

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu\text{g}/\text{kg}$)	Indoor exposure soil conc., noncarcinogen ($\mu\text{g}/\text{kg}$)	Risk-based indoor exposure soil conc., ($\mu\text{g}/\text{kg}$)	soil saturation conc., C_{sat} ($\mu\text{g}/\text{kg}$)	Final indoor exposure soil conc., ($\mu\text{g}/\text{kg}$)
4.81E+07	NA	4.81E+07	5.02E+03	NOC

MESSAGE SUMMARY BELOW:

MESSAGE: The values of C_{source} and C_{building} on the INTERCALCS worksheet are based on unity and do not represent actual values.

NOC = NOT OF CONCERN. The contaminant is a solid at the soil temperature and not of concern for this pathway.

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

END

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

DATA ENTRY SHEET

SL-SCREEN
Version 3.1; 02/01

Reset to
Defaults

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

YES ☒ OR

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

YES ☐

ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
Chemical CAS No. (numbers only, no dashes)	Initial soil conc., C_a ($\mu\text{g/kg}$)	Chemical			
06737		Fluorene			

MORE
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ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
Depth below grade to bottom of enclosed space floor, L_f (15 or 200 cm)	Depth below grade to top of contamination space floor, L_t (cm)	Average soil temperature, T_s ($^{\circ}\text{C}$)	Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	250	15	SC		

MORE
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ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
Vadose zone SCS soil type (Looking Soil Parameters)	Vadose zone soil dry bulk density, ρ_b (g/cm^3)	Vadose zone soil total porosity, n (unitless)	Vadose zone soil water-filled porosity, θ_w (cm^3/cm^3)	Vadose zone soil organic carbon fraction, f_{oc} (unitless)	Average vapor flow rate into bldg. (leave blank to calculate) Q_{soil} (L/m)
SC	1.63	0.385	0.197	0.002	5

MORE
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ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
Averaging time for carcinogens, ATC (Yrs)	Averaging time for noncarcinogens, ATNC (Yrs)	Exposure duration, ED (Yrs)	Exposure frequency, EF (days/yr)	Target risk for carcinogens, TR (unitless)	Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-05	1

END

Used to calculate risk-based
soil concentration.

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RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu\text{g}/\text{kg}$)	Indoor exposure soil conc., noncarcinogen ($\mu\text{g}/\text{kg}$)	Risk-based indoor exposure soil conc., ($\mu\text{g}/\text{kg}$)	Soil saturation conc., C_{sat} ($\mu\text{g}/\text{kg}$)	Final indoor exposure soil conc., ($\mu\text{g}/\text{kg}$)
NA	1.41E+07	1.41E+07	5.49E+04	NOC

MESSAGE SUMMARY BELOW:

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

END

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

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure carcinogen conc., (µg/kg)	Indoor exposure soil conc., (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	3.24E+08	3.24E+08	2.84E+05	NOC

MESSAGE SUMMARY BELOW:

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

END

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

Approach to Developing Risk-Based Human Health Criteria

Protection of Future Site Users from Potential Vapour Inhalation

The approach to developing site specific risk-based criteria is based on the Johnson and Ettinger (J&E) (1991) one-dimensional analytical model to determine theoretical values that would apply to soil at depth based on a potential to generate vapours at levels that would pose a risk to future site users.

Johnson and Ettinger (J&E) (1991) provides a screening-level model that incorporates both convective and diffusive mechanisms for estimating the transport of contaminant vapours emanating from either subsurface soils or groundwater into indoor spaces located directly above the source of contamination.

A users guide to the Johnson and Ettinger (J&E) (1991) model has been developed by the US EPA (2004).

Calculating Risk-Based Criteria

To calculate risk-based criteria, the model is run using a populated spreadsheet that requires variable input based on site and soil conditions.

Specific contaminant compounds of concern at the Site were selected based on whether the compounds are considered to have sufficient volatility and toxicity to pose a risk to human health. Table 1 of the users guide lists 114 chemicals that may be found at hazardous waste sites and indicates whether the chemical is sufficiently toxic and volatile to result in a potentially unacceptable indoor inhalation risk.

The contaminants selected were based on the contaminants of concern at the Site, which included those identified in the table.

Benzene	o-xylene	Benzo(b)fluoranthene
Toluene	p-xylene	Chrysene
Ethylbenzene	Naphthalene	Fluorene
m-xylene	Acenaphthene	Pyrene

The chemical properties of these compounds drive the calculations. The soil conditions are based on a set of variables for particular soil types. The soil type selected was based on the expectation that backfill material will consist of a sandy clay material. The following properties were used to populate each spreadsheet for individual compounds:

- Depth of floor base – 15cm (i.e. concrete slab on ground).
- Depth of risk based interval – 250cm, 400cm or 800cm (i.e. depth to which criteria apply).
- Soil temperature – 15°C.
- Soil type – Sandy Clay.
- Soil bulk density – 1.63g/cm³ (model default).
- Soil porosity – 0.385 unitless (model default).
- Soil water-filled porosity – 0.197cm³/cm³ (model default).

The remainder of the variable inputs are model defaults. The results tab on the calculation spreadsheet provides a final indoor exposure soil concentration (in µg/kg). This value was used as the risk-based soil criteria value. The results spreadsheet for each compound is provided at the rear of this appendix.