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	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004532	[cm²/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.0008963	[cm²/s]
	"A" Parameter	8.010e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	456.5	
	"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	2.799	[µg/m³]	0.4129	[ppbv]	4.994	[µg/m³]	0.7367	[ppbv]	5.714	[µg/m³]	0.8430	[ppbv]
Cancer Risk	3.450e-6				6.156e-6				7.045e-6			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

The results you obtain from this OnSite implementation of the Johnson and Ettinger model may differ from other versions of the Johnson & Ettinger Model. In addition to the OSWER implementation that was used for the draft vapor intrusion guidance, EPA Office of Emergency Response and Remediation (OERR) distributes a set of spreadsheet implementations of the model. The differences among these implementations is described in detail on the results page. Beyond these differences the on-line version includes a simplified uncertainty analysis the other implementations lack.

Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	33.7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,2,4-Trichlorobenzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		120821			
Molecular Weight (MW)		181.45	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.02329789	[unitless]		
Free-Air Diffusion Coefficient (D_a)		3.000e-2	[cm²/s]		
Diffusivity in Water (D_w)		8.230e-6	[cm²/s]		
Unit Risk Factor (URF)		0.	[(µg/m³)-1]		
Reference Concentration (RfC)		0.200	[mg/m³]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZh)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001892	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D_{Teff})	0.0008528	[cm²/s]

"A" Parameter	7.621e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1093.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 7.505e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.02185 [µg/m³]	0.002946 [ppbv]	0.05892 [µg/m³]	0.007945 [ppbv]	0.08268 [µg/m³]	0.01115 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	1.092e-4		2.946e-4		4.134e-4	

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation: full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase II		
Enter sample concentration, units and media type	159	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Trichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		79016		
Molecular Weight (MW)		131.39	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.2367947	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.900e-2	[cm^2/s]	
Diffusivity in Water (D_w)		9.100e-6	[cm^2/s]	
Unit Risk Factor (URF)		4.10e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		2e-03	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.004973	[cm^2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (**D^T_{eff}**)	0.001014	[cm^2/s]
	"A" Parameter	9.061e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	416.0	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		8.897e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.855	[µg/m3]	0.3454	[ppbv]	3.350	[µg/m3]	0.6238	[ppbv]	3.849	[µg/m3]	0.7168	[ppbv]
Cancer Risk	3.125e-6				5.644e-6				6.486e-6			
Hazard Quotient	0.9274				1.675				1.925			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	1.68	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Vinyl chloride (chloroethene)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75014		
Molecular Weight (MW)		62.5	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.8021316	[unitless]	
Free-Air Diffusion Coefficient (D_a)		0.1060	[cm^2/s]	
Diffusivity in Water (D_w)		1.230e-5	[cm^2/s]	
Unit Risk Factor (URF)		8.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.100	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (**D_{eff}**)	0.006672	[cm^2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (**D^T_{eff}**)	0.001289	[cm^2/s]

"A" Parameter	1.152e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	310.1	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.126e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.08613	[µg/m3]	0.03372	[ppbv]	0.1517	[µg/m3]	0.05939	[ppbv]	0.1729	[µg/m3]	0.06767	[ppbv]
Cancer Risk	3.115e-7				5.486e-7				6.251e-7			
Hazard Quotient	8.613e-4				0.001517				0.001729			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

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Background

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.101	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		319846		
Molecular Weight (MW)		290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.000009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)		1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	1.344e-6 [µg/m³]	1.131e-7 [ppbv]	1.539e-6 [µg/m³]	1.295e-7 [ppbv]	4.188e-6 [µg/m³]	3.523e-7 [ppbv]
Cancer Risk	9.942e-10		1.138e-9		3.098e-9	
Hazard Quotient	0.		0.		0.	

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT eff**)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction1		Best Estimate		High Prediction2	
Indoor Air Concentration	1.344e-6 [µg/m3]	1.131e-7 [ppbv]	1.539e-6 [µg/m3]	1.295e-7 [ppbv]	4.188e-6 [µg/m3]	3.523e-7 [ppbv]
Cancer Risk	9.942e-10		1.138e-9		3.098e-9	
Hazard Quotient	0.		0.		0.	

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Backward Calculation full uncertainty analysis

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Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.291	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		319846		
Molecular Weight (MW)		290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00009006	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm²/s]	
Diffusivity in Water (D_w)		7.340e-6	[cm²/s]	
Unit Risk Factor (URF)		1.80e-3	[(µg/m³)⁻¹]	
Reference Concentration (RfC)		0.	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient ($D_{T\,eff}$)	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	3.872e-6	[µg/m³]	3.257e-7	[ppbv]	4.434e-6	[µg/m³]	3.730e-7	[ppbv]	1.207e-5	[µg/m³]	1.015e-6	[ppbv]
Cancer Risk	2.864e-9				3.280e-9				8.926e-9			
Hazard Quotient	0.				0.				0.			

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.296	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		319846		
Molecular Weight (MW)		290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)		1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.001699	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT eff**)	0.001780	[cm2/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	3.939e-6 [µg/m3]	3.313e-7 [ppbv]	4.510e-6 [µg/m3]	3.794e-7 [ppbv]	1.227e-5 [µg/m3]	1.033e-6 [ppbv]
Cancer Risk	2.914e-9		3.336e-9		9.080e-9	
Hazard Quotient	0.		0.		0.	

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.835	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	gamma-HCH (Lindane)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		58899		
Molecular Weight (MW)		290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.0001305	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm²/s]	
Diffusivity in Water (D_w)		7.340e-6	[cm²/s]	
Unit Risk Factor (URF)		3.71e-4	[(µg/m³)⁻¹]	
Reference Concentration (RfC)		1.05e-3	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.001503	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT eff**)	0.001573	[cm2/s]

"A" Parameter	1.406e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1376.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.367e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	1.301e-5 [µg/m3]	1.095e-6 [ppbv]	1.490e-5 [µg/m3]	1.254e-6 [ppbv]	3.584e-5 [µg/m3]	3.015e-6 [ppbv]
Cancer Risk	1.984e-9		2.272e-9		5.464e-9	
Hazard Quotient	1.239e-5		1.419e-5		3.413e-5	

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.00436	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Heptachlor		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number	76448		
Molecular Weight (MW)	373.32	[g/mole]	
Henry's Law Constant at ground water temperature (H)	16.77690	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.120e-2	[cm2/s]	
Diffusivity in Water (Dw)	5.690e-6	[cm2/s]	
Unit Risk Factor (URF)	1.30e-3	[(µg/m3)-1]	
Reference Concentration (RfC)	1.75e-3	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZh)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m2]	
Subsurface Foundation Area (A_B)	105.0	[m2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.0007050	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.0001337	[cm²/s]

"A" Parameter	1.194e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	2935.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.192e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	4.943e-4	[µg/m³]	3.240e-5	[ppbv]	8.716e-4	[µg/m³]	5.712e-5	[ppbv]	9.934e-4	[µg/m³]	6.510e-5	[ppbv]
Cancer Risk	2.641e-7				4.656e-7				5.307e-7			
Hazard Quotient	2.825e-4				4.981e-4				5.676e-4			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.111	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	Dieldrin		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		60571			
Molecular Weight (MW)		380.91	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.00010980	[unitless]		
Free-Air Diffusion Coefficient (D_a)		1.250e-2	[cm^2/s]		
Diffusivity in Water (D_w)		4.740e-6	[cm^2/s]		
Unit Risk Factor (URF)		4.60e-3	[$(\mu g/m^3)^{-1}$]		
Reference Concentration (RfC)		1.75e-4	[mg/m^3]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZh)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.001254	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DTeff)	0.001312	[cm2/s]

"A" Parameter	1.172e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1649.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.145e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.219e-6	[µg/m3]	7.829e-8	[ppbv]	1.397e-6	[µg/m3]	8.972e-8	[ppbv]	3.151e-6	[µg/m3]	2.024e-7	[ppbv]
Cancer Risk	2.304e-9				2.641e-9				5.956e-9			
Hazard Quotient	6.965e-6				7.982e-6				1.800e-5			

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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EPA On-line Tools for Site Assessment Calculation

Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker - Phase II		
Enter sample concentration, units and media type	1.68	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Vinyl chloride (chloroethene)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75014		
Molecular Weight (MW)		62.5	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.8021316	[unitless]	
Free-Air Diffusion Coefficient (D_A)		0.1060	[cm^2/s]	
Diffusivity in Water (D_W)		1.230e-5	[cm^2/s]	
Unit Risk Factor (URF)		8.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.100	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.006672	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.001289	[cm²/s]
"A" Parameter	1.152e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	310.1		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			1.126e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA							
	Low Prediction[1]				Best Estimate			
Indoor Air Concentration	0.08613	[µg/m³]	0.03372	[ppbv]	0.1517	[µg/m³]	0.05939	[ppbv]
Cancer Risk	1.854e-7				3.266e-7			
Hazard Quotient	5.899e-4				0.001039			

High Prediction[2]			
0.1729	[µg/m³]	0.06767	[ppbv]
3.721e-7			
0.001184			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II			
Enter sample concentration, units and media type	1.01e-1	µg/L	Ground Water	
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters	
This value can change by +/-		1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number		319846		
Molecular Weight (MW)		290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)		1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.	[mg/m^3]	

Soil Properties

Total Porosity (n)			0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)			0.332	[unitless]	
Height of Capillary Zone (CZ_h)			0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})			5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_{eff})	0.001780	[cm²/s]
	"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	1218.	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	1.344e-6 [µg/m³]	1.131e-7 [ppbv]	1.539e-6 [µg/m³]	1.295e-7 [ppbv]	4.188e-6 [µg/m³]	3.523e-7 [ppbv]
Cancer Risk	5.918e-10		6.776e-10		1.844e-9	
Hazard Quotient	0.		0.		0.	

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	.835	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	gamma-HCH (Lindane)		
What type of building are you investigating at your site?			Slab-on-Grade
What type of soil is beneath the building?			Loam
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		58899			
Molecular Weight (MW)		290.83	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.00013057	[unitless]		
Free-Air Diffusion Coefficient (D_a)		1.420e-2	[cm²/s]		
Diffusivity in Water (D_w)		7.340e-6	[cm²/s]		
Unit Risk Factor (URF)		3.71e-4	[(µg/m³)-1]		
Reference Concentration (RfC)		1.05e-3	[mg/m³]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.001503	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_{eff})		0.001573	[cm²/s]
"A" Parameter	1.406e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	1376.		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			1.367e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA							
	Low Prediction1				Best Estimate			
Indoor Air Concentration	1.301e-5	[µg/m³]	1.095e-6	[ppbv]	1.490e-5	[µg/m³]	1.254e-6	[ppbv]
Cancer Risk	1.181e-9				1.353e-9			
Hazard Quotient	8.488e-6				9.722e-6			

	High Prediction2							
Indoor Air Concentration	3.584e-5	[µg/m³]	3.015e-6	[ppbv]				
Cancer Risk	3.252e-9							
Hazard Quotient	2.338e-5							

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	4.36e-3	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Heptachlor		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	76448		
Molecular Weight (MW)	373.32	[g/mole]	
Henry's Law Constant at ground water temperature (H)	16.77690	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.120e-2	[cm^2/s]	
Diffusivity in Water (D_w)	5.690e-6	[cm^2/s]	
Unit Risk Factor (URF)	1.30e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	1.75e-3	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m^2]
Subsurface Foundation Area (A_B)	106.0	[m^2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.0007050	[cm^2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.0001337	[cm^2/s]
	"A" Parameter	1.194e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	2935.	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		1.192e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	4.943e-4	[µg/m³]	3.240e-5	[ppbv]	8.716e-4	[µg/m³]	5.712e-5	[ppbv]	9.934e-4	[µg/m³]	6.510e-5	[ppbv]
Cancer Risk	1.572e-7				2.772e-7				3.159e-7			
Hazard Quotient	1.935e-4				3.411e-4				3.888e-4			

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	2.91e-1	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm2/s]	
Unit Risk Factor (URF)	1.80e-3	[(µg/m3)-1]	
Reference Concentration (RfC)	0.	[mg/m3]	

Soil Properties

Total Porosity (n)		0.300	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m2]
Subsurface Foundation Area (A_B)	106.0	[m2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_{eff})		0.001780	[cm²/s]
"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	1218.		
"C" Parameter	0.004918		

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	3.872e-6	[µg/m³]	3.257e-7	[ppbv]	4.434e-6	[µg/m³]	3.730e-7	[ppbv]	1.207e-5	[µg/m³]	1.015e-6	[ppbv]
Cancer Risk	1.705e-9				1.952e-9				5.313e-9			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	2.96e-1	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)	1.60e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_{eff})	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	3.939e-6 [µg/m³]	3.313e-7 [ppbv]	4.510e-6 [µg/m³]	3.794e-7 [ppbv]	1.227e-5 [µg/m³]	1.033e-6 [ppbv]
Cancer Risk	1.734e-9		1.986e-9		5.405e-9	
Hazard Quotient	0.		0.		0.	

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	1.11e-1	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Dieldrin		
What type of building are you investigating at your site?		Slab on Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		60571		
Molecular Weight (MW)		380.91	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00010989	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.250e-2	[cm^2/s]	
Diffusivity in Water (D_w)		4.740e-6	[cm^2/s]	
Unit Risk Factor (URF)		4.60e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		1.75e-4	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZh)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.001254	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient ($D_{T\,eff}$)		0.001312	[cm^2/s]
"A" Parameter	1.172e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	1649.		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			1.145e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.219e-6	[µg/m3]	7.829e-8	[ppbv]	1.397e-6	[µg/m3]	8.972e-8	[ppbv]	3.151e-6	[µg/m3]	2.024e-7	[ppbv]
Cancer Risk	1.372e-9				1.572e-9				3.545e-9			
Hazard Quotient	4.771e-6				5.467e-6				1.233e-5			

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Background

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	1.6	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Benzene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		71432		
Molecular Weight (MW)		78.11	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1316031	[unitless]	
Free-Air Diffusion Coefficient (D_a)		8.800e-2	[cm^2/s]	
Diffusivity in Water (D_w)		9.800e-6	[cm^2/s]	
Unit Risk Factor (URF)		7.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.005540	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001190	[cm2/s]

"A" Parameter	1.064e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	373.4	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.041e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.01188	[µg/m3]	0.003721	[ppbv]	0.02192	[µg/m3]	0.006866	[ppbv]	0.02538	[µg/m3]	0.007950	[ppbv]
Cancer Risk	3.808e-8				7.027e-8				8.136e-8			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	.316	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,4-Dichlorobenzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		106467		
Molecular Weight (MW)		147	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.04543560	[unitless]	
Free-Air Diffusion Coefficient (D_a)		6.900e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.900e-6	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.800	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**D_{eff}**)	0.004345	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**D^T_{eff}**)	0.001140	[cm²/s]

"A" Parameter	1.018e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	476.1	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.977e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	7.075e-4	[µg/m³]	1.177e-4	[ppbv]	0.001432	[µg/m³]	2.384e-4	[ppbv]	0.001719	[µg/m³]	2.860e-4	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	8.843e-7				1.791e-6				2.148e-6			

[1] "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Click For an Example

Enter Site Name (optional):	adult resident - Phase II		
Enter sample concentration, units and media type	2.91	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,1-Dichloroethane		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75343		
Molecular Weight (MW)		98.96	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1399030	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		1.050e-5	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.500	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.390	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**D_{eff}**)	0.004671	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**D^T_{eff}**)	0.001027	[cm^2/s]

"A" Parameter	9.175e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	442.9	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.006e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA							
	Low Prediction[1]				Best Estimate			
Indoor Air Concentration	0.01964	[µg/m³]	0.004857	[ppbv]	0.03667	[µg/m³]	0.009065	[ppbv]
Cancer Risk	0.				0.			
Hazard Quotient	3.929e-5				7.333e-5			

	High Prediction[2]			
Indoor Air Concentration	0.04263	[µg/m³]	0.01054	[ppbv]
Cancer Risk	0.			
Hazard Quotient	8.525e-5			

[1] "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	1.6	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Benzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	71432		
Molecular Weight (MW)	78.11	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.1316031	[unitless]	
Free-Air Diffusion Coefficient (D_a)	8.800e-2	[cm²/s]	
Diffusivity in Water (D_w)	9.800e-6	[cm²/s]	
Unit Risk Factor (URF)	7.80e-6	[(µg/m³)-1]	
Reference Concentration (RfC)	0.	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.005540	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D_{eff})		0.001190	[cm^2/s]
"A" Parameter	1.064e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	373.4		
"C" Parameter	0.004918		

Johnson & Ettinger Attenuation Factor (α) 1.041e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction[1]			Best Estimate			High Prediction[2]			
Indoor Air Concentration	0.01188	[µg/m3]	0.003721 [ppbv]	0.02192	[µg/m3]	0.006866 [ppbv]	0.02538	[µg/m3]	0.007950 [ppbv]	
Cancer Risk	2.267e-8			4.183e-8			4.843e-8			
Hazard Quotient	0.			0.			0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	.316	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,4-Dichlorobenzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		106467			
Molecular Weight (MW)		147	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.04543560	[unitless]		
Free-Air Diffusion Coefficient (D_a)		6.900e-2	[cm^2/s]		
Diffusivity in Water (D_w)		7.900e-6	[cm^2/s]		
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]		
Reference Concentration (RfC)		0.800	[mg/m^3]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.004345	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.001140	[cm^2/s]
"A" Parameter	1.018e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	476.1		
"C" Parameter	0.004918		

Johnson & Ettinger Attenuation Factor (α) 9.977e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	7.075e-4	[µg/m3]	1.177e-4	[ppbv]	0.001432	[µg/m3]	2.384e-4	[ppbv]	0.001719	[µg/m3]	2.860e-4	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	6.057e-7				1.226e-6				1.471e-6			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	2.91	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	1,1-Dichloroethane		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		75343		
Molecular Weight (MW)		98.96	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1399030	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		1.050e-5	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.500	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.004671	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D_{eff})		0.001027	[cm2/s]
"A" Parameter	9.175e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	442.9		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			9.006e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.01964 [µg/m3]	0.004857 [ppbv]	0.03667 [µg/m3]	0.009065 [ppbv]	0.04263 [µg/m3]	0.01054 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	2.691e-5		5.023e-5		5.839e-5	

[1] "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - Phase II		
Enter sample concentration, units and media type	83.5	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	cis-1,2-Dichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		156592		
Molecular Weight (MW)		96.94	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.09948721	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.360e-2	[cm^2/s]	
Diffusivity in Water (D_w)		1.130e-5	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		3.50e-2	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.004634	[cm2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT eff**)	0.001090	[cm2/s]
	"A" Parameter	9.743e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	446.4	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		9.553e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.4124	[µg/m3]	0.1041	[ppbv]	0.7936	[µg/m3]	0.2003	[ppbv]	0.9331	[µg/m3]	0.2355	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	0.008071				0.01553				0.01826			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	.377	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Ethylbenzene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		100414		
Molecular Weight (MW)		106.17	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1613978	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.500e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.800e-6	[cm^2/s]	
Unit Risk Factor (URF)		1.10e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		1.00	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D^{eff})		0.004721	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.0009855	[cm^2/s]
"A" Parameter	8.807e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	438.2		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			8.652e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.002885 [µg/m3]	6.647e-4 [ppbv]	0.005265 [µg/m3]	0.001213 [ppbv]	0.006071 [µg/m3]	0.001399 [ppbv]
Cancer Risk	7.762e-10		1.417e-9		1.634e-9	
Hazard Quotient	1.976e-6		3.606e-6		4.158e-6	

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Naphthalene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties					
	CAS Number		91203		
	Molecular Weight (MW)		128.18	[g/mole]	
	Henry's Law Constant at ground water temperature (H)		0.00810528	[unitless]	
	Free-Air Diffusion Coefficient (D_a)		5.900e-2	[cm^2/s]	
	Diffusivity in Water (D_w)		7.500e-6	[cm^2/s]	
	Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
	Reference Concentration (RfC)		3.00e-3	[mg/m^3]	
Soil Properties					
	Total Porosity (n)		0.399	[unitless]	
	Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
	Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
	Height of Capillary Zone (CZ_h)		0.375	[m]	
	Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	
Building Properties					
	Air Exchange Rate (E_B)		0.250	[hr^{-1}]	
	Building Mixing Height (H_B)		2.44	[m]	
	Building Footprint Area (F_B)		100.0	[m^2]	
	Subsurface Foundation Area (A_B)		106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.003724	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.001883	[cm^2/s]
"A" Parameter	1.683e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	555.6		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			1.627e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.003254 [µg/m3]	6.211e-4 [ppbv]	0.009234 [µg/m3]	0.001762 [ppbv]	0.01351 [µg/m3]	0.002579 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	7.429e-4		0.002108		0.003084	

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	161	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Tetrachloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55		Farenheit

Chemical Properties

CAS Number	127184		
Molecular Weight (MW)	165.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.3934997	[unitless]	
Free-Air Diffusion Coefficient (D_a)	7.200e-2	[cm^2/s]	
Diffusivity in Water (D_w)	8.200e-6	[cm^2/s]	
Unit Risk Factor (URF)	3.00e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m^2]
Subsurface Foundation Area (A_B)	106.0	[m^2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.004532	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT_{eff})		0.0008963	[cm^2/s]
"A" Parameter	8.010e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	456.5		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	2.799	[µg/m³]	0.4129	[ppbv]	4.994	[µg/m³]	0.7367	[ppbv]	5.714	[µg/m³]	0.8430	[ppbv]
Cancer Risk	2.054e-6				3.665e-6				4.193e-6			
Hazard Quotient	0.				0.				0.			

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - phase II		
Enter sample concentration, units and media type	33.7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,2,4-Trichlorobenzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		120821			
Molecular Weight (MW)		181.45	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.02329789	[unitless]		
Free-Air Diffusion Coefficient (D_a)		3.000e-2	[cm2/s]		
Diffusivity in Water (D_w)		8.230e-6	[cm2/s]		
Unit Risk Factor (URF)		0.	[(µg/m3)-1]		
Reference Concentration (RfC)		0.200	[mg/m3]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m2]	
Subsurface Foundation Area (A_B)	106.0	[m2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.001892	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})		0.0008528	[cm2/s]
"A" Parameter	7.621e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	1093.		
"C" Parameter	0.004918		
Johnson & Ettinger Attenuation Factor (α)			7.505e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.02185	[µg/m3]	0.002946	[ppbv]	0.05892	[µg/m3]	0.007945	[ppbv]	0.08268	[µg/m3]	0.01115	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	7.481e-5				2.018e-4				2.832e-4			

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Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker - Phase II		
Enter sample concentration, units and media type	159	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(LT)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Trichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		79016		
Molecular Weight (MW)		131.39	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.2367947	[unitless]	
Free-Air Diffusion Coefficient (Da)		7.900e-2	[cm²/s]	
Diffusivity in Water (Dw)		9.100e-6	[cm²/s]	
Unit Risk Factor (URF)		4.10e-6	[(µg/m³)-1]	
Reference Concentration (RfC)		2e-03	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θw)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure (θw,cap)		0.332	[unitless]	
Height of Capillary Zone (CZh)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Qsoil)		5.00	[L/min]	

Building Properties

Air Exchange Rate (ER)	0.250	[hr⁻¹]	
Building Mixing Height (HB)	2.44	[m]	
Building Footprint Area (FB)	100.0	[m²]	
Subsurface Foundation Area (AB)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.004973	[cm2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (DTeff)	0.001014	[cm2/s]
	"A" Parameter	9.061e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	416.0	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		8.897e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction1				Best Estimate				High Prediction2			
Indoor Air Concentration	1.855	[µg/m3]	0.3454	[ppbv]	3.350	[µg/m3]	0.6238	[ppbv]	3.849	[µg/m3]	0.7168	[ppbv]
Cancer Risk	1.860e-6				3.360e-6				3.861e-6			
Hazard Quotient	0.6352				1.147				1.318			

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	54.6	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	Tetrachloroethylene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		127184	
Molecular Weight (MW)		165.83	[g/mole]
Henry's Law Constant at ground water temperature (H)		0.3934997	[unitless]
Free-Air Diffusion Coefficient (D_a)		7.200e-2	[cm^2/s]
Diffusivity in Water (D_w)		8.200e-6	[cm^2/s]
Unit Risk Factor (URF)		3.00e-6	[$(\mu g/m^3)^{-1}$]
Reference Concentration (RfC)		0.	[mg/m^3]

Soil Properties

Total Porosity (n)		0.399		[unitless]
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332		[unitless]
Height of Capillary Zone (CZ_h)		0.375		[m]
Soil-gas Flow Rate into the Building (Q_{soil})		5.00		[L/min]

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]
Building Mixing Height (H_B)	2.44	[m]
Building Footprint Area (F_B)	100.0	[m^2]
Subsurface Foundation Area (A_B)	106.0	[m^2]

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004532	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D_{eff})	0.0008963	[cm²/s]

"A" Parameter	8.010e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	456.5	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.9491	[µg/m³]	0.1400	[ppbv]	1.693	[µg/m³]	0.2498	[ppbv]	1.938	[µg/m³]	0.2859	[ppbv]
Cancer Risk	1.170e-6				2.088e-6				2.389e-6			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	41.4	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Trichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	79016		
Molecular Weight (MW)	131.39	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.2367947	[unitless]	
Free-Air Diffusion Coefficient (D_a)	7.900e-2	[cm^2/s]	
Diffusivity in Water (D_w)	9.100e-6	[cm^2/s]	
Unit Risk Factor (URF)	4.10e-5	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	2e-03	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004973	[cm^2/s]
	Unsaturated / Capillary Zone Effective Diffusion Coefficient (DT_{eff})	0.001014	[cm^2/s]
	"A" Parameter	9.061e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	416.0	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		8.897e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.4829	[µg/m3]	0.08993	[ppbv]	0.8722	[µg/m3]	0.1624	[ppbv]	1.002	[µg/m3]	0.1866	[ppbv]
Cancer Risk	8.137e-7				1.470e-6				1.689e-6			
Hazard Quotient	0.2415				0.4361				0.5011			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	11	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Vinyl chloride (chloroethene)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75014		
Molecular Weight (MW)		62.5	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.8021316	[unitless]	
Free-Air Diffusion Coefficient (D_a)		0.1060	[cm^2/s]	
Diffusivity in Water (D_w)		1.230e-5	[cm^2/s]	
Unit Risk Factor (URF)		8.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.100	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.006672	[cm²/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001289	[cm²/s]
	"A" Parameter	1.152e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	310.1	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		1.126e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.5639	[µg/m³]	0.2208	[ppbv]	0.9933	[µg/m³]	0.3888	[ppbv]	1.132	[µg/m³]	0.4430	[ppbv]
Cancer Risk	2.039e-6				3.592e-6				4.093e-6			
Hazard Quotient	0.005639				0.009933				0.01132			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	.0375	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)	1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**D_{eff}**)	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT_{eff}**)	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA							
	Low Prediction[1]				Best Estimate			
Indoor Air Concentration	4.990e-7	[µg/m³]	4.198e-8	[ppbv]	5.714e-7	[µg/m³]	4.807e-8	[ppbv]
Cancer Risk	3.691e-10				4.227e-10			
Hazard Quotient	0.				0.			

	High Prediction[2]			
Indoor Air Concentration	1.555e-6	[µg/m³]	1.308e-7	[ppbv]
Cancer Risk	1.150e-9			
Hazard Quotient	0.			

[1] "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

[2] "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	.136	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)	1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.300	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.001699	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DTeff)	0.001780	[cm²/s]

"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1218.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	1.810e-6 [µg/m³]	1.522e-7 [ppbv]	2.072e-6 [µg/m³]	1.743e-7 [ppbv]	5.640e-6 [µg/m³]	4.744e-7 [ppbv]
Cancer Risk	1.339e-9		1.533e-9		4.172e-9	
Hazard Quotient	0.		0.		0.	

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB			
Enter sample concentration, units and media type	.0204	µg/L	Ground Water	
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters	
This value can change by +/-		1	meters	
What is your contaminant of concern (COC)?	Dieldrin			
What type of building are you investigating at your site?			Slab-on-Grade	
What type of soil is beneath the building?			Loam	
What is the average soil/ground water temperature?			55	Farenheit

Chemical Properties

CAS Number			60571		
Molecular Weight (MW)			380.91	[g/mole]	
Henry's Law Constant at ground water temperature (H)			0.00010989	[unitless]	
Free-Air Diffusion Coefficient (D_a)			1.250e-2	[cm^2/s]	
Diffusivity in Water (D_w)			4.740e-6	[cm^2/s]	
Unit Risk Factor (URF)			4.60e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)			1.75e-4	[mg/m^3]	

Soil Properties

Total Porosity (n)			0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]	
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)		0.250	[hr^{-1}]	
Building Mixing Height (H_B)		2.44	[m]	
Building Footprint Area (F_B)		100.0	[m^2]	
Subsurface Foundation Area (A_B)		106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001254	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001312	[cm^2/s]

"A" Parameter	1.172e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1649.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.145e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	2.240e-7	[µg/m³]	1.439e-8	[ppbv]	2.567e-7	[µg/m³]	1.649e-8	[ppbv]	5.790e-7	[µg/m³]	3.719e-8	[ppbv]
Cancer Risk	4.235e-10				4.853e-10				1.095e-9			
Hazard Quotient	1.280e-6				1.467e-6				3.309e-6			

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2 "High Prediction" concentration produced with HIGHEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	0.136	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm²/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm²/s]	
Unit Risk Factor (URF)	1.80e-3	[(µg/m³)-1]	
Reference Concentration (RfC)	0.	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZh)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m2]	
Subsurface Foundation Area (A_B)	106.0	[m2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (Lcrack)	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (EDc)	25	[years]
	Exposure Frequency for Carcinogens (EFc)	250	[days/year]
	Averaging Time for Carcinogens (ATc)	70	[years]
	Exposure Duration for Non-Carcinogens (EDnc)	25	[years]
	Exposure Frequency for Non-Carcinogens (EFnc)	250	[days/year]
	Averaging Time for Non-Carcinogens (ATnc)	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.001699	[cm2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (DTeff)	0.001780	[cm2/s]
	"A" Parameter	1.591e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	1218.	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		1.541e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.810e-6	[µg/m3]	1.522e-7	[ppbv]	2.072e-6	[µg/m3]	1.743e-7	[ppbv]	5.640e-6	[µg/m3]	4.744e-7	[ppbv]
Cancer Risk	7.968e-10				9.124e-10				2.483e-9			
Hazard Quotient	0.				0.				0.			

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Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	.0204	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Dieldrin		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		60571		
Molecular Weight (MW)		380.91	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00010989	[unitless]	
Free-Air Diffusion Coefficient (D_a)		1.250e-2	[cm^2/s]	
Diffusivity in Water (D_w)		4.740e-6	[cm^2/s]	
Unit Risk Factor (URF)		4.60e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		1.75e-4	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.001254	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001312	[cm²/s]

"A" Parameter	1.172e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	1649.	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.145e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	2.240e-7	[µg/m³]	1.439e-8	[ppbv]	2.567e-7	[µg/m³]	1.649e-8	[ppbv]	5.790e-7	[µg/m³]	3.719e-8	[ppbv]
Cancer Risk	2.521e-10				2.889e-10				6.516e-10			
Hazard Quotient	8.768e-7				1.005e-6				2.266e-6			

1 "Low Prediction" concentration produced with BEST ESTIMATE moisture content and DEEPEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	2.94	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	Benzene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		71432		
Molecular Weight (MW)		78.11	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1316031	[unitless]	
Free-Air Diffusion Coefficient (D_a)		8.800e-2	[cm^2/s]	
Diffusivity in Water (D_w)		9.800e-6	[cm^2/s]	
Unit Risk Factor (URF)		7.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (Lcrack)	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.005540	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001190	[cm2/s]

"A" Parameter	1.064e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	373.4	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.041e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.02183 [µg/m3]	0.006838 [ppbv]	0.04028 [µg/m3]	0.01262 [ppbv]	0.04664 [µg/m3]	0.01461 [ppbv]
Cancer Risk	6.997e-8		1.291e-7		1.495e-7	
Hazard Quotient	0.		0.		0.	

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation: full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	3.43	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7		meters
This value can change by +/-	1		meters
What is your contaminant of concern (COC)?	1,1-Dichloroethane		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75343		
Molecular Weight (MW)		98.96	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1099030	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		1.050e-5	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.500	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (Deff)	0.004671	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (DT eff)	0.001027	[cm²/s]

"A" Parameter	9.175e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	442.9	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.006e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.02315 [µg/m³]	0.005725 [ppbv]	0.04322 [µg/m³]	0.01069 [ppbv]	0.05024 [µg/m³]	0.01242 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	4.631e-5		8.644e-5		1.005e-4	

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Backward Calculation full uncertainty analysis

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	300	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	cis-1,2-Dichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		156592		
Molecular Weight (MW)		96.94	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.0004721	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.360e-2	[cm2/s]	
Diffusivity in Water (D_w)		1.130e-5	[cm2/s]	
Unit Risk Factor (URF)		0.	[(µg/m3)-1]	
Reference Concentration (RfC)		3.50e-2	[mg/m3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m2]	
Subsurface Foundation Area (A_B)	106.0	[m2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.004634	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DTeff**)	0.001090	[cm2/s]

"A" Parameter	9.743e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	446.4	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.553e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.482	[µg/m3]	0.3740	[ppbv]	2.851	[µg/m3]	0.7196	[ppbv]	3.353	[µg/m3]	0.8461	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	0.04234				0.08147				0.09579			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (Vi). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

This on-line calculator implements the Johnson and Ettinger (J&E) (Johnson and Ettinger, 1991) simplified model to evaluate the vapor intrusion pathway into buildings. This J&E model replicates the implementation that the US EPA Office of Solid Waste and Emergency Response (OSWER) used in developing its draft vapor intrusion guidance, but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants and gaseous diffusivities, automatic sensitivity analysis of certain parameters, and others described on the background page.

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Naphthalene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		91203			
Molecular Weight (MW)		128.18	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.00810628	[unitless]		
Free-Air Diffusion Coefficient (D_a)		5.900e-2	[cm^2/s]		
Diffusivity in Water (D_w)		7.500e-6	[cm^2/s]		
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]		
Reference Concentration (RfC)		3.00e-3	[mg/m^3]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZh)		0.375	[m]		
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.003724	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001883	[cm2/s]

"A" Parameter	1.683e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	555.6	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.627e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.003254 [µg/m3]	6.211e-4 [ppbv]	0.009234 [µg/m3]	0.001762 [ppbv]	0.01351 [µg/m3]	0.002579 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	0.001085		0.003078		0.004503	

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Adult Resident - Phase IIB		
Enter sample concentration, units and media type	54.6	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Tetrachloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		127184			
Molecular Weight (MW)		165.83	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.3934997	[unitless]		
Free-Air Diffusion Coefficient (D_a)		7.200e-2	[cm²/s]		
Diffusivity in Water (Dw)		8.200e-6	[cm²/s]		
Unit Risk Factor (URF)		3.00e-6	[(µg/m³)⁻¹]		
Reference Concentration (RfC)		0.	[mg/m³]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

Phase IIB Data

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Screening Level Implementation of the Johnson and Ettinger Vapor Intrusion Model with two variable/uncertain parameters (source depth, moisture content)

Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	2.94	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Benzene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number			71432		
Molecular Weight (MW)			78.11	[g/mole]	
Henry's Law Constant at ground water temperature (H)			0.1316031	[unitless]	
Free-Air Diffusion Coefficient (D_A)			8.80Ue-2	[cm^2/s]	
Diffusivity in Water (D_W)			9.800e-6	[cm^2/s]	
Unit Risk Factor (URF)			7.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)			0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr-1]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})		0.005540	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient ($D_{T\,eff}$)		0.001190	[cm²/s]
"A" Parameter	1.064e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.	
"B" Parameter	373.4		
"C" Parameter	0.004918		

Johnson & Ettinger Attenuation Factor (α) 1.041e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.02183	[µg/m³]	0.006838	[ppbv]	0.04028	[µg/m³]	0.01262	[ppbv]	0.04664	[µg/m³]	0.01461	[ppbv]
Cancer Risk	4.165e-8				7.686e-8				8.899e-8			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	3.43	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	1,1-Dichloroethane		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75343		
Molecular Weight (MW)		98.96	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.1399030	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)		1.050e-5	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.500	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004671	[cm²/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001027	[cm²/s]

"A" Parameter	9.175e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	442.9	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.006e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA									
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.02315	[µg/m³]	0.005725	[ppbv]	0.04322	[µg/m³]	0.01069	[ppbv]	0.05024	[µg/m³]	0.01242	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	4.631e-5				8.644e-5				1.005e-4			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase I/B		
Enter sample concentration, units and media type	300	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	cis-1,2-Dichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		156592			
Molecular Weight (MW)		96.94	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.09948721	[unitless]		
Free-Air Diffusion Coefficient (D_a)		7.300e-2	[cm^2/s]		
Diffusivity in Water (D_w)		1.130e-5	[cm^2/s]		
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]		
Reference Concentration (RfC)		3.50e-2	[mg/m^3]		

Soil Properties

Total Porosity (n)		0.399	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	30	[years]
	Exposure Frequency for Carcinogens (EF_c)	350	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	30	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	365	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	30	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.004634	[cm2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DTeff**)	0.001090	[cm2/s]

"A" Parameter	9.743e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	446.4	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 9.553e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	1.482	[µg/m³]	0.3740	[ppbv]	2.851	[µg/m³]	0.7196	[ppbv]	3.353	[µg/m³]	0.8461	[ppbv]
Cancer Risk	0.				0.				0.			
Hazard Quotient	0.04234				0.08147				0.09579			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	7	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)		7	meters
This value can change by +/-		1	meters
What is your contaminant of concern (COC)?	Naphthalene		
What type of building are you investigating at your site?		Slab-on-Grade	
What type of soil is beneath the building?		Loam	
What is the average soil/ground water temperature?		55	Farenheit

Chemical Properties

CAS Number		91203		
Molecular Weight (MW)		128.18	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.00810628	[unitless]	
Free-Air Diffusion Coefficient (D_a)		5.900e-2	[cm^2/s]	
Diffusivity in Water (D_w)		7.500e-6	[cm^2/s]	
Unit Risk Factor (URF)		0.	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		3.00e-3	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.003724	[cm^2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001883	[cm^2/s]
	"A" Parameter	1.683e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	555.6	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		1.627e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA					
	Low Prediction[1]		Best Estimate		High Prediction[2]	
Indoor Air Concentration	0.003254 [µg/m3]	6.211e-4 [ppbv]	0.009234 [µg/m3]	0.001762 [ppbv]	0.01351 [µg/m3]	0.002579 [ppbv]
Cancer Risk	0.		0.		0.	
Hazard Quotient	7.429e-4		0.002108		0.003084	

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	54.6	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Tetrachloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		127184			
Molecular Weight (MW)		165.83	[g/mole]		
Henry's Law Constant at ground water temperature (H)		0.3934997	[unitless]		
Free-Air Diffusion Coefficient (D_a)		7.200e-2	[cm^2/s]		
Diffusivity in Water (D_w)		8.200e-6	[cm^2/s]		
Unit Risk Factor (URF)		3.00e-6	[$(\mu g/m^3)^{-1}$]		
Reference Concentration (RfC)		0.	[mg/m^3]		

Soil Properties

Total Porosity (n)		0.389	[unitless]		
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148		High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]		
Height of Capillary Zone (CZ_h)		0.375	[m]		
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]		

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (**Deff**)	0.004532	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (**DT eff**)	0.0008963	[cm^2/s]

"A" Parameter	8.010e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	456.5	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 7.882e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.9491	[µg/m³]	0.1400	[ppbv]	1.693	[µg/m³]	0.2498	[ppbv]	1.938	[µg/m³]	0.2859	[ppbv]
Cancer Risk	6.965e-7				1.243e-6				1.422e-6			
Hazard Quotient	0.				0.				0.			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation: full uncertainty analysis

Background

Migration of volatile chemicals from the subsurface into overlying buildings is called vapor intrusion (VI). Volatile organic chemicals in contaminated soils or groundwater can emit vapors, which may migrate through subsurface soils and may enter the indoor air of overlying buildings. Building depressurization may cause these vapors to enter the home through cracks in the foundation. Depressurization can be caused by a combination of wind effects and stack effects, which are the result of heating within the building and/or mechanical ventilation. In extreme cases, the vapors may accumulate in dwellings to levels that may pose near-term safety hazards, such as explosion. Typically, however, vapor concentrations are present at low levels, to which long-term exposure may pose increased risk for chronic health effects.

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Click For an Example

Enter Site Name (optional):	Industrial Worker - Phase IIB		
Enter sample concentration, units and media type	41.4	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Trichloroethylene		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		79016		
Molecular Weight (MW)		131.39	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.2367947	[unitless]	
Free-Air Diffusion Coefficient (D_a)		7.900e-2	[cm²/s]	
Diffusivity in Water (D_w)		9.100e-6	[cm²/s]	
Unit Risk Factor (URF)		4.10e-8	[(µg/m³)⁻¹]	
Reference Concentration (RfC)		2e-03	[mg/m³]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate Into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr⁻¹]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m²]	
Subsurface Foundation Area (A_B)	106.0	[m²]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

	Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.004973	[cm2/s]
	Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001014	[cm2/s]
	"A" Parameter	9.061e-5	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
	"B" Parameter	416.0	
	"C" Parameter	0.004918	
	Johnson & Ettinger Attenuation Factor (α)		8.897e-5

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA							
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.4829	[µg/m3]	0.08993	[ppbv]	0.8722	[µg/m3]	0.1624	[ppbv]	1.002	[µg/m3]	0.1866	[ppbv]
Cancer Risk	4.844e-7				8.748e-7				1.005e-6			
Hazard Quotient	0.1654				0.2987				0.3432			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	11	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	Vinyl chloride (chloroethene)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number		75014		
Molecular Weight (MW)		62.5	[g/mole]	
Henry's Law Constant at ground water temperature (H)		0.0021316	[unitless]	
Free-Air Diffusion Coefficient (D_a)		0.1060	[cm^2/s]	
Diffusivity in Water (D_w)		1.230e-5	[cm^2/s]	
Unit Risk Factor (URF)		8.80e-6	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)		0.100	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	

	Building Crack Ratio (η)	0.00038	[unitless]
	Building Foundation Slab Thickness (L_{crack})	0.100	[m]
Exposure Parameters			
	Exposure Duration for Carcinogens (ED_c)	25	[years]
	Exposure Frequency for Carcinogens (EF_c)	250	[days/year]
	Averaging Time for Carcinogens (AT_c)	70	[years]
	Exposure Duration for Non-Carcinogens (ED_{nc})	25	[years]
	Exposure Frequency for Non-Carcinogens (EF_{nc})	250	[days/year]
	Averaging Time for Non-Carcinogens (AT_{nc})	25	[years]

CALCULATE RESULTS

RESULTS

Unsaturated Zone Effective Diffusion Coefficient (D_{eff})	0.006672	[cm^2/s]
Unsaturated + Capillary Zone Effective Diffusion Coefficient (D^T_{eff})	0.001289	[cm^2/s]

"A" Parameter	1.152e-4	Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.
"B" Parameter	310.1	
"C" Parameter	0.004918	

Johnson & Ettinger Attenuation Factor (α) 1.126e-4

	INDOOR AIR RESULTS FOR GROUND WATER SAMPLE DATA											
	Low Prediction[1]				Best Estimate				High Prediction[2]			
Indoor Air Concentration	0.5639	[µg/m3]	0.2208	[ppbv]	0.9933	[µg/m3]	0.3888	[ppbv]	1.132	[µg/m3]	0.4430	[ppbv]
Cancer Risk	1.214e-6				2.138e-6				2.436e-6			
Hazard Quotient	0.003863				0.006804				0.007752			

1 "Low Prediction" concentration produced with HIGHEST moisture content and DEEPEST depth to contamination.

2 "High Prediction" concentration produced with LOWEST moisture content and SHALLOWEST depth to contamination.

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Forward Calculation of Indoor Air Concentration

Backward Calculation full uncertainty analysis

Background

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Click For an Example

Enter Site Name (optional):	Industrial Worker- Phase IIB		
Enter sample concentration, units and media type	0.0375	µg/L	Ground Water
What is the depth of the soil gas sample or ground water table (for ground water contamination)?(L_T)	7	meters	
This value can change by +/-	1	meters	
What is your contaminant of concern (COC)?	alpha-HCH (alpha-BHC)		
What type of building are you investigating at your site?	Slab-on-Grade		
What type of soil is beneath the building?	Loam		
What is the average soil/ground water temperature?	55	Farenheit	

Chemical Properties

CAS Number	319846		
Molecular Weight (MW)	290.83	[g/mole]	
Henry's Law Constant at ground water temperature (H)	0.00009886	[unitless]	
Free-Air Diffusion Coefficient (D_a)	1.420e-2	[cm^2/s]	
Diffusivity in Water (D_w)	7.340e-6	[cm^2/s]	
Unit Risk Factor (URF)	1.80e-3	[$(\mu g/m^3)^{-1}$]	
Reference Concentration (RfC)	0.	[mg/m^3]	

Soil Properties

Total Porosity (n)		0.399	[unitless]	
Unsaturated Zone Moisture Content (θ_w)	Low 0.0610	Best Estimate 0.148	High 0.240	[unitless]
Capillary Zone Moisture Content at Air-Entry Pressure ($\theta_{w,cap}$)		0.332	[unitless]	
Height of Capillary Zone (CZ_h)		0.375	[m]	
Soil-gas Flow Rate into the Building (Q_{soil})		5.00	[L/min]	

Building Properties

Air Exchange Rate (E_B)	0.250	[hr^{-1}]	
Building Mixing Height (H_B)	2.44	[m]	
Building Footprint Area (F_B)	100.0	[m^2]	
Subsurface Foundation Area (A_B)	106.0	[m^2]	