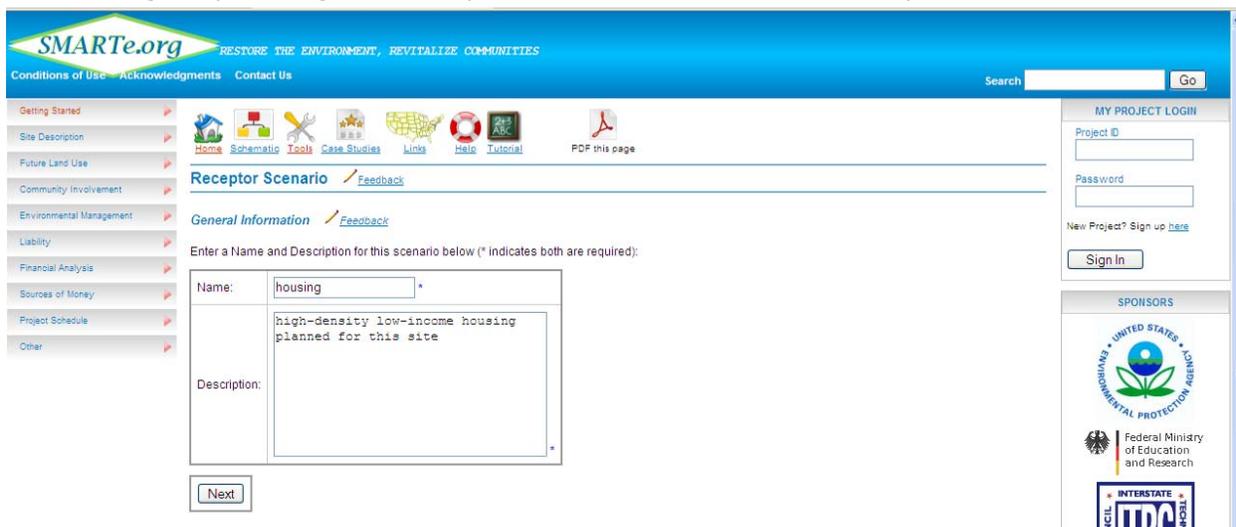




Human Health Risk Assessment Calculator

The SMARTe human health risk assessment calculator can be accessed either via the tools menu, via the Environmental Management section, or via My Projects within SMARTe. The tool is introduced with this caution: “It is recommended that this tool should be used by a qualified human health risk assessor from your project team.”

The user begins by creating a new receptor scenario with a name and description.



The screenshot shows the SMARTe.org website interface. The main navigation menu includes: Getting Started, Site Description, Future Land Use, Community Involvement, Environmental Management, Liability, Financial Analysis, Sources of Money, Project Schedule, and Other. The current page is titled "Receptor Scenario" and contains the following form:

Enter a Name and Description for this scenario below (* indicates both are required):

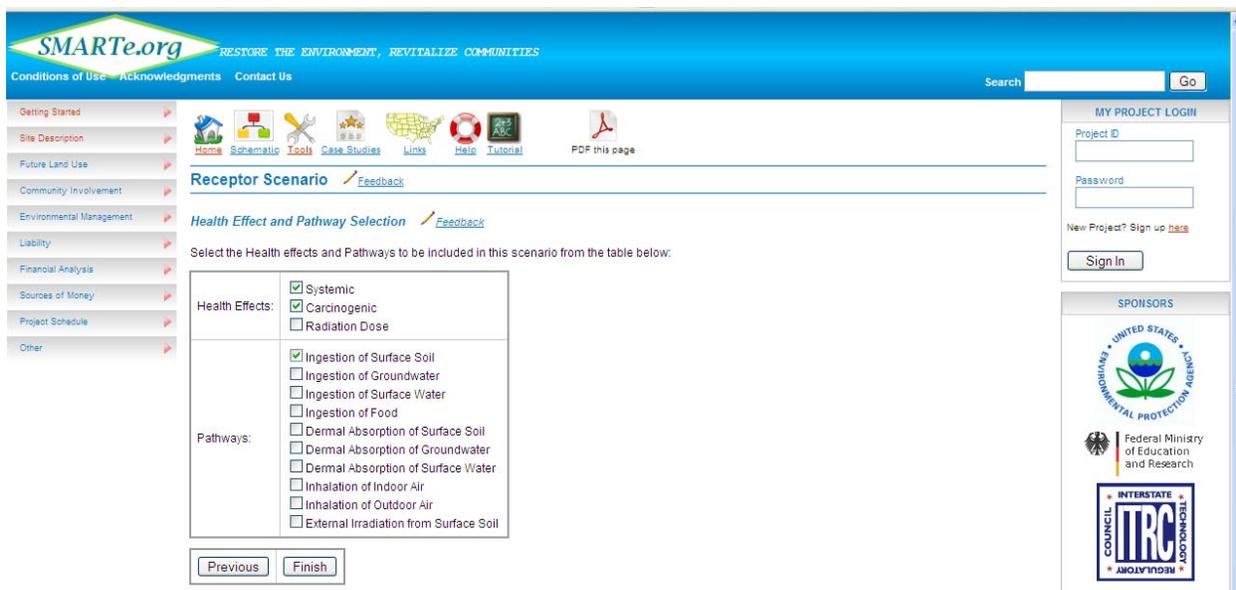
Name:

Description:

Next

On the right side, there is a "MY PROJECT LOGIN" section with fields for Project ID and Password, and a "Sign In" button. Below that is a "SPONSORS" section with logos for the Environmental Protection Agency, Federal Ministry of Education and Research, and the Interstate Technology and Regulatory Council (ITRC).

Health effects and pathways are then selected for this scenario:



The screenshot shows the SMARTe.org website interface. The main navigation menu is the same as in the previous screenshot. The current page is titled "Health Effect and Pathway Selection" and contains the following form:

Select the Health effects and Pathways to be included in this scenario from the table below:

Health Effects:	<input checked="" type="checkbox"/> Systemic <input checked="" type="checkbox"/> Carcinogenic <input type="checkbox"/> Radiation Dose
Pathways:	<input checked="" type="checkbox"/> Ingestion of Surface Soil <input type="checkbox"/> Ingestion of Groundwater <input type="checkbox"/> Ingestion of Surface Water <input type="checkbox"/> Ingestion of Food <input type="checkbox"/> Dermal Absorption of Surface Soil <input type="checkbox"/> Dermal Absorption of Groundwater <input type="checkbox"/> Dermal Absorption of Surface Water <input type="checkbox"/> Inhalation of Indoor Air <input type="checkbox"/> Inhalation of Outdoor Air <input type="checkbox"/> External Irradiation from Surface Soil

Previous Finish

On the right side, there is a "MY PROJECT LOGIN" section with fields for Project ID and Password, and a "Sign In" button. Below that is a "SPONSORS" section with logos for the Environmental Protection Agency, Federal Ministry of Education and Research, and the Interstate Technology and Regulatory Council (ITRC).

The user then has the option of accepting default exposure parameters, or changing them to fit their particular scenario:

The above inputs may be entered as constants or as distributions if the user has an understanding of the uncertainty associated with their inputs. Distributional inputs allow SMARTe to perform a probabilistic risk assessment. A “tip” for entering distributional inputs is available by clicking on the lifesaver next to “Exposure Parameters” or next to the name of any pathway.

Probabilistic Inputs [Feedback](#)

A probability distribution can be specified in place of a single value for any of the concentrations, exposure parameters, or risk parameters. The currently implemented distributions are as follows:

Distribution Name	Input Notation	Parameter Explanation
Normal (Gaussian)	$N(\mu, \sigma)$	μ = mean, σ = standard deviation
Lognormal	$LN(\mu, \sigma)$	μ = geometric mean, σ = geometric standard deviation
Gamma	$G(\alpha, \beta)$	α = shape parameter, β = scale parameter, mean = $\alpha\beta$
Uniform	$U(a, b)$	a = minimum value, b = maximum value
Beta	$B(\alpha, \beta)$	α, β = shape parameters, mean = $\alpha / (\alpha + \beta)$
Beta (General)	$B(\alpha, \beta, a, b)$	α, β = shape parameters, a = minimum value, b = maximum value

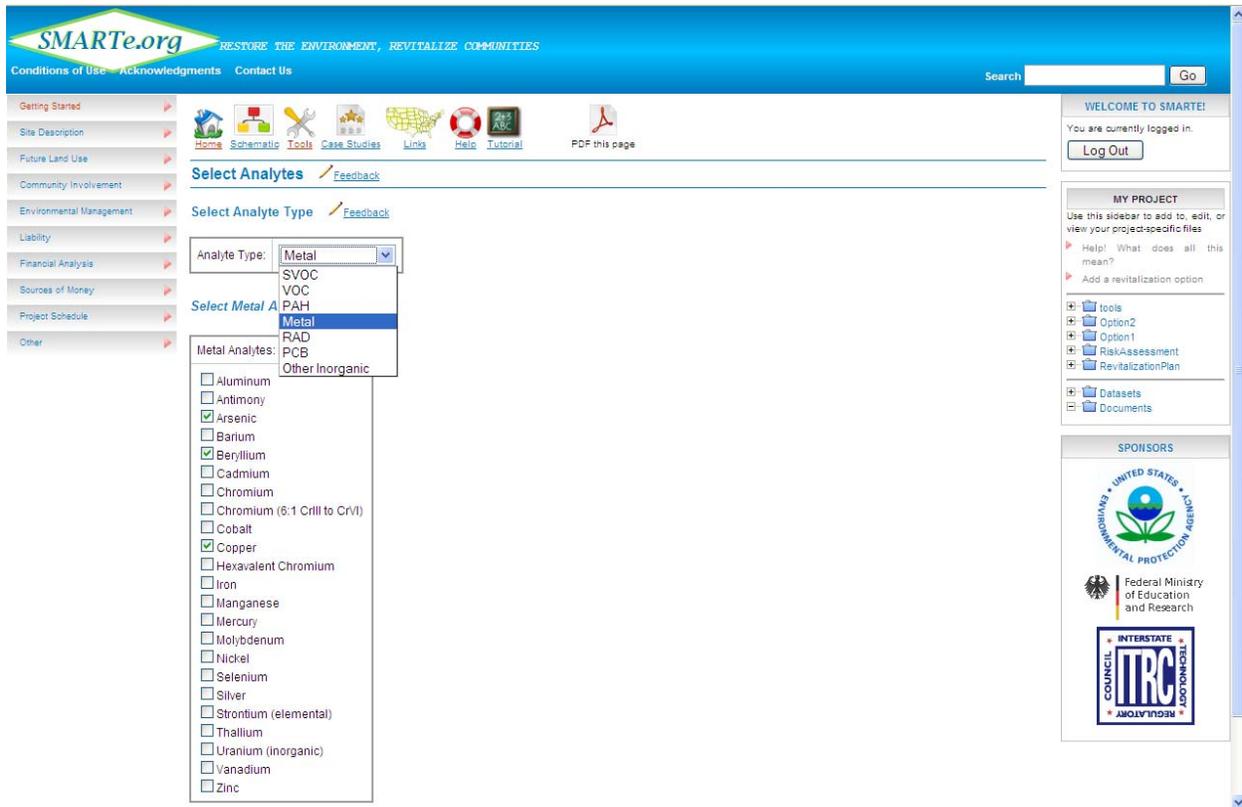
All probabilistic values are generated only once. That is, for parameters that are utilized for more than one analyte-pathway combination (such as exposure and risk parameters), these parameters are not re-randomized for each, to ensure consistency when summing probabilistic quantities.

All probabilistic values are drawn independently of one another.

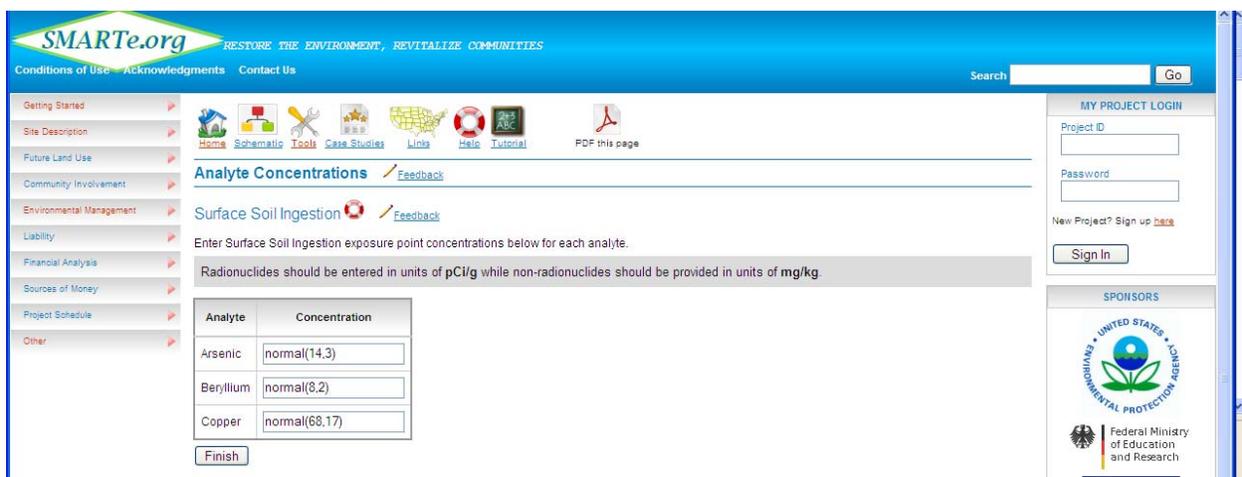
Note: The assumption of independence may lead to strange results in some cases. For example, if body weight and body surface area are drawn independently, it will be common to generate a receptor with a high body weight and small surface area and vice-versa. Correlations for certain parameters will be implemented in future versions.

Note: There is also some concern in randomizing exposure point concentrations for different pathways when the source term is the same. For example, suppose that the concentration of silver in soil is uncertain, and that one is interested both in soil ingestion and dermal ingestion of soil. The exposure point concentration for silver can be specified probabilistically for each pathway, but each will be drawn independently, which may be undesirable if the true uncertainty lies in the source concentration rather than in the fate and transport of the source.

For this risk scenario, the user then identifies the analytes to be included from pull-down menus. There are lists of analytes grouped by analyte type, including VOCs, SVOCs, PAHs, Metals, Radionuclides, PCBs, and Other Inorganics:



For each pathway, a concentration must be entered for each analyte. These concentrations may be entered as constants or as distributions if the user has an understanding of the uncertainty associated with their estimate of the concentration.



When the risk calculator is run, results for each scenario are presented by potential health effects (i.e., systemic or carcinogenic). A sample results screen is shown below for a simple example with distributional inputs. This screen shows the systemic risk to an adult for this scenario.

The screenshot shows the SMARTe.org website interface. The main content area displays the 'Risk Assessment Summary' for 'Systemic Risk - Adult'. The page includes a navigation menu on the left, a search bar at the top right, and a 'MY PROJECT LOGIN' section on the right. The central data is presented in two tables: 'Mean Systemic Risk in Adult' and '95th Percentile for Systemic Risk in Adult'.

Analyte	Ingestion of Surface Soil	Analyte Total
Arsenic	0.1595	0.1595
Beryllium	9.469e-05	9.469e-05
Copper	0.005893	0.005893
Metal	0.1655	0.1655
Path Total	0.1655	0.1655

Analyte	Ingestion of Surface Soil	Analyte Total
Arsenic	0.2149	0.2149
Beryllium	0.0001359	0.0001359
Copper	0.00834	0.00834
Metal	0.2213	0.2213
Path Total	0.2213	0.2213

This screen show carcinogenic risks for this scenario.

The screenshot shows the SMARTe.org website interface. The main content area displays the 'Risk Assessment Summary' for 'Carcinogenic Risk'. The page includes a navigation menu on the left, a search bar at the top right, and a 'MY PROJECT LOGIN' section on the right. The central data is presented in two tables: 'Mean Carcinogenic Risk' and '95th Percentile for Carcinogenic Risk'.

Analyte	Ingestion of Surface Soil	Analyte Total
Arsenic	2.899e-05	2.899e-05
Beryllium	0	0
Copper	0	0
Metal	2.899e-05	2.899e-05
Path Total	2.899e-05	2.899e-05

Analyte	Ingestion of Surface Soil	Analyte Total
Arsenic	3.904e-05	3.904e-05
Beryllium	0	0
Copper	0	0
Metal	3.904e-05	3.904e-05
Path Total	3.904e-05	3.904e-05

Interpretation of the results is left to the user, thus the caution that this tool be used by someone with experience in human health risk assessments.