

Chapter 24: Callibrating the Ecological Risk Model

Ecological Benchmarks

Ecological benchmarks are a central component in an ecological risk evaluation. Benchmarks are environmental effects concentrations derived from toxicity testing, extrapolated from other benchmarks, or from simulations of an assessment endpoint. SADA provides a number of benchmarks for surface water, sediment, soil, and biota (tissue concentrations). SADA developers have made a point of not independently deriving benchmarks, so benchmarks in the SADA database are all from published sources. Sources and citations are described in more detail in the SADA help file. For surface water, the SADA ecological benchmark database includes:

- acute and chronic National Ambient Water Quality Criteria,
- Great Lakes Tier II secondary acute and chronic values,
- criteria from three EPA regions (4, 5, and 6),
- Canadian water quality guidelines,
- and Lowest chronic values, EC20s, and population EC25s from Suter and Tsao (1996).

Sediment values include no effects concentrations, threshold effects concentrations, and probable effects concentrations from sources such as:

- EPA's Great Lakes Assessment and Remediation of Contaminated Sediment program,
- Canadian sediment quality guidelines,
- consensus-based values (MacDonald et al. 2000),
- EPA region 4, 5, and 6 values,
- Florida Department of Environmental Protection,
- the National Oceanic and Atmospheric Administration,
- Ontario Ministry of the Environment,
- and Washington state.

Fewer benchmarks are available for soil, but the database includes values from:

- EPA's ecological soil screening level program,
- screening levels from EPA regions 4, 5, and 6,
- invertebrate, microbe, and plant values from Oak Ridge National Laboratory,
- and Dutch target and intervention levels.

While the benchmark database includes 424 chemicals, it is important to realize that not all sources have values for every chemical in the database.

Some benchmarks (i.e., certain metals in surface water) are a function of environmental variables. SADA allows the user to enter site-specific pH, water hardness, and fraction of organic carbon and, where appropriate, calculates benchmark values associated with site-specific environmental variables.

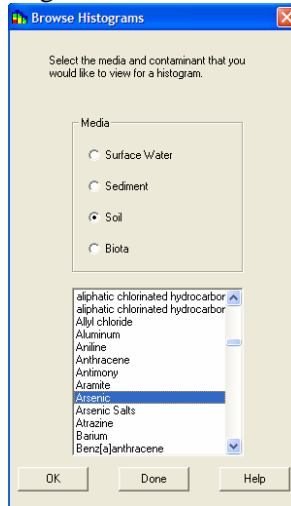
Browsing Ecological Benchmarks – Benchmark Histograms

You can view benchmark values in the database in a couple of ways. One is as a histogram showing values from all benchmark sources for the selected contaminant and media type. You can browse values from any SADA file or from a master benchmark file.

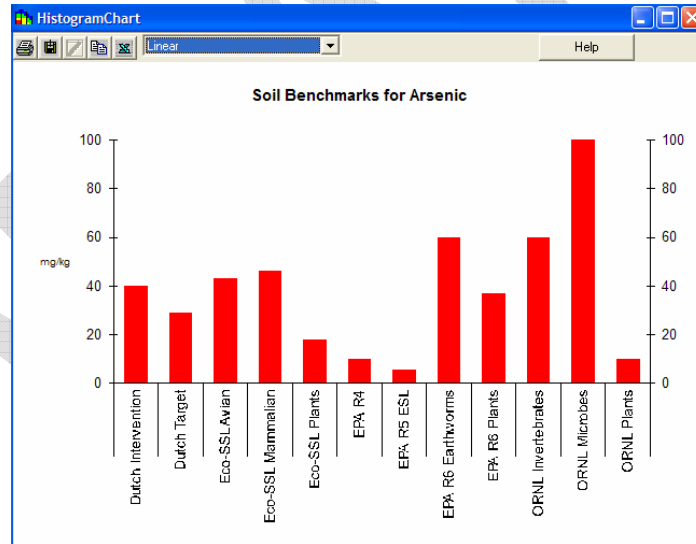
If you do not already have EcologicalRisk.sda open open it now in SADA. This file was created in the previous chapter. Select Ecological from the Analysis list, then go to the Ecological

dropdown menu and click on **Browse→Benchmark Histogram from...** Find and select the benchmark source database you want to view, then click **Open**.

SADA responds with the **Browse Histogram** window.



Here you select the data type (media) and data set (i.e., arsenic) for which you want to see the benchmark histogram, then select **OK**. SADA then displays a histogram of available benchmarks for the selected media and contaminant.



You can also view a histogram of benchmarks simply by choosing a data type and data set, then selecting **Benchmark Histogram** from the **Ecological** dropdown menu. The difference is that **Benchmark Histogram** views benchmarks currently loaded in your **.SDA** file for contaminants that exist in your data set while the **Browse Histogram From ...** option allows you to view benchmarks from other **.SDA** files or from a master benchmark database not included in your **.SDA** file as well as choosing contaminants that are not in your data set.

Hint: If a source appears on the histogram but appears to have no value, try selecting a log scale representation from the dropdown menu on the histogram window instead of the default linear plot.

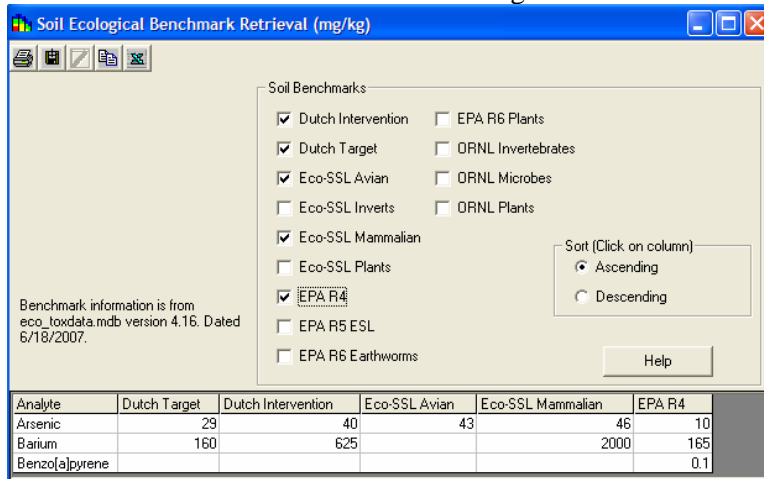
Browsing Ecological Benchmarks – Benchmark Tables

Another way to view benchmark values is in tabular form. This works the same way as for benchmark histograms. You can browse the benchmarks you’ve linked with your .SDA file, benchmarks from another .SDA file, or benchmarks from a master database external to SADA.

Select Ecological from the Analysis list, then go to the Ecological dropdown menu and click on Browse→Benchmark Table From.... Find and select the benchmark source database you want to view, then click Open.

SADA responds with the Browse Tables window that looks very much like the Browse Histograms window. Select the media and contaminant(s) for which you want to see a tabular display of benchmarks. Note that you can select multiple contaminants by holding the control (CTRL) key while you click on contaminant names. When you’ve selected the media and contaminant(s) you want, click OK.

Whereas the Benchmark Histogram option displayed values for all sources for a single contaminant at this stage, for a tabular display you have to select which benchmark sources you want to view. Select them by clicking in the appropriate box, and SADA will display the corresponding benchmark values in table form in the Ecological Benchmark Retrieval window.



You can print the table, save it to a file, copy and paste it, or export it to Excel using the buttons in the upper left corner of the window.

As with benchmark histograms, there is a shortcut for viewing a benchmark table for the analytes in your .SDA file. Simply select a media type, an individual contaminant (or pooled if you want to see benchmarks for all analytes in your file), and then Benchmark Table from the Ecological dropdown menu. Next, select the benchmarks to be viewed from the Ecological Benchmark Retrieval window. Using this route also gives you the option of specifying a statistic (i.e., mean, UCL95, max detect) to be displayed for the analyte(s) of interest. This is useful when trying to get a feel for where your data fall relative to available benchmarks.

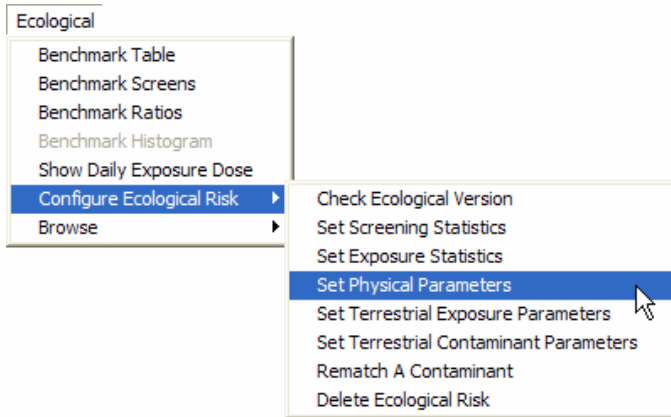
Note: Screening benchmarks are meant to be conservative, so one approach is to use the most conservative value available for a given contaminant. It is inappropriate to browse the available benchmarks looking for the least conservative. For the purposes of conducting an assessment, the best approach is to discuss available benchmark sources with risk assessment staff from involved

regulatory agencies and other stakeholders to determine a preferred source, then agree on a process to identify screening values for contaminants lacking values in the preferred source.

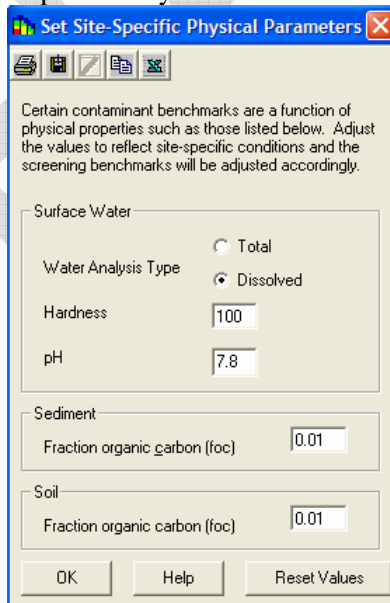
Setting Physical Parameters

As noted previously, some benchmarks are functions of environmental variables (water hardness or pH for surface water, fraction organic carbon for soil and sediment). Defaults are set at 100 mg CaCO₃/L for hardness, 7.8 for pH, and 1% for fraction organic carbon. SADA allows you to use site-specific values for these variables and will recalculate benchmarks, where appropriate.

To set physical parameters, from the Ecological dropdown menu select Configure Ecological Risk→Set Physical Parameters.



SADA responds with the Set Site-specific Physical Parameters window.



Enter site-specific values and click OK. The values are now set and will be used when viewing benchmarks and when conducting functions that use benchmarks in risk calculations.

Note that for surface water there is also the option of expressing concentrations as Total or Dissolved. EPA has Total to Dissolved conversion factors for some metals, and for these,

benchmarks will be recalculated depending on whether Total or Dissolved is selected. Values of analytes without conversion factors will not be changed.

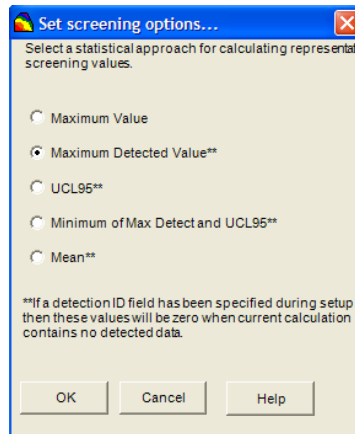
Values can be reset to the defaults by clicking the Reset Values button.

Setting Exposure Statistics

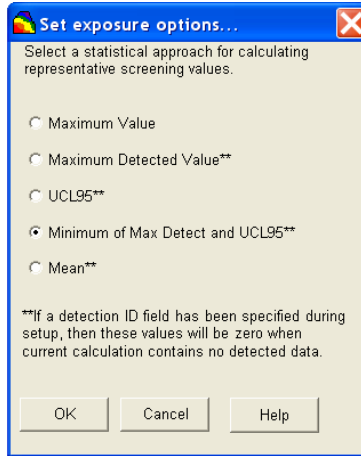
To conduct the benchmark screening, you need to select a contaminant(s), select a screening statistic (usually the maximum detected concentration), and a benchmark(s).

The simplest screen is a pass/fail comparison of the maximum concentration against a conservative screening benchmark. SADA allows you to specify the screening statistic (default is maximum detected value) and choose a single benchmark source.

To conduct a benchmark screen for a given media and contaminant(s) combination, first check the screening statistic to be sure it is what you want. Select Set Screening Statistics from the Ecological → Configure Ecological Risk menu. At the Set Screening Options window, confirm that your desired statistic is selected, then click OK.



Similarly for the calculation of benchmark ratios you will need to specify the representative exposure statistic. The default exposure statistic is the lower of the maximum detect and the UCL95. If computing ratios for screening purposes, be sure to change the exposure statistic (not the screening statistic) to that you want used for the ratio screen. To change the exposure statistic, select **Ecological → Configure Ecological Risk → Set Exposure Statistics**.



By convention if no data are detected for a given contaminant, the representative concentration for the purposes of screening will be zero for all choices but maximum value.

Save your EcologicalRisk.sda file. If you are continuing to the next chapter, keep it open. Otherwise you may close it.