VAPOR INTRUSION SCREENING LEVELS CALCULATOR FACT SHEET

The U.S. Environmental Protection Agency (USEPA) provides a simple to use online Vapor Intrusion Screening Levels (VISL) Calculator and VISL User's Guide for assessing vapor intrusion (VI) risk given contaminant concentrations in groundwater, soil vapor, or indoor air. The VISL Calculator is linked to the USEPA Regional Screening Level tables and is updated approximately twice per year. The VISL Calculator is available online and is free to use (USEPA 2024a).

As stated on the VISL home page: "The primary objective of risk-based screening is to identify sites or buildings unlikely to pose a health concern through the soil VI pathway. Generally, at properties where subsurface concentrations of vapor-forming chemicals, such as those in groundwater or "near surface" soil vapor, fall below the recommended screening levels (i.e., VISLs), no further action or study is warranted." Figure 1 is a screenshot of the VISL Calculator as of March 2025.

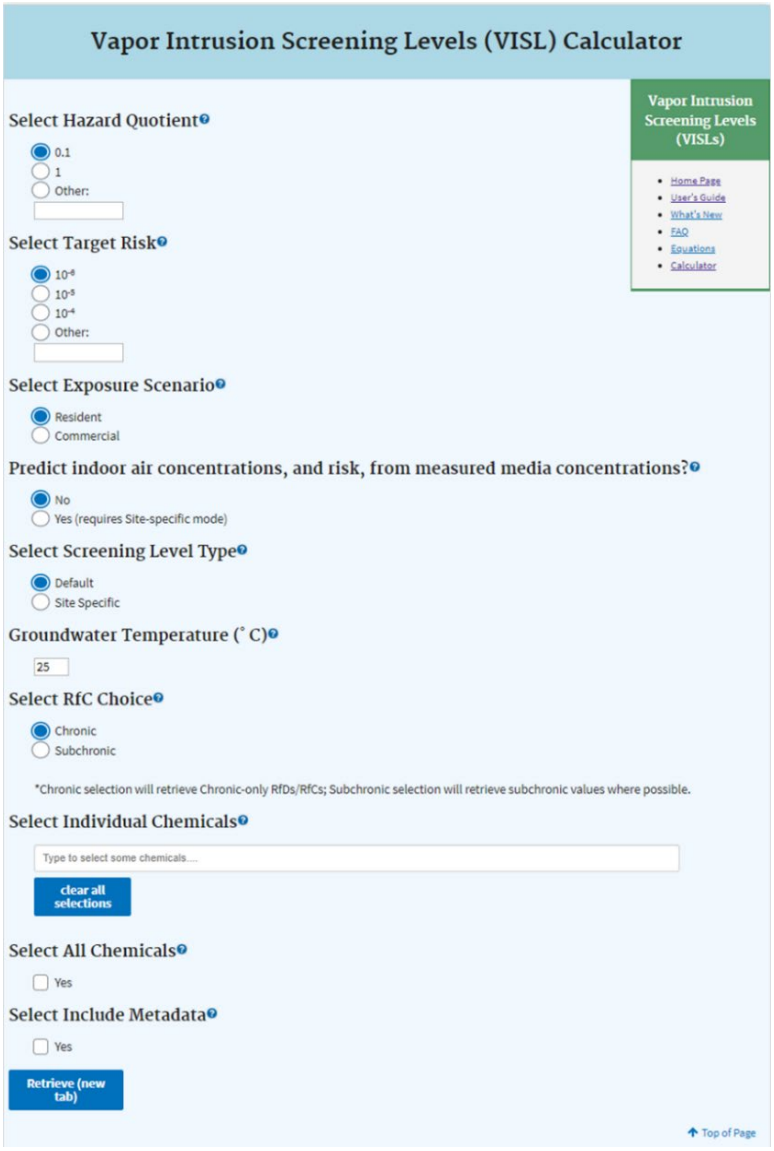


Figure 1. Screenshot of the online VISL Calculator default input screen.

VISL is a conservative screening tool that does have limitations, specifically the following:

- Vertical distance between the building foundation and the soil vapor or groundwater location cannot be selected.
- The user cannot input site-specific soil characteristics.
- The calculator does not factor for site-specific building foundation chemicals nor for air exchange rate.
- Chemical fate and transport mechanisms are lumped into attenuation factors. Bioattenuation and O_2 availability are not accounted for.

As a conservative estimator, and as stated on the VISL home page, sites where near surface soil vapor or groundwater concentrations do not exceed the calculated VISLs do not likely pose a health risk and generally can be removed from further action or additional investigation. If the VISLs are exceeded, more detailed site-specific modeling using one of the other models described in Chapter 9: Modeling may be appropriate for

further screening. Collecting indoor air samples, if feasible, may be used for further assessing health risks.

The VISL User's Guide (USEPA 2024b) lists additional requirements for use:

- A source of vapors underneath the building(s) either in the vadose zone or in the uppermost, continuous zone of groundwater
- Vapor migration via diffusion upward through unsaturated soils from these sources toward the ground surface and overlying buildings
- Buildings with poured concrete foundations (e.g., basement or slab-on-grade foundations) that are susceptible to soil vapor entry

The VISL calculations rely on default attenuation factors. The user may specify a different site-specific attenuation factor. The default attenuation factors tend to be conservative, leading to an overestimate of indoor air concentrations, and therefore risk. Please see **Chapter 5: Site Screening** or the **Attenuation Factors Fact Sheet** for more information. The VISL User's Guide lists the following scenarios for which the use of default attenuation factors may be inappropriate:

- Significant openings to the subsurface that facilitate soil vapor entry into the building (e.g., sumps, unlined crawl spaces, earthen floors) other than typical utility penetrations
- Very shallow groundwater sources (e.g., depths to water less than 5 feet below foundation level)
- Significant routes for preferential, subsurface vapor migration whether naturally occurring (e.g., fractured bedrock) or anthropogenic routes
- Those originating in landfills where methane is generated in sufficient quantities to induce advective transport in the vadose zone
- Those originating in commercial or industrial settings where vapor-forming chemicals can be released within an enclosed space and the density of the chemicals' vapor may result in significant advective transport of the vapors downward through cracks and openings in floors and into the vadose zone.
- Leaking vapors from pressurized gas transmission lines

Default input values are listed and can be changed using the radio buttons. A discussion of the input options follows:

- **Select Hazard Quotient:** The default non-cancer Hazard Quotient (HQ) is 0.1, which is commonly used for sites with multiple chemical contaminants of concern to account for additive risk. The user may specify an HQ of 1 or input another value. Generally, an HQ exceeding 1 indicates a potential imminent health risk.
- **Select Target Risk:** The default cancer risk is $1 \times 10\text{-}6$, indicating an additional lifetime cancer risk of one in one million due to chronic exposure of the contaminant of concern. The user may select or input a different value.
- **Select Exposure Scenario:** The options are Residential or Commercial. The primary difference is the exposure duration used in the background calculations. The Residential selection assumes longer lifetime exposure.

- **Predict indoor air concentrations, and risk, from measured media concentrations?** The default is No. Selecting Yes will open an option for selecting the medium in which you have data. (As shown in Figure 2, only one medium may be selected.)

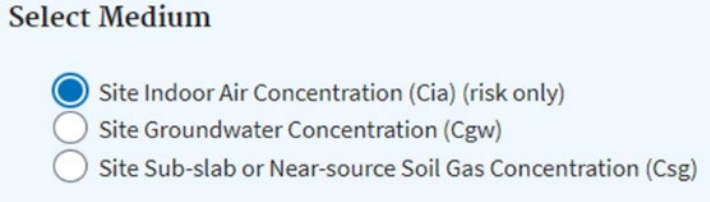


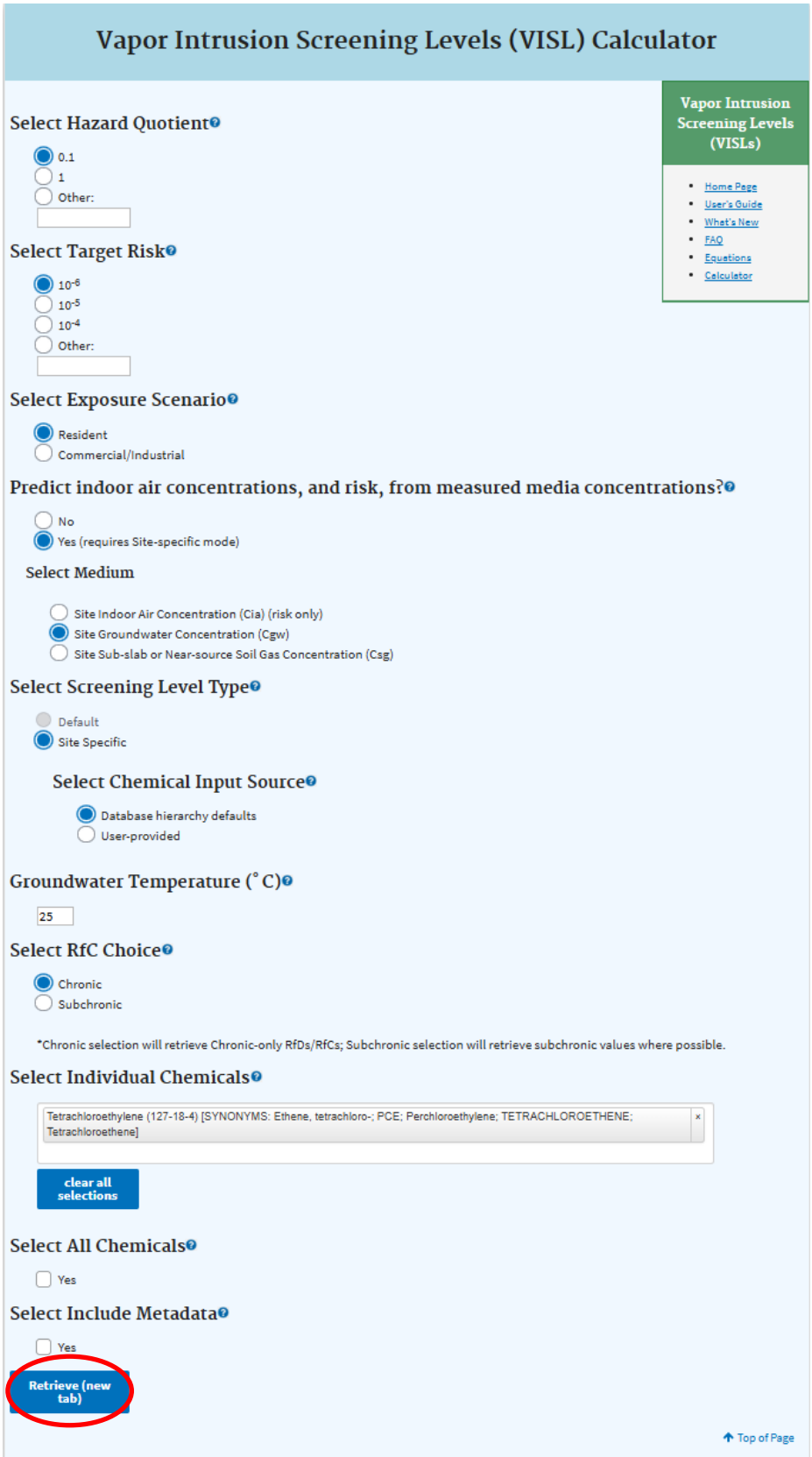
Figure 2. Screenshot of the online VISL Calculator.

- **Select Screening Level Type:** If the user would like to specify attenuation factors and vary site-specific exposure values, choose "Site Specific." Otherwise, default values will be used and reported in the output data. For example, for tetrachloroethene (PCE) the default soil vapor attenuation factor is 0.03. The default groundwater attenuation factor is 0.001.
- **Groundwater Temperature (°C):** The default temperature is 25°C. The user may choose to input a different value. For chronic risk, the average annual shallow ground temperature at the site should be selected. Entering the maximum annual ground temperature is more conservative and may be preferred for calculating acute risk (HQ).
- **Select RfC Choice:** The default choice is Chronic for RfC (Chronic Inhalation Reference Concentration). Users are advised to consult with a toxicologist, risk assessor, or the VISL User's Guide before selecting Subchronic.
- **Select Individual Chemicals:** As the user begins typing in a chemical name, the list of potential database chemicals that may match populates and is narrowed down. Common synonyms are listed as well. Multiple chemicals may be selected, and a "clear all selections" button is available for starting over.
- **Select All Chemicals?** This option should not be selected when using VISL as a screening tool for a specific known contaminant of concern. Selecting Yes will generate a table of chemical properties for use in more complicated model inputs for all chemicals listed in the VISL Calculator database.
- **Select Include Metadata?** Selecting Yes will generate detailed information on toxicology, such as target organs, study date, etc. if available.

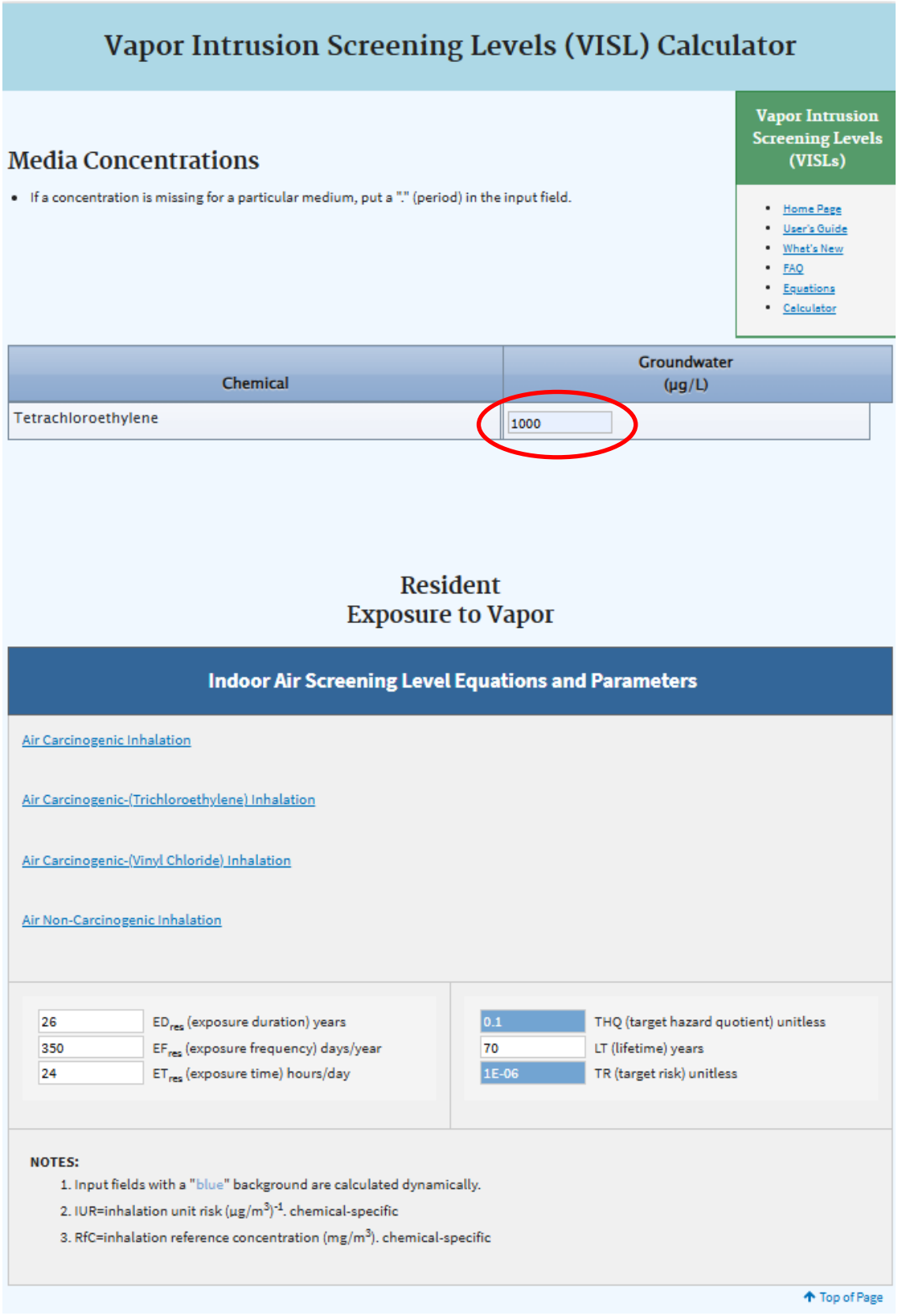
The VISL User's Guide and other online information provides more detail on the input parameters, assumptions, default values, and equations used in the calculations.

The following example illustrates the use of the VISL Calculator for estimating risk based on this scenario: dissolved-phase PCE is present in a groundwater plume beneath residential buildings. The user wants to know what the risk is when the PCE concentration in groundwater is 1,000 micrograms per liter (µg/L).

User inputs are shown below.



A new tab will open, allowing for the PCE concentration to be entered and listing default chemical characteristics and exposure inputs for the risk equations.



Vapor Intrusion Screening Levels (VISL) Calculator

Media Concentrations

- If a concentration is missing for a particular medium, put a "." (period) in the input field.

Vapor Intrusion Screening Levels (VISLs)

- Home Page
- User's Guide
- What's New
- FAQ
- Equations
- Calculator

Chemical	Groundwater (µg/L)
Tetrachloroethylene	1000

Resident
Exposure to Vapor

Indoor Air Screening Level Equations and Parameters

Air Carcinogenic Inhalation

Air Carcinogenic-(Trichloroethylene) Inhalation

Air Carcinogenic-(Vinyl Chloride) Inhalation

Air Non-Carcinogenic Inhalation

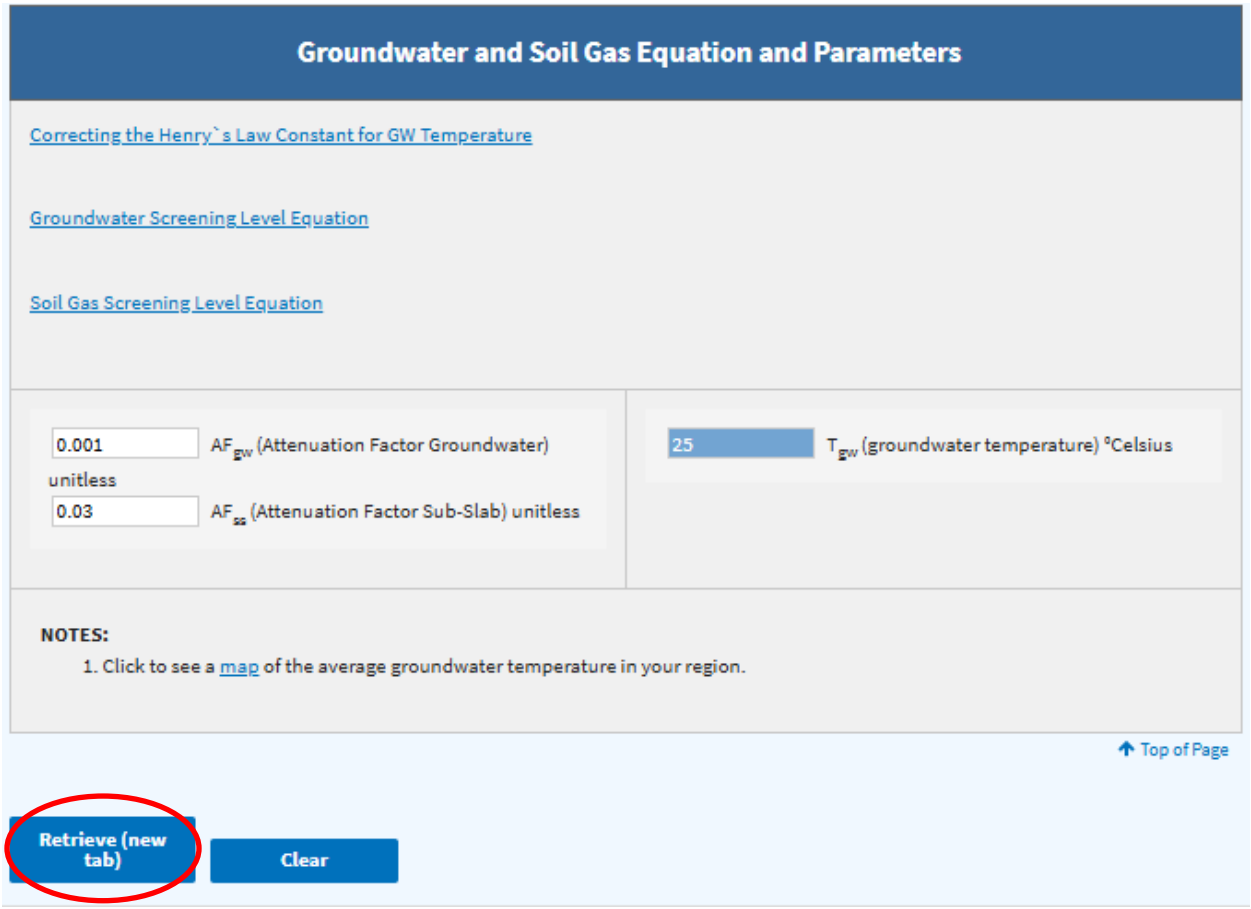
26	ED_{res} (exposure duration) years	0.1	THQ (target hazard quotient) unitless
350	EF_{res} (exposure frequency) days/year	70	LT (lifetime) years
24	ET_{res} (exposure time) hours/day	1E-06	TR (target risk) unitless

NOTES:

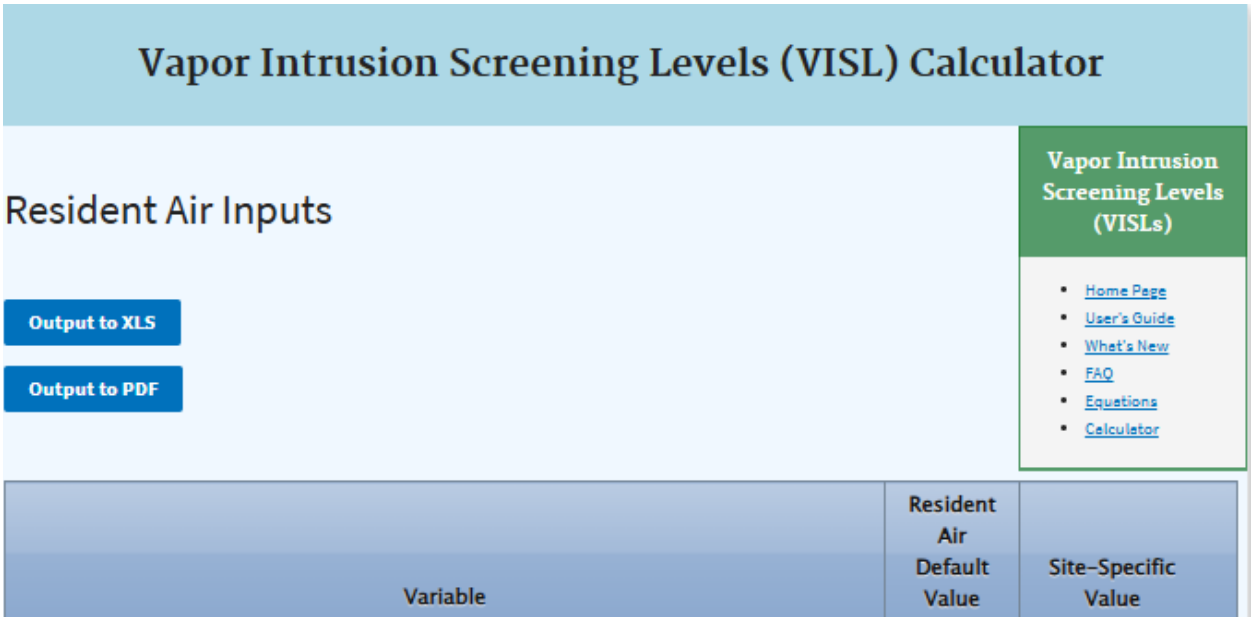
1. Input fields with a "blue" background are calculated dynamically.
2. IUR=inhalation unit risk $(\mu g/m^3)^{-1}$. chemical-specific
3. RfC=inhalation reference concentration (mg/m^3). chemical-specific

Top of Page

Scroll to the bottom of the page to complete the calculations.



Another tab will open with outputs, which can be exported to a spreadsheet or PDF.



The PDF outputs for the above inputs are shown below.

Resident Air Inputs

Variable	Resident Air Default Value	Site-Specific Value
AF_{gw} (Attenuation Factor Groundwater) unitless	0.001	0.001
AF_{ss} (Attenuation Factor Sub-Slab) unitless	0.03	0.03
ED_{nc} (exposure duration) years	26	26
$ED_{0\text{-}2}$ (mutagenic exposure duration first phase) years	2	2
$ED_{2\text{-}6}$ (mutagenic exposure duration second phase) years	4	4
$ED_{6\text{-}16}$ (mutagenic exposure duration third phase) years	10	10
$ED_{16\text{-}26}$ (mutagenic exposure duration fourth phase) years	10	10
EF_{nc} (exposure frequency) days/year	350	350
$EF_{0\text{-}2}$ (mutagenic exposure frequency first phase) days/year	350	350
$EF_{2\text{-}6}$ (mutagenic exposure frequency second phase) days/year	350	350
$EF_{6\text{-}16}$ (mutagenic exposure frequency third phase) days/year	350	350
$EF_{16\text{-}26}$ (mutagenic exposure frequency fourth phase) days/year	350	350
ET_{nc} (exposure time) hours/day	24	24
$ET_{0\text{-}2}$ (mutagenic exposure time first phase) hours/day	24	24
$ET_{2\text{-}6}$ (mutagenic exposure time second phase) hours/day	24	24
$ET_{6\text{-}16}$ (mutagenic exposure time third phase) hours/day	24	24
$ET_{16\text{-}26}$ (mutagenic exposure time fourth phase) hours/day	24	24
THQ (target hazard quotient) unitless	0.1	0.1
LT (lifetime) years	70	70
TR (target risk) unitless	1.0E-06	1.0E-06

Resident Vapor Intrusion Screening Levels (VISL)

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Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; U = user provided; G = see RSL User's Guide Section 5; CA = cancer; NC = noncancer.

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source? ($C_{vp} > C_{La}$,Target?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? ($C_{hc} > C_{La}$,Target?)	Target Indoor Air Concentration (TCR=1E-06 or THQ=0.1) MIN($C_{ia,c}$,$C_{ia,nc}$) (µg/m³)	Toxicity Basis	Target Sub-Slab and Near-source Soil Gas Concentration (TCR=1E-06 or THQ=0.1) C_{sg},Target (µg/m³)	Target Groundwater Concentration (TCR=1E-06 or THQ=0.1) C_{gw},Target (µg/L)
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	4.17E+00	NC	1.39E+02	5.76E+00

Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp}\ (25 ℃)\ (µg/m³)	Maximum Groundwater Vapor Concentration C_{hc}\ (µg/m³)	Temperature for Maximum Groundwater Vapor Concentration (℃)	Lower Explosive Limit LEL (% by volume)	LEL Ref	IUR (ug/m³)⁻¹	IUR Ref	RfC (mg/m³)	RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-06 $C_{ia,c}$ (µg/m³)	Noncarcinogenic VISL THQ=0.1 $C_{ia,nc}$ (µg/m³)
No (5)	1.65E+08	1.49E+08	25	-		2.60E-07	I	4.00E-02	I	No	1.08E+01	4.17E+00

Resident Vapor Intrusion Risk

Chemical	CAS Number	Site Groundwater Concentration C_{gw} \ (µg/L)	Site Indoor Air Concentration C_{La} \ (µg/m³)	VI Carcinogenic Risk CDI (µg/m³)	VI Carcinogenic Risk CR	VI Hazard CDI (mg/m³)	VI Hazard HQ	IUR (ug/m³)⁻¹
Tetrachloroethylene	127-18-4	1000	7.24E+02	2.58E+02	6.70E-05	6.94E-01	1.73E+01	2.60E-07
*Sum		-	-	-	6.70E-05	-	1.73E+01	-

IUR Ref	Chronic RfC (mg/m³)	RfC Ref	Temperature (℃)\ for Groundwater Vapor Concentration	Mutagen?
I	4.00E-02	I	25	No
	-		-	

Note that for this scenario, both the target Carcinogenic Risk (1 × 10-6) and the HQ (0.1) are exceeded, indicating that further assessment is warranted and the residential units above the groundwater plume with PCE concentrations at or above 1,000 µg/L should not be screened out. For more information on quantifying health risk, please see **Chapter 8: Data Evaluation and Vapor Intrusion Risk Assessment**.

REFERENCES

USEPA. 2024a. "Vapor Intrusion Screening Level Calculator." Data and Tools. https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator.

USEPA. 2024b. "VISL User's Guide." Data and Tools. https://www.epa.gov/vaporintrusion/visl-users-guide.