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August 5, 2002

SOMA 02-2325

Mr. Joe Sordi
KB Home South Bay Inc.
2201 Walnut Avenue, Suite 150
Fremont, California 94538

Subject: Risk Evaluation Update
Marina Cove Subdivision (former Weyerhaeuser Site)
1801 Hibbard Street
Alameda, California

Dear Mr. Sordi:

In accordance with our verbal agreement with ICES, SOMA Corporation (SOMA) has performed a risk evaluation update for soil and groundwater at the Marina Cove Subdivision, formerly known as the Weyerhaeuser property. The property is located at 1801 Hibbard Street, in Alameda, California (the Site). We understand that the Alameda County Health Agency, Department of Environmental Health (ACDEH) has requested this risk evaluation update to a previous Risk Assessment Report performed by West & Associates Environmental Engineers, Inc. (West & Associates) in August, 1999.

Low level concentrations of gasoline residues (benzene, ethylbenzene, and xylenes) in soil and groundwater and trace amounts of chlorinated solvents (1,1-dichloroethane [1,1-DCA], trichloroethene [TCE], and tetrachloroethene [PCE]) were reported in groundwater at the Site (West & Associates, 1999a). These chemicals are considered chemicals of potential concern (COPCs).

This evaluation was undertaken to supplement the risk-based evaluation performed by West & Associates (1999a) and should be considered in addition to existing environmental information and reports developed for the Site (West & Associates, 1999b; Excelchem, 1999). The primary differences between this risk evaluation and the West & Associates (1999a) evaluation are SOMA's: (1) use of updated toxicity criteria for COPCs, (2) inclusion of additional complete exposure pathways for the construction worker and resident, and (3) revisions to certain exposure input parameters. In addition to the inhalation route of exposure that was previously evaluated by West & Associates (1999a) for the construction worker, SOMA included the dermal contact and incidental ingestion routes of exposure to soil and also evaluated exposure to groundwater via the dermal contact route of exposure. For the outdoor residential receptor, in addition to the inhalation route of exposure that was previously evaluated by West &Associates (1999a), SOMA included the dermal contact and incidental ingestion routes of exposure to soil. A new exposure assessment forms the primary component to this risk evaluation update and features the following subsections:

- Summary of background information (including chemical characterization)
- Description of the exposure assessment methodology used in the risk evaluation
- Description of the exposure setting
- Evaluation of exposure pathways.

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- Development of Risk Based Screening Levels (RBSLs) for soil and groundwater

Background

SOMA was provided with the following document for use in developing the exposure evaluation:

West & Associates Environmental Engineers, Inc. 1999. Submittal of Risk Assessment Report, Weyerhaeuser Paper Company, 1801 Hibbard Street, Alameda 94501, STID 1202. August 24.

Table 1 presents the concentrations of chemicals detected in soil collected on July 19, 1999 (West & Associates, 1999a) and groundwater samples collected on August 13, 1998 (Excelchem, 1999). Original laboratory data sheets were not provided to SOMA, therefore, the data evaluated were derived from report tables (West & Associates, 1999a) and actual chemical concentrations in soil and groundwater could not be verified. The chemicals detected in soil and evaluated in the risk assessment included the gasoline constituents, benzene, ethylbenzene, and total xylenes (BTEX). Highest concentrations of all three constituents were detected in soil boring B-9 (depth not specified). BTEX were detected at highest concentrations in MW-3B. Additionally, the chlorinated solvents 1,1-DCA, TCE, and PCE were also detected at highest concentrations in MW-3B.

Exposure Assessment Methodology

U.S. EPA (1989) identifies three components of an exposure assessment: (1) characterizing the exposure setting, (2) identifying exposure pathways, and (3) quantifying exposures. The exposure setting characterization includes a discussion of land use. The identification of potentially complete exposure pathways includes a discussion of exposed populations, exposure pathways that may be complete, exposure scenarios, and hypothetical receptors. EPA (1989) describes exposure pathways in terms of four primary components:

- A source and mechanism of chemical release
- A retention or transport medium (or media, in cases involving media transfer of chemicals)
- A point of human (receptor) contact with the contaminated medium (known as the exposure point)
- An exposure route (such as ingestion) at the contact point

All four of these components must be present for a potential exposure pathway to be considered complete and for exposure to occur.

Exposure Setting

This risk evaluation was developed to assess potential exposure and risks from the residual chemicals assuming development of the Site as a residential subdivision. Potentially exposed populations under the future land-use setting evaluated in this risk assessment are construction workers during property development and single-family residents.

It should be noted that construction activities are assumed to occur over a 1-year period. Site-specific health and safety protocols and engineering controls are expected to be implemented during the construction activities, and should preclude significant construction worker exposures.

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Identification of Exposure Pathways

For this risk evaluation, the source and mechanism of release include the historical activities at the Site. The retention or transport media include chemical-affected subsurface soil and groundwater. Chemicals detected in soil include the gasoline constituents BTEX. In groundwater, these compounds and chlorinated volatile organic compounds (VOCs) have been detected.

The exposure pathways evaluated for each receptor are summarized in Table 2. For the chemicals detected in soil, the outdoor air (inhalation of VOC emissions) and direct contact (dermal contact and incidental ingestion) exposure pathways are complete for the construction worker. Inhalation exposure to VOCs sorbed onto particulates was not considered in the risk evaluation because vapor emissions were expected to contribute the majority of inhalation exposure. For the residential receptor, the outdoor and indoor air (inhalation of VOC emissions) and direct contact (dermal contact and incidental ingestion) exposure pathways are complete. Potentially complete groundwater pathways are indoor air exposure for the residential receptor and direct contact and outdoor air exposure for the construction worker.

Development of Risk-Based Screening Levels

RBSLs were developed using Site-specific input exposure parameters as shown in Table 3. Exposure parameter values used to develop the risk-based screening levels are based on the conservative assumptions presented in U.S. Environmental Protection Agency (U. S. EPA) risk assessment guidance for Superfund sites (U. S. EPA, 2001a) and California Environmental Protection Agency (CalEPA) guidance documents for multimedia risk assessments (CalEPA, 1992). Other sources of exposure parameter values are cited in Table 3. Chemical-specific toxicity values used in the development of RBSLs are shown in Table 4.

The U.S. EPA has developed slope factors (SFs) for the oral and inhalation routes of exposure for chemicals that are classified as known or potential human carcinogens. The slope factor is defined as a plausible upper-bound estimate of the probability of a carcinogenic response in human populations per unit intake of a chemical (averaged over a lifetime of 70 years). The primary sources of SFs, presented in order of preference include:

CalEPA cancer potency factors on-line at http://www.oehha.ca.gov/risk/chemicalDB/index.asp

U.S. EPA's Integrated Risk Information System (IRIS), an on-line database that contains current health risk and regulatory information for a large number of chemicals (U.S. EPA, 2001).

U.S. EPA Region 9 table of Preliminary Remediation Goals (PRGs) (U. S. EPA, 2000).

U.S. EPA Region 9 lists the sources of these additional values as the National Center for Environmental Assessment (NCEA).

Health Effects Assessment Summary Tables (HEAST), published periodically by the U.S. EPA (1997b).

The potential for noncancer health effects resulting from chemical exposure is assessed using reference doses (RfDs). RfDs represent average daily intakes (expressed as mg/k-day), that are not expected to result in adverse health effects to human (including sensitive populations) during a lifetime of exposure (for chronic RfDs). The RfDs are specific to the chemical, exposure route, and duration. Separate RfDs are used to evaluate oral and inhalation exposures. Inhalation RfDs may be cited as reference concentrations (RfCs), expressed as micrograms per cubic meter ($\mu g/m^3$). The following are the primary sources of RfDs in order of preference:

USEPA's Integrated Risk Information System (IRIS), an on-line database that contains current health risk and regulatory information for a large number of chemicals (U. S. EPA, 2001).

U.S. EPA Region 9 table of Preliminary Remediation Goals (PRGs) (U. S. EPA, 2000).

Health Effects Assessment Summary Tables (HEAST), published periodically by the U.S. EPA (1997b).

Cal EPA's chronic reference exposure levels (RELs) (CalEPA, 1997).

Calculation of RBSLs

Cancer and noncancer RBSLs were calculated for Site chemicals detected in soil and groundwater. For carcinogens, an excess lifetime cancer target risk of 1E-06 was used to back calculate corresponding RBSL soil and groundwater concentrations. For noncarcinogens, a cumulative target Hazard Index (HI) of 1 was used to estimate corresponding RBSL soil and groundwater concentrations. Equations used in these calculations are presented in the *Application of Risk-Based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater* (RWQCB, 2001).

Soil and Groundwater RBSLs in Indoor Air

RBSLs for potential indoor impacts to the residential receptor were estimated using an electronic copy (U.S. EPA, 2001b) of the Johnson and Etttinger indoor air model (1991). The Soil Screen Model (Version 2.3) and the Groundwater Screen Model (Version 2.3) were used. The model considers both diffusive and convective flow of subsurface vapors into buildings. Although the models provide a calculation of the excess cancer risk and noncancer hazards, the models were only used to derive the estimated air concentrations in a building (i.e. the indoor air EPC for VOCs). Site-specific key parameters used in the models include the following:

L_F	=	Depth below grade to bottom of enclosed space floor, 15 cm
L_t	=	Depth below grade to top of contamination, assumed to be 213.36 cm (7 feet)
L_{WT}		Depth below grade to water table, assumed to be 228.6 cm (7.5 feet)
Soil Type	=	Vadose Zone SCS soil type, assumed to be "SLC" (sandy clay loam)
$P_b{}^A$	=	Vadose zone bulk density, assumed to be 1.7 grams per cubic centimeter

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n^V = Vadose zone soil total porosity, assumed to be 0.38 (unitless)

$\theta_W{}^V$ = Vadose zone soil water-filled porosity, assumed to be 0.12 cubic centimeters per cubic centimeter

Additionally, the building ventilation rate for a residential building was used as follows:

$Q_{Bldg\text{-}r}$ = Building ventilation rate for a residential building assumed to be 2.5E+05 cubic centimeters per second, equivalent to 2 indoor exchanges per hour (RWQCB, 2001)

Model spreadsheet results used to calculate RBSLs for indoor air from soil and air groundwater chemical concentrations are presented in Attachment A.

Soil RBSLs

Tables 5, 6, and 7 present a comparison of maximum soil concentrations to cancer-based and noncancer-based site-specific RBSLs for chemicals detected in soil. The RBSLs are based on the maximum detected chemical concentrations for each potential receptor. The construction worker RBSLs are based upon complete exposure via incidental ingestion of soil, dermal contact with soil, and inhalation of VOC emissions from soil. For the outdoor residential receptor, the RBSLs are based on complete exposure through the incidental ingestion of soil, dermal contact with soil, and inhalation of soil VOC emissions. The indoor resident RBSLs are based on complete exposure via the inhalation pathway in an enclosed residence.

Because the levels are based upon target noncancer hazard levels and cancer risks, it is possible to ratio the maximum on-site soil concentrations to the RBSLs to provide screening-level estimates of potential residential noncancer hazards and excess cancer risks. The percent contribution of each chemical to total risk and hazard are also presented in Tables 5, 6, and 7. Assuming soil is exposed, the total construction worker excess cancer risk is 5.1E-10 and the noncancer hazard is less than 1 (Table 5). For the adult outdoor resident, the excess cancer risk is 2.8E-08 and the noncancer hazard is less than one (Table 6). For the adult indoor resident, excess cancer risk is 4.4E-07 and the noncancer hazard is less than 1 (Table 7).

The cancer risk of 1E-06 is generally considered a regulatory point of departure (i.e., total excess cancer risks less than 1E-06 would not be considered significant). None of the risks estimated for soil exposures to the construction worker, outdoor worker, and residential receptors were greater than 1E-06. A noncancer hazard above 1 indicates a potential for noncancer health effects to occur. Hazard indices for all of the receptors evaluated did not exceed 1.

Groundwater RBSLs

Tables 5 and 7 present a comparison of maximum soil concentrations to cancer-based and noncancer-based site-specific RBSLs for chemicals detected in shallow groundwater. For the construction worker, the excess cancer risk is 7.3E-05, based on complete exposure via the inhalation and dermal contact routes of exposure and the noncancer hazard is greater than 1 (Table 5). Although the risk due to chemicals in groundwater is greater than the 1E-06 target risk and exceeds the noncancer hazard index of 1, the majority of risk is due to the single detection of benzene in 1999 at 99 µg/L in MW-3B (Table 1). Benzene was apparently not detected from other wells in the general vicinity of MW-3B, therefore the single detection of benzene may be isolated to the source area. We understand that MW-3B was destroyed and the former location of the well is currently covered with asphalt under Ohlone Road. The closest lot line is 20 to 30 feet from the former well location, workers exposed to direct contact with groundwater should take appropriate health and safety precautions during construction activities in the vicinity of the former location of MW-3B.

Assuming that the indoor air exposure pathway is complete for the resident, the excess cancer risk is 6.2E-07 and the noncancer hazard is less than 1 (Table 7). The cancer risk of 1E-06 is generally considered a regulatory point of departure therefore, the Site-specific total excess cancer risks less than 1E-06 would not be considered significant for the indoor resident.

Cumulative Risk and Hazard

Soil and groundwater risk and hazard for the resident were summed since it is the only potential receptor that was evaluated for both soil and groundwater exposures. Cumulative total excess lifetime cancer risk and hazard are 9.9E-07 and less than 1, respectively. Summing the indoor risks from soil and groundwater represents the worst case scenario in mathematical terms, however, this does not occur in reality since the risk from the inhalation route of exposure accounts for an inhalation rate of 20 m^3 per day for each media evaluated (i.e. soil and groundwater). While adding the two estimates of risk from indoor and outdoor exposures can be done mathematically, the assumption that an individual breathes 40 m^3 per day is not representative of actual breathing rates.

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Conclusions

Indoor and outdoor residential exposures to chemicals did not result in cumulative total excess lifetime cancer risks or noncancer hazard that exceed the regulatory benchmarks warranting further evaluation. However, for the construction worker, the excess cancer risk of 7.3E-05 and an HI greater than 1 resulted from exposure to groundwater and exceeded the regulatory target risk of 1E-06 and noncancer HI of 1. Based upon the results of the groundwater screening-level evaluation, risk mitigation measures appear to be warranted for the construction worker in the vicinity of former well MW-3B if groundwater is encountered during Site development. As noted previously, the former well has been destroyed and is currently covered by asphalt under Ohlone Street.

If you have any questions, please call either of the undersigned at (510) 654-3900.

Sincerely,

Estelle N. Shiroma, D.Env.
Project Scientist

Norman T. Ozaki, Ph.D.
President and Principal Toxicologist

Attachments (Tables 1 through 7; Attachments A and B)

cc: Ms. Eva Chu, Alameda County Department of Environmental Health
Mr. Derek Wong, ICES

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References

California Environmental Protection Agency (CalEPA). 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control, Office of the Science Advisor. July.

CalEPA, Department of Toxic Substances Control (DTSC). 2000. Guidance for the Dermal Exposure Pathway. Draft Memorandum from S. DiZio, M. Wade, and D. Oudiz to Human and Ecological Risk Division. January 17.

California Regional Water Quality Control Board, San Francisco Region. 2001. *Application of Risk-Based Screening Levels and Decision Making to Sites with Impacted Soil and Groundwater. Volume 2: Background Documentation for the Development of Tier 1 Soil and Groundwater Screening Levels. Interim Final.* December.

ExcelChem. 1999. Analysis Report to B. Mahoney. Project : WBC Alameda, EPA Method 8240B. Date analyzed: August 19, 1999. As cited in West & Associates (1999a).

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U.S. EPA. 2002. Integrated Risk Information System (IRIS). Toxicological Profiles downloaded from http://www.epa.gov/iris website

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West & Associates Environmental Engineers, Inc. (West & Associates) 1999a. Submittal of Risk Assessment Report, Weyerhaeuser Paper Company, 1801 Hibbard Street, Alameda 94501, STID 1202. August 24.

West & Associates. 1999b. Letter to L. Seto, Alameda County Health Agency from B. Mahoney, 1999. July 21. (As cited in West & Associates 1999a.)

TABLES

TABLE 1
SITE SOIL AND GROUNDWATER DATA USED IN RISK EVALUATION
Marine Cove Subdivision
1801 Hibbard Street - Alameda, California

Subsurface Soil Data Set
Samples Collected on July 16, 1999 (West & Associates, 1999)

Chemical	B-9 (mg/Kg)	B-10 (mg/Kg)
Benzene	**0.005**	0.0025
Ethylbenzene	**0.071**	**0.049**
m&p Xylenes	**0.009**	0.0025

Groundwater Data Set
Samples Collected on August 13, 1998 (Excelchem, 1999)

Chemical	MW-3B (µg/L)	MW-4B (µg/L)	MW-5 (µg/L)	MW-6 (µg/L)	MW-10 (µg/L)	MW-11 (µg/L)
Benzene	**99**	0.25	0.25	0.25	0.25	0.25
Ethylbenzene	**51.9**	0.25	0.25	0.25	0.25	0.25
m&p Xylenes	**13.9**	0.25	0.25	0.25	0.25	0.25
1,1-Dichloroethene	**37.4**	0.25	7.6	4.1	0.25	0.25
Trichloroethene	**5**	0.7	0.25	0.25	0.25	0.25
Tetrachloroethene	**5**	1.3	0.25	0.25	0.25	0.25

Notes:

Original laboratory data reports were not available for review; for chemicals that were not detected, one-half the detection limit was reportedly used as the input exposure concentration. However, chemicals that were not detected are not clearly identified in the 1999 risk assessment (West & Associates, 1999a).
Maximum concentrations detected in soil and groundwater are denoted in bold typeface.
mg/kg = milligrams per kilogram
µg/L = micrograms per liter

TABLE 2

EXPOSURE PATHWAYS EVALUATED
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Potential Receptor	Media Evaluated	Route of Exposure Evaluated
Future Construction Worker	Soil	Inhalation - Outdoor Air (Volatiles) Incidental Ingestion Dermal Contact
	Groundwater	Inhalation - Outdoor Air from Exposed Water (Volatiles) Dermal Contact
Future Resident	Soil	Inhalation - Outdoor Air (Volatiles) Inhalation - Indoor Air (Volatiles) Incidental Ingestion Dermal Contact
	Groundwater	Inhalation - Indoor Air (Volatiles)

TABLE 3
EXPOSURE PARAMETERS
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Single Family Child Resident Variables	Acronym	Units	Values	Source
Inhalation Rate - Single Family Child Resident	SFChRes IR	m^3/day	10	U.S. EPA 1997 - default child 6-8 years of age mean recommended inhalation rate
Ingestion Rate - Single Family Child Resident	SFChRes Ing	mg/day	200	Cal EPA 1992 / U.S. EPA 1997
Unit conversion factor for soil	CFs	mg/kg	1.00E+06	NA
Unit conversion factor for groundwater	CFw	µg/mg	1.00E+03	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Single Family Child Resident	SFChRes SA	cm^2/day	2000	Cal EPA 1992
Skin adherence factor - Single Family Child Resident	SAF	mg/cm^2	0.2	DTSC 2000 / U.S. EPA 2001 - Default child residential value
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Exposure Frequency - Single Family Child Resident	SFChRes EF	days/year	350	Cal EPA 1992 / U.S. EPA 1991 - default residential value
Exposure Duration - Single Family Child Resident	SFChRes ED	years	6	Cal EPA 1992 / U.S. EPA 1991 - default child residential when adult resident is 6 years (30 years total)
Body Weight - Single Family Child Resident	SFChRes BW	kg	15	U.S. EPA 1991 / Cal EPA 1992 - Default child value
Averaging Time-Non-carcinogenic - Single Family Child Resident	SFChRes ATnon-carc	days	2190	Calculated
Averaging Time-Carcinogenic	ATcarc	days	25550	U.S. EPA 1991 / Cal EPA 1992

Notes:
m^3 = Cubic meter
µg = Microgram
mg = Milligram
kg = Kilogram
cm^2 = square centimeter

References:

California Environmental Protection Agency (Cal EPA) 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control, Office of the Science Advisor. July.
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TABLE 3
EXPOSURE PARAMETERS
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Construction Worker Variables	**Acronym**	**Units**	**Values**	**Source**
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	Cal EPA 1992 - Total commercial/industrial work day default value
Ingestion Rate - Construction Worker	CW Ing	mg/day	100	Cal EPA 1992 - Equivalent to agricultural worker
Unit conversion factor for soil	CFs	mg/kg	1.00E+06	NA
Unit conversion factor for groundwater	CFw	ug/mg	1.00E+03	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	DTSC 2000
Skin adherence factor - Construction Worker	SAF	mg/cm^2	0.24	Holmes et. al. 1999 - Maximum Geometric Mean value for soil loading (hands) for construction workers
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	U.S. EPA 1992
Groundwater Dermal Exposure Time	ET	hr	0.5	Professional Judgement
Exposure Frequency - Construction Worker	CW EF	days/year	250	U.S. EPA 1991, Cal EPA 1992
Exposure Duration - Construction Worker	CW ED	years	1	Professional Judgement
Body Weight - Construction Worker	CW BW	kg	70	U.S. EPA 1991 / Cal EPA 1992
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	Calculated
Averaging Time-Carcinogenic	ATcarc	days	25550	U.S. EPA 1991 / Cal EPA 1992
Single Family Adult Resident Variables	**Acronym**	**Units**	**Values**	**Source**
Inhalation Rate - Single Family Adult Resident	SFAdRes IR	m^3/day	20	Cal EPA 1992 - default residential total indoor and outdoor combined daily inhalation rate
Ingestion Rate - Single Family Adult Resident	SFAdRes Ing	mg/day	100	Cal EPA 1992 - Default adult residential rate - equivalent to an agricultural worker
Unit conversion factor for soil	CFs	mg/kg	1.00E+06	NA
Unit conversion factor for groundwater	CFw	µg/mg	1.00E+03	NA
Fraction Ingested	FI	Unitless	1	U.S. EPA 1991
Skin Surface Area - Single Family Adult Resident	SFAdRes SA	cm^2/day	5800	Cal EPA 1992
Skin adherence factor - Single Family Adult Resident	SAF	mg/cm^2	0.07	DTSC 2000 / U.S. EPA 2001 - Default adult residential value
Dermal absorption factor	DAF	Unitless	Chem-Spec	SCAQMD 1988
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	U.S. EPA 2000
Volatilization factor for groundwater	VFw	L/m^3	0.5	U.S. EPA 2000
Exposure Frequency - Single Family Adult Resident	SFAdRes EF	days/year	350	Cal EPA 1992 / U.S. EPA 1991
Exposure Duration - Single Family Adult Resident	SFAdRes ED	years	24	Cal EPA 1992 / U.S. EPA 1991 - default adult residential when child resident is 6 years (30 years total)
Body Weight - Single Family Adult Resident	SFAdRes BW	kg	70	U.S. EPA 1991 / Cal EPA 1992 - default adult value
Averaging Time-Non-carcinogenic - Single Family Adult Resident	SFAdRes ATnon-carc	days	8760	Calculated
Averaging Time-Carcinogenic	ATcarc	days	25550	U.S. EPA 1991 / Cal EPA 1992

TABLE 4
TOXICITY VALUES
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Chemicals	Oral Cancer Slope Factor * [1/(mg/kg-day)]	Source Oral Cancer Slope Factor	Inhalation Unit Risk Factor [1/(µg/m^3)]	Inhalation Cancer Slope Factor [1/(mg/kg-day)]	Source Inhalation Unit Risk and Cancer Slope Factors	Chronic Inhalation REL [ab] (µg/m^3)	Source Chronic Inhalation REL	Inhalation RfC [bc] (µg/m^3)	Inhalation RfD (mg/kg-day)	Source Inhalation RfD and RfC	Oral RfD ** (mg/kg-day)	Source Oral RfD
Benzene	1.00E-01	OEHHA	2.90E-05	1.00E-01	OEHHA	6.00E+01	OEHHA	--	1.70E-03	NCEA	3.00E+03	NCEA
Ethylbenzene	NC	NC	NC	NC	IRIS	2.00E+03	OEHHA	1.00E+00	2.86E-01	IRIS	1.00E-01	IRIS
m,p-Xylenes	NC	NC	NC	NC	IRIS	7.00E+02	Cal EPA	--	2.00E-01	Cal EPA	2.00E+00	IRIS
1,1-Dichloroethane	5.70E-03	OEHHA	1.60E-06	5.70E-03	OEHHA	--	--	--	1.40E-01	HEAST	1.00E-01	HEAST
Trichloroethene	1.53E-02	OEHHA	2.00E-06	1.00E-02	OEHHA	6.00E+02	OEHHA	--	1.71E-01	OEHHA	1.71E-01	R
Tetrachloroethene	1.50E-01	OEHHA	5.60E-05	5.40E-01	OEHHA	--	--	--	1.10E-01	NCEA	1.00E-02	IRIS

Notes:

* Oral Cancer Slope Factor value used as a surrogate for dermal Cancer Slope Factor

** Oral RfD value used as a surrogate for dermal RfD

a = To calculate an inhalation RfD from a Chronic REL, the following equation and assumptions may be used: Inhalation RfD (mg/kg-day) = REL (µg/m^3) x 1 mg/1000 µg x 20 m^3/day x 1/70 kg

b = For Johnson and Ettinger Model, when an RfC was unable for a chemical, the REL was used.

c = To calculate an inhalation RfD from an RfC, the following equation and assumptions may be used: Inhalation RfD (mg/kg-day) = RfC (mg/m^3) x 20 m^3/day x 1/70kg

-- = Not available

NC = Chemical is not classified as a carcinogen

RfD = Reference Dose

RfC = Reference Concentration

REL = Reference Exposure Level

R = Route-to-route extrapolation

m^3 = Cubic meter

ug = Microgram

mg = Milligram

kg = Kilogram

References:

California Environmental Protection Agency (CalEPA). 2001. Toxicity Criteria Database. Office of Environmental Health Hazard Assessment (OEHHA). **Http://www.oehha.ca.gov/risk/chemicalDB/index.asp** October 31.

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TABLE 5

SUMMARY OF RISK-BASED SCREENING LEVELS (RBSLs) 1
Construction Worker Scenario
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Chemicals	Maximum Soil Concentration (mg/kg)	Cancer RBSL Soil (mg/Kg)	Soil Cancer Risk	% Contribution to Soil Total Risk	Non-Cancer RBSL Soil (mg/kg)	Soil Noncancer Hazard	% Contribution to Soil Total Hazard
Soil							
Benzene	0.005	9.77	5.1E-10	100%	24	0.0002	93%
Ethylbenzene	0.071	NC	NC	NC	5547	0.00001	5.8%
m,p-Xylenes	0.009	NC	NC	NC	4479	0.000002	0.9%
Total			**5.1E-10**			**0.0002**	
Groundwater	**Maximum Groundwater Concentration (µg/L)**	**Cancer RBSL Groundwater (µg/L)**	**Groundwater Cancer Risk**	**% Contribution to Groundwater Total Risk**	**Non-Cancer RBSL Groundwater (µg/L)**	**Groundwater Noncancer Hazard**	**% Contribution to Groundwater Total Hazard**
Benzene	99	1.7	6.0E-05	82%	17	5.7	84%
Ethylbenzene	51.9	NC	NC	NC	85	0.6	9%
m,p-Xylenes	13.9	NC	NC	NC	903	0.02	0.2%
1,1-Dichloroethane	37.4	52	7.2E-07	0.99%	482	0.1	1.1%
Trichloroethene	5	15	3.4E-07	0.47%	497	0.01	0.1%
Tetrachloroethene	5	0	1.2E-05	16%	13	0.4	5.5%
Total			**7.3E-05**			**6.8**	

Notes:
[1] RBSLs are based on maximum chemical concentrations detected in soil and groundwater.
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
NC = Noncarcinogen

TABLE 6

SUMMARY OF RISK-BASED SCREENING LEVELS (RBSLs) 1
Outdoor Residential Scenario
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Chemicals	Maximum Soil Concentration (mg/kg)	Cancer RBSL Soil Outdoor Resident (mg/kg)	Soil Cancer Risk	% Contribution to Soil Total Risk	Non-Cancer RBSL Soil Outdoor Resident - Child (mg/kg)	Soil Noncancer Hazard	% Contribution to Soil Total Hazard
Soil							
Benzene	0.005	0.18	2.8E-08	100%	7	0.0007	92%
Ethylbenzene	0.071	NC	NC	NC	1,457	0.00005	6.7%
m,p-Xylenes	0.009	NC	NC	NC	1,362	0.000007	0.9%
Total			**2.8E-08**			**0.0007**	

Notes:

[1] RBSLs are based on maximum chemical concentrations detected in soil and groundwater.

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

NC = Noncarcinogen

TABLE 7

SUMMARY OF RISK-BASED SCREENING LEVELS (RBSLs) 1
Indoor Residential Scenario
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Chemicals	Maximum Soil Concentration (mg/kg)	Cancer RBSL Soil Indoor Resident (mg/kg)	Soil Cancer Risk	% Contribution to Soil Total Risk	Non-Cancer RBSL Soil Indoor Resident (mg/kg)	Soil Noncancer Hazard	% Contribution to Soil Total Hazard
Soil							
Benzene	0.005	0.01	3.4E-07	100%	11	0.0005	75%
Ethylbenzene	0.071	NC	NC	NC	530	0.00013	22%
m,p-Xylenes	0.009	NC	NC	NC	442	0.000020	3%
Total			**3.4E-07**			**0.0006**	
Groundwater	**Maximum Groundwater Concentration (µg/L)**	**Cancer RBSL Groundwater Indoor Resident (µg/L)**	**Groundwater Cancer Risk**	**% Contribution to Groundwater Total Risk**	**Non-Cancer RBSL Groundwater Indoor Resident (µg/L)**	**Groundwater Noncancer Hazard**	**% Contribution to Groundwater Total Hazard**
Benzene	99	201	4.9E-07	80%	149,623	0.001	91%
Ethylbenzene	51.9	NC	NC	NC	2,318,844	0.00002	3%
m,p-Xylenes	13.9	NC	NC	NC	1,784,515	0.00001	1.1%
1,1-Dichloroethane	37.4	3690	1.0E-08	1.6%	1,265,023	0.0000	4.1%
Trichloroethene	5	1900	2.6E-09	0.4%	977,005	0.00001	0.7%
Tetrachloroethene	5	46	1.1E-07	18%	NA	NA	NA
Total			**6.2E-07**			**0.001**	

Notes:
[1] RBSLs are based on maximum chemical concentrations detected in soil and groundwater.
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
NC = Noncarcinogen

ATTACHMENT A

CALCULATIONS OF RISK-BASED SCREENING LEVELS

TABLE A-1

CONSTRUCTION WORKER RISK CALCULATIONS - SOIL
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Variables	Acronym	Units	Values	Benzene	Ethylbenzene	m,p-Xylenes
Target Noncarcinogenic Hazards:						
Soil Hazard Index - Construction Worker	**Soil CW HI**	unitless	Chem-Spec	1	1	1
Target Carcinogenic Risk:						
Soil Carcinogenic Risk - Construction Worker	**Soil CW RISK**	unitless	Chem-Spec	1.00E-06	1.00E-06	1.00E-06
Exposure Parameters:						
Unit conversion factor	CF	mg/kg	1.00E+06	--	--	--
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	--	--
Ingestion Rate - Construction Worker	CW Ing	mg/day	100	--	--	--
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	--	--
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.10	0.10	0.10
Skin adherence factor	SAF	mg/cm^2	0.24	--	--	--
Exposure Frequency - Construction Worker	CW EF	days/year	250	--	--	--
Exposure Duration - Construction Worker	CW ED	years	1	--	--	--
Body Weight - Construction Worker	CW BW	kg	70	--	--	--
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	--	--
Averaging Time-Carcinogenic	ATcarc	days	25550	--	--	--
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	2.80E+03	4.20E+03	4.40E+03
Toxicity Criteria:						
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	2.86E-01	2.00E-01
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Cancer Slope Factor, Ingestion	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg\text{-}day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Risk-Based Screening Level (RBSL):						
RBSL Soil Concentration - Carcinogenic	**$C_{s\ car}$**	**mg/kg**	**Chem-Spec**	**9.8**	**NC**	**NC**
RBSL Soil Concentration - Noncarcinogenic	**$C_{s\ non\text{-}car}$**	**mg/kg**	**Chem-Spec**	**24**	**5547**	**4479**

TABLE A-2

CONSTRUCTION WORKER RISK CALCULATIONS - GROUNDWATER
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Variables	Acronym	Units	Values	Benzene	Ethylbenzene	m,p-Xylenes	1,1-Dichloroethane	Trichloroethene	Tetrachloroethene
Target Noncarcinogenic Hazards:									
Groundwater Hazard Index - Construction Worker	**GW CW HI**	unitless	Chem-Spec	1	1	1	1	1	1
Target Carcinogenic Risk:									
Groundwater Carcinogenic Risk - Construction Worker	**GW CW RISK**	unitless	Chem-Spec	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
Exposure Parameters:									
Unit conversion factor for groundwater	CFw	ug/mg	1.00E+03	--	--	--	--	--	--
Inhalation Rate - Construction Worker	CW IR	m^3/day	20	--	--	--	--	--	--
Skin Surface Area - Construction Worker	CW SA	cm^2/day	3160	--	--	--	--	--	--
Chemical-Specific Water Permeability Coefficient	Kp	cm/hr	Chem-Spec	2.1E-02	7.4E-02	8.0E-02	8.9E-03	1.6E-02	4.8E-02
Groundwater Dermal Exposure Time	ET	hr	0.5	--	--	--	--	--	--
Exposure Frequency - Construction Worker	CW EF	days/year	250	--	--	--	--	--	--
Exposure Duration - Construction Worker	CW ED	years	1	--	--	--	--	--	--
Body Weight - Construction Worker	CW BW	kg	70	--	--	--	--	--	--
Averaging Time-Non-carcinogenic - Construction Worker	CW ATnon-carc	days	365	--	--	--	--	--	--
Averaging Time-Carcinogenic	ATcarc	days	25550	--	--	--	--	--	--
Volatilization factor for groundwater	VFw	L/m^3	0.5	--	--	--	--	--	--
Toxicity Criteria:									
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	2.86E-01	2.00E-01	1.40E-01	1.71E-01	1.10E-01
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00	1.00E-01	1.71E-01	1.00E-02
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00	1.00E-01	1.71E-01	1.00E-02
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC	5.7E-03	1.0E-02	5.4E-01
Cancer Slope Factor, Ingestion	CSF_{ing}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC	5.7E-03	1.5E-02	1.5E-01
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC	5.7E-03	1.5E-02	1.5E-01
Risk-Based Screening Level (RBSL):									
RBSL Groundwater Concentration - Carcinogenic	**Cw_{car}**	**ug/L**	**Chem-Spec**	**1.7**	**NC**	**NC**	**52**	**15**	**0.4**
RBSL Groundwater Concentration - Noncarcinogenic	**$Cw_{non-car}$**	**ug/L**	**Chem-Spec**	**17**	**85**	**903**	**482**	**497**	**13**

TABLE A-3
OUTDOOR RESIDENTIAL RISK CALCULATIONS - SOIL
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Variables	Acronym	Units	Values	Benzene	Ethylbenzene	m,p-Xylenes
Target Noncarcinogenic Hazards:						
Soil Hazard Index - Residential	**Soil Res HI**	unitless	Chem-Spec	1	1	1
Target Carcinogenic Risk:						
Soil Carcinogenic Risk - Residential	**Soil Res RISK**	unitless	Chem-Spec	1.00E-06	1.00E-06	1.00E-06
Exposure Parameters:						
Unit conversion factor	CF	mg/kg	1.00E+06	--	--	--
Inhalation Rate - Adult Resident	AdRes IR	m^3/day	20	--	--	--
Inhalation Rate - Child Resident	ChRes	m^3/day	10	--	--	--
Ingestion Rate - Adult Resident	AdRes Ing	mg/day	100	--	--	--
Ingestion Rate - Child Resident	ChRes Ing	mg/day	200	--	--	--
Skin Surface Area - Adult Resident	AdRes SA	cm^2/day	5800	--	--	--
Skin Surface Area - Child Resident	ChRes SA	cm^2/day	2000	--	--	--
Dermal absorption factor	DAF	Unitless	Chem-Spec	0.10	0.10	0.10
Skin adherence factor - Adult Resident	AdRes SAF	mg/cm^2	0.07	--	--	--
Skin adherence factor - Child Resident	ChRes SAF	mg/cm^2	0.2	--	--	--
Exposure Frequency - Adult and Child Resident	AdRes - ChRes EF	days/year	350	--	--	--
Exposure Duration - Adult Resident	AdRes ED	years	24	--	--	--
Exposure Duration - Child Resident	ChRes ED	years	6	--	--	--
Body Weight - Adult Resident	AdRes BW	kg	70	--	--	--
Body Weight - Child Resident	ChRes BW	kg	15	--	--	--
Averaging Time-Non-carcinogenic - Adult Resident	AdRes ATnon-carc	days	8760	--	--	--
Averaging Time-Non-carcinogenic - Child Resident	ChRes ATnon-carc	days	2190	--	--	--
Averaging Time-Carcinogenic	ATcarc	days	25550	--	--	--
Volatilization factor for soil	Vfs	m^3/kg	Chem-Spec	2.80E+03	4.20E+03	4.40E+03

TABLE A-3
OUTDOOR RESIDENTIAL RISK CALCULATIONS - SOIL
Marina Cove Subdivision
1801 Hibbard Street - Alameda, California

Variables	Acronym	Units	Values	Benzene	Ethylbenzene	m,p-Xylenes
Age-Adjusted Exposure Factors:						
Ingestion	IFS_{adj}	mg-yr/kg-day	114.29	--	--	--
Dermal Contact	SFS_{adj}	mg-yr/kg-day	299.20	--	--	--
Inhalation	$InhF_{adj}$	m^3-yr/kg-day	10.86	--	--	--
Toxicity Criteria:						
Verified Reference Dose, Inhalation	RfD_{inh}	mg/kg-day	Chem-Spec	1.70E-03	2.86E-01	2.00E-01
Verified Reference Dose, Ingestion	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00
Verified Reference Dose, Dermal (oral)	RfD_{ing}	mg/kg-day	Chem-Spec	3.00E+03	1.00E-01	2.00E+00
Cancer Slope Factor, Inhalation	CSF_{inh}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Cancer Slope Factor, Ingestion	CSF_{ing}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Cancer Slope Factor, Dermal (oral)	CSF_{ing}	$(mg/kg-day)^{-1}$	Chem-Spec	1.0E-01	NC	NC
Risk-Based Screening Level (RBSL):						
RBSL Soil Concentration - Adult and Child Carcinogen	**$C_{s\ car}$**	**mg/kg**	**Chem-Spec**	**0.18**	**NC**	**NC**
RBSL Soil Concentration - Child Noncarcinogenic	**$C_{s\ non\text{-}car}$**	**mg/kg**	**Chem-Spec**	**7.4**	**1457**	**1362**

ATTACHMENT B

RESULTS OF INDOOR AIR MODELING
RESIDENTIAL RECEPTOR

ATTACHMENT B-1

RESULTS OF SOIL SCREEN (Version 2.3)

DATA ENTRY SHEET

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

SL-SCREEN
Version 2.3; 03/01

YES	X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES	

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
71432		Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	213.36	20	SCL		

MORE ↓

ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
1.7	0.38	0.12	0.002

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	2.9E-05	6.0E-02	L

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
198.36	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	1.00E+00	2.50E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\cdot m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm·s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
9.24E+05	4.16E-04	15	8,019	4.41E-03	1.83E-01	1.78E-04	6.87E-03	198.36

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	1.18E-01	8.48E+02	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	6.75E-06	5.72E-03

Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
2.9E-05	6.0E-02

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
1.47E+01	1.09E+04	1.47E+01	3.79E+05	1.47E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

SL-SCREEN
Version 2.3; 03/01

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
100414		Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	213.36	20	SCL		

MORE ↓

ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
1.7	0.38	0.12	0.002

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.50E-02	7.80E-06	7.88E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	0.0E+00	1.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
198.36	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	1.00E+00	2.50E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
9.24E+05	4.16E-04	15	10,040	5.90E-03	2.45E-01	1.78E-04	5.85E-03	198.36

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	7.26E-01	2.94E+02	0.10	1.78E+00	5.85E-03	3.84E+02	1.45E+05	6.69E-06	1.97E-03

Unit risk factor, URF $(µg/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E+00

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	5.30E+05	5.30E+05	1.41E+05	1.41E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

SL-SCREEN
Version 2.3; 03/01

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
108383		m-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	213.36	20	SCL		

MORE ↓

ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)
1.7	0.38	0.12	0.002

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.00E-02	7.80E-06	7.34E-03	25	8,523	412.27	617.05	4.07E+02	1.61E+02	0.0E+00	7.0E-01	L

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
198.36	0.260	0.180	2.07E-09	0.905	1.88E-09	3,844	1.00E+00	2.50E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
9.24E+05	4.16E-04	15	10,138	5.48E-03	2.28E-01	1.78E-04	5.46E-03	198.36

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^1) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	8.14E-01	2.48E+02	0.10	1.78E+00	5.46E-03	3.84E+02	3.40E+05	6.66E-06	1.65E-03

Unit risk factor, URF $(µg/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	7.0E-01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (µg/kg)	Indoor exposure soil conc., noncarcinogen (µg/kg)	Risk-based indoor exposure soil conc., (µg/kg)	Soil saturation conc., C_{sat} (µg/kg)	Final indoor exposure soil conc., (µg/kg)
NA	4.42E+05	4.42E+05	1.48E+05	1.48E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

ATTACHMENT B-2

RESULTS OF GROUNDWATER SCREEN (Version 2.3)

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71432		Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	2.9E-05	6.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	8,071	3.47E-03	1.47E-01	1.77E-04	6.87E-03	3.45E-05	2.75E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	1.47E+02	0.10	1.78E+00	6.87E-03	3.84E+02	2.51E+04	2.85E-06	4.18E-04	2.9E-05	6.0E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
2.01E+02	1.50E+05	2.01E+02	1.75E+06	2.01E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343		1,1-Dichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component - water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	5.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	7,395	3.64E-03	1.54E-01	1.77E-04	5.79E-03	3.12E-05	2.48E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	1.54E+02	0.10	1.78E+00	5.79E-03	3.84E+02	1.65E+05	2.68E-06	4.12E-04	1.6E-06	5.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
3.69E+03	1.27E+06	3.69E+03	5.06E+06	3.69E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414		Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.50E-02	7.80E-06	7.88E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	0.0E+00	1.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	10,098	4.36E-03	1.84E-01	1.77E-04	5.85E-03	2.68E-05	2.14E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	1.84E+02	0.10	1.78E+00	5.85E-03	3.84E+02	1.45E+05	2.44E-06	4.50E-04	NA	1.0E+00

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	2.32E+06	2.32E+06	1.69E+05	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.6E-05	0.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	9,502	1.05E-02	4.46E-01	1.77E-04	5.62E-03	2.18E-05	1.75E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	4.46E+02	0.10	1.78E+00	5.62E-03	3.84E+02	2.39E+05	2.12E-06	9.47E-04	5.6E-05	NA

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
4.59E+01	NA	4.59E+01	2.00E+05	4.59E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES | X

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.10E+03	2.0E-06	6.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	8,495	6.26E-03	2.65E-01	1.77E-04	6.17E-03	2.64E-05	2.12E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	2.65E+02	0.10	1.78E+00	6.17E-03	3.84E+02	7.97E+04	2.42E-06	6.40E-04	2.0E-06	6.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
1.90E+03	9.77E+05	1.90E+03	1.10E+06	1.90E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

END

DATA ENTRY SHEET

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

GW-SCREEN
Version 2.3; 03/01

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108383		m-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	228.6	SCL	15

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
SCL			1.7	0.38	0.12

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.00E-02	7.80E-06	7.34E-03	25	8,523	412.27	617.05	4.07E+02	1.61E+02	0.0E+00	7.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
213.6	0.260	0.180	2.06E-09	0.905	1.86E-09	25.86	0.38	0.047	0.333	3,844

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\cdot m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.50E+05	9.24E+05	4.16E-04	15	10,197	4.04E-03	1.71E-01	1.77E-04	5.46E-03	2.61E-05	2.09E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
213.6	15	1.71E+02	0.10	1.78E+00	5.46E-03	3.84E+02	3.40E+05	2.39E-06	4.09E-04	NA	7.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	1.78E+06	1.78E+06	1.61E+05	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The groundwater conc. at or above the solubility limit is not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

END