

## Appendix H: RISC Output for Benzene and Xylene



SUMMARY OF CLEAN-UP LEVELS  
-----

Clean-up Levels in Surface Soil Receptor: Child Resident - Typical	SSTLs [mg/kg]
Benzene	8.1E+02
Xylenes	4.2E+04

The exposure routes that depend on this source are:  
Ingestion of soil  
Dermal contact with soil

Vapor Model Soil Source

The receptor considered is: Child Resident - Typical

Exposure pathways depending on this source:  
Inhalation of indoor air

Summary of Original Source Conditions  
for Vapor Model Soil Source

	Original Source Conc [mg/kg]	Solubility [mg/l]	Residual Conc. [mg/kg]
Benzene	1.1E+00	1.8E+03	3.7E+02
Xylenes	2.0E+01	2.0E+02	1.2E+02

Site-Specific Target Levels (SSTLs)  
for Vapor Model Soil Source

	SSTL [mg/kg]
Benzene	1.1E+00
Xylenes	2.0E+01

Title:  
New Project  
09/30/05 11:39

Scenarios:  
Child Resident - Typical

Routes:  
INGESTION OF SOIL  
DERMAL CONTACT WITH SOIL  
INHALATION OF INDOOR AIR

Chemicals:  
Benzene  
Xylenes

SUMMARY OF INPUT PARAMETERS  
-----  
SCENARIO: 1

LIFETIME AND BODY WEIGHT  
Body Weight (kg) 11.1  
Lifetime (years) 70.0

INGESTION OF SOIL  
Soil Ingestion Rate (mg/day) 109.  
Exp. Frequency Soil (events/year) 130.  
Exp. Duration Soil (years) 6.00  
Absorption Adjustment Factor for  
Ingestion of Soil (-)  
Benzene 1.0  
Xylenes 1.0

Soil Bioavailability (-)  
Benzene 1.0  
Xylenes 1.0

DERMAL CONTACT WITH SOIL  
Total Skin Surface Area (cm<sup>2</sup>) 6.176E+03  
Fraction Skin Exposed to Soil (-) 0.225  
Adherence Factor for Soil (mg/cm<sup>2</sup>) 0.200  
Exposure Freq. Soil (events/year) 130.  
Exposure Duration Soil (years) 6.00  
Absorption Adjustment Factor for  
Dermal Exposure to Soil (-)  
Benzene 0.10  
Xylenes 0.10

Soil Bioavailability (-)  
Benzene 1.0  
Xylenes 1.0

INHALATION OF INDOOR AIR  
Inhalation rate (m<sup>3</sup>/hr) 0.150  
Time indoors (hours/day) 20.7  
Lung Retention Factor (-) 1.00  
Exp. Freq. Indoor Air (events/yr) 365.  
Exp. Duration Indoor Air (yr) 6.00  
Absorption Adjustment Factor for  
Inhalation (-)  
Benzene 1.0  
Xylenes 1.0

MEDIA CONCENTRATIONS  
-----

Concentration in Surficial Soil (mg/kg)  
- Used to calculate risk and hazard index.  
Benzene 8.09E+02  
Xylenes 4.19E+04

Concentration in Indoor Air (mg/m<sup>3</sup>)  
Obtained from Fate and Transport output  
AVERAGE Concentration (over exposure duration)

(used to calculate carcinogenic risk)  
Exposure Duration (years) 6.0  
Benzene 3.10E-02  
Xylenes 0.22  
Concentration used to calculate hazard index  
(Averaged over 7 years or exposure duration, if less than 7 years)  
Exposure Duration (years) 6.0  
Benzene 3.10E-02  
Xylenes 0.22

SLOPE FACTORS AND REFERENCE DOSES  
-----

Ingestion Slope Factor [1/(mg/kg-day)]  
Benzene 3.40E-02  
Xylenes ND  
Ingestion Reference Dose (mg/kg-day)  
Benzene 4.00E-03  
Xylenes 0.18  
Inhalation Slope Factor [1/(mg/kg-day)]  
Benzene 1.10E-02  
Xylenes ND  
Inhalation Reference Dose (mg/kg-day)  
Benzene 8.60E-03  
Xylenes 6.10E-02  
Dermal Slope Factor [1/(mg/kg-day)]  
Benzene 2.90E-02  
Xylenes ND  
Dermal Reference Dose (mg/kg-day)  
Benzene 4.00E-03  
Xylenes 0.20

SUMMARY OF RESULTS  
-----

INGESTION OF SOIL

Daily Doses and Risk for : Benzene  
CADD (mg/kg-day) 2.82E-03  
LADD (mg/kg-day) 2.41E-04  
Cancer Risk (-) 8.209E-06  
Hazard Index (-) 7.042E-01

Daily Doses and Risk for : Xylenes  
CADD (mg/kg-day) 1.46E-01  
LADD (mg/kg-day) 1.25E-02  
Cancer Risk (-) 0.000E+00  
Hazard Index (-) 8.150E-01

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Benzene  
CADD (mg/kg-day) 7.18E-04  
LADD (mg/kg-day) 6.16E-05  
Cancer Risk (-) 1.785E-06  
Hazard Index (-) 1.795E-01

Daily Doses and Risk for : Xylenes  
CADD (mg/kg-day) 3.72E-02  
LADD (mg/kg-day) 3.19E-03  
Cancer Risk (-) 0.000E+00  
Hazard Index (-) 1.860E-01

INHALATION OF INDOOR AIR

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	8.61E-03
LADD (mg/kg-day)	7.38E-04
Cancer Risk (-)	8.121E-06
Hazard Index (-)	1.002E+00

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	6.10E-02
LADD (mg/kg-day)	5.22E-03
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.992E-01

FATE AND TRANSPORT MODEL OUTPUT FOR: Benzene

Start of model output for:  
Johnson and Ettinger Indoor air model  
with volatile emissions from soil

(Indoor Air Conc./Conc. in soil vapor at the source)		
Source concentration [g/cm3]	.....	1.16E-06
Source " [mg/m3]	.....	1.16E+03
Indoor air concentration [g/cm3]	.....	3.10E-11
Indoor " " [mg/m3]	.....	3.10E-02

CONCENTRATION IN BUILDING (annual average)  
Benzene

Time (yr)	Flux into Building (mg/m <sup>2</sup> /day)	Concentration in Building (mg/m <sup>3</sup> )	Soil Gas Conc. at Building (mg/m <sup>3</sup> )
1.0	9.92E-01	3.10E-02	1.14E+03

The concentration is constant (steady-state model)

Calculating Vapor Phase Concentration at Source:  
(Using Equilibrium Partitioning Equation)

Inputs:

Total concentration in soil [mg/kg]	.....	1.1
Total porosity [-]	.....	0.30
Air content [-]	.....	0.18
Moisture content [-]	.....	0.12
Fraction organic carbon [-]	.....	2.00E-03
Organic carbon partitioning coeff. [ml/g]	.....	59.
Soil bulk density [g/cm3]	.....	1.7
Henry's Law coeff. [-]	.....	0.23
Chemical solubility [mg/l]	.....	1.75E+03

Outputs:

Calculated dissolved phase conc. [mg/l]	.....	5.1
Effective solubility [mg/l]	.....	1.75E+03
Source concentration is BELOW residual limit because calculated dissolved phase conc. is LESS than the effective solubility.		
Dissolved phase conc. at source [mg/l]	.....	5.1
Source vapor concentration [g/cm <sup>3</sup> ]	.....	1.16E-06
Source vapor concentration [mg/m <sup>3</sup> ]	.....	1.16E+03
Residual level [mg/kg]	.....	3.72E+02
(assuming pure chemical solubility)		

VAPOR TRANSPORT FROM SOIL TO INDOOR AIR USING THE JOHNSON-ETTINGER MODEL

Effective Diffusion Coefficient for Vadose zone

Total thickness of subunit [cm]	.....	50.
Air-filled porosity [-]	.....	0.18
Water-filled porosity [-]	.....	0.12
Total porosity [-]	.....	0.30
Effective diff. coeff. for subunit [cm <sup>2</sup> /s]	.....	3.22E-03

Effective Diffusion Coefficient for Foundation

Total thickness of subunit [cm]	.....	15.
Air-filled porosity [-]	.....	0.25
Water-filled porosity [-]	.....	0.0
Total porosity [-]	.....	0.25
Effective diff. coeff. for subunit [cm <sup>2</sup> /s]	.....	1.39E-02

Contaminant Flux Into Building

Soil gas flow rate [cm <sup>3</sup> /sec]	.....	0.24
Diffusive (x-sectional) area for flux [m <sup>2</sup> ]	.....	1.50E+02
Conc. in soil vapor at foundation [g/cm <sup>3</sup> ]	.....	1.14E-06
Conc. in soil vapor " " [mg/m <sup>3</sup> ]	.....	1.14E+03
Flux rate into building [g/cm <sup>2</sup> /s]	.....	1.15E-12
Flux rate " " [mg/m <sup>2</sup> /d]	.....	0.99

Attenuation Coefficient [-]	.....	2.68E-05
-----------------------------	-------	----------