Risk Evaluation Application

User Guide

State of Idaho
Department of Environmental Quality

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Contents

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1 System Requirements

The Risk Evaluation Application (REA) requires the **Microsoft .NET Framework 4 Client Profile** (Profile). The REA installer contains an automatic check for the Profile that will download and install the Profile if necessary. If the installer fails to automatically download and install the Profile, it can be done manually at *www.microsoft.com/en-us/download/details.aspx?id=24872*.

The REA works optimally on **Windows 7** but will work on any computer or device that supports the Profile, including the following operating systems:

- Windows XP
- Windows Vista
- Windows 8

The REA is designed for a screen resolution of 1280 × 900 pixels. It is useable at a minimum of 800 × 600.

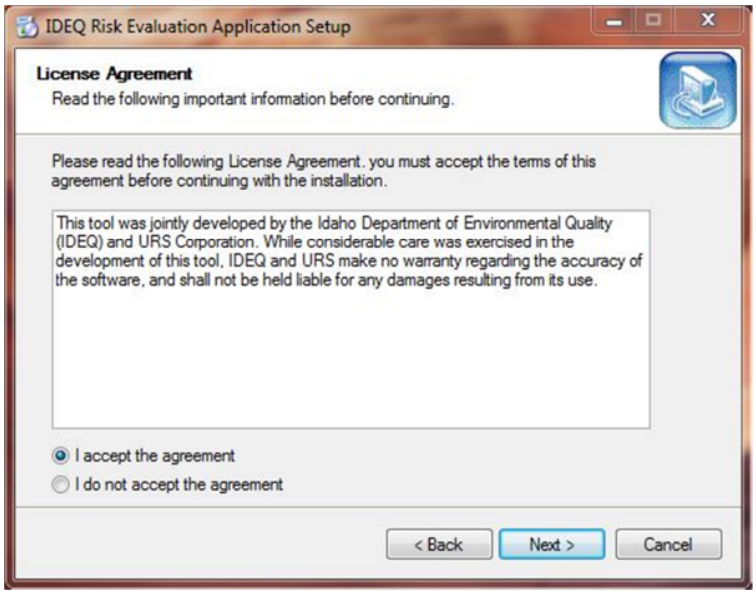
2 Installation

On the Risk Evaluation Manuals webpage (*www.deq.idaho.gov/waste-mgmt-remediation/remediation-activities/risk-evaluation-manuals*), click on the **Petroleum Risk Evaluation Software** link to download the "setup.exe" file. Save this file to an appropriate directory on your computer.

Create a folder where risk evaluation site files will be located. Click on the **Petroleum Risk Evaluation Example File** link to download the "test example.risk" file and save to this newly created folder.

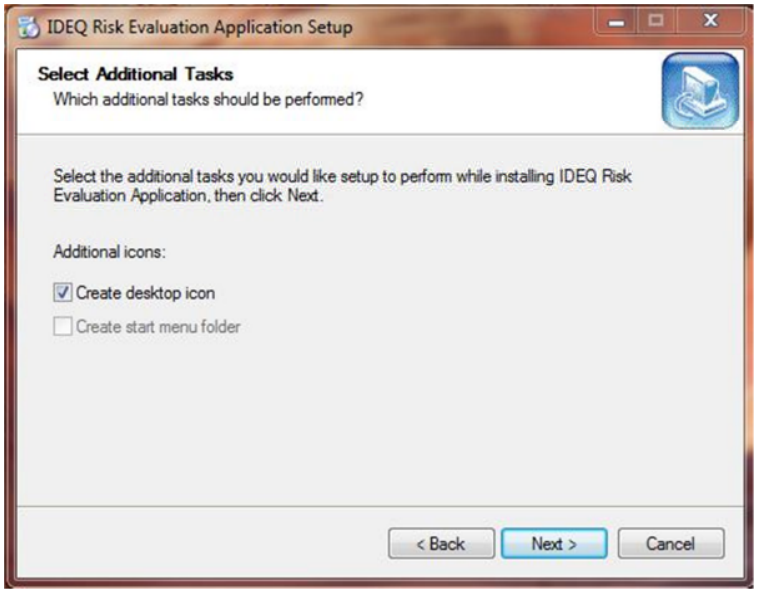
Double-click on the "setup.exe" file to start the installation process. Click **Yes** to allow the program to install on your computer.

Select the radio button to accept the license agreement terms of use and click **Next**.



Click **Next** to select the default folder in which the application files will be located.

Select whether or not you will want a desktop icon for the application by checking or unchecking the **Create desktop icon** checkbox and then click **Next**.



Click **Finish** to exit the setup process.

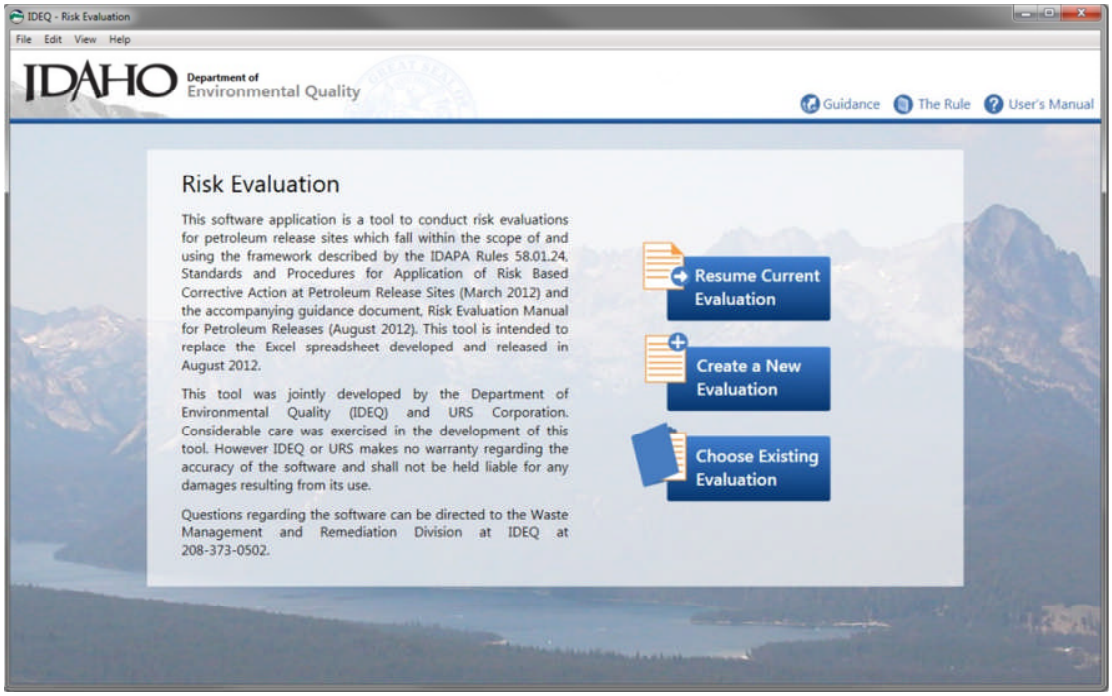
If a desktop icon was created, double-click this icon to start the application.

Alternatively, the application can be opened from the Start menu option or by double-clicking a Risk Evaluation (.risk) file, which is associated with the REA application after installation.

3 Running the REA

Once the REA is launched, the opening Home screen provides information on how to use the REA, including the following three options:

1. **Resume Current Evaluation** (Note: If this is the first time using the REA, this option will not be available.)
    a. If the user just started the REA, this opens the most recently used risk evaluation file and navigates to the Site Information page.
    b. If the user is in the middle of editing a risk evaluation, this will resume that evaluation where the user left off.
2. **Create a New Evaluation**
    a. Starts a new evaluation and closes any that are open.
3. **Choose Existing Evaluation**
    a. Navigates to the Existing Evaluations page. First-time users of the REA should select this option, use the **Browse** button to navigate to the folder where the downloaded example "test example.risk" file was placed, and double-click this file to open.

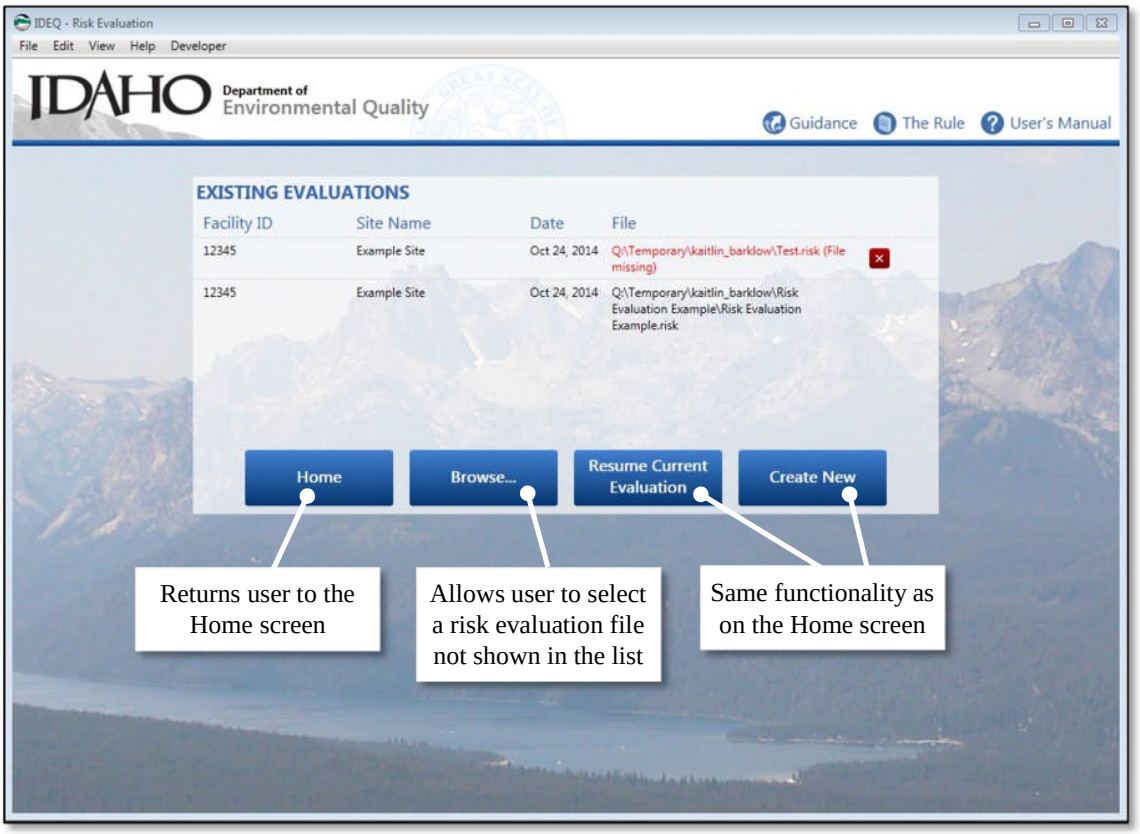


4 Loading and Saving Evaluations

Risk evaluation files are saved with the ".risk" extension. Double-click on any ".risk" file and the REA will launch, opening that specific evaluation.

The Existing Evaluations page shows a list of up to 20 of the most recently accessed evaluations. Clicking on any item in the list opens that specific evaluation.

Recent evaluations whose file no longer exists in the expected location are shown in red, with "(File missing)" added. The user can remove the item from the list using the red X button.



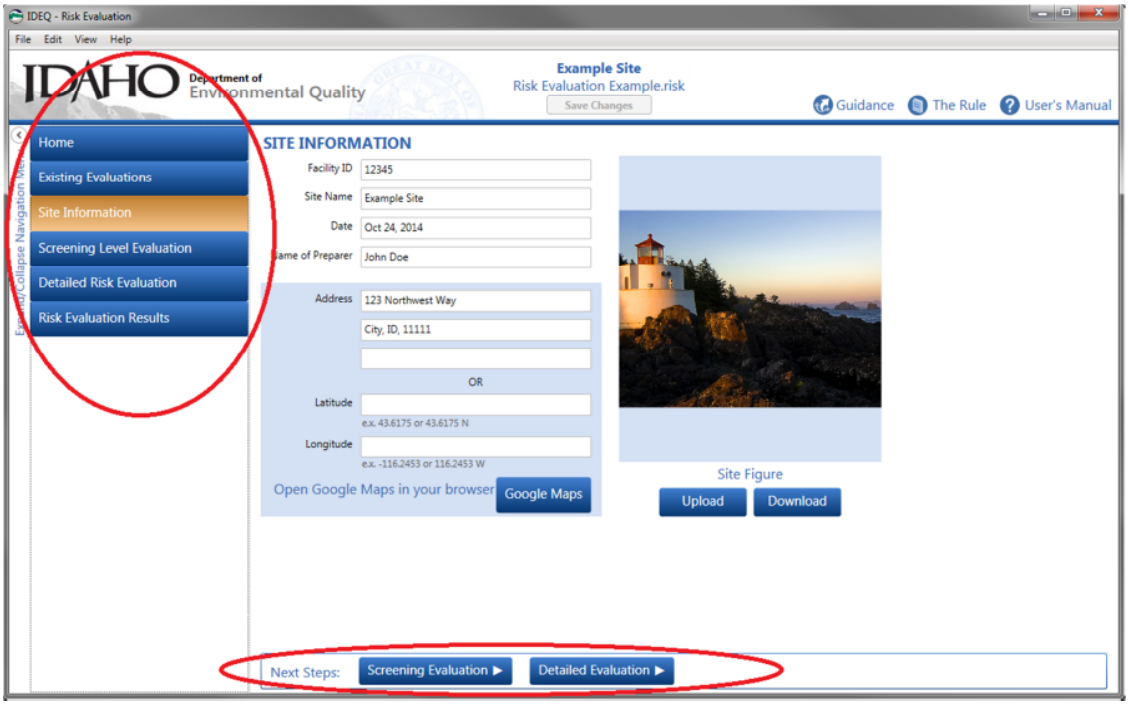
An evaluation can be saved at any time by going to **File** > **Save** or pressing **Ctrl+S**. Using **Save As** allows the user to save the evaluation in the desired file location. The first time a file is saved, the user can navigate/save in the desired file location.

5 Navigating the REA

The left sidebar is a Navigation Menu that shows the REA pages in the same order used for the completion of a full risk evaluation. The Navigation Menu can be collapsed (hidden) or expanded (shown) by clicking anywhere in the white bar labeled **Expand/Collapse Navigation Menu** on the far left of the screen. The order of buttons on the Navigation Menu corresponds with the workflow a user would typically perform in doing a complete risk evaluation. Screenshots from the application that correspond to these buttons and illustrate the workflow are

shown below. A detailed explanation of each page begins on page 8. Every page has **Next Steps** buttons at the bottom of the page to help users make their way through the REA. The upper right of every page has buttons that provide links to the *Idaho Risk Evaluation Manual for Petroleum Releases* guidance, the associated rule, and this user's manual.

Site Information



Screening Level Evaluation

1. Chemicals of Interest

2. Comparison Chart

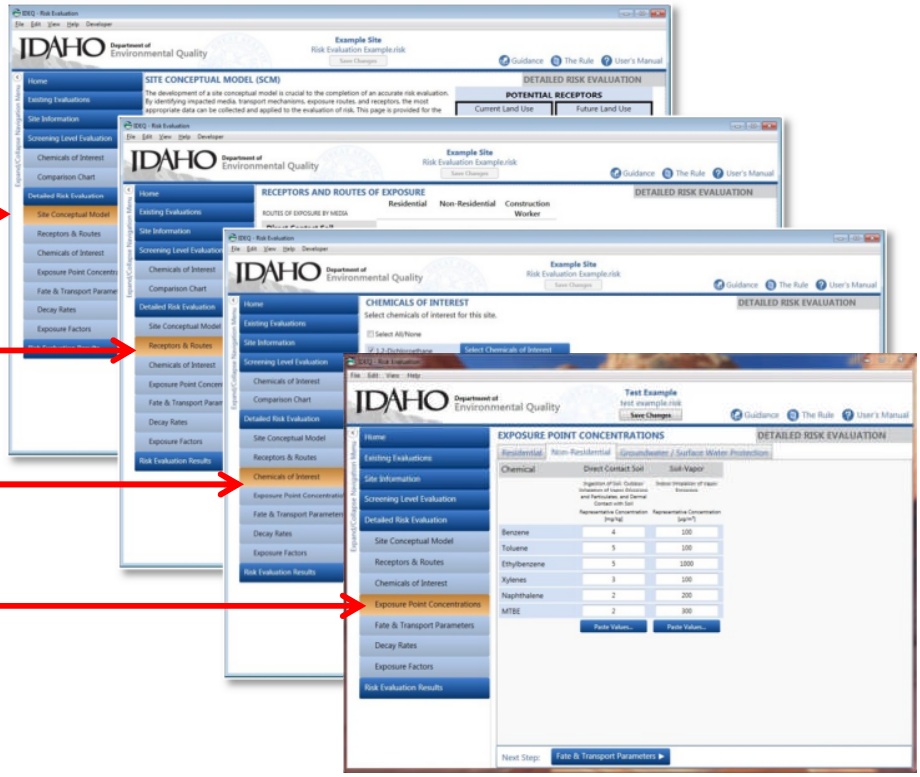
Detailed Risk Evaluation

1. Site Conceptual Model

2. Receptors and Routes

3. Chemicals of Interest

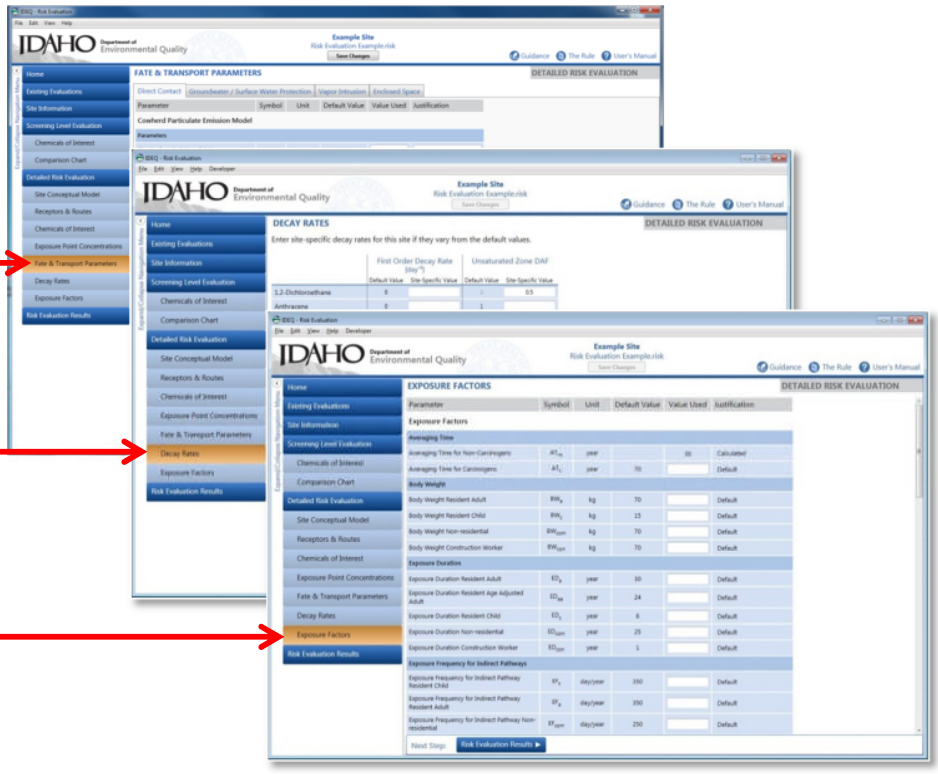
4. Exposure Point Concentrations



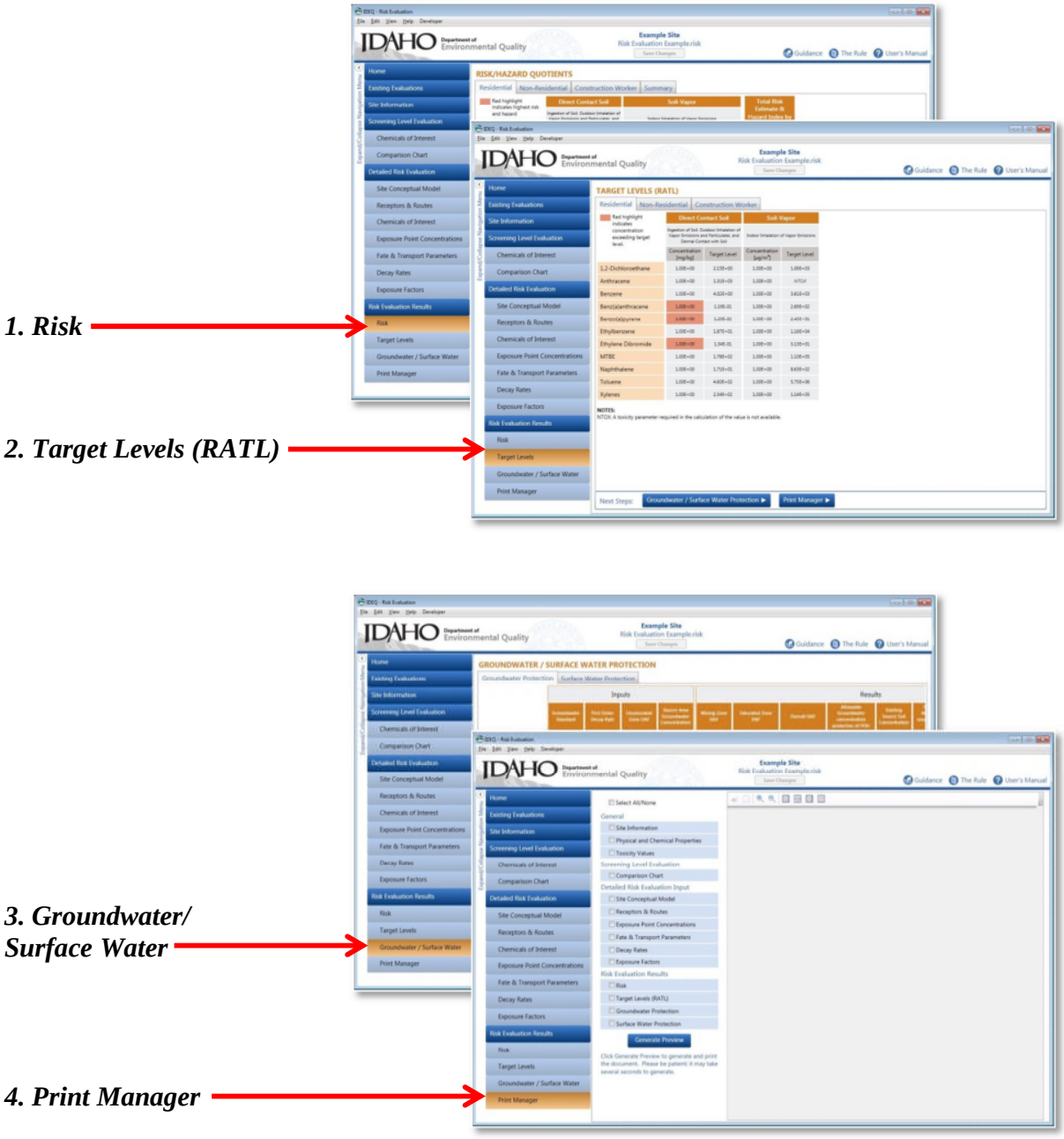
5. Fate & Transport Parameters

6. Decay Rates

7. Exposure Factors



Risk Evaluation Results

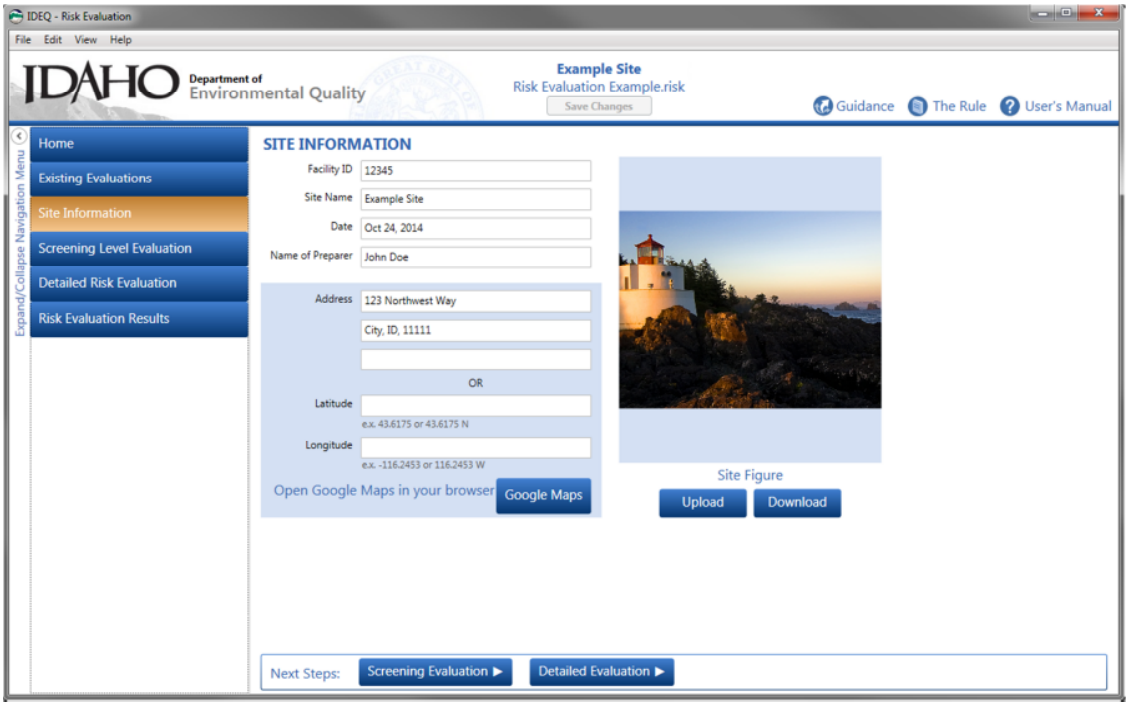


6 Site Information

The following information is provided by the user:

- **Facility ID:** This information is critical and should be included in every evaluation submitted to DEQ.
- **Site Name:** Appears in the footer in the printed report.
- **Date:** Defaults to current date for new evaluations.
- **Name of Preparer** (User)
- **Address**: Enter address of site as you would on an envelope using the three lines available (street, city/state, and zip code). If site does not have an address, enter the latitude and longitude instead.
- **Latitude and Longitude:** Enter in decimal degree format.
- **Google Maps:** Opens Google maps to the address entered to allow viewing the site. If no address was entered, opens to the latitude and longitude entered.
- **Upload Site Figure**: User can upload *one* site figure in any of the following formats:
  - Bitmap (.bmp); JPEG (.jpg, .jpeg, .jpe, .jfif); GIF (.gif); TIFF (.tif, .tiff); Portable Document Format (.pdf)

Click **Upload** to add a site figure to the risk evaluation. If the site figure is an image, it will be shown on this form and on the printed report. If the site figure is a PDF file, an image will not be shown on the form. A placeholder image will say “Attached (Download to View).” The PDF image will be embedded in the “.risk” file and be available for viewing. Click the **Download** button to save and view the attached PDF using an external application such as Adobe Reader. Uploading a second site figure will overwrite the first.



7 Screening Level Evaluation

Refer to Section 3 of the *Idaho Risk Evaluation Manual for Petroleum Releases* (*available at www.deq.idaho.gov/waste-mgmt-remediation/remediation-activities/risk-evaluation-manuals*).

7.1 Chemicals of Interest

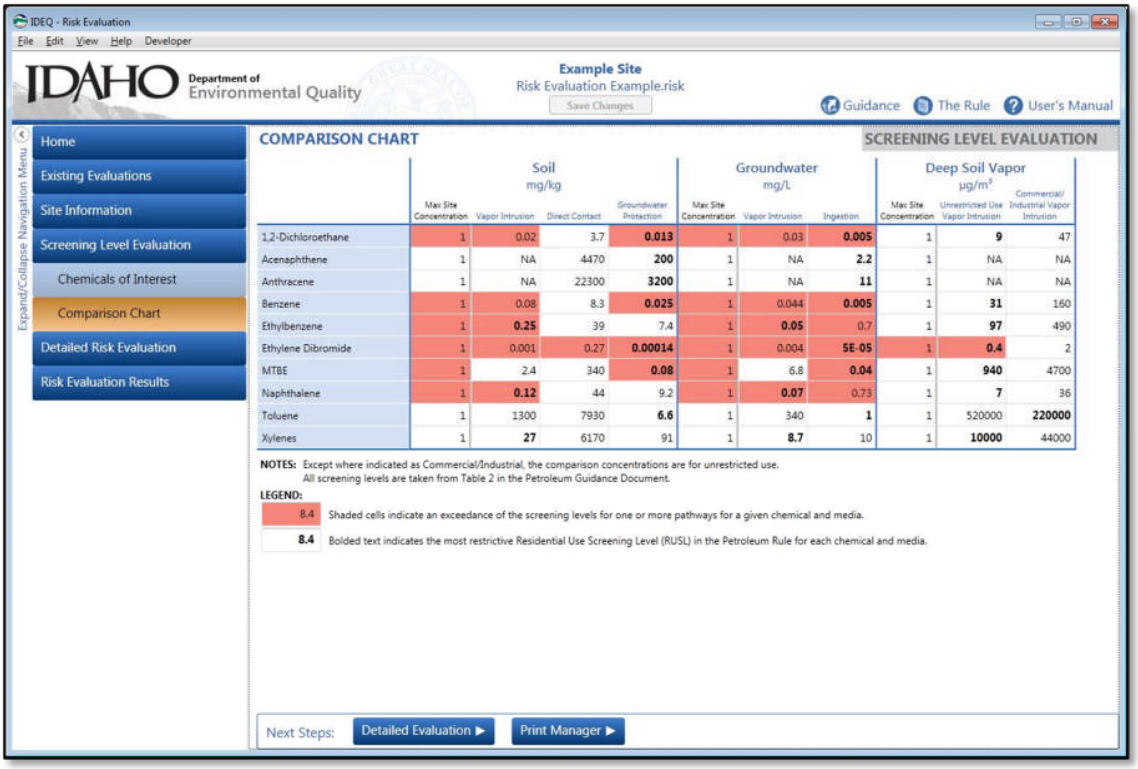
Several methods to select the chemicals of interest for a screening evaluation are available:

- Select the chemicals of interest at the site by checking the boxes to the left of each chemical.
- Select the type of release or multiple types, if applicable. This option is commonly selected when performing an evaluation after a tank removal and closure. The boxes checked will have no effect on the selected chemicals of interest until the **Select Chemicals of Interest based on Type of Release** button is clicked.
    - Clicking **Select Chemicals of Interest based on Type of Release** will automatically check the boxes to the left of each chemical of interest based on the selected type(s) of release. The user can manually change these selections afterward.
- For each selected chemical of interest, enter the maximum chemical concentrations for the site for all applicable media (soil, groundwater, or deep soil vapor) in the units listed.
- Selecting **All/None** will alternate between selecting and clearing all available chemicals.

7.2 Comparison Chart

This chart is a read-only output page for viewing the results of the screening evaluation.

- Each selected chemical of interest is shown in the left column.
- For each medium, the user-entered maximum site concentration is shown on the left and compared to various screening levels.
  - The most restrictive (lowest) screening level for the medium is shown as bold. These are the levels contained in the petroleum rule.
  - All screening levels that are exceeded by the site concentration are highlighted red.
  - If the site concentration exceeds any of the screening levels, the site concentration box is also highlighted red.



8 Detailed Risk Evaluation

Refer to Section 4 of the *Idaho Risk Evaluation Manual for Petroleum Releases* (available at *www.deq.idaho.gov/waste-mgmt-remediation/remediation-activities/risk-evaluation-manuals*).

8.1 Site Conceptual Model

This is a stand-alone page intended to help users develop a site conceptual model for their risk evaluation. Selections on this page are not used anywhere in the REA.

- A few possible release concerns are listed above the table (free product, utilities threatened, etc.). Check each concern that is applicable to this site and release scenario.
- A checkbox is provided for each potential exposure pathway. Check each box if it represents a complete exposure pathway for this site and release.

8.2 Receptors and Routes

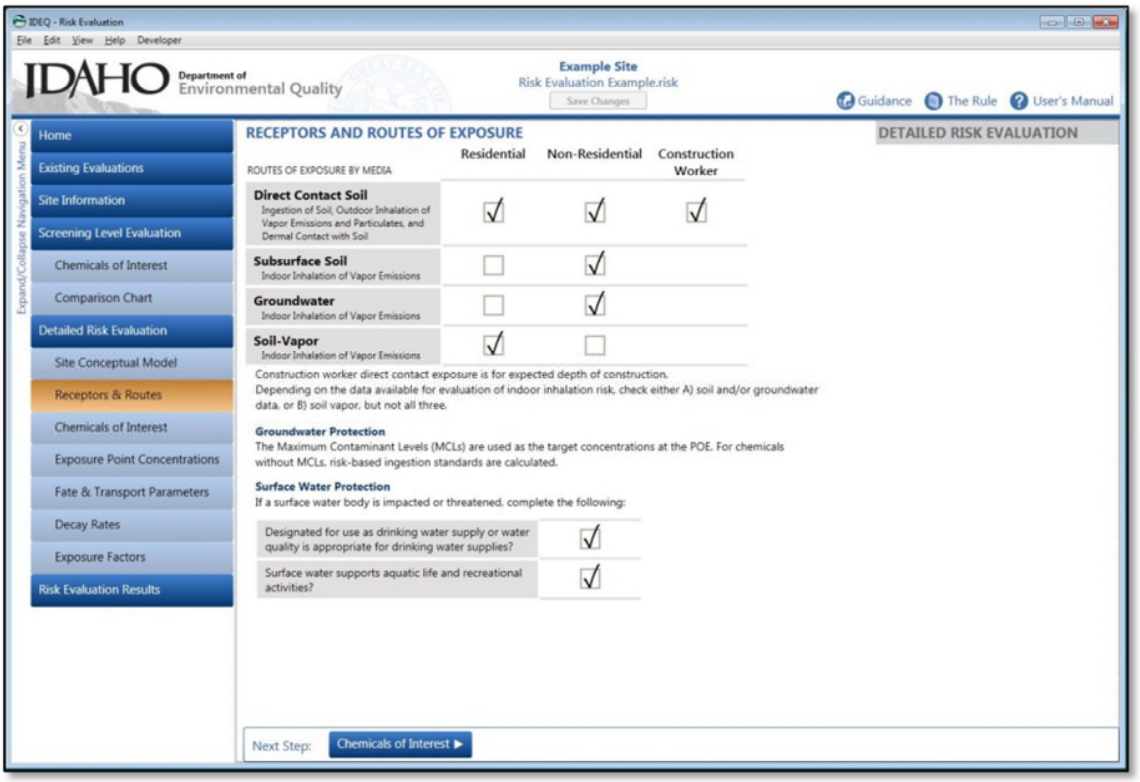
This page shows a simplified view of exposure pathways. The selections made by the user on this page drive the available options in the rest of the REA.

- Select **Direct Contact Soil** for each applicable receptor.

There are two different models for evaluating risk from indoor inhalation of vapor emissions; *only one should be used*, depending on available data:

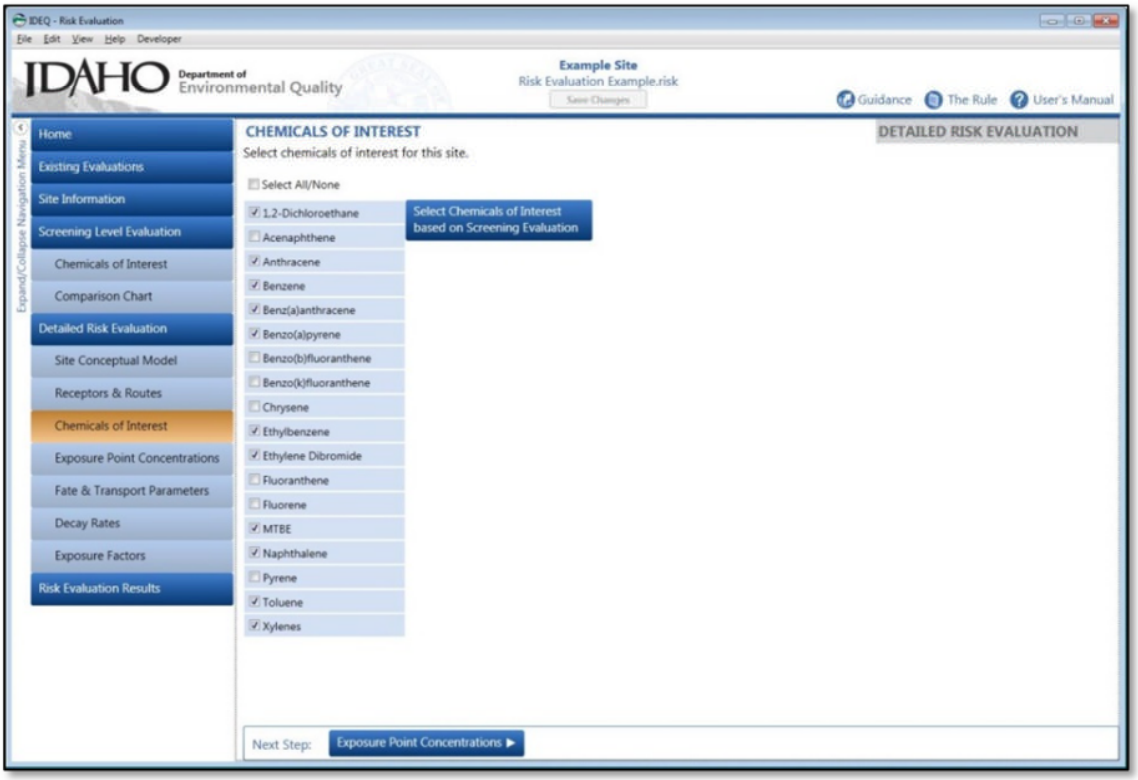
- Concentrations in impacted soil or groundwater media—Select subsurface soil or groundwater (or both) depending on impacted media. Use with concentration data for subsurface soil (mg/kg) and groundwater (mg/L). The soil-vapor concentration will be derived.
- Soil-vapor data—Use with direct measurements of concentration data for soil-vapor (µg/m³).

Groundwater protection is automatically selected and requires no additional input on this page. Answer the interview questions for surface water protection if a surface water body is impacted or threatened.



8.3 Chemicals of Interest

- Select the chemicals of interest at the site by checking the boxes to the left of each chemical.
- Clicking **Select Chemicals of Interest based on Screening Evaluation** will automatically check the boxes to the left of each chemical of interest based on those selected in the **Screening Level Evaluation**. The user can manually change the selections afterward.

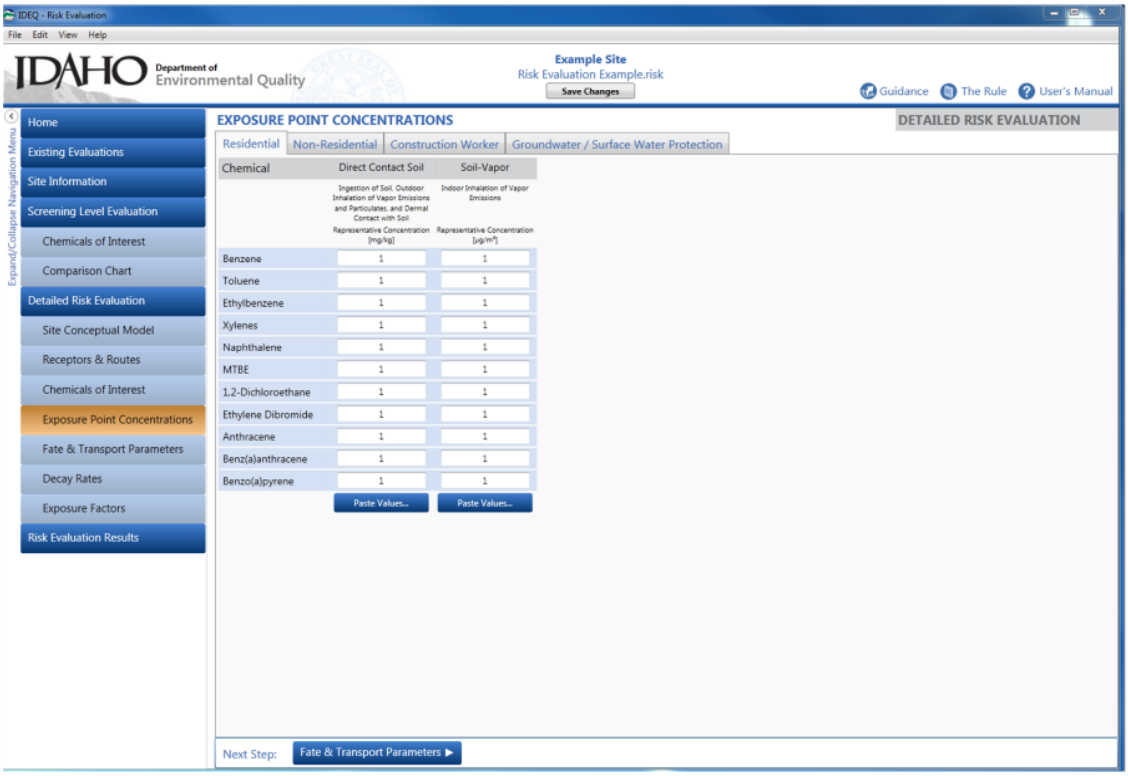


8.4 Exposure Point Concentrations

At the top is a tab for each receptor or pathway selected (Residential, Non-Residential, Construction Worker, Groundwater/Surface Water Protection). One tab is shown per receptor, provided at least one pathway is marked complete for that receptor on the Receptors & Routes page. Each tab shows all chemicals of interest and a column per complete pathway for that receptor.

There is one additional tab to enter concentrations relating to groundwater and surface water protection. **Note**: The representative soil concentration at the source and the representative groundwater concentration at the point of contact are for reference only and are not used in calculations.

- Enter the representative concentrations for each complete pathway chosen on the Receptors & Routes page.
- Click the **Paste Values…** button below a column to copy exposure point concentrations (EPCs) already entered in another column.



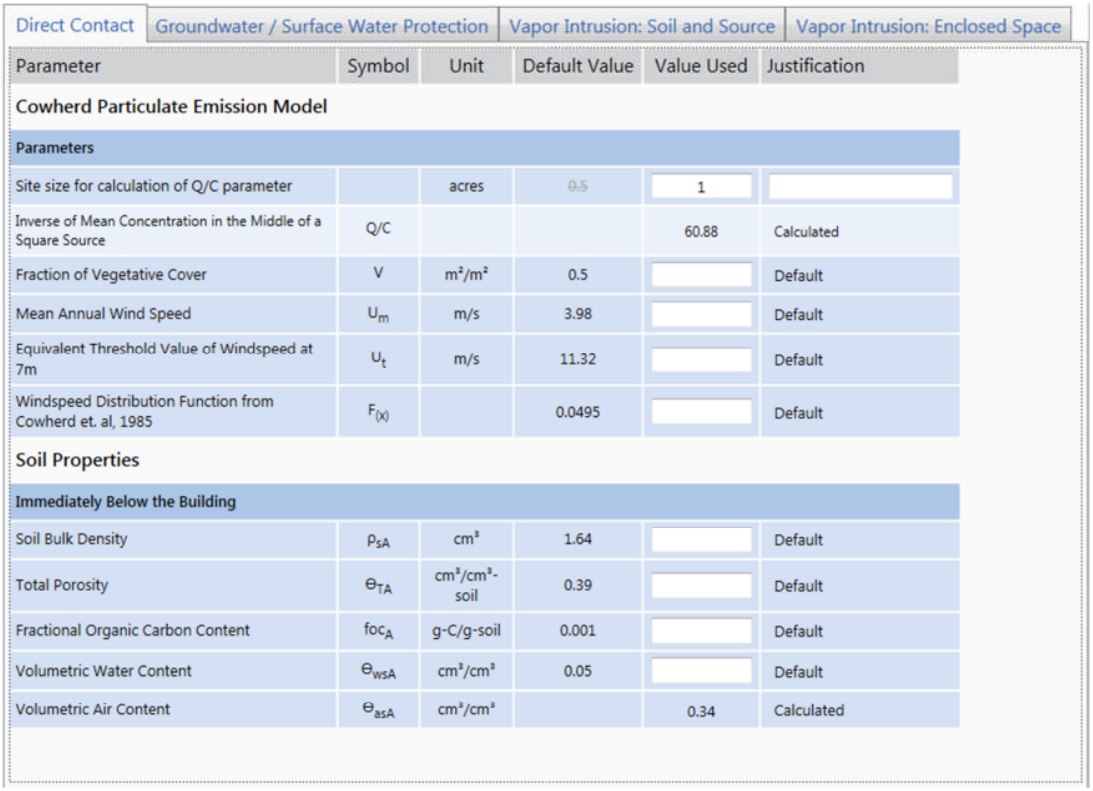
8.5 Fate & Transport Parameters

This page shows fate and transport parameters required for the risk calculations. There are four tabs associated with the fate and transport parameters. The tabs are grouped based on their use in calculations for different routes of exposure: direct contact, groundwater/surface water protection, and two for vapor intrusion (soil and source and enclosed space). Most parameters have a default value that the user can override by entering a value in the value used column.

- If the user overrides the value of a parameter, the user is given the option to provide brief justification for the new value in the justification column.
- If no value is entered, the default value shown is used in the calculations.

8.5.1 Direct Contact

The Direct Contact tab consists of parameters for the Cowherd particulate emission model and soil properties related to dermal contact and ingestion. The Q/C dispersion factor is automatically calculated based on the size of the site.



Direct Contact | Groundwater / Surface Water Protection | Vapor Intrusion: Soil and Source | Vapor Intrusion: Enclosed Space

Parameter	Symbol	Unit	Default Value	Value Used	Justification
Cowherd Particulate Emission Model					
Parameters					
Site size for calculation of Q/C parameter		acres	0.5	1	
Inverse of Mean Concentration in the Middle of a Square Source	Q/C			60.88	Calculated
Fraction of Vegetative Cover	V	m^2/m^2	0.5		Default
Mean Annual Wind Speed	U_m	m/s	3.98		Default
Equivalent Threshold Value of Windspeed at 7m	U_t	m/s	11.32		Default
Windspeed Distribution Function from Cowherd et. al, 1985	$F_{(x)}$		0.0495		Default
Soil Properties					
Immediately Below the Building					
Soil Bulk Density	ρ_{sA}	cm^3	1.64		Default
Total Porosity	Θ_{TA}	cm^3/cm^3-soil	0.39		Default
Fractional Organic Carbon Content	foc_A	g-C/g-soil	0.001		Default
Volumetric Water Content	Θ_{wsA}	cm^3/cm^3	0.05		Default
Volumetric Air Content	Θ_{asA}	cm^3/cm^3		0.34	Calculated

8.5.2 Groundwater/Surface Water Protection

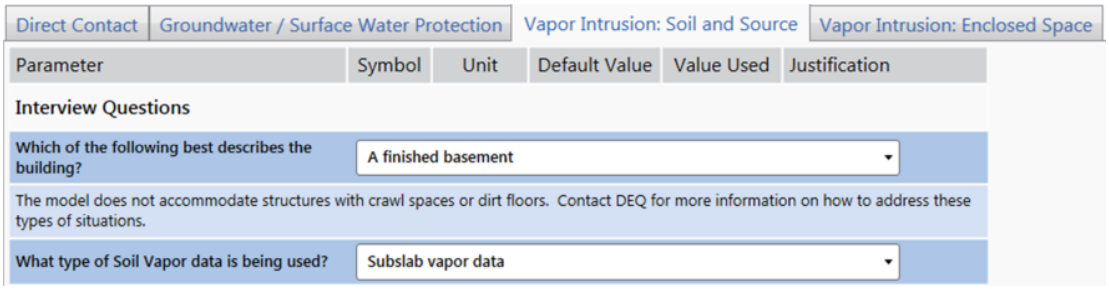
The Groundwater/Surface Water Protection tab contains parameters necessary to calculate how chemicals are likely to leach to groundwater and be transported downgradient to points of exposure in groundwater or surface water media.

Direct Contact | Groundwater / Surface Water Protection | Vapor Intrusion: Soil and Source | Vapor Intrusion: Enclosed Space

Parameter	Symbol	Unit	Default Value	Value Used	Justification
Common Water Inputs					
Source Zone Soil Properties					
Dry Soil Bulk Density of the source zone soil	ρ_s	g/cm³	1.64		Default
Fractional Organic Carbon Content in the source zone soil	foc	g-C/g-soil	0.001		Default
Total Soil Porosity of the source zone soil	Θ_T	cm³/cm³-soil	0.39		Default
Volumetric Water Content in the source zone soil	Θ_{ws}	cm³/cm³	0.17		Default
Volumetric Air Content in the source zone soil	Θ_{as}	cm³/cm³		0.22	Calculated
Saturated Zone Soil Properties					
Dry Soil Bulk Density of the saturated zone soil	ρ_{ss}	g/cm³	1.64		Default
Fractional Organic Carbon Content in the saturated zone soil	focs	g-C/g-soil	0.001		Default
Total Soil Porosity in the saturated zone soil	Θ_{ts}	cm³/cm³-soil	0.39		Default
Source Area Parameters					
Groundwater Darcy Velocity	U_{gw}	ft/year	109.6		Default
Groundwater Mixing Zone Length	L_{mz}	ft	40.03		Default
Groundwater Mixing Zone Thickness	δ_{gw}	ft	5.02		Default
Groundwater Mixing Zone Width	W_{gw}	ft	40.03		Default
Infiltration Rate	I	ft/year	0.8202		Default
Exposure and Compliance Point Distances from Source					
Groundwater Protection Parameters					
Distance to Point of Exposure (POE)	$X_{poe,gw}$	ft	0		Default
Longitudinal dispersivity	α_x	ft		0	Calculated
Transverse dispersivity	α_y	ft		0	Calculated

8.5.3 Vapor Intrusion: Soil and Source

The Vapor Intrusion: Soil and Source tab contains interview questions regarding the type of building construction and soil vapor data available. These questions should be answered before entering other parameters. The answers to these questions, along with the selections on the Receptors & Routes page, determine which other parameters on this tab will be available for data input.



Direct Contact	Groundwater / Surface Water Protection	Vapor Intrusion: Soil and Source	Vapor Intrusion: Enclosed Space

Parameter	Symbol	Unit	Default Value	Value Used	Justification
Interview Questions					
Which of the following best describes the building?	A finished basement				
The model does not accommodate structures with crawl spaces or dirt floors. Contact DEQ for more information on how to address these types of situations.					
What type of Soil Vapor data is being used?	Subslab vapor data				

The application supports up to three different soil strata, plus a capillary fringe for groundwater. The number of soil strata available for input depend on the answers to the interview questions above.

- If subsurface soil data are being used, determine the number of soil strata between the bottom of the building and the top of the source.
- If groundwater data are being used, determine the number of soil strata between the bottom of the building and the capillary fringe.
- If deep soil vapor data are being used, determine the number of soil strata between the bottom of the building and the depth at which soil vapor measurements were obtained.
- If subslab soil vapor data are being used, only one strata directly below the building slab is available.

These selections will determine how many strata (named A, B, and C) require parameters. The distance between the building and the source must equal the sum of strata thicknesses.

Soil Source					
What is the number of soil strata between the building and top of the source (up to 3)?	N_S		~~1~~	3	
Thickness of Soil Strata between the top of the source and the bottom of the building					
Distance from top of the soil source to bottom of building	L_{TS}	cm	~~30~~	50	
Distance from bottom of soil source to bottom of building	L_{TS-B}	cm	183		Default
Stratum A (Immediately below the building)	h_A	cm	~~15~~	25	
Stratum B	h_B	cm	~~0~~	15	
Stratum C	h_C	cm	~~0~~	10	
Groundwater Source					
What is the number of soil strata between the building and the capillary fringe (up to 3)?	N_{GW}		~~1~~	2	
Thickness of Soil Strata between groundwater and the bottom of the building					
Distance from top of groundwater to bottom of building	L_{TGW}	cm	30		Must equal the sum of strata thicknesses
Stratum A (Immediately below the building)	h_A	cm	5		Default
Stratum B	h_B	cm	~~0~~	10	
Stratum D (Capillary fringe)	h_{cap}	cm		25	Calculated

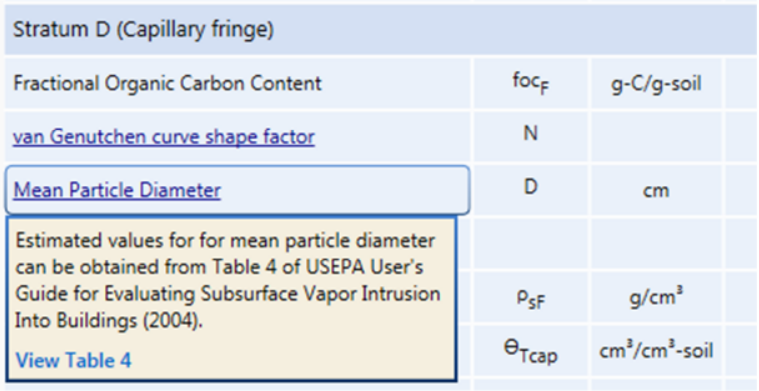
If soil vapor data are being used, an additional interview question will determine whether the application allows multiple strata. If subslab vapor data are being used, only Stratum A is available.

What type of Soil Vapor data is being used?	Subslab vapor data				
Soil Vapor Source					
Thickness of Soil Strata between the depth of the soil vapor sample and the bottom of the building					
Depth of the soil vapor sample from the bottom of the building	L_{tsv}	cm	15		Default
Stratum A (Immediately below the building)	h_A	cm	15		Default

If deep soil vapor data are being used, determine the number of soil strata between the bottom of the building and the soil vapor sample.

What type of Soil Vapor data is being used?	Deep soil vapor data				
Soil Vapor Source					
What is the number of soil strata between the building and the soil vapor sample (up to 3)?	N_S		1	2	
Thickness of Soil Strata between the depth of the soil vapor sample and the bottom of the building					
Depth of the soil vapor sample from the bottom of the building	L_{tsv}	cm	91	123	
Stratum A (Immediately below the building)	h_A	cm	91		Default
Stratum B	h_B	cm	0	32	

Some parameters offer tips or additional information on their use, indicated by underlined, blue text. Click the parameter text to view a pop-up box containing this information. Click anywhere else to close the pop-up. The example below shows parameters associated with different soil types that can be selected to represent the capillary fringe and are used to calculate capillary fringe thickness.

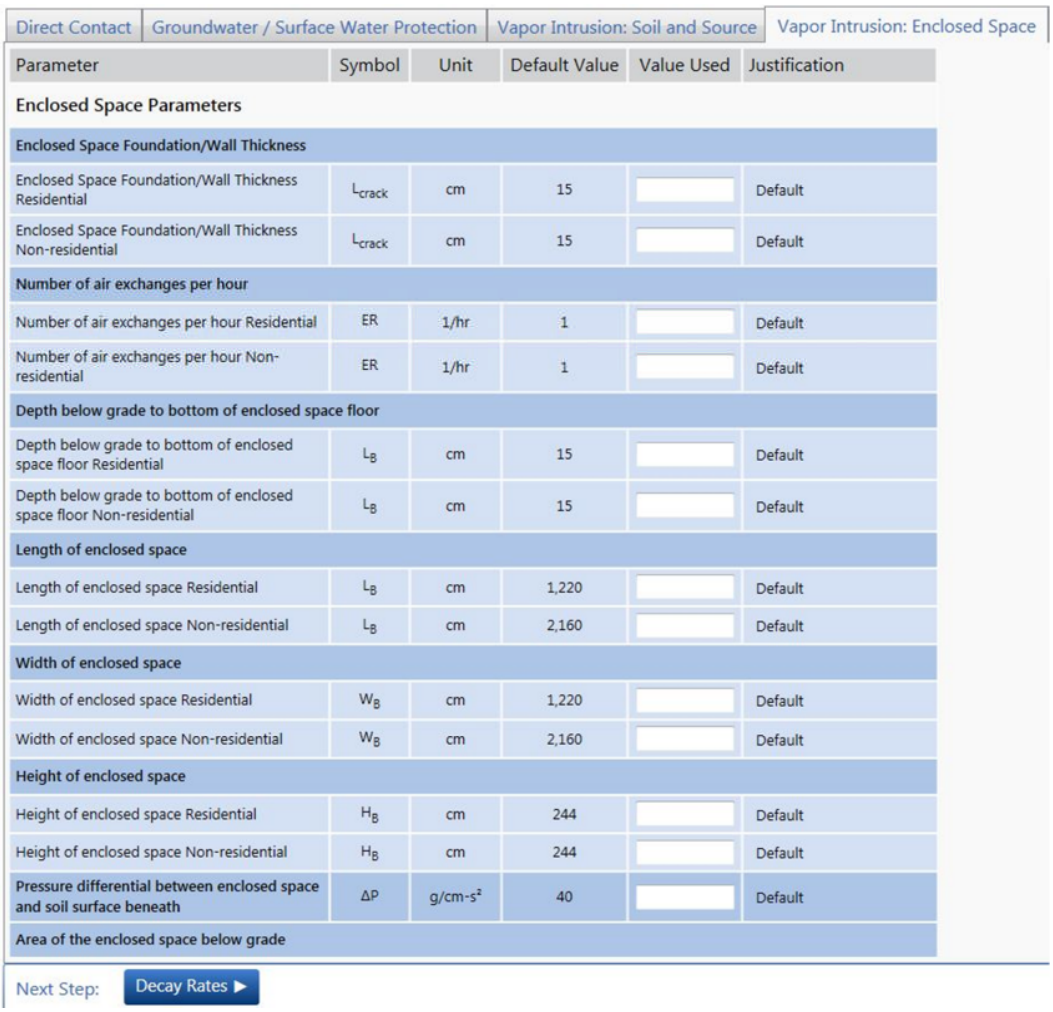


8.5.4 Vapor Intrusion: Enclosed Space

The Vapor Intrusion: Enclosed Space tab contains parameters that describe the structure into which subsurface vapor move. These impact the rate at which vapors intrude and how the structure influences the estimated concentrations found within the structure. The default values for selected parameters on this page are affected by the answer to the interview question relating

to the type of structure, either slab on grade or basement. Structures with crawl spaces with dirt floors are not suitable to be evaluated by this software, and in these instances appropriate DEQ staff should be consulted.

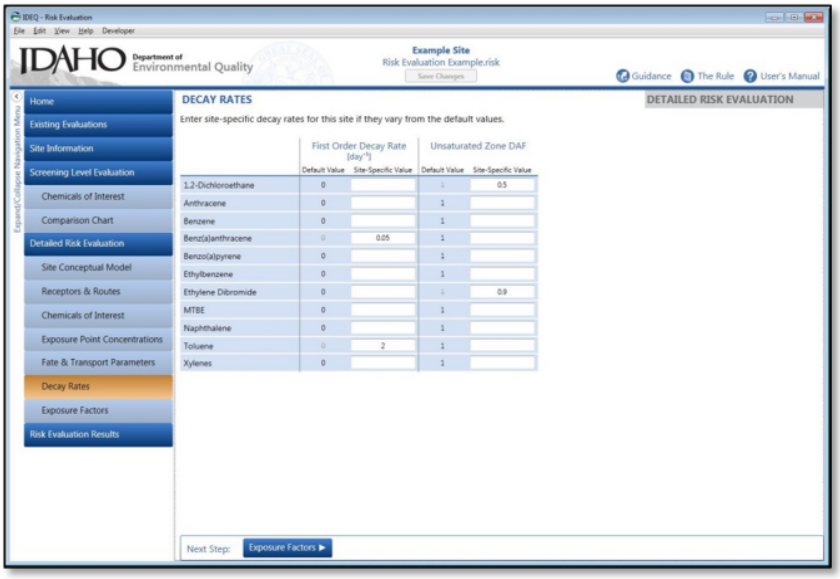
The parameters on this page are divided into two portions: the upper portion (shown in the figure below) provides parameters for which values can be entered by the user and the bottom portion shows the results of internal calculations of other parameter values utilizing the user-entered values.



8.6 Decay Rates

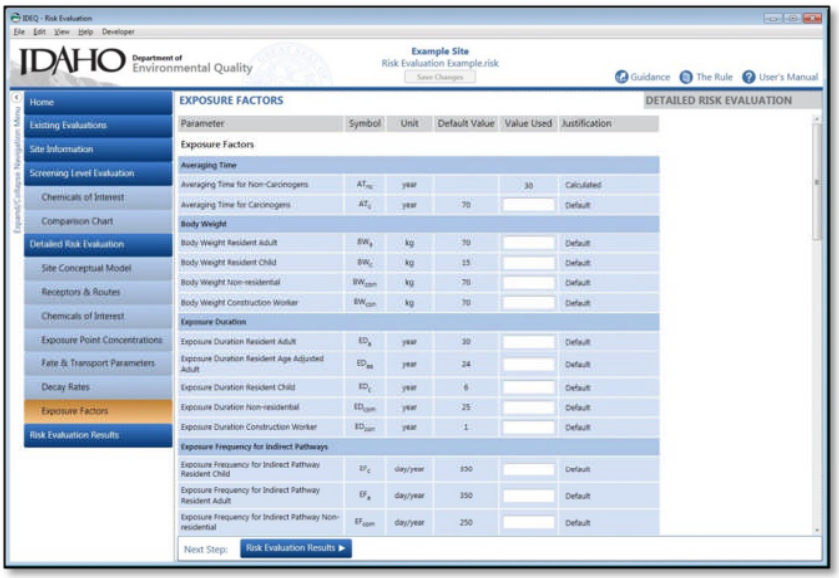
This page allows the user to specify first-order decay rates and unsaturated zone dilution attenuation factors (DAF). By default, the first-order decay rate for all chemicals is set to 0 day^{-1}, and the default unsaturated zone DAF is set to 1 (no attenuation).

The user should enter alternate values only if they can be supported by site-specific data.



8.7 Exposure Factors

Similar to the Fate & Transport Parameters page, this page shows exposure factors required for the risk calculations and allows the user to override the default values when site-specific values are available and appropriate.

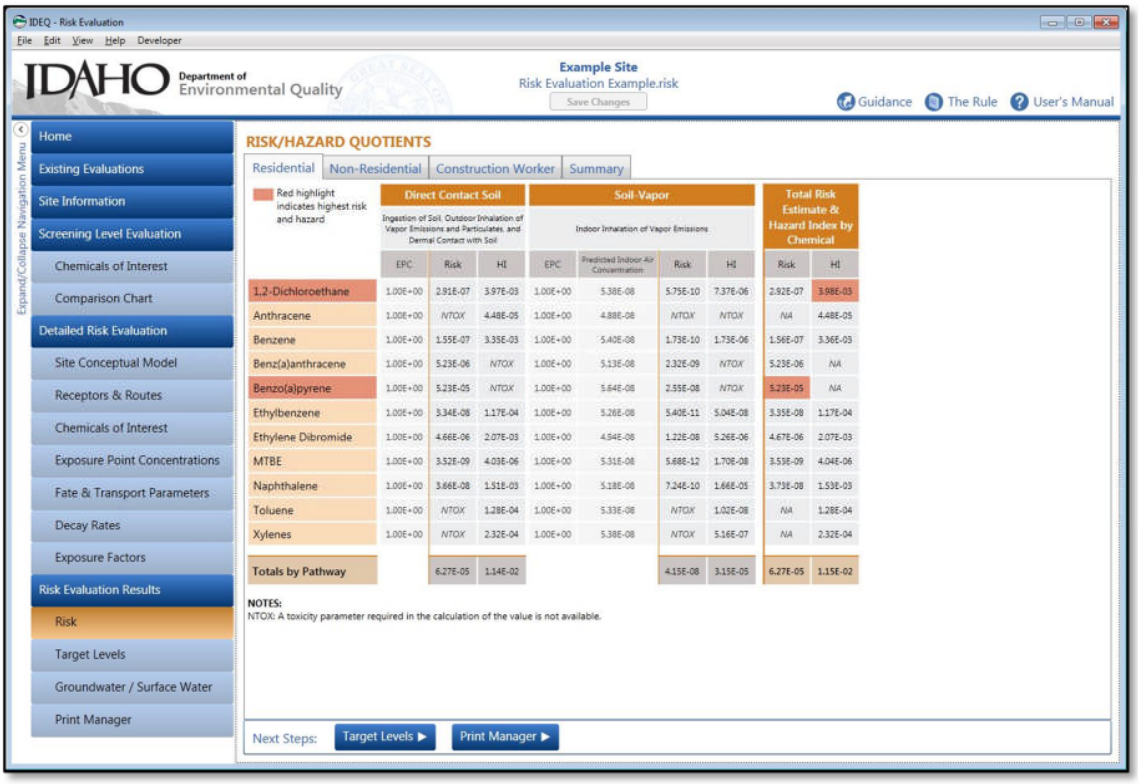


9 Risk Evaluation Results

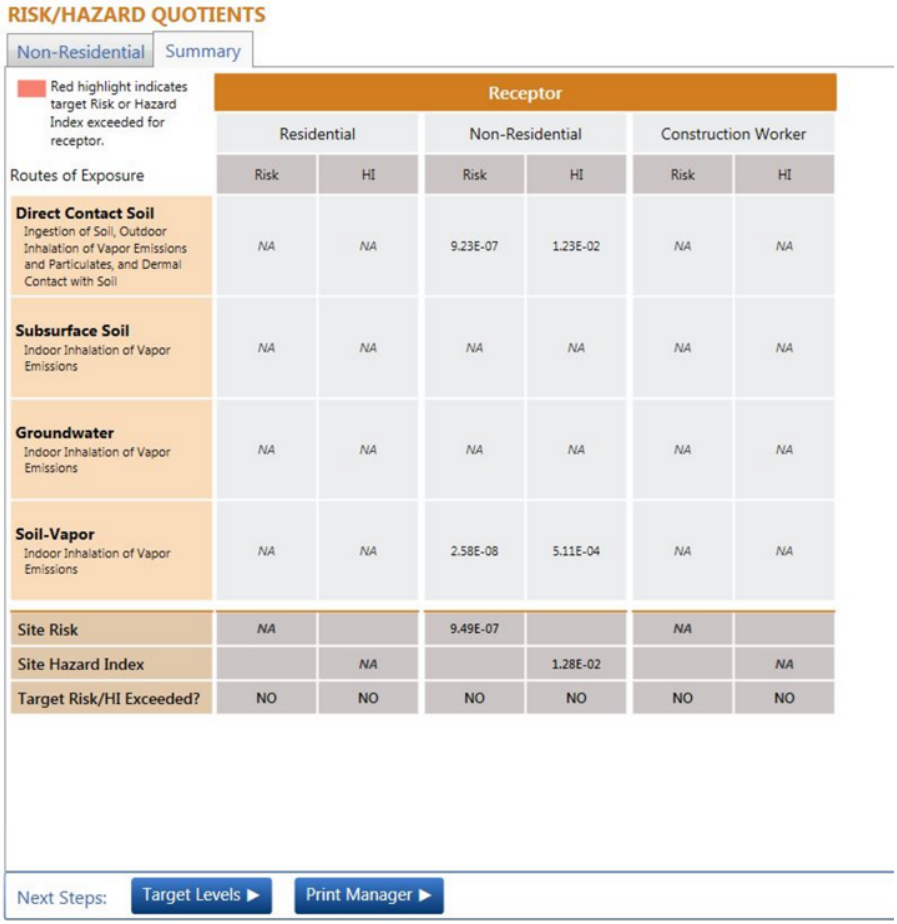
9.1 Risk/Hazard Quotients

At the top is a tab for each receptor. One tab is shown per receptor, provided at least one pathway is marked complete for that receptor on the Receptors & Routes page. Each tab shows all chemicals of interest and a column per complete pathway for that receptor.

- Inputs (EPC and, in the case of soil vapor, predicted indoor air concentration) are separated from outputs (risk and hazard index [HI]) with a thin orange border.
- The total risk and HI for each *pathway* is shown at the bottom of the column.
- The total risk and HI for each *chemical* is shown on the right**.** The highest total risk and HI are both highlighted red, along with their corresponding chemicals.
- The overall total risk and HI for the *receptor* is shown in the bottom right corner.
- If a calculation could not be completed for a particular pathway/chemical combination, a note reference is shown (*italicized*) in place of the result. Each note is explained below the table.



There is an additional Summary tab that indicates the total risk and HI for all receptors. If the overall total risk or HI exceeds the target specified on the Exposure Factors page, the last row will show YES and the entire column will highlight red.



RISK/HAZARD QUOTIENTS

Non-Residential | Summary

Red highlight indicates target Risk or Hazard Index exceeded for receptor.

Routes of Exposure	Receptor					
	Residential		Non-Residential		Construction Worker	
	Risk	HI	Risk	HI	Risk	HI
Direct Contact Soil Ingestion of Soil, Outdoor Inhalation of Vapor Emissions and Particulates, and Dermal Contact with Soil	NA	NA	9.23E-07	1.23E-02	NA	NA
Subsurface Soil Indoor Inhalation of Vapor Emissions	NA	NA	NA	NA	NA	NA
Groundwater Indoor Inhalation of Vapor Emissions	NA	NA	NA	NA	NA	NA
Soil-Vapor Indoor Inhalation of Vapor Emissions	NA	NA	2.58E-08	5.11E-04	NA	NA
Site Risk	NA		9.49E-07		NA	
Site Hazard Index		NA		1.28E-02		NA
Target Risk/HI Exceeded?	NO	NO	NO	NO	NO	NO

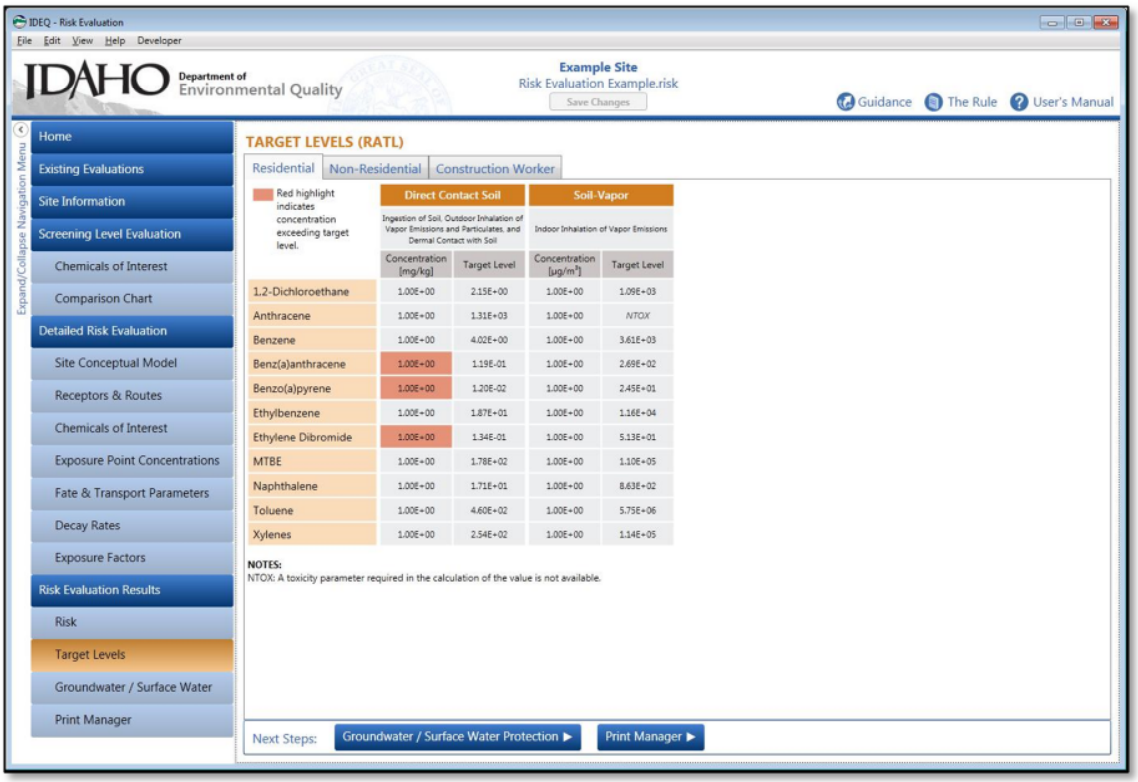
Next Steps: Target Levels ▶ Print Manager ▶

9.2 Target Levels

This page shows the calculated remedial action target levels (RATL) for each complete pathway selected on the Receptors & Routes page. One tab is shown per receptor, provided at least one pathway is marked complete for that receptor on the Receptors & Routes page. Each tab shows all chemicals of interest and a column per complete pathway for that receptor.

For each pathway, the EPC is compared with the calculated RATL. If the EPC exceeds the RATL, it is highlighted red.

If the overall total risk and the overall total HI for a receptor both meet their targets, then RATLs are not required, although the tab for that receptor is still shown for reference. A blue text box showing “RATLs Not Required” will appear at the top of the tab.

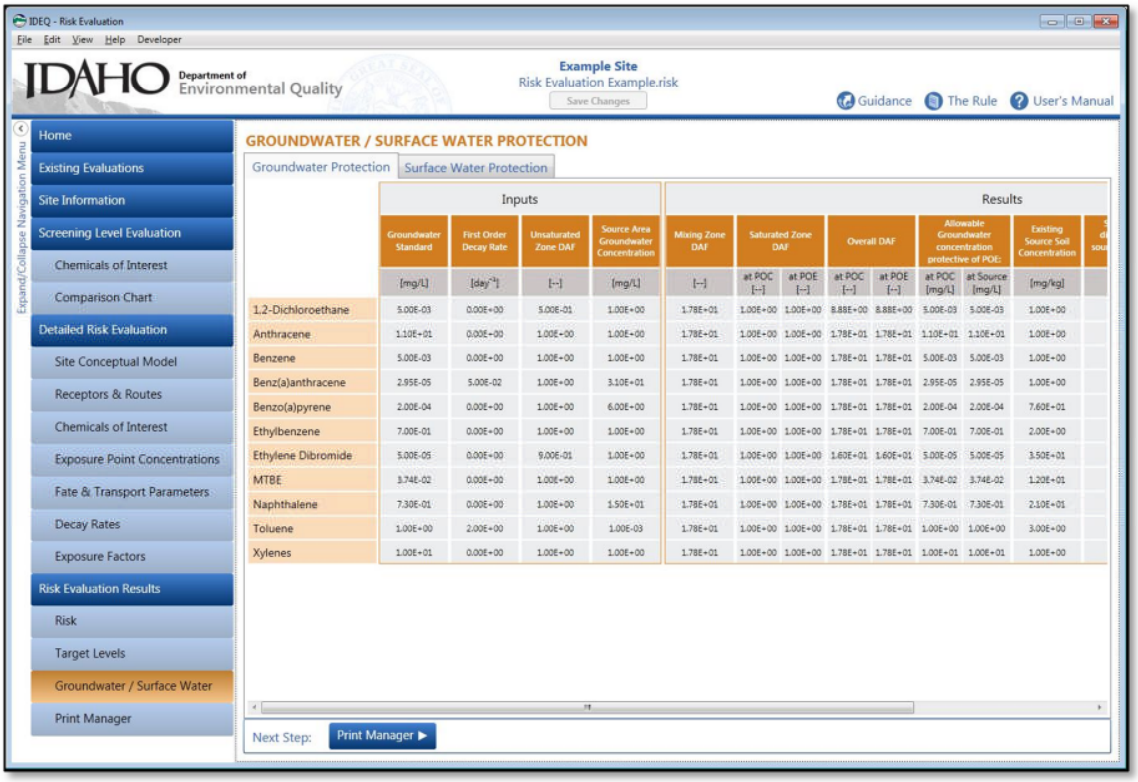


9.3 Groundwater/Surface Water Protection

This page shows inputs and results or calculated values relating to groundwater and surface water protection. At the top is a tab specifically for Groundwater Protection and a tab specifically for Surface Water Protection.

For each page, the arrangement of inputs and results is similar. The chemicals of interest are shown in the far left column. The inputs include the concentrations to be achieved at the point of exposure, groundwater decay rates (when available) and site-specific unsaturated zone attenuation, and the source area groundwater concentrations. Primary results are the Allowable Groundwater Concentrations and Soil Concentration Directly Beneath the Source that is Protective of GW or SW. These calculated target concentrations can be compared to the existing groundwater and soil concentrations in the source area (shown in columns on these sheets).

The two rightmost columns provide the results of predictions of downgradient groundwater concentrations at designated points of compliance or exposure based on input source area concentrations.



9.4 Print Manager

This page allows the user to generate a printable report of individual screens in the REA.

- Check the box next to each section to be included in the report.
- Selecting **All/None** will alternate between selecting and clearing all available report sections.
- Click the **Generate Preview** button to create and review the report. **Note**: the entire report may take several seconds to complete.
- The preview will display to the right. The zoom and page layout buttons at the top of the previewer may help when reviewing the document. These do not affect the appearance of the printed report.
- Click the **Print** icon at the top left of the previewer to print the report.
- If a site figure has been attached as a PDF, a placeholder will appear on the Site Information page with the text "See Attached Site Figure," and a notice will appear below the Generate Preview button. Click **Download Site Figure** to save and open the attached site figure separately.