenario						1E-03

Table 2-37

SUMMARY OF CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -CHILD- SCENARIO

Chemical	Cancer Risk				Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact (Bathing)	Groundwater Ingestion	
Metals					
Arsenic	1.74E-06	8.75E-05	NA	9.83E-05	1.87E-04
Beryllium	2.53E-07	1.27E-05	NA	3.74E-05	5.03E-05
PAHs					
Carcinogenic PAHs	2.37E-06	1.86E-06	NA	NA	4.23E-06
Pesticides					
Aldrin	NA	NA	NA	3.89E-06	3.89E-06
VOCs					
1,1,2-Trichloroethane	NA	NA	6.18E-07	3.91E-07	1.01E-06
1,2-Dichloroethane	NA	NA	1.92E-05	1.21E-05	3.13E-05
Benzene	NA	NA	2.31E-04	1.46E-04	3.77E-04
Carbon tetrachloride	NA	NA	1.42E-06	9.01E-07	2.33E-06
Chloroform	NA	NA	1.60E-07	1.01E-07	2.61E-07
Total for Pathway	4.36E-06	1.02E-04	2.53E-04	2.99E-04	
				<i>Total for Scenario</i>	<i>7E-04</i>

Table 2-38
SUMMARY OF COMBINED CARCINOGENIC RISKS FOR THE
FUTURE ON-SITE RESIDENT -ADULT AND CHILD- SCENARIOS

Chemical	Summed Cancer Risk					Total for Chemical
	Dermal Contact with Soil	Soil Ingestion	Dermal Contact with Groundwater	Groundwater Ingestion	Vapor Inhalation (Showering)	
Metals						
Arsenic	3.39E-06	1.25E-04	NA	2.19E-04	NA	3.48E-04
Beryllium	4.93E-07	1.82E-05	NA	8.34E-05	NA	1.02E-04
Carcinogenic PAHs	4.62E-06	2.67E-06	NA	NA	NA	7.28E-06
Pesticides						
Aldrin	NA	NA	NA	8.68E-06	NA	8.68E-06
VOCs						
1,1,2-Trichloroethane	NA	NA	6.18E-07	3.91E-07	NA	1.01E-06
1,2-Dichloroethane	NA	NA	1.92E-05	1.21E-05	NA	3.13E-05
Benzene	NA	NA	6.73E-04	3.27E-04	5.32E-04	1.53E-03
Carbon tetrachloride	NA	NA	4.15E-06	2.01E-06	2.60E-06	8.76E-06
Chloroform	NA	NA	1.60E-07	1.01E-07	NA	2.61E-07
Total for Pathway	8.50E-06	1.46E-04	6.97E-04	6.53E-04	5.35E-04	
Total for Scenario						2E-03

TABLE 2-39
SUMMARY OF HAZARD INDICES
FOR CRITICAL EFFECT OR COMMON TARGET ORGAN
UNION PACIFIC RAILROAD SITE

Scenario	Critical Effect or Common Target Organ*				
	Hematopoietic Toxicity	Renal Toxicity	Developmental Toxicity	Hepatotoxicity	PAHs
Current On-site Trespasser	0.047	0.018	--	0.30	0.19
Current Off-site Residents					
Adult	--	< 0.001	--	0.012	0.030
Child	--	< 0.001	--	0.014	0.034
Child and Adult (total)	--	< 0.001	--	0.026	0.064
Future Off-site Residents					
Adult	--	--	--	7.0	0.030
Child	--	< 0.001	--	2.5	0.0048
Child and Adult (total)	--	< 0.001	--	9.5	0.035
Future On-site Residents					
Adult	0.091	0.46	0.28	9.8	0.14
Child	0.23	0.43	0.11	4.5	0.23
Child and Adult (total)	0.32	0.89	0.39	14	0.37

* Chemicals were classified by critical effect or common target organ as in the BHRA (Dames & Moore, 1991a, Appendix J); chromium was included as a hepatotoxicant per DTSC comment.

TABLE 2-40
SUMMARY OF SUPPLEMENTAL BASELINE RISK ASSESSMENT
UNION PACIFIC RAILROAD SITE

Scenario	Estimated Lifetime Cancer Risk	Chemicals(s) with Highest Cumulative Risks	Exposure Pathways with Risks Exceeding 1×10^{-6}	Non-carcinogenic Hazard Indices	Chemicals with Hazard Indices Exceeding 1.0
Current On-site Trespasser	9×10^{-6}	Arsenic; carcinogenic PAHs	Soil ingestion; none	<1	--
Current Off-site Residents					
Adult	4×10^{-5}	Arsenic	Inhalation of outdoor air	<1	--
Child	5×10^{-5}	Arsenic	Inhalation of outdoor air	<1	--
Adult and Child (total)	9×10^{-5}	Arsenic	Inhalation of outdoor air	<1	--
Future Off-site Residents					
Adult	4×10^{-5}	Arsenic; 1,2-dichloroethane; carbon tetrachloride	Inhalation of outdoor air; dermal contact (showering); dermal contact (showering)	>1	1,1-dichloroethene
Child	5×10^{-5}	Arsenic; 1,2-dichloroethane; carbon tetrachloride	Inhalation of outdoor air; dermal contact (bathing); dermal contact (bathing)	>1	1,1-dichloroethene
Adult and Child (total)	1×10^{-4}	Arsenic; 1,2-dichloroethane; carbon tetrachloride	Inhalation of outdoor air; dermal contact with groundwater; dermal contact with groundwater	>1	1,1-dichloroethene
Future On-site Residents					
Adult	1×10^{-3}	Benzene; arsenic; beryllium	Vapor inhalation (showering); groundwater ingestion; groundwater ingestion	>1	1,1-dichloroethene
Child	7×10^{-4}	Benzene; arsenic; beryllium	Dermal contact (bathing); groundwater ingestion; groundwater ingestion	>1	Thallium, 1,1-dichloroethene
Adult and Child (total)	2×10^{-3}	Benzene; arsenic; beryllium	Dermal contact with groundwater; groundwater ingestion; groundwater ingestion	>1	Arsenic, thallium, 1,1-dichloroethene