SADA Version 2.3
Training Guide

University of Tennessee

2002

SADA™

Spatial Analysis and Decision Assistance

SADA Version 2 Overview

Free stand alone package for Windows 95, 98, 98SE, NTSP4 or higher, 2000, and ME.

Contact information, updates, documentation, and downloads are available on-line at http://www.tiem.utk.edu/~sada/

Works with layers from most major GIS products such as ArcInfo, MapInfo, etc.

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What's New In Version 2.0

Ecological Risk Assessment

Custom Analysis

Natural Neighbor Interpolation

Judgmental Sample Design

Improved 3D viewer: Better Speed and Isoclines

Data Editing, Adding Contaminants

Export To Excel

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Goals of Training

- Know how to "get around" in SADA.
  - How is the interface organized?
  - What are all those buttons for?
  - How do I switch between contaminants?
  - Learn about auto-documentation
  - Why are some things disabled at times and available at other times?
  - How do I get information out of SADA?
- Be able to import data into a SADA file.
- Be able to perform a geospatial analysis.
- Use the decision analysis and cost benefit frameworks.
- Understand and use the sample design strategies.
- Setup human health, ecological, and custom analysis.
- Integrate human health, ecological, and custom analysis with geospatial analysis, decision frameworks, and sample design.

Achieving the Goals

We'll divide the training session into two sections:

Section 1

Proceed through SADA from front to back with an example data set. At each major point we'll provide some background information, show you how to use the tool, and then give you a chance to check it out for yourself.

Section 2

Provide a second example data set for you to step through from scratch.

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Part 1: The Basics

Basic Familiarity with SADA and SADA Files (.sda)

Importing Data into SADA

Switching Contaminants and Media Types

Importing GIS Layers

Zooming, Shifting, Formatting

Creating Polygons and Space Definitions

Creating new Legend Types

Using The Contaminant Manager

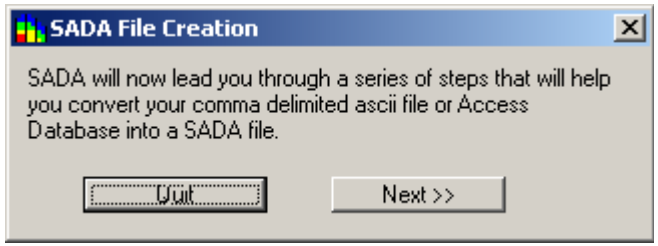
Getting Information

Creating and Using an Auto-Documentation Report

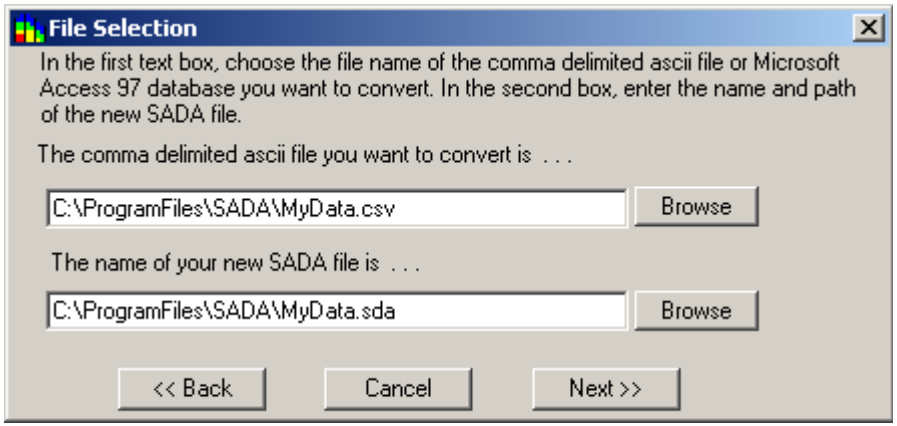
Importing Data Into SADA

The creation sequence accepts a valid comma delimited ascii text file or a Microsoft Access Office file containing appropriate sampling information and subsequently establishes a SADA file.

To begin the creation sequence, open SADA, select File, and from the menu bar choose New. The following window will appear.



Press Next >> to continue. At this point, enter the name of the comma-delimited ascii file or Access database that contains your data into the first textbox or press the Browse button. Then enter the name of your new SADA file. SADA will convert your data file into this new SADA file. Note: the external file itself is not affected by the conversion process.



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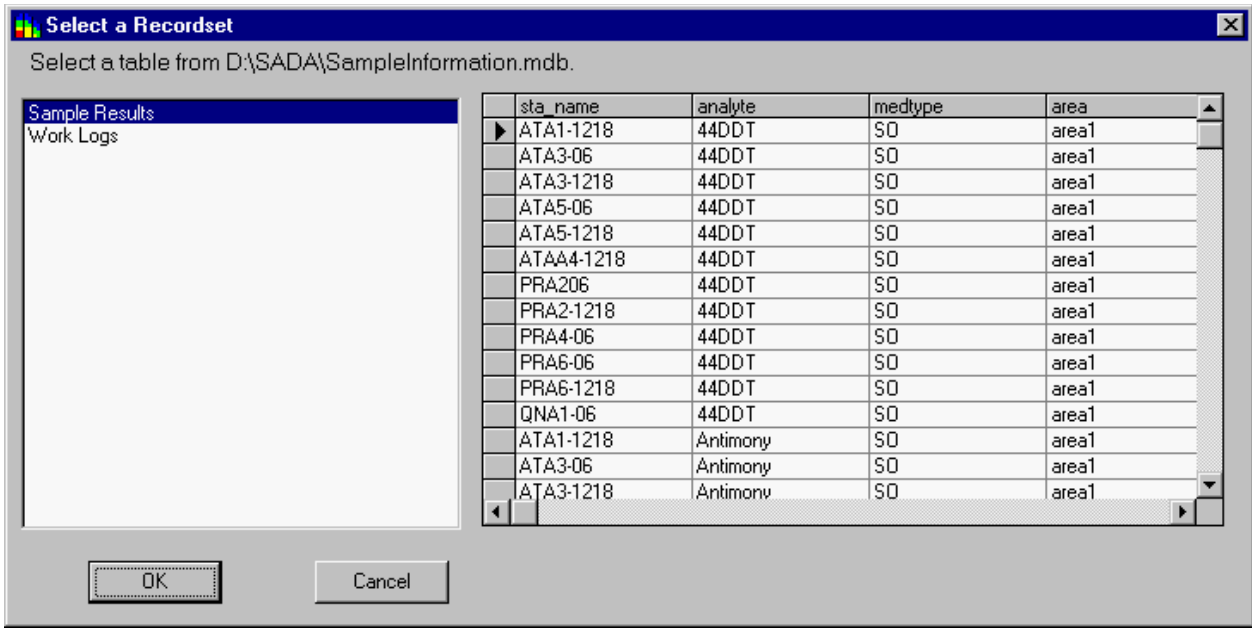
Importing Data Into SADA

If your input file is an Access database, the following window will appear.



The pane on the left shows all the available tables in your database. Select the appropriate table and press OK.

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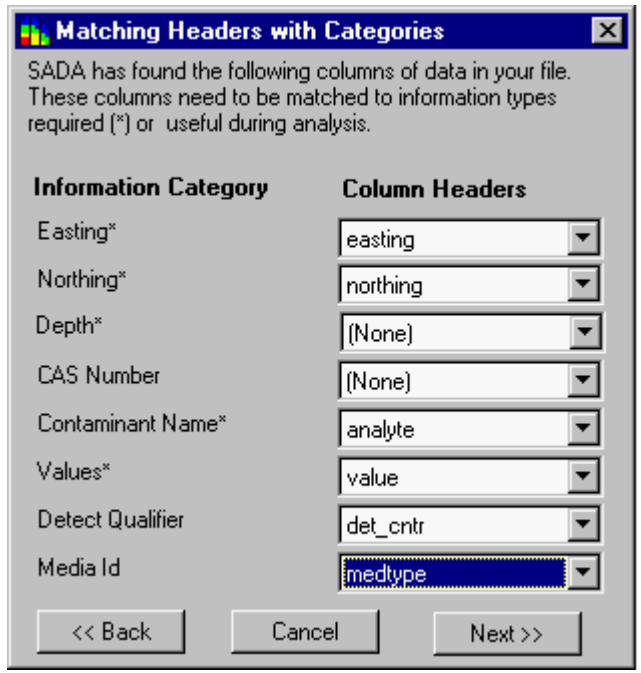
Importing Data Into SADA

The next step in the process is to identify the columns of information in the ascii data file and match these columns of information to information categories that are required or may be useful in SADA. SADA scans the text file for column headers and applies default matches to these information categories. The results are shown in the Matching Headers with Categories window. If a column is mismatched with an information category type, then you can select a new column header by pressing the down arrows and highlighting the new column header.

Required information categories are followed by an (*) and must be assigned to a column in the ascii data file. A category is not assigned if the (none) option is selected in the drop down box. The Depth category is required only when data exist at varying depths. If the Detect Qualifier is not assigned, the data are assumed to be all detects.

If Media ID, which denotes the type of media the contaminants are sampled in (e.g. soil or groundwater) is not defined, then the human health risk and/or ecological risk modules cannot be setup later. The media is a critical information category to the risk modules. Also, SADA expects certain units for measured values in the risk modules.

After the columns have been set, press Next>>. SADA begins the conversion process and presents the data as it will be imported into the Data Editor.

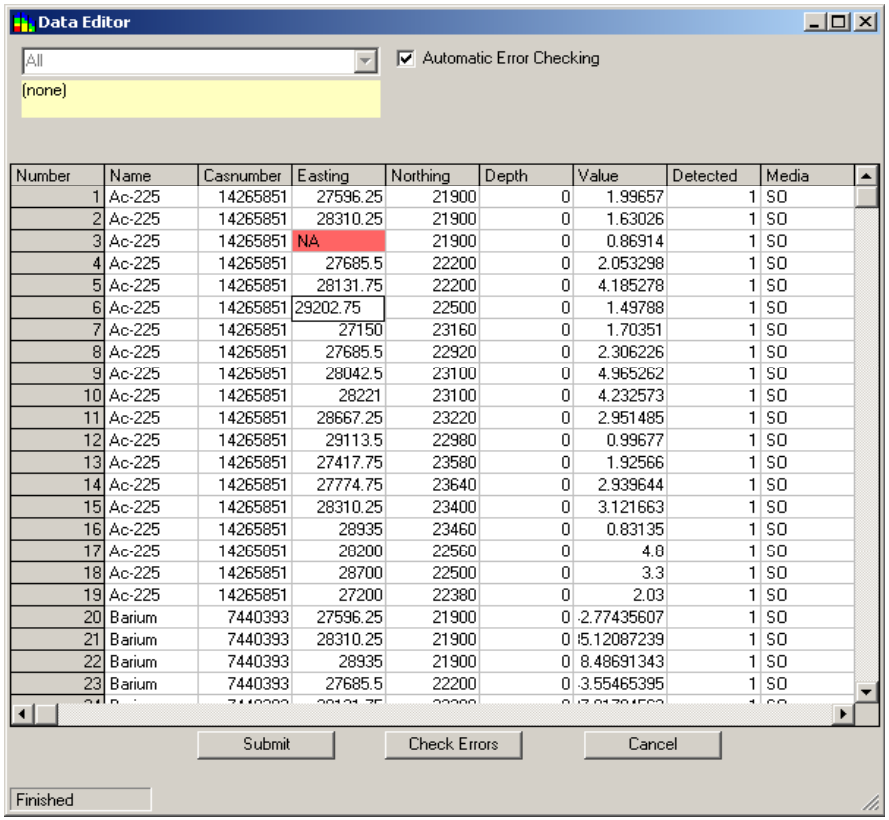


Importing Data Into SADA

The Data Editor is a simple spreadsheet that shows how SADA views the data as it's being imported. It provides the user a chance to identify errors in the data set and correct them during the import process. At this point, the Data Editor is very simple in functionality and is designed to correct minor errors in the data. If for some reason the data import appears to be largely different than the user intended, the exact cause should be identified outside of SADA and the setup repeated.

SADA highlights cells with red if they contain an unacceptable value for SADA. In the following example, the easting column contains a value of NA. Since SADA requires numerical values for every easting entry, the cell is now red. To determine the exact error, place the mouse over the red cell and the yellow text box near the top explains the problem with the entry.

Once the spreadsheet contains no red cells, the process may continue. Near the top is a checkbox called Automatic Error Checking. It is recommended that this box remain checked. When unchecked, SADA is no longer looking for mistakes as you type. Under these conditions, you must press the Check Errors button at the bottom of the page to run the check. It may be preferable to uncheck the Automatic Error Checking box and use Check Errors later when the user is entering or pasting large amounts of data and does not wish the process to be slowed by SADA checking values as they are entered. However, generally during the import process it should remain checked.

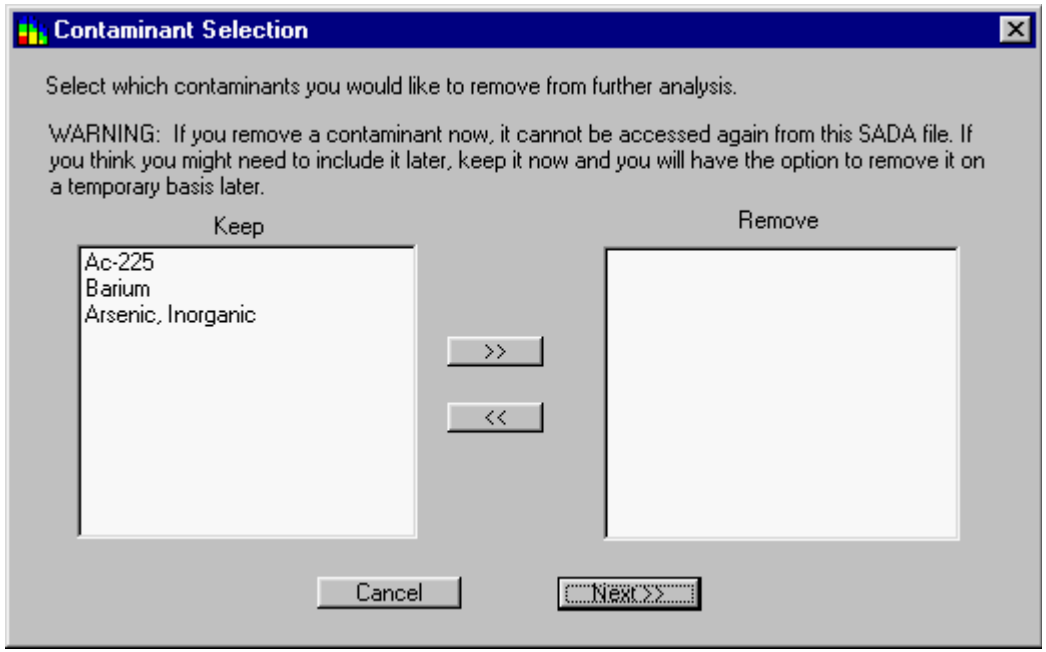


Number	Name	Casnumber	Easting	Northing	Depth	Value	Detected	Media
1	Ac-225	14265851	27596.25	21900	0	1.99657	1	SO
2	Ac-225	14265851	28310.25	21900	0	1.63026	1	SO
3	Ac-225	14265851	NA	21900	0	0.86914	1	SO
4	Ac-225	14265851	27685.5	22200	0	2.053298	1	SO
5	Ac-225	14265851	28131.75	22200	0	4.185278	1	SO
6	Ac-225	14265851	29202.75	22500	0	1.49788	1	SO
7	Ac-225	14265851	27150	23160	0	1.70351	1	SO
8	Ac-225	14265851	27685.5	22920	0	2.306226	1	SO
9	Ac-225	14265851	28042.5	23100	0	4.965262	1	SO
10	Ac-225	14265851	28221	23100	0	4.232573	1	SO
11	Ac-225	14265851	28667.25	23220	0	2.951485	1	SO
12	Ac-225	14265851	29113.5	22980	0	0.99677	1	SO
13	Ac-225	14265851	27417.75	23580	0	1.92566	1	SO
14	Ac-225	14265851	27774.75	23640	0	2.939644	1	SO
15	Ac-225	14265851	28310.25	23400	0	3.121663	1	SO
16	Ac-225	14265851	28935	23460	0	0.83135	1	SO
17	Ac-225	14265851	28200	22560	0	4.8	1	SO
18	Ac-225	14265851	28700	22500	0	3.3	1	SO
19	Ac-225	14265851	27200	22380	0	2.03	1	SO
20	Barium	7440393	27596.25	21900	0	-2.77435607	1	SO
21	Barium	7440393	28310.25	21900	0	5.12087239	1	SO
22	Barium	7440393	28935	21900	0	8.48691343	1	SO
23	Barium	7440393	27685.5	22200	0	-3.55465395	1	SO

Importing Data Into SADA

After scanning in the contaminants, SADA allows you to exclude those you do not wish to consider further.

Note: The purpose of the exclusion is to reduce system requirements and file size. This exclusion is permanent and cannot be reversed. If there is a possibility of needing the contaminant later, include it now. You will be able to include or exclude contaminants later during the analysis with the Contaminant Manager.

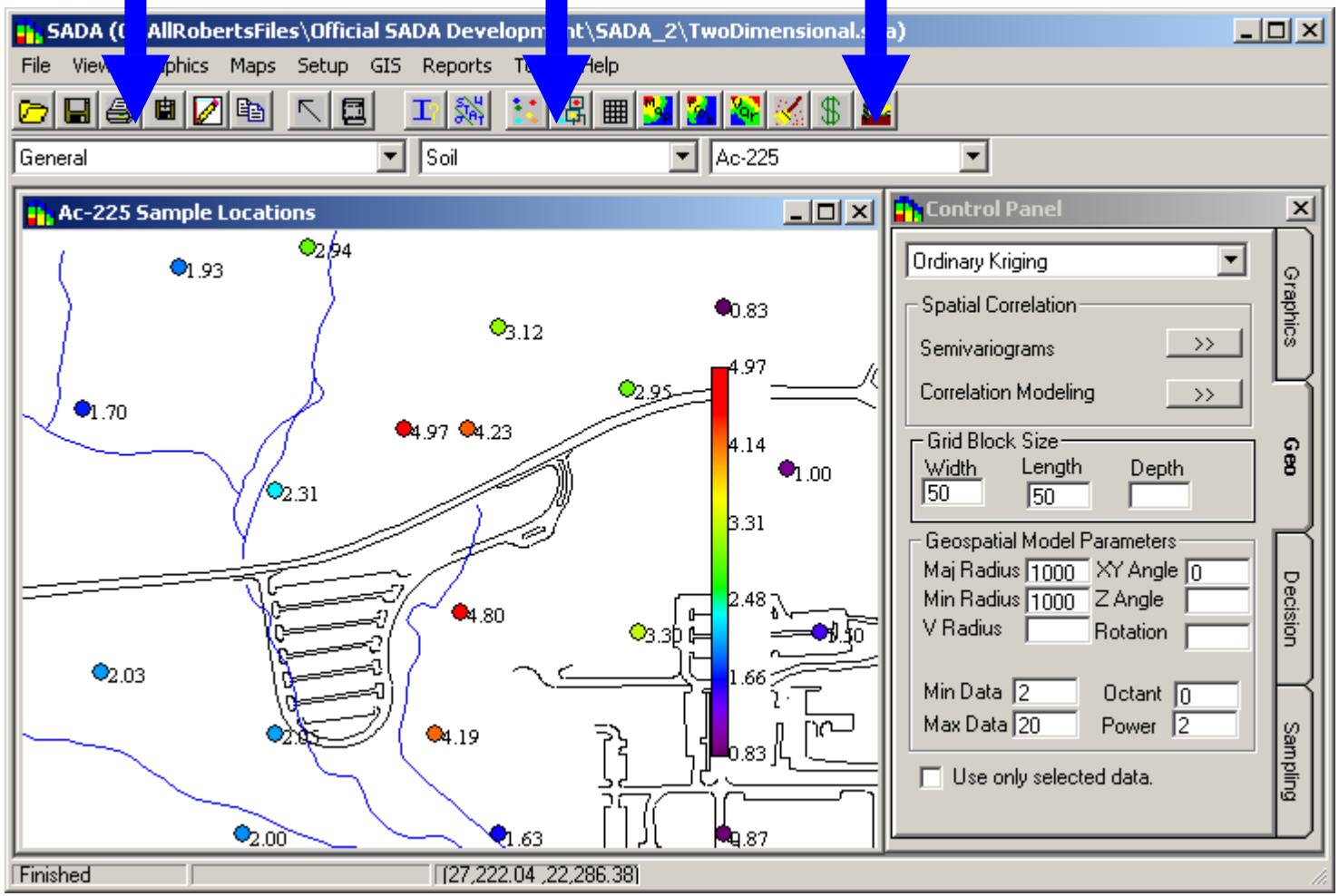


After contaminants have been selected, press Next>> and SADA checks for duplicate values. If duplicate values are found, the user is warned that the maximal value (detected if possible) will be used. You can accept this option or cancel the setup.

The SADA file is now successfully created and is automatically opened.

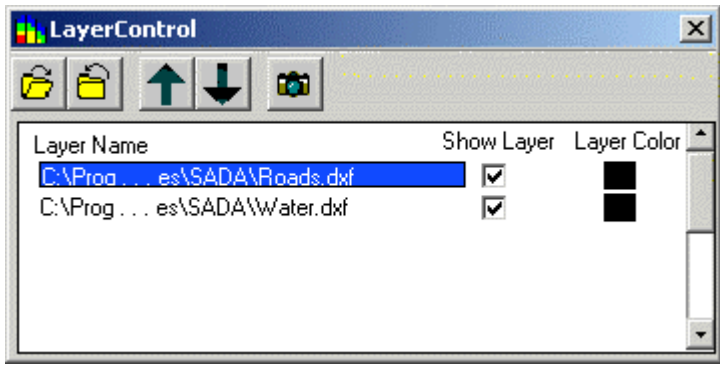
Switching Analyses, Media, And Contaminant Types

Analysis List Media List Contaminant List



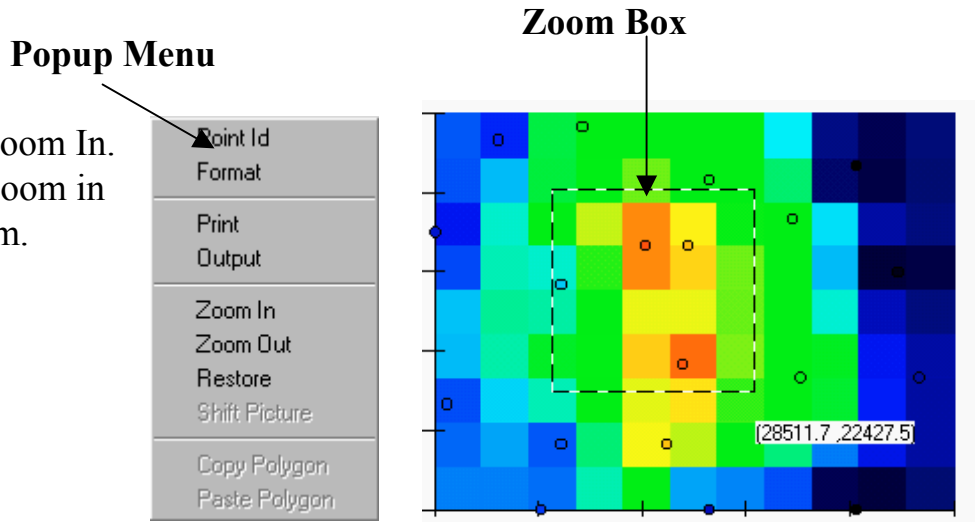
Importing GIS Layers

SADA can read and overlay pictures with a layer that has been produced by a Geographic Information System (GIS) and saved in a Data eXchange Format (DXF). To add a layer to your data or modeling results, choose GIS from the main menu and select Layer Control. The following window appears.



To open another layer press the Open DXF button. To close a layer, select the layer and press the Close DXF button. To change the position of a layer in the layering scheme, press the Layer Up and Layer Down buttons. To make a layer visible, check the box next to the name under the Show Layer column. To change the Layer Color, click the corresponding Layer Color box and choose a color from the Palette window. To view your changes, press the Apply button.

Zooming, Shifting, Restoring



Zooming In
Right mouse click over any map plot and select Zoom In. Using the left mouse button, select the region to zoom in on. Releasing the mouse button produces the zoom.

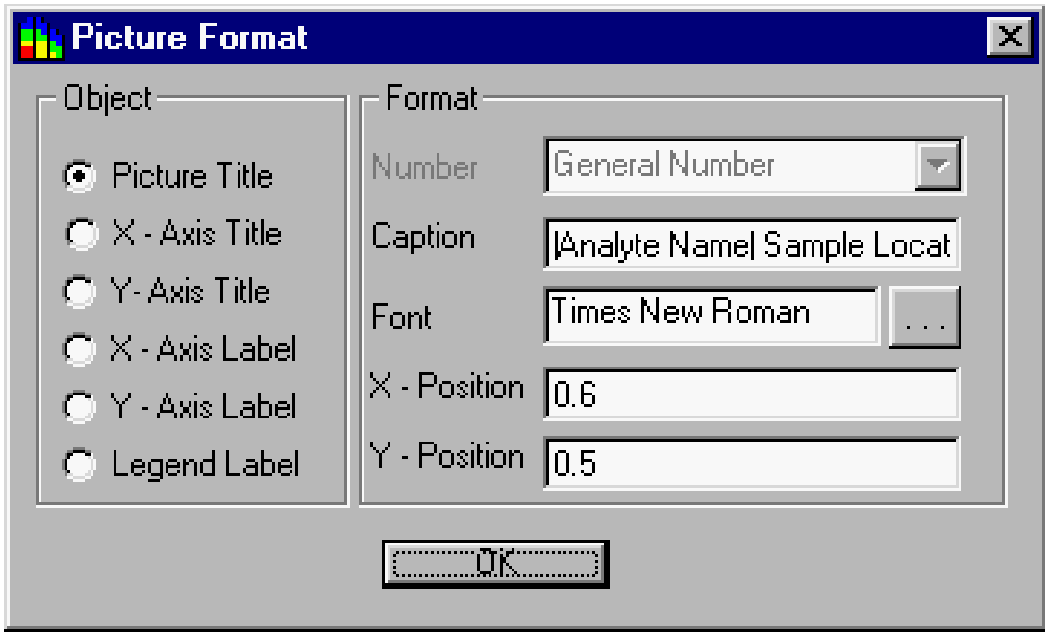
Zooming Out
Right mouse click over any map plot and select Zoom Out. Select the zoom area with the mouse, and the portion of the image that is visible is placed in the zoom box to cause the zoom out effect.

Shifting
Right mouse click over any map plot and select Shift. After selecting this option, click your mouse at any point in the picture and pull the mouse in the direction you wish to move the image. A line will appear demonstrating how far the picture will move. Release the mouse button and the picture will redraw.

Restoring
Select Restore picture from the popup menu (see above) to return the picture to its original scaling and position.

Formatting

The Format option becomes available in a popup menu when the right mouse button is pressed over a graphical image.



Select the portion of the picture you wish to format on the left side of the window under Object. The current formatting scheme will appear on the right hand side.

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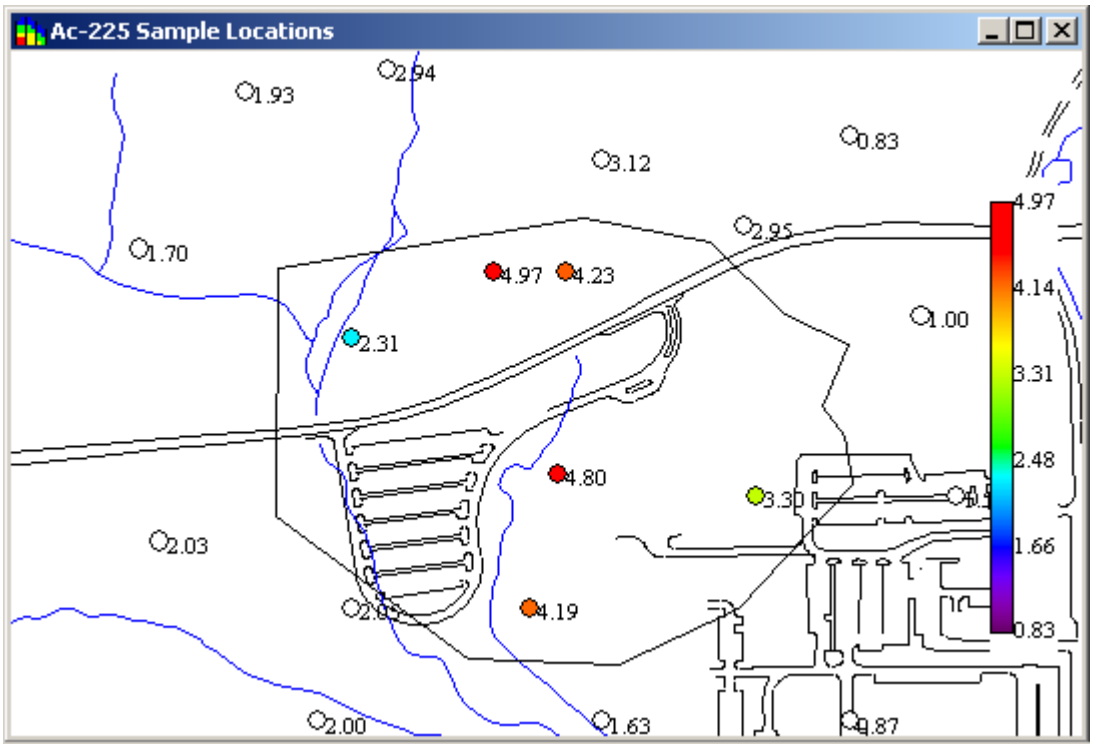
Polygons And Space Definitions

SADA allows users to subset an area or define a space of their site by enclosing it in a polygon.

Only one polygon at a time is allowed in Version 2.0.

Two methods for using polygons exist: Select Tool, Space Definition Manager

In 3d Space, polygons are drawn on each layer (more on this later).



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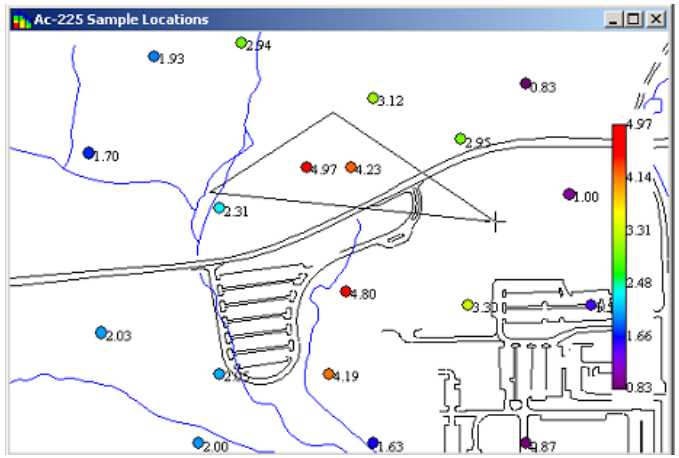
Select Tool

The objective of the select tool is to allow users to draw quick and temporary polygons to retrieve information about the data or model results within the boundaries. They cannot be retrieved after they are removed.

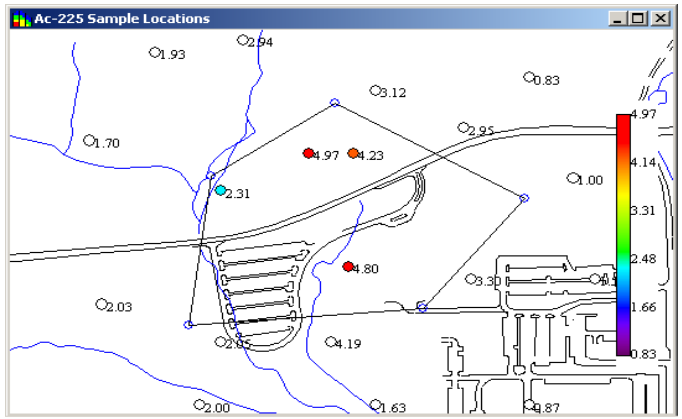
You may use a select tool whenever a graphical display is available with the exception of sample designs.

To create the polygon, press the Select Tool button on the main menu. Click anywhere in the graphics window to start your polygon. Each click produces a new vertex. Double click when you are finished.



Items outside the boundary are deselected and appear empty.

To edit the polygon, double click over the polygon and blue vertices will appear. Left click into one of the vertices and drag it to move this section of the polygon. Right click into any polygon and drag to move the entire polygon.

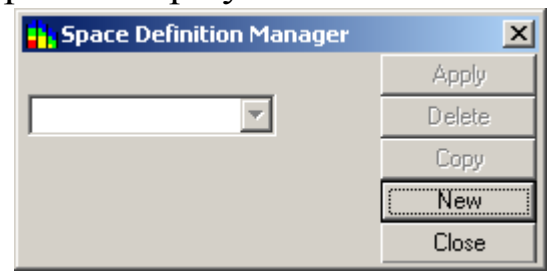


Press the Select Tool again to remove the polygon.

Space Definition Manager

The space definition manager draws and modifies polygons in the same way as the select tool. However, the manager allows you to store the polygon by name and recall it later. The polygon drawing methods are the same.

You may use a space definition manager whenever a graphical display is available with the exception of sample designs.

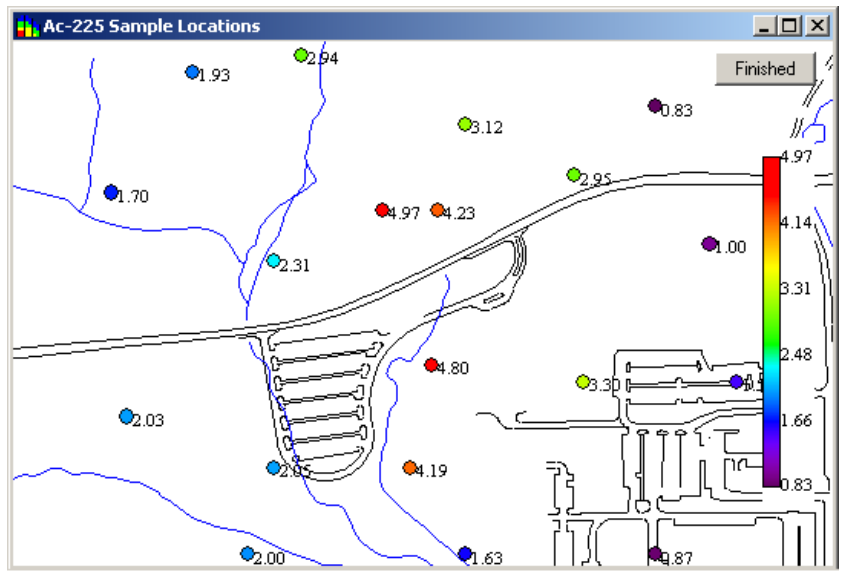


To create a space definition, press the Space Definition Tool button on the main menu. The left hand side contains previously saved space definitions (none here). Choose one of these or press New to create a new one.

After pressing new, begin drawing the polygon. When you are finished, press the Finish button.

Pressing the Manager button again will remove the polygon.

If you edit the polygon, SADA will give you a chance to rename before saving.

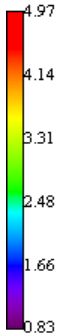


Managing Legends

SADA allows users to modify the legends that control the color range of data and result output. Two types of legends are permitted.

Continuous

An unbroken color band that ranges from dark purple through a spectrum to bright red. Continuous legends can be customized by manually stretching or compressing a subset of the color band.

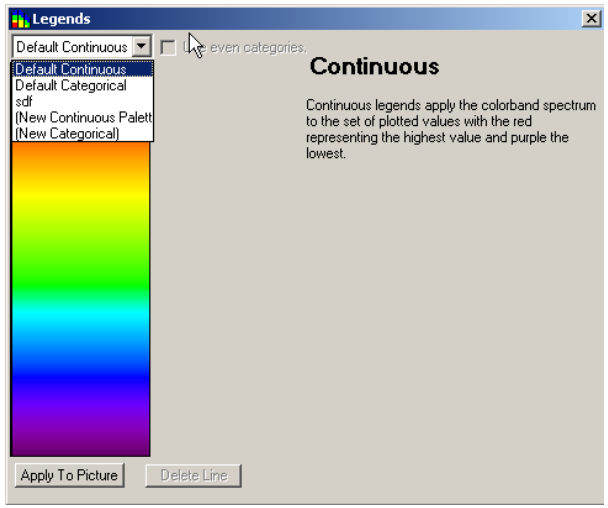


Categorical

Categorical legends permit the user to break the legend into a series of ranges or categories with set names and colors.

To modify a legend or create a new legend, simply right mouse click over the legend itself or choose Legend Manager from the Main View Menu.

You can choose from the list of available legend types or build a new one of your own. See the Help File.



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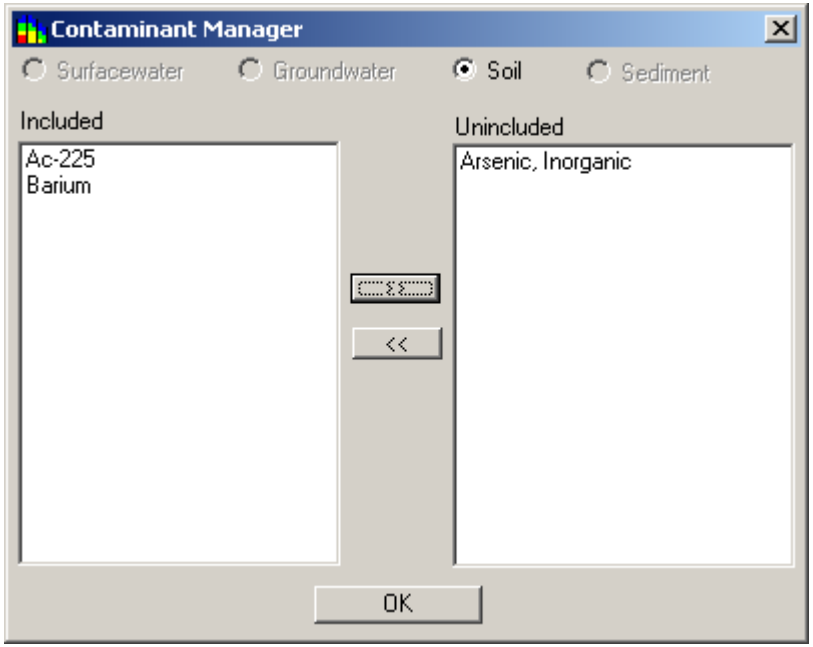
Contaminant Manager

At any time, you may remove a contaminant from the analysis. This is done with the contaminant manager. To see the manager, click on Tools then Contaminant manager in the main menu.



Select those contaminants you wish to remove from the analysis and press the >> button. Similarly, choose those contaminant in the box on the right you wish to return and press the << button.

The media buttons allow you to toggle between media types. You may remove a particular contaminant from one media without removing it from the others.

Getting Information

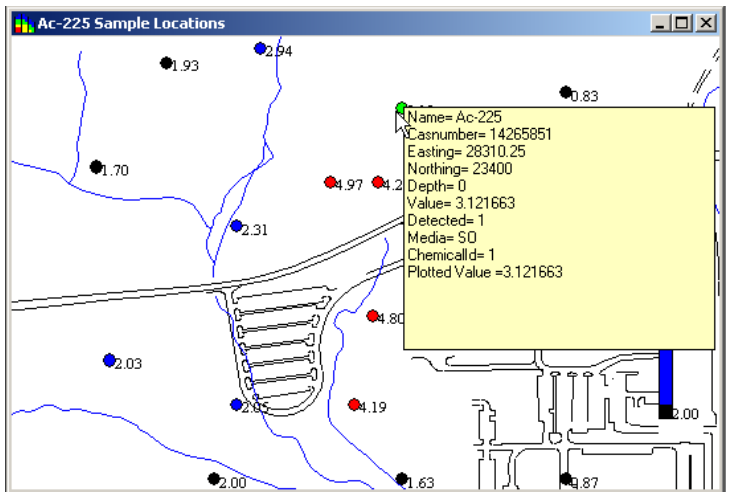
There are several ways to get basic information from SADA.

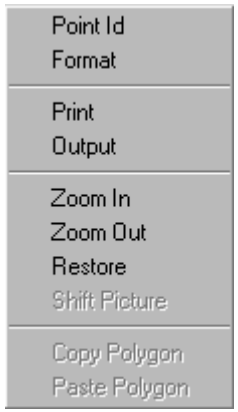
Point ID

This feature allows you to click on a data point and retrieve all available information about that data point from the SADA file. To use point ID, have a data plot map open, right mouse click and choose Point ID from the pop-up menu.

Next left click on any data point and a yellow box will appear with all available information.

Right mouse click and deselect Point ID to turn this feature off.





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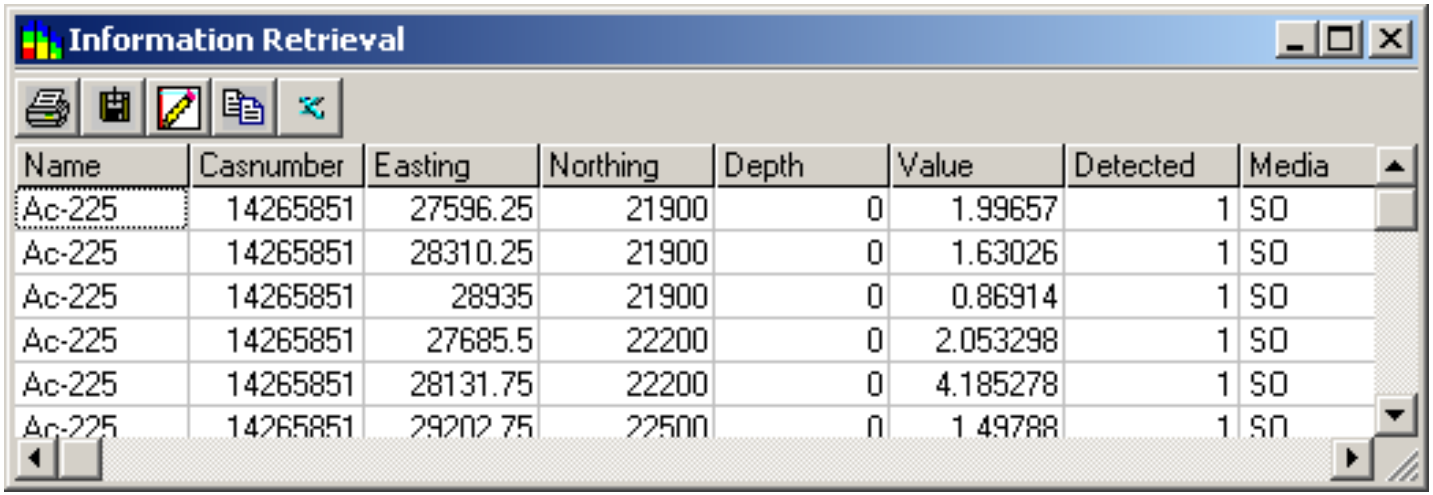
Getting Information

Basic Information

Use this option to retrieve all available information on every data point (or modeled value). When a polygon tool is on, this will return only those points found in the polygon.



Name	Casnumber	Easting	Northing	Depth	Value	Detected	Media
Ac-225	14265851	27596.25	21900	0	1.99657	1	SO
Ac-225	14265851	28310.25	21900	0	1.63026	1	SO
Ac-225	14265851	28935	21900	0	0.86914	1	SO
Ac-225	14265851	27685.5	22200	0	2.053298	1	SO
Ac-225	14265851	28131.75	22200	0	4.185278	1	SO
Ac-225	14265851	29202.75	22500	0	1.49788	1	SO

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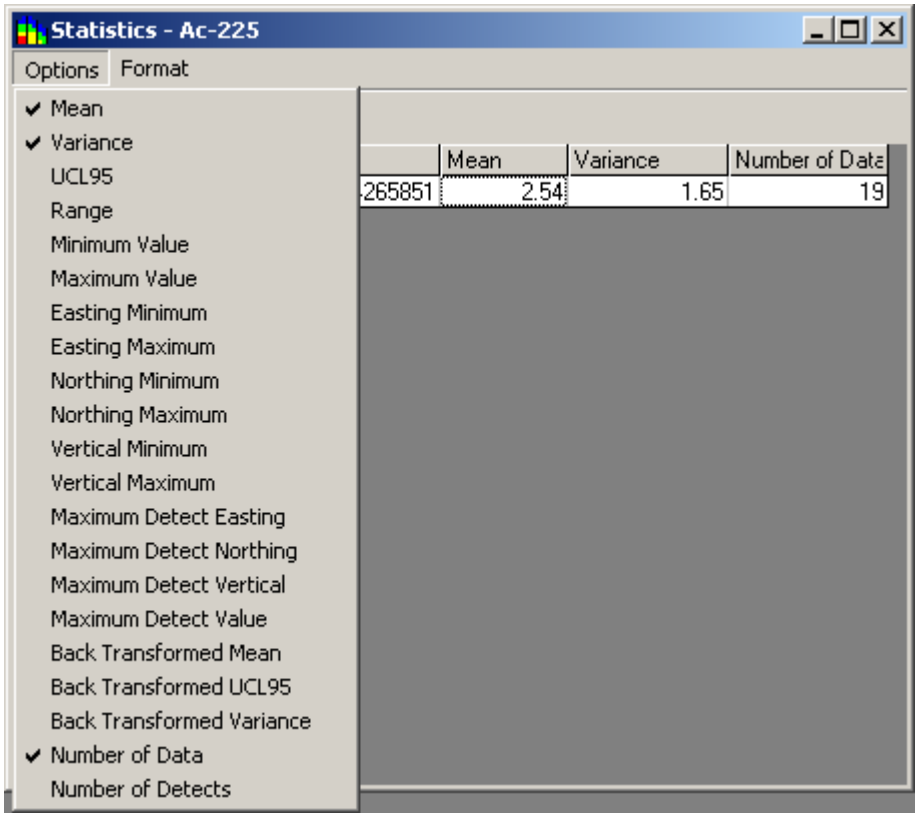
Getting Information

Statistics

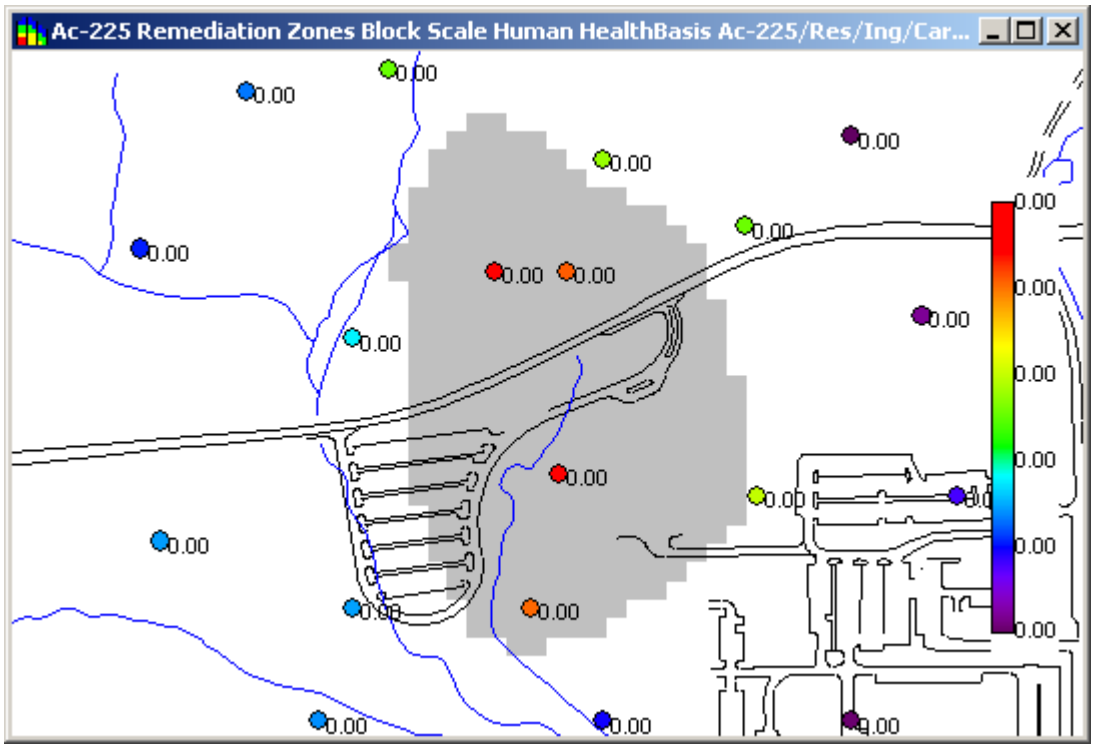
Use this option to calculate a number of statistical values on on every data point (or modeled values). When a polygon tool is on, this feature will return only those points found in the polygon.

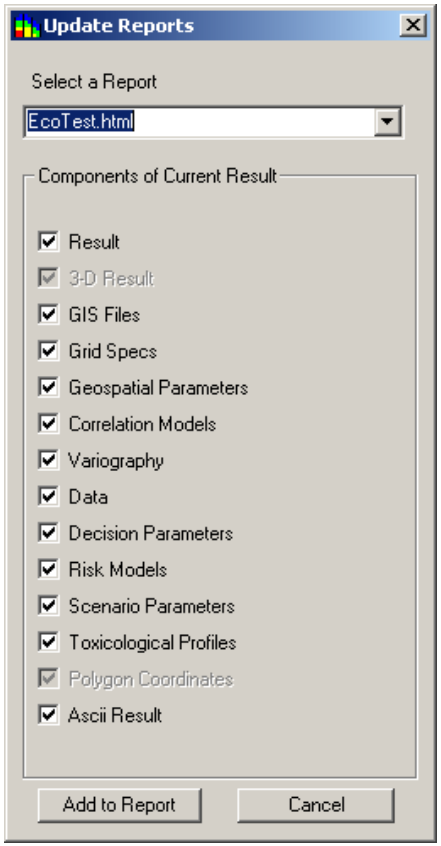
Under the Options menu are all the available statistical choices. To format a particular statistical value type, click any cell in that column and choose format from the main menu. Type in the number format you wish and continue.



Auto Documentation

For any given result in SADA, when the user presses the auto-documentation button, SADA analyzes the result and produces a list of every type of model, parameter, assumption, result, etc. used in creating that result. The user may then select those items of interest and SADA then automatically writes everything to the HTML report.



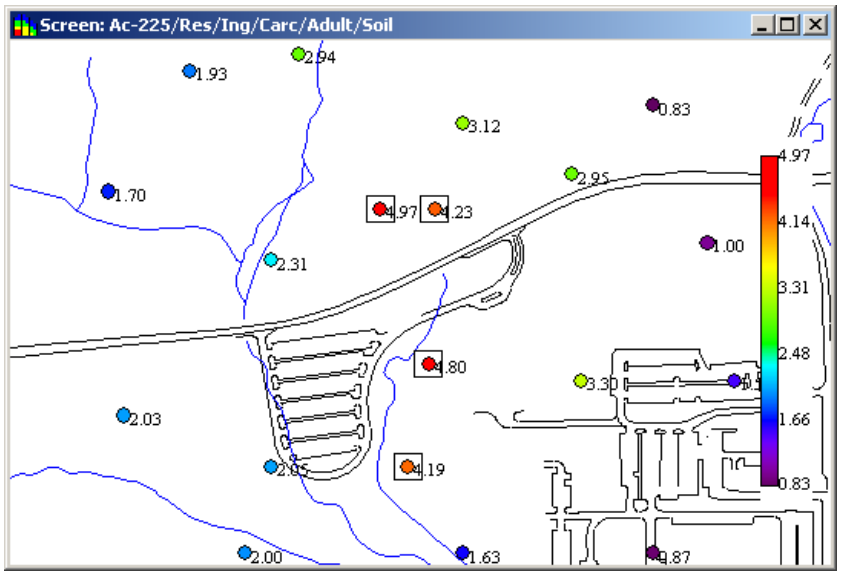


Auto Documentation

You can begin using auto-documentation immediately. If you do not have a report started, SADA will prompt you to start one.

Begin by choosing human health as the analysis, selecting human health as the decision basis on the control panel Decision tab, choosing Ac-225 and Soil, and pressing the spatial screen button.

What is created is a risk based data screening.



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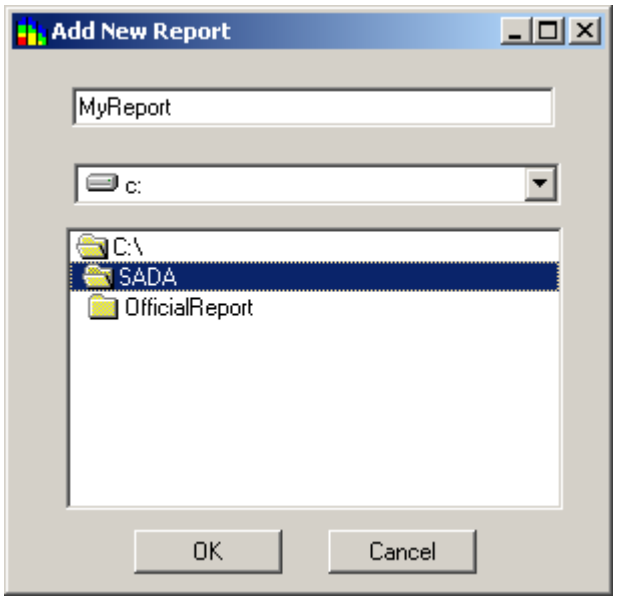
Auto Documentation

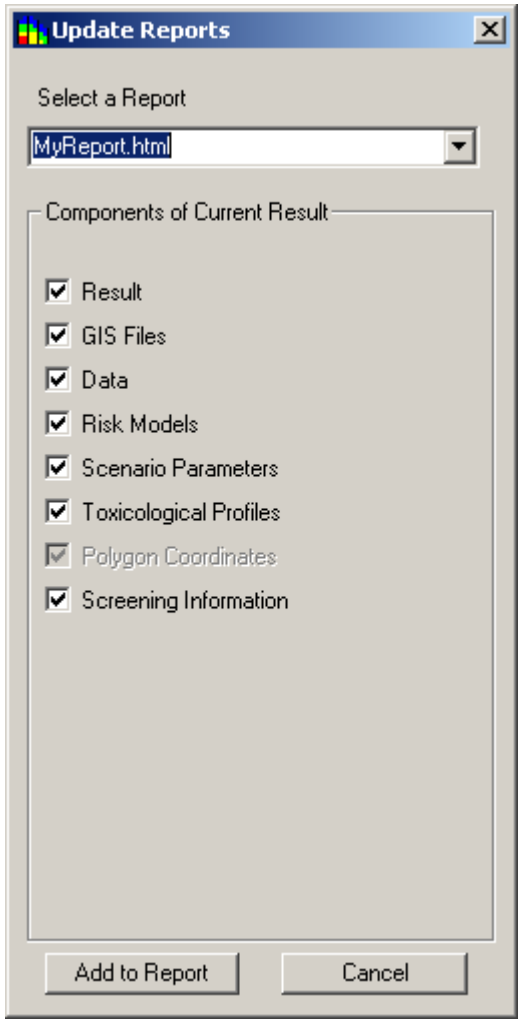
Now press the Auto-Documentation button. Since you do not have a report open, SADA will ask you to create a new one. Type the name of the report without adding any suffixes to the end (e.g. .html, .wpd).



SADA will create a subdirectory and an html file with this name in that report. This directory is like a web site which will contain all the files your report will need.

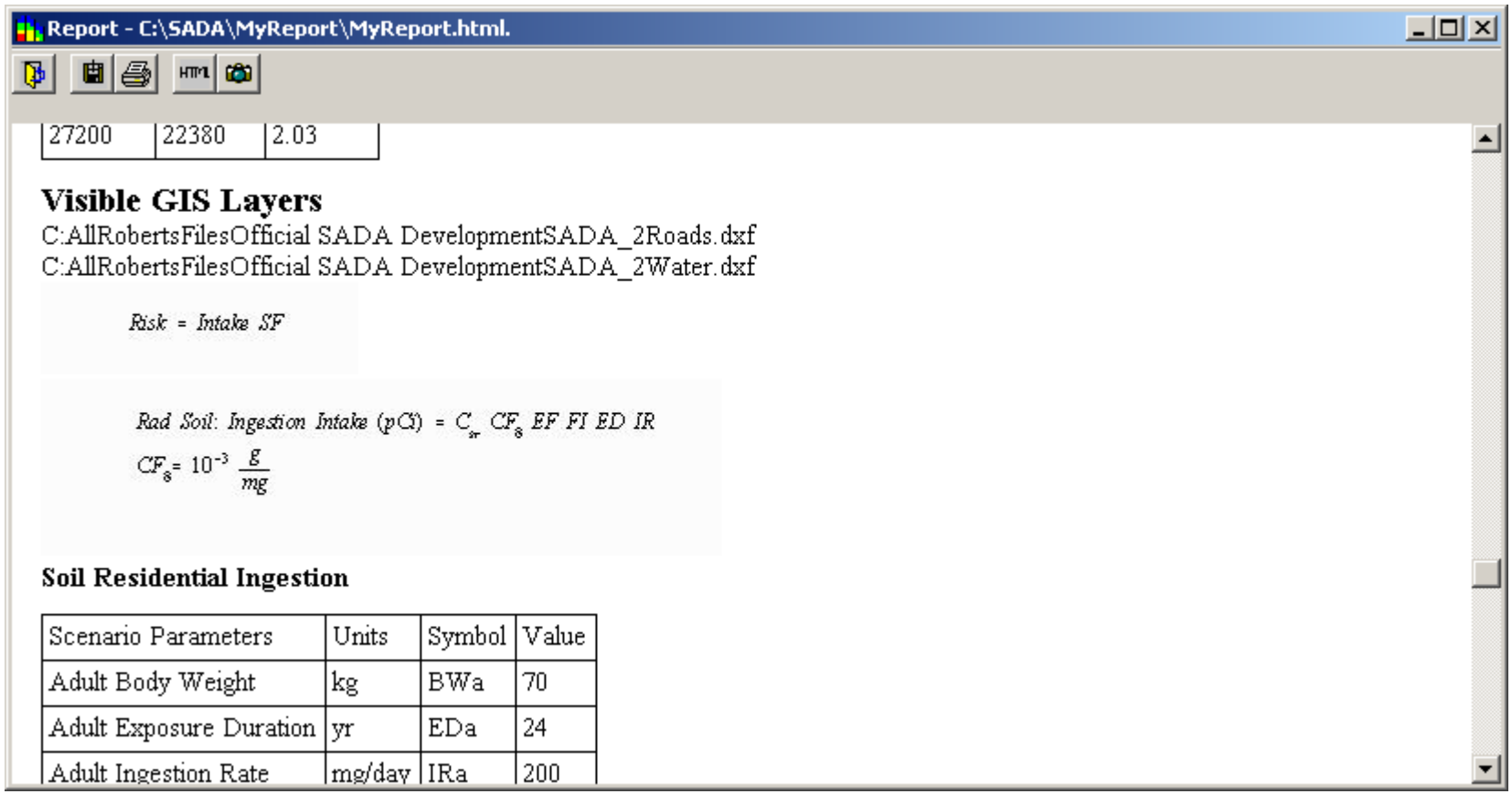
Auto Documentation

SADA now presents a list of every “ingredient” used in creating this risk based screening. Check each item you want to include. Select the report you want to add it to at the top and press Add To Report.



Auto Documentation

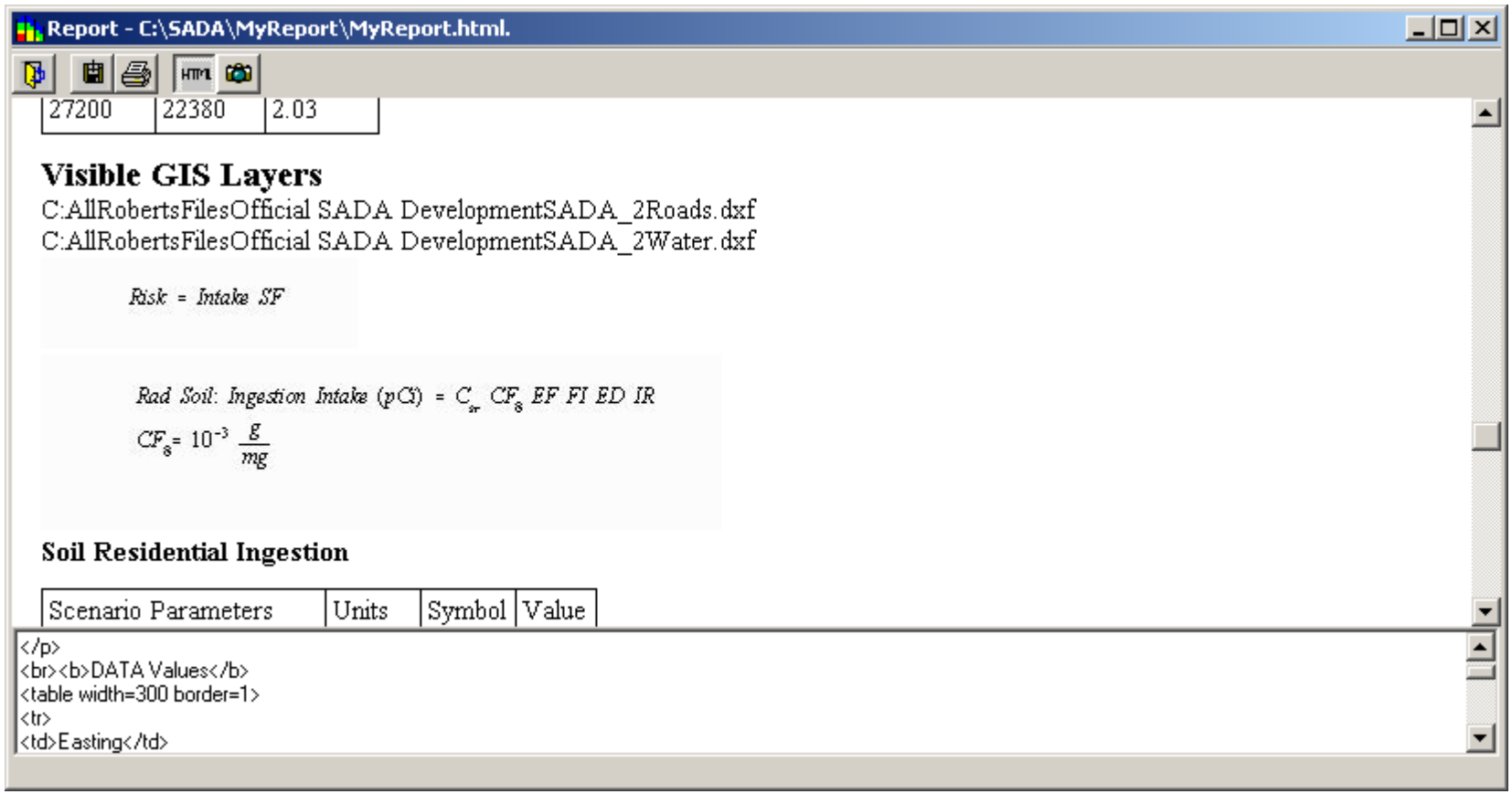
SADA now shows the result in your report.



This tool has a bug with the scroll bar. To view your report, click on the report and use the page down function.

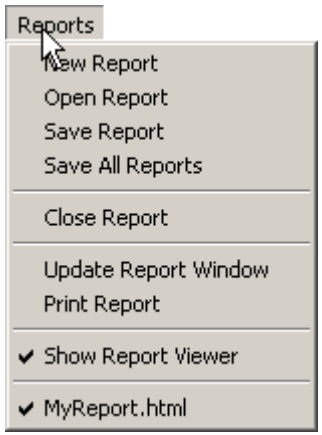
Auto Documentation

You can also add notes to your report. Press the HTML button on the tool bar and an HTML editor window will appear at the bottom. If you know a little HTML, you can type your own codes here. Otherwise, you can import this file into Word Perfect or Word later and add notes then.



Auto Documentation

All remaining report functions can be found on the main menu bar. See the help file.



SADA™
Spatial Analysis and Decision Assistance

Part 2: Human Health

- Setting Up Human Health
- Viewing Scenario Parameters
- Viewing Toxicological Parameters
- Changing Target Risk/Hazard Index
- PRG Tables
- PRG Screen Tables
- Risk Tables
- Spatial PRG Screens
- Point Risk Maps
- Rematching a Single Contaminant

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Setup Human Health (1)

- After a SADA file is created
- Imports toxicity and exposure data to the SADA file
- Link contaminants in toxicity file to those in SADA file

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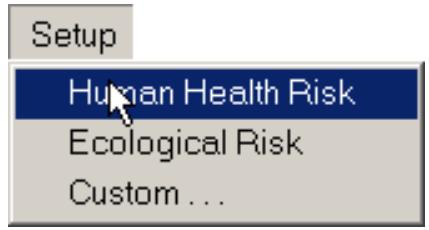
Setup Human Health (2)

- Select **Setup** -> **Human Health Risk**
- Click **Yes** on Risk Setup Wizard
- Browse for ToxicologicalProfiles.mdb
- Select **Open,** Then **Next** (or **Reset**)
- Browse for ScenarioParameters.mdb
- Select **Open,** Then **Next** (or **Reset**)
- **Register** Contaminants
- Select **Next**



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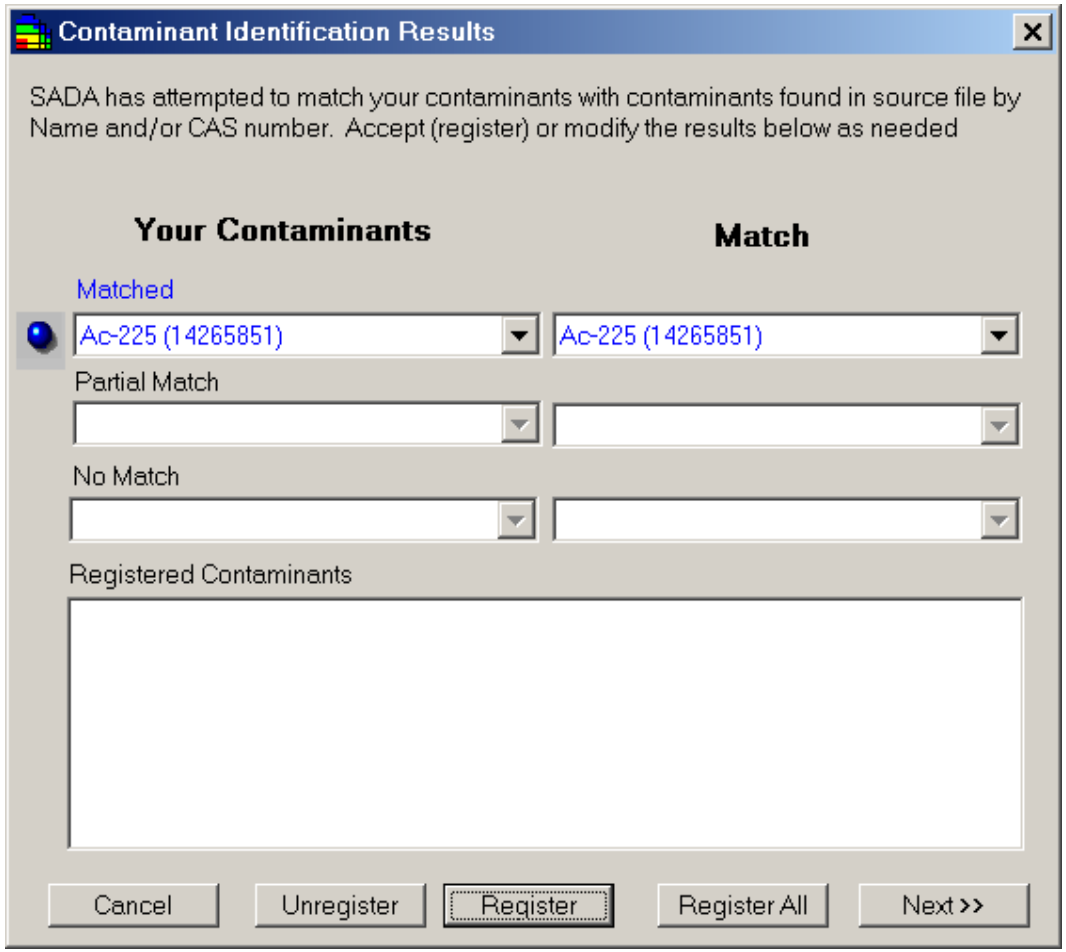
Setup Human Health (3)



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Spatial Analysis and Decision Assistance

Viewing Scenario Parameters (1)

- For each media
  - Soil, Sediment, Surface Water, Groundwater
- Exposure Scenarios
  - Residential, Industrial, Recreational, Agricultural, Excavation
- Exposure Pathways
  - Ingestion, Inhalation, Dermal Contact, Food Chain (Beef, Milk, and Vegetable Ingestion)
- Customizable

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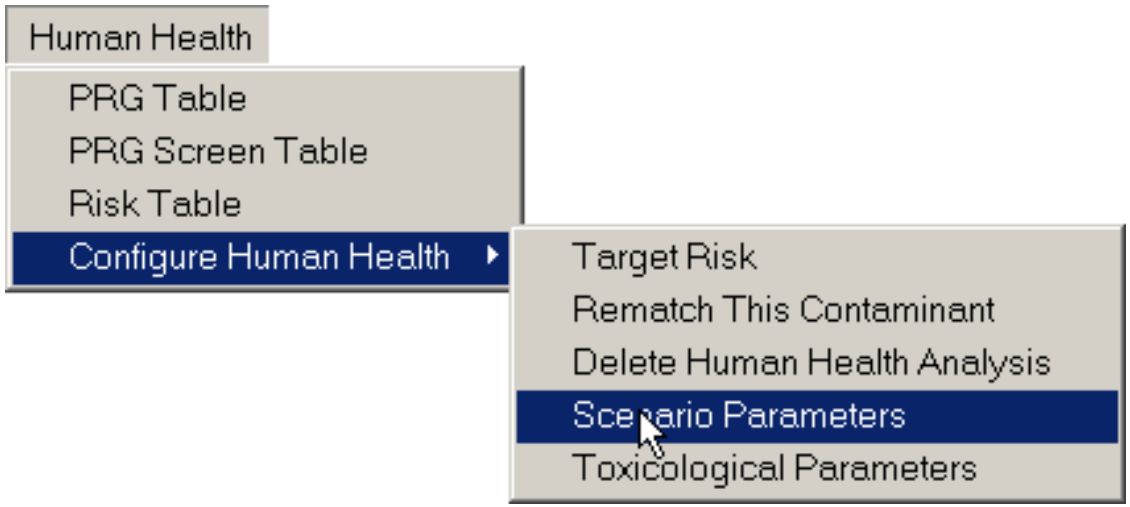
Viewing Scenario Parameters (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> Configure Human Health -> Scenario Parameters**



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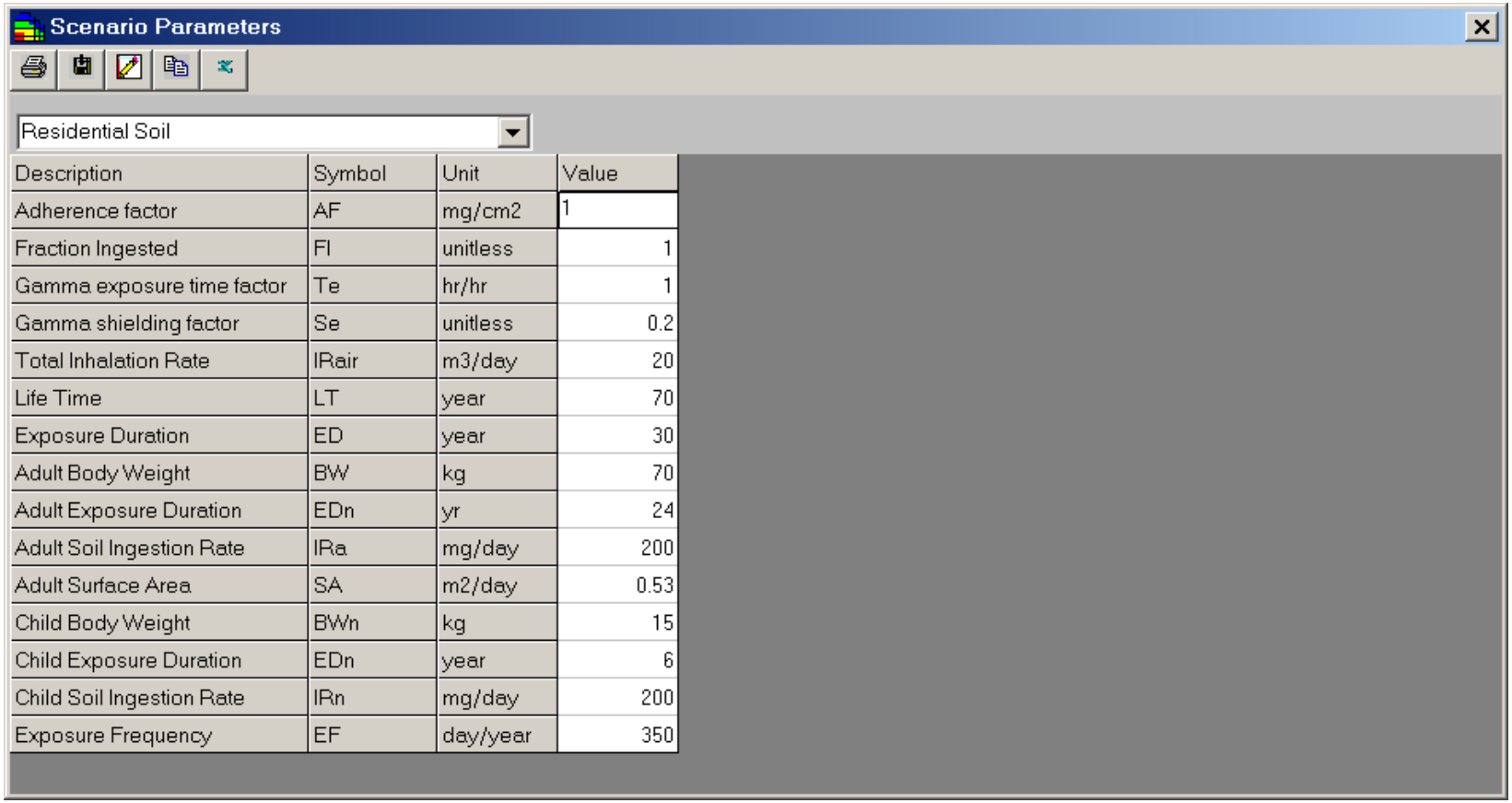
Viewing Scenario Parameters (3)



Description	Symbol	Unit	Value
Adherence factor	AF	mg/cm2	1
Fraction Ingested	FI	unitless	1
Gamma exposure time factor	Te	hr/hr	1
Gamma shielding factor	Se	unitless	0.2
Total Inhalation Rate	IRair	m3/day	20
Life Time	LT	year	70
Exposure Duration	ED	year	30
Adult Body Weight	BW	kg	70
Adult Exposure Duration	EDn	yr	24
Adult Soil Ingestion Rate	IRa	mg/day	200
Adult Surface Area	SA	m2/day	0.53
Child Body Weight	BWn	kg	15
Child Exposure Duration	EDn	year	6
Child Soil Ingestion Rate	IRn	mg/day	200
Exposure Frequency	EF	day/year	350

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Viewing Toxicological Parameters (1)

- IRIS and HEAST Toxicity Databases
- Physical Parameters
  - Bioaccumulation Factors
  - Volatilization, Particulate Emission Factors
  - Permeability Constants, Absorption Factors
  - Saturation Coefficients, Radionuclide Half-Lives

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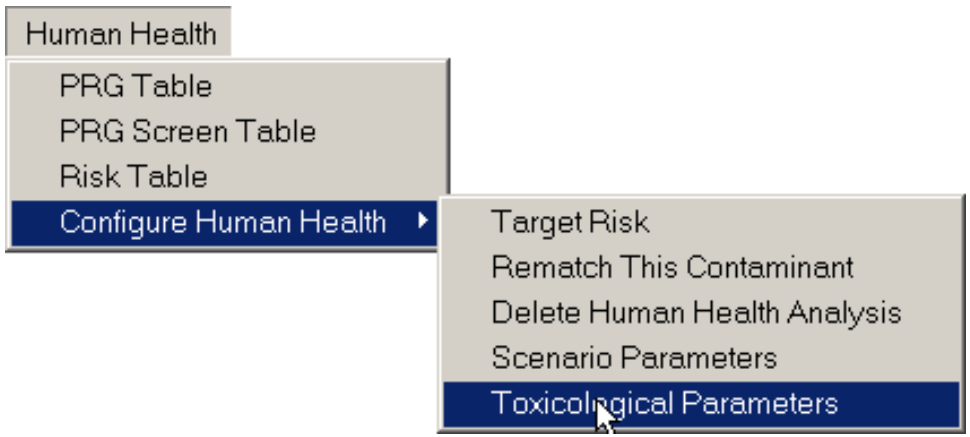
Viewing Toxicological Parameters (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> Configure Human Health -> Toxicological Parameters**



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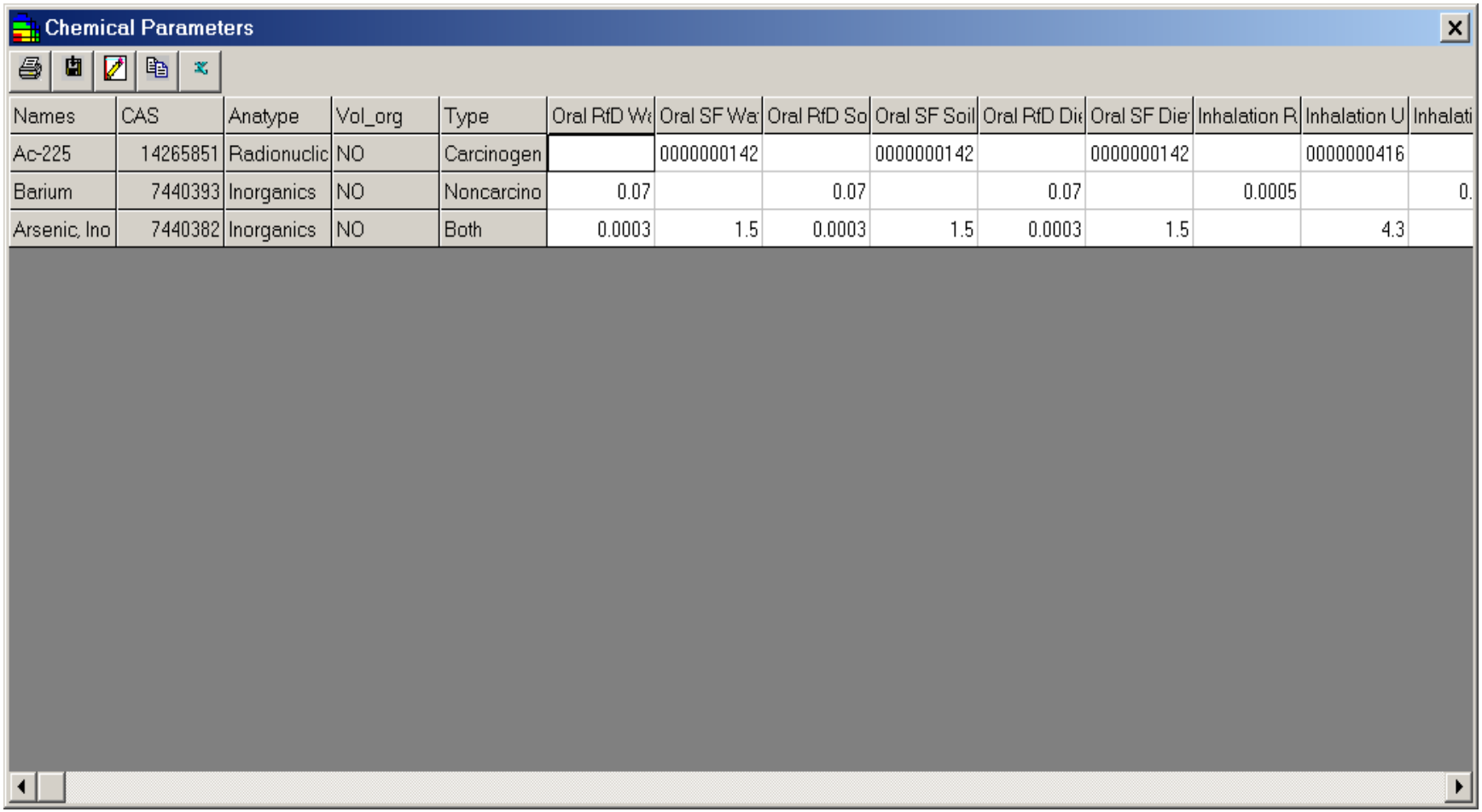
Viewing Toxicological Parameters (3)



Names	CAS	Anatype	Vol_org	Type	Oral RfD Wa	Oral SF Wa	Oral RfD So	Oral SF Soil	Oral RfD Die	Oral SF Die	Inhalation R	Inhalation U	Inhalati
Ac-225	14265851	Radionuclic	NO	Carcinogen		0000000142		0000000142		0000000142		0000000416	
Barium	7440393	Inorganics	NO	Noncarcino	0.07		0.07		0.07		0.0005		0.
Arsenic, Ino	7440382	Inorganics	NO	Both	0.0003	1.5	0.0003	1.5	0.0003	1.5		4.3	

Setting Target Risk/Hazard Index (1)

- Default values of 1E-6 for carcinogenic risk and 1 for Hazard Index
- User can change

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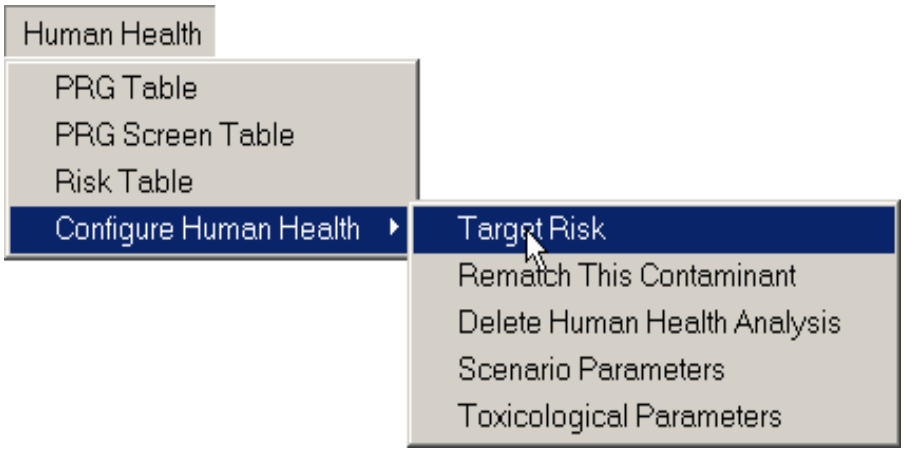
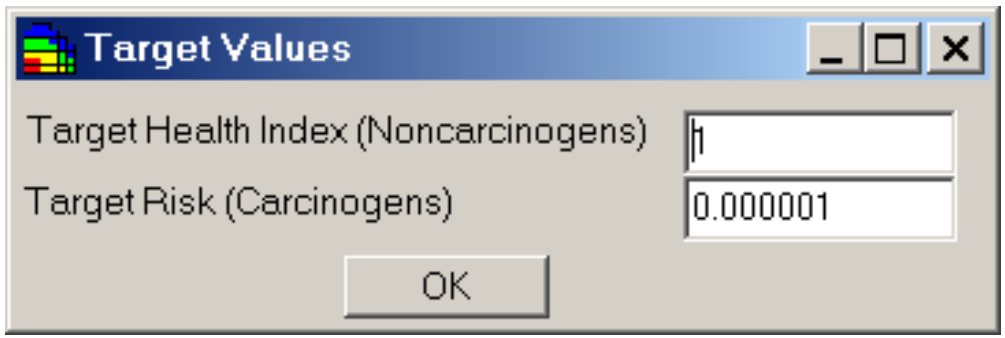
Setting Target Risk/Hazard Index (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> Configure Human Health -> Target Risk**





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PRG Tables (1)

- View site-specific Preliminary Remediation Goals for media and pathway(s) combinations
- Carcinogenic risk or noncarcinogenic hazard basis

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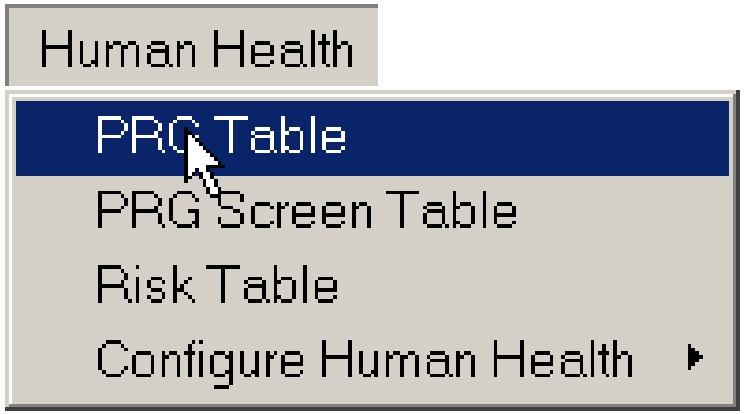
PRG Tables (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> PRG Table**



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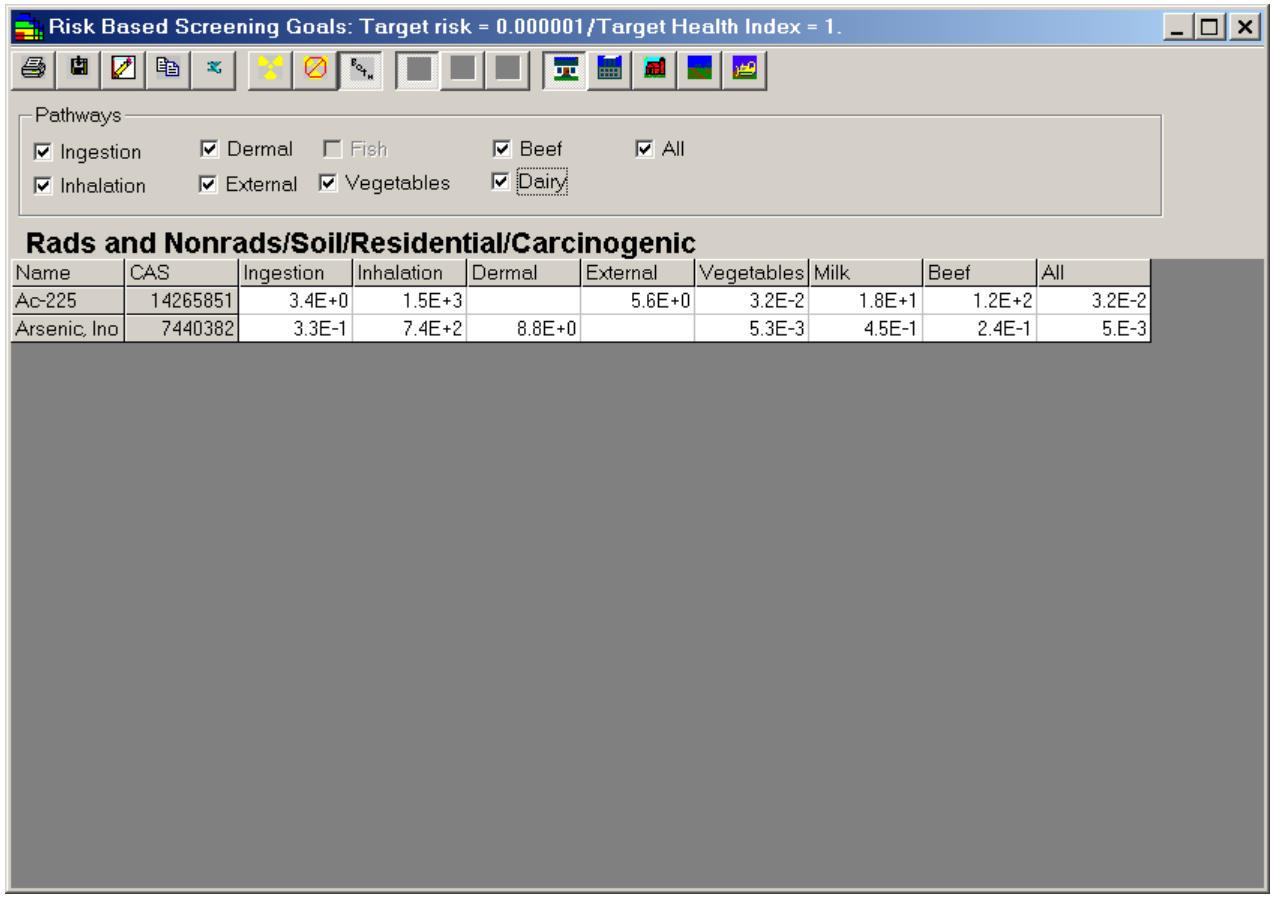
PRG Tables (3)



Name	CAS	Ingestion	Inhalation	Dermal	External	Vegetables	Milk	Beef	All
Ac-225	14265851	3.4E+0	1.5E+3		5.6E+0	3.2E-2	1.8E+1	1.2E+2	3.2E-2
Arsenic, Ino	7440382	3.3E-1	7.4E+2	8.8E+0		5.3E-3	4.5E-1	2.4E-1	5.E-3

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PRG Screen Tables (1)

- For a given set of points, SADA finds the maximum value
- Calculates a PRG for the contaminant, exposure scenario, and target risk level
- Returns **Yes** if maximum is equal to or higher, Blank if lower or no PRG is available

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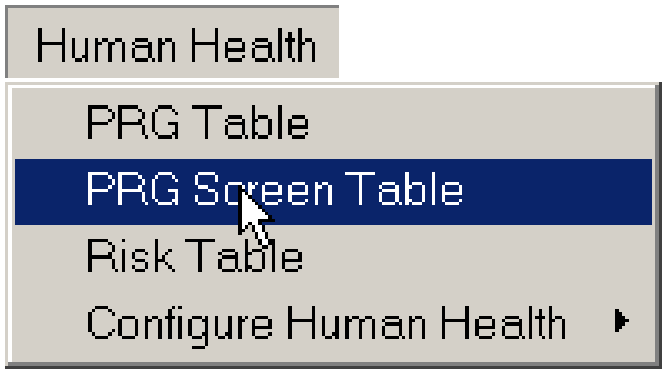
PRG Screen Tables (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> PRG Screen Table**



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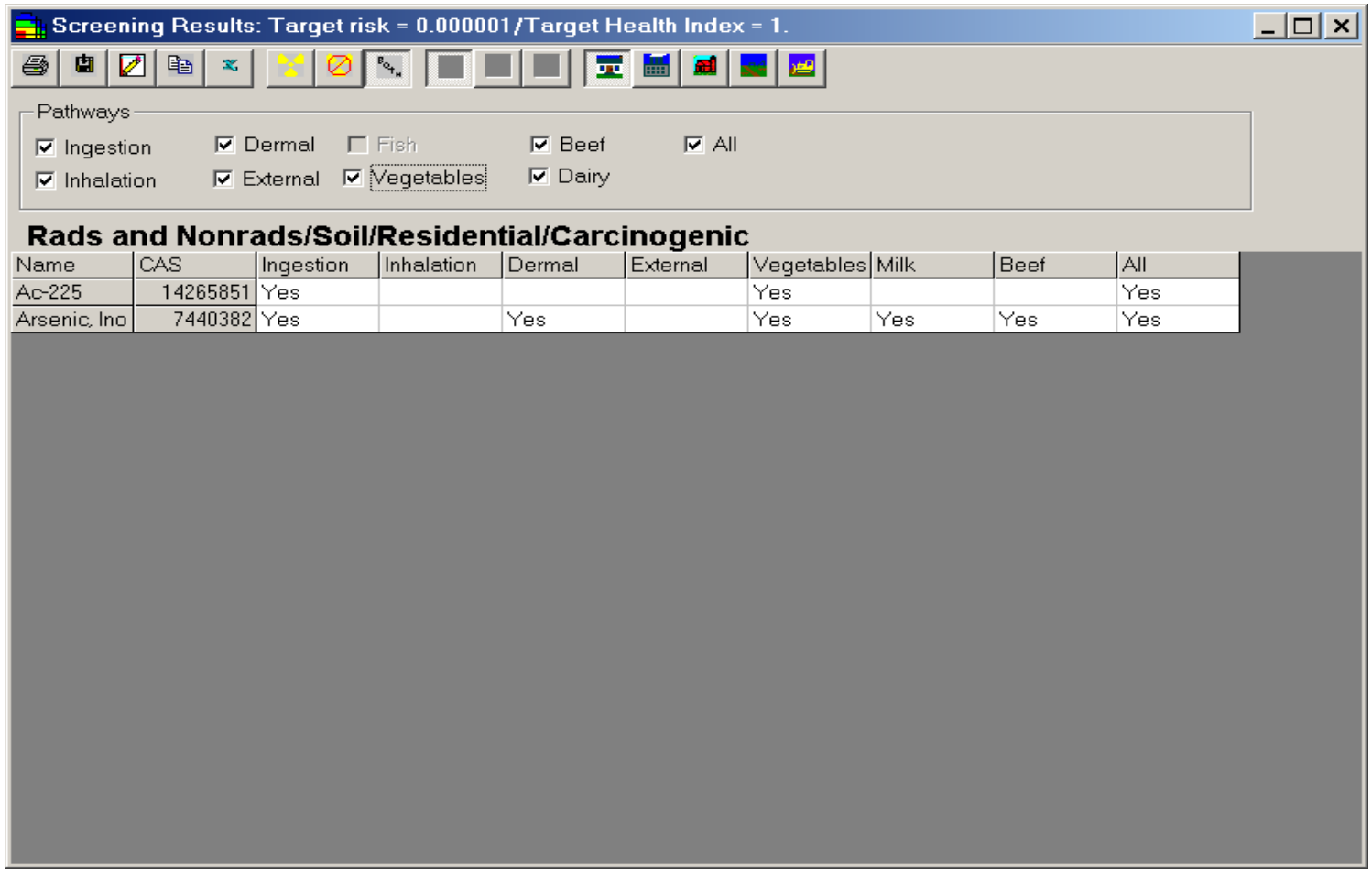
PRG Screen Tables (3)



Name	CAS	Ingestion	Inhalation	Dermal	External	Vegetables	Milk	Beef	All
Ac-225	14265851	Yes				Yes			Yes
Arsenic, Ino	7440382	Yes		Yes		Yes	Yes	Yes	Yes

Risk Tables (1)

- For a given set of values, SADA finds the minimum of the UCL95 and the maximum value
- Using this exposure concentration, calculates risk based on the contaminant and exposure scenario

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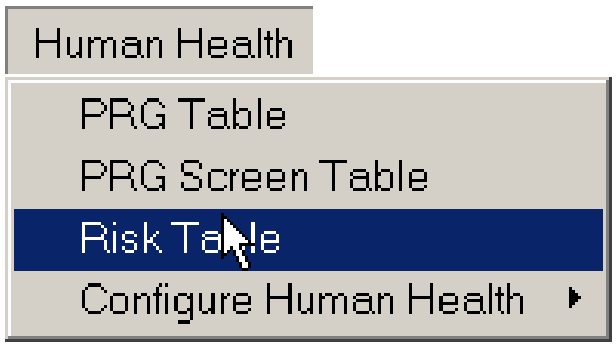
Risk Tables (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> Risk Table**



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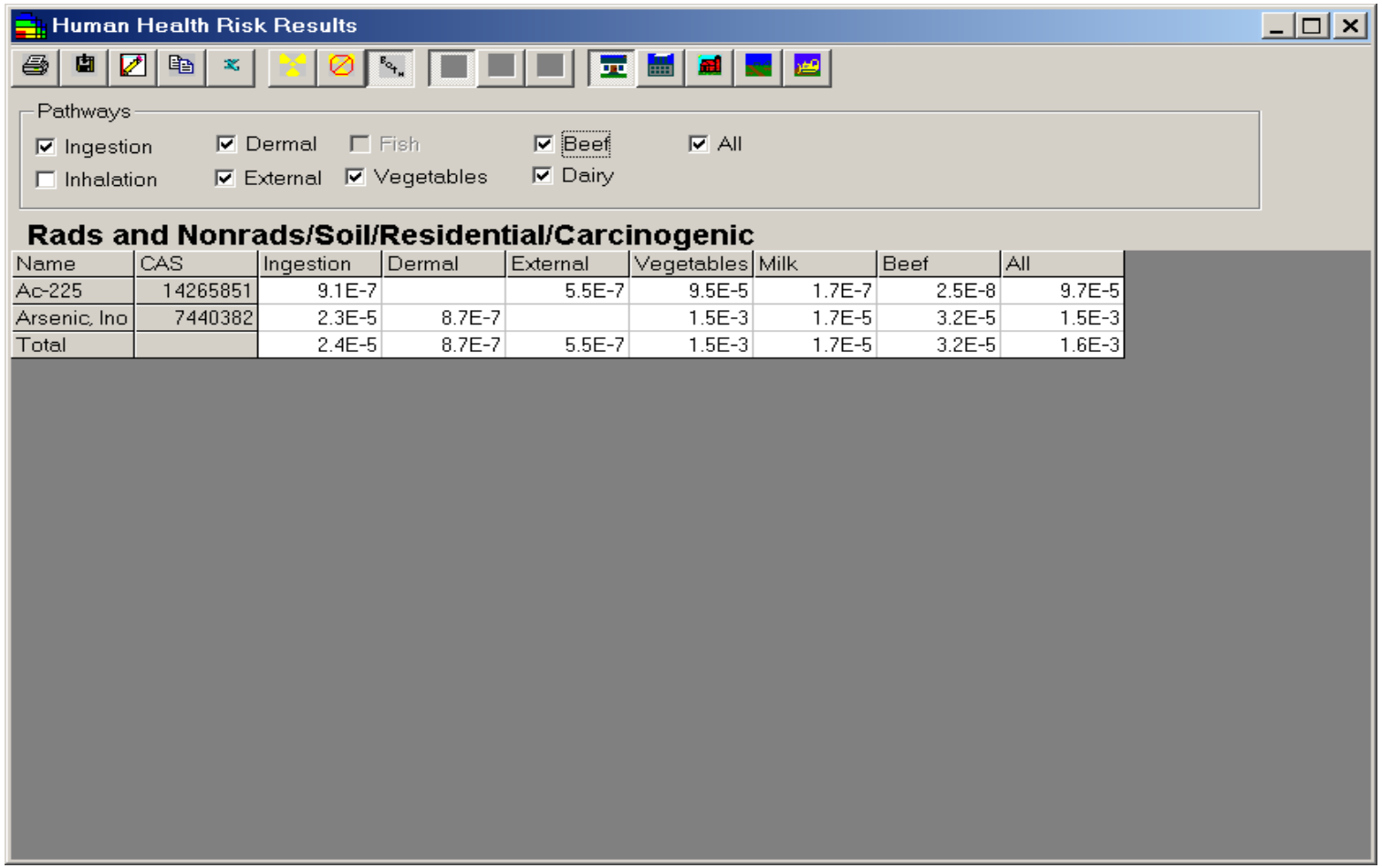
Risk Tables (3)



Rads and Nonrads/Soil/Residential/Carcinogenic

Name	CAS	Ingestion	Dermal	External	Vegetables	Milk	Beef	All
Ac-225	14265851	9.1E-7		5.5E-7	9.5E-5	1.7E-7	2.5E-8	9.7E-5
Arsenic, Ino	7440382	2.3E-5	8.7E-7		1.5E-3	1.7E-5	3.2E-5	1.5E-3
Total		2.4E-5	8.7E-7	5.5E-7	1.5E-3	1.7E-5	3.2E-5	1.6E-3

Spatial PRG Screens (1)

- SADA calculates a PRG for the contaminant, exposure scenario, and target risk level
- Compares the concentration at each location to the PRG
- Location is boxed if it exceeds PRG

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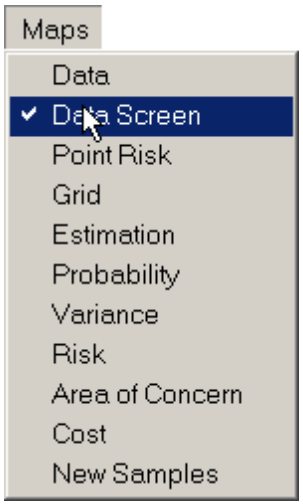
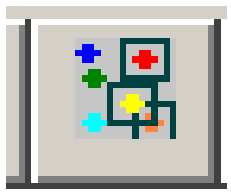
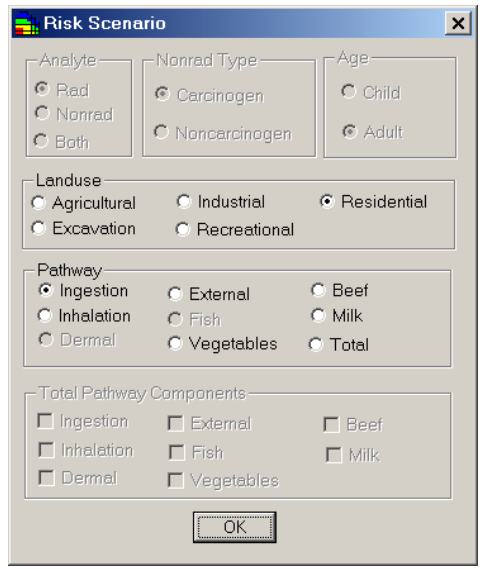
Spatial PRG Screens (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Maps -> Data Screen**

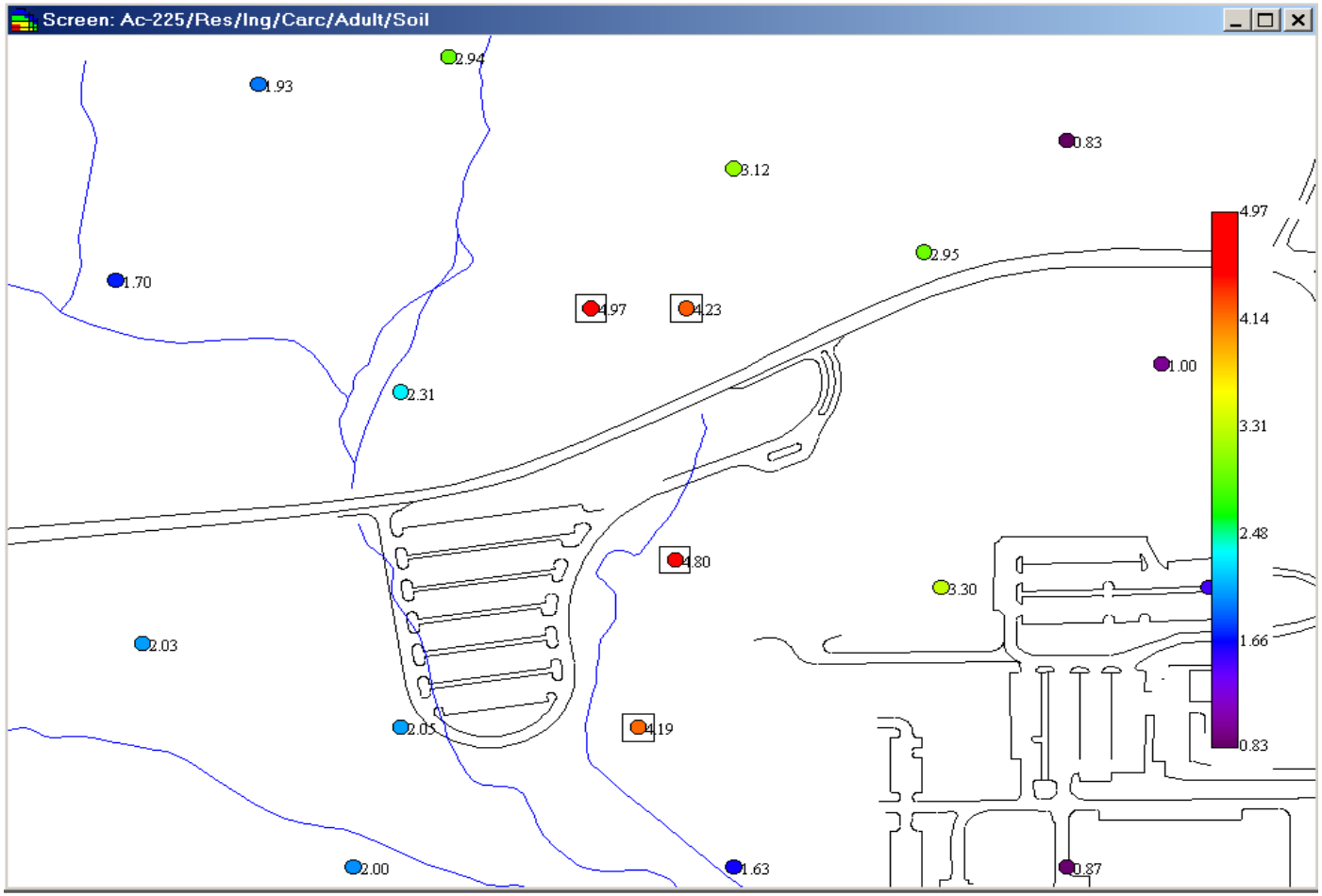
  (or Select Data Screen Button)
- Select Exposure Scenario and Pathways







Spatial PRG Screens (3)



Point Risk Maps (1)

- SADA calculates risk for each sampling location based on contaminant and exposure scenario
- Legend scale changes to risk

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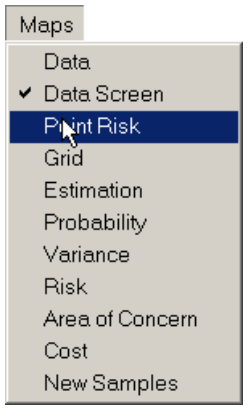
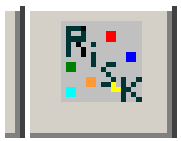
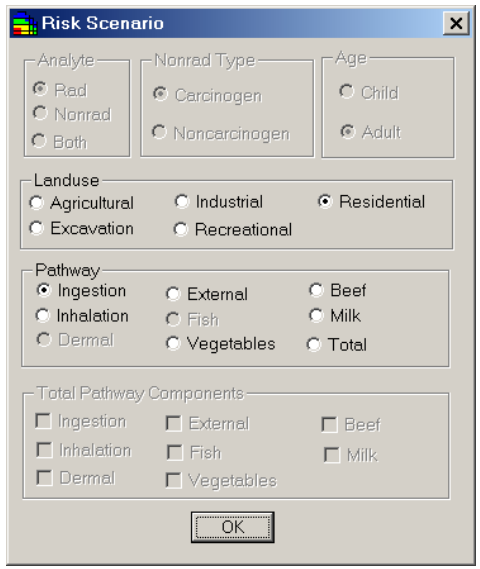
Point Risk Maps (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Maps -> Point Risk**

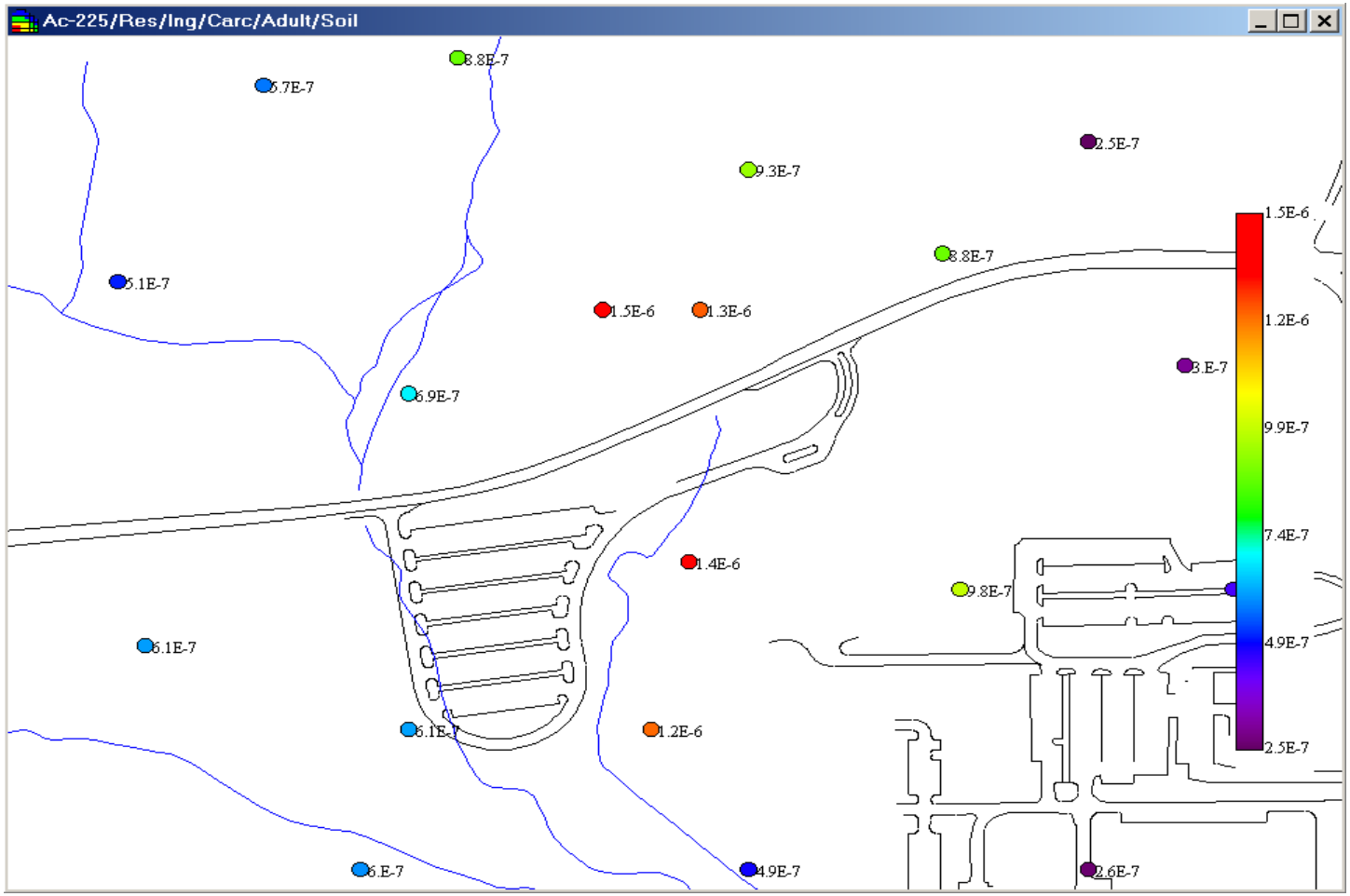
  (or Select Point Risk Button)
- Select Exposure Scenario and Pathways







Point Risk Maps (3)



Rematching a Single Contaminant (1)

- Allows user to change the toxicity information that a contaminant is linked to
- Preferable to resetting up the entire file

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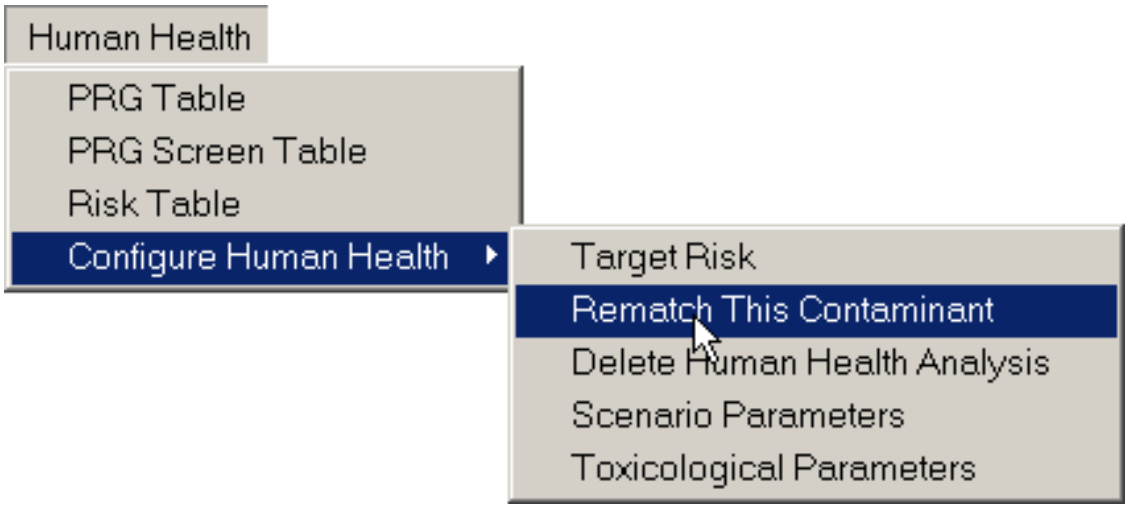
Rematching a Single Contaminant (2)

- Select **Human Health** on Analysis Drop Down List
- Select **Human Health -> Configure Human Health -> Rematch This Contaminant**



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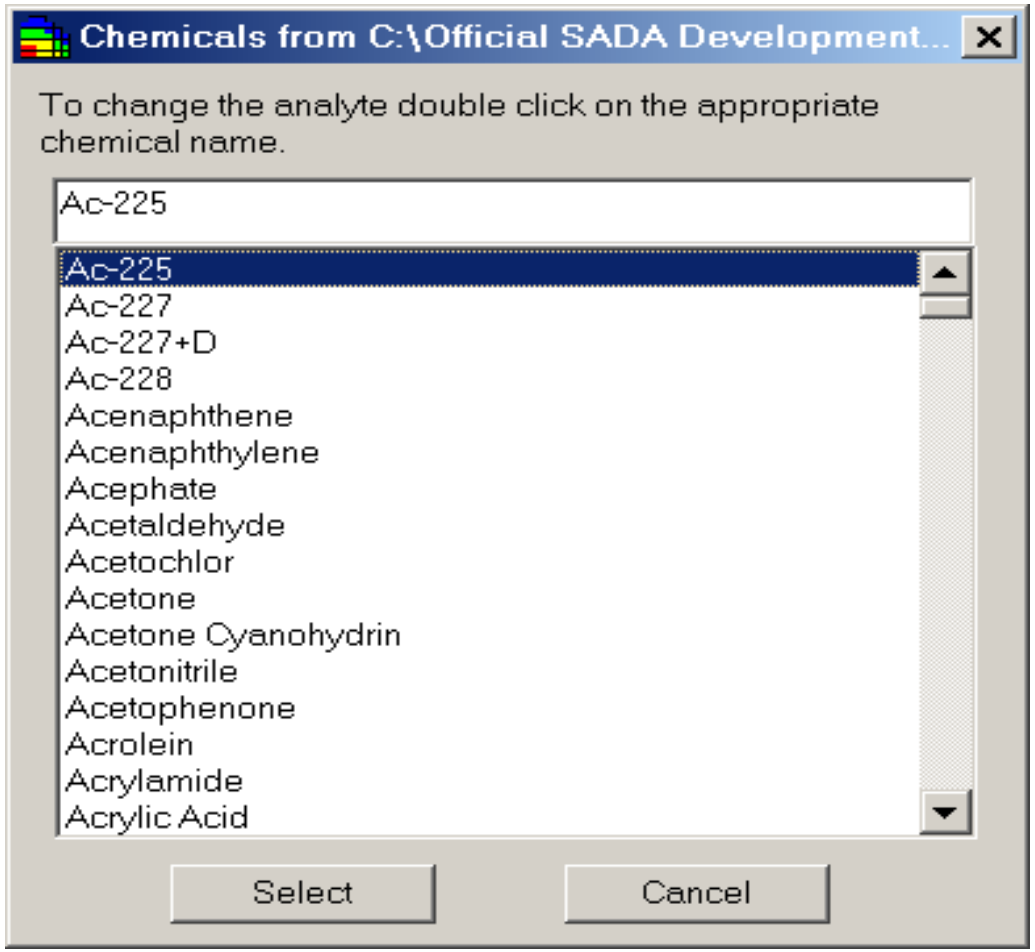
Rematching a Single Contaminant (3)



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Spatial Analysis and Decision Assistance

Part 3: Ecological

- Setting Up Ecological Risk
- Description of Ecological Benchmark Database
- Histograms of Benchmark Values
- Tables of Benchmark Values
- Setting Physical Parameters
- Area Result Tables (Screens, Ratios)
- Map Result Values (Screens, Ratios)
- Rematching a Single Contaminant
- Checking Ecological Version
- Future Directions

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Setup Ecological Risk (1)

- Identify source benchmarks database
- Match contaminants in data to benchmark contaminants
- Adds ecological information to SADA file

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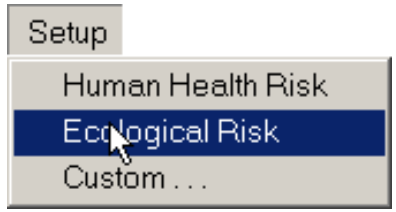
Setup Ecological Risk (2)

- Select **Setup** -> **Ecological Risk**
- Click **Yes** on Risk Setup Wizard
- Browse for eco_toxdata.mdb
- Select **Open,** Then **Next**
- **Register** Contaminants
- Select **Next**



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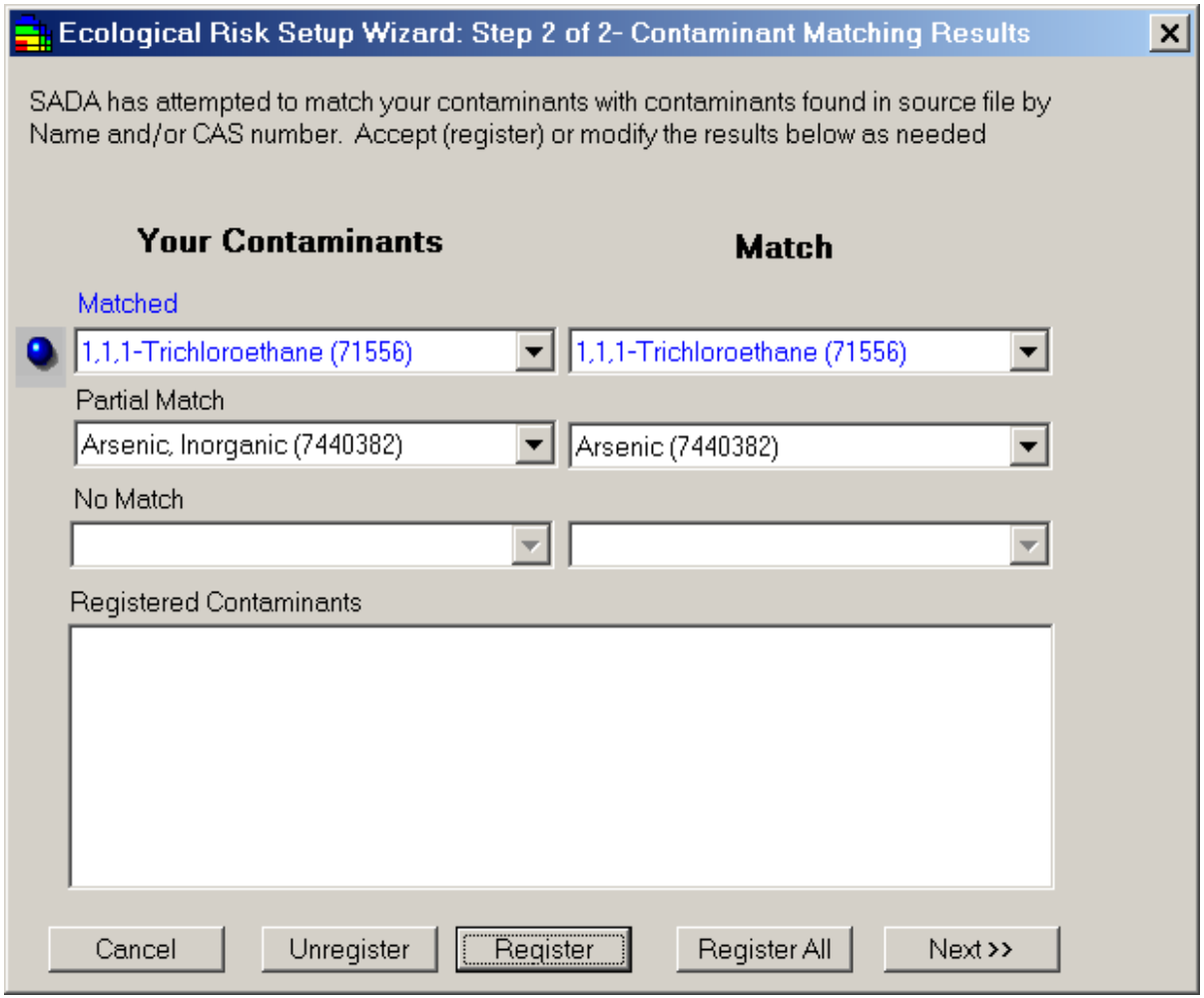
Setup Ecological Risk (3)



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Ecological Benchmarks Databases

- Surface Water (16 Benchmarks)
- Sediment (20 Benchmarks)
- Soil (7 Benchmarks)
- Suitable for performing benchmark screening
- Benchmarks are function of environmental variables where appropriate (pH, Hardness, Organic Carbon, etc.)

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Surface Water Benchmarks

- Canadian Water Quality Guidelines
- EPA Region 4 (Acute and Chronic)
- EPA Region 5 ESLs
- NAWQC (Acute and Chronic)
- ORNL Benchmarks (EC20s and LCVs)
- OSWER ET Tier II (Acute and Chronic)

Sediment Benchmarks

- Canadian Sediment Quality Guidelines (ISQL and PEL)
- Consensus (TEC and PEC)
- Great Lakes ARCS (NEC, TEC, PEC)
- EPA Region 4
- EPA Region 5 ESLs
- EPA Region 6 (Freshwater and Marine)
- Florida DEP (TEL and PEL)
- NOAA (ERL and ERM)
- Ontario (Low and Severe)
- OSWER Ecotox Thresholds
- Washington State (NEL and MAEL)

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Soil Benchmarks

- Dutch (Target and Intervention)
- EPA Region 4
- EPA Region 5 ESLs
- ORNL (Inverts, Microbes, Plants)

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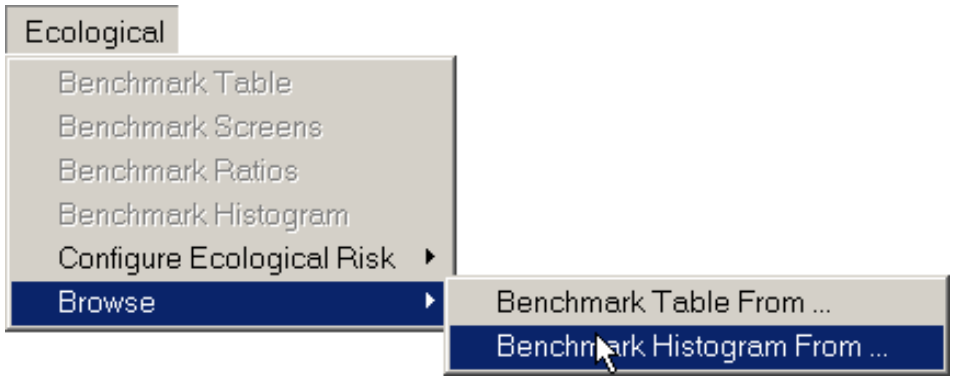
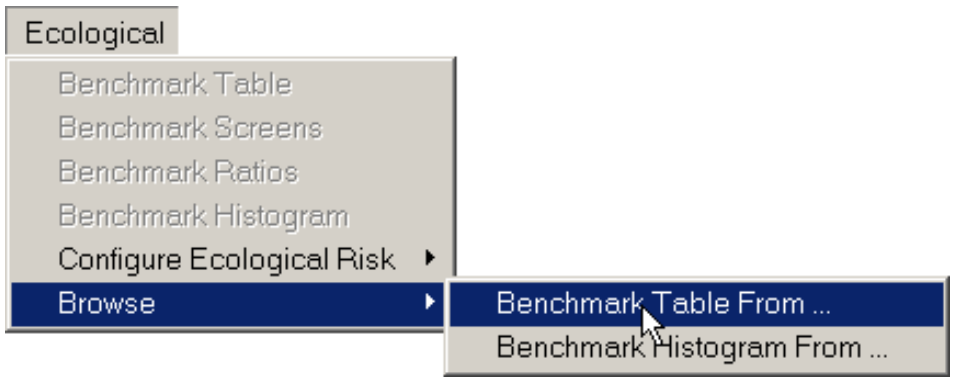
Browse Features

- Histogram



- Tabular View



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Browse Benchmark Histogram (1)

- Can be used to browse benchmarks in master benchmark file or in any SADA file
- Shows all available benchmarks in histogram view
- Based on physical properties saved in file when appropriate (hardness, pH, etc.)

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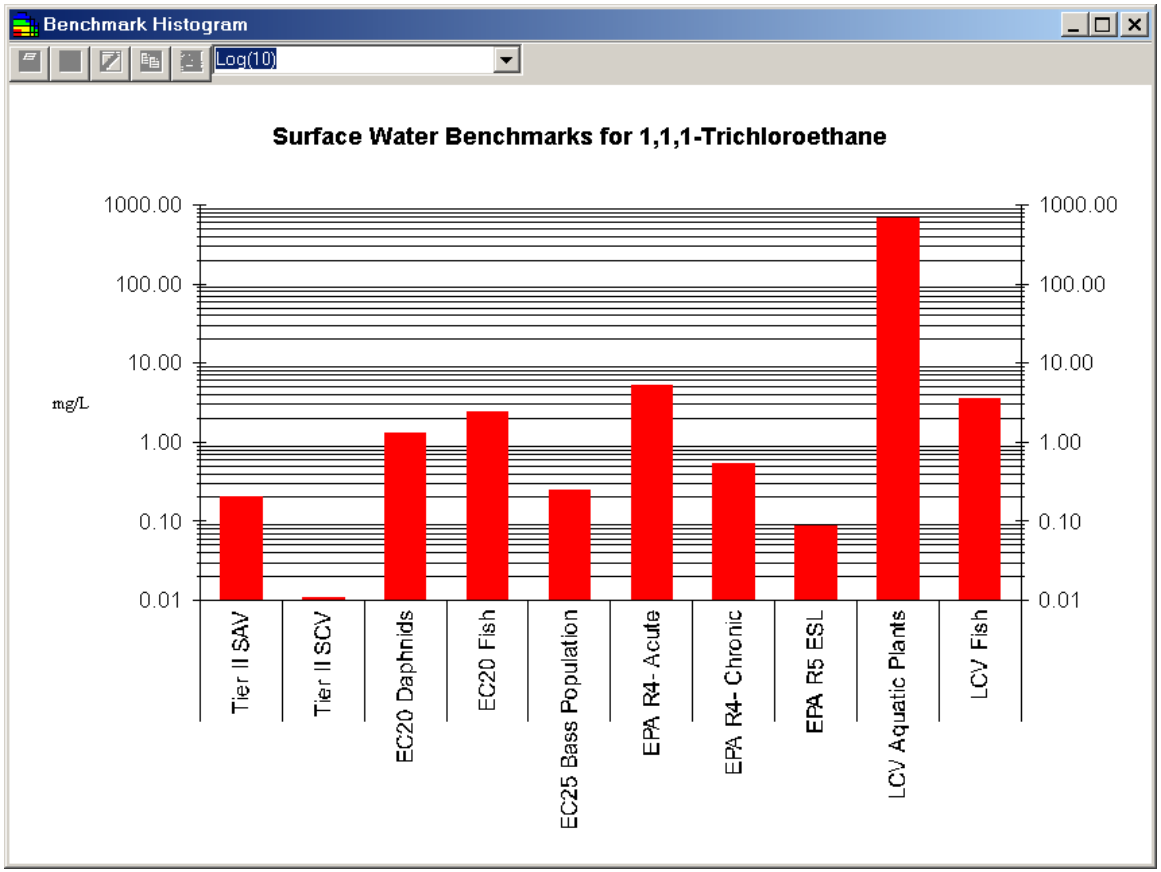
Browse Benchmark Histogram (2)



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Spatial Analysis and Decision Assistance

Browse Benchmark Tables (1)

- Can be used to browse benchmarks in master benchmark file or in any SADA file
- Shows available benchmarks in table view, select which benchmarks to see
- Will update based on physical properties when changed (hardness, pH, etc.)
- Export Results

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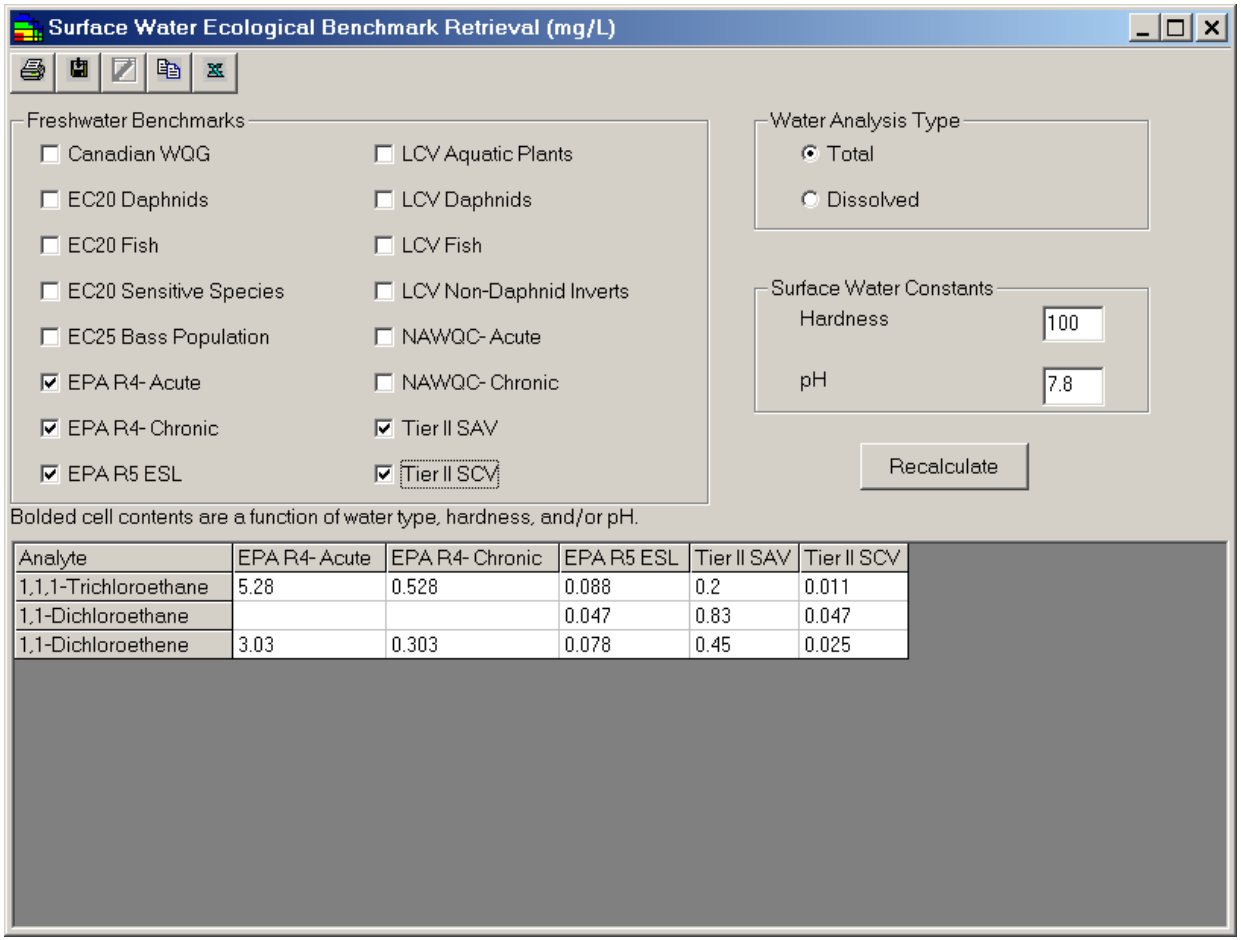
Spatial Analysis and Decision Assistance

Browse Benchmark Tables (2)



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Spatial Analysis and Decision Assistance

Setting Physical Parameters (1)

- Allows users to set site-specific parameters for organic carbon, hardness, pH, and water analysis type
- Benchmarks that are a function of these parameters will be updated

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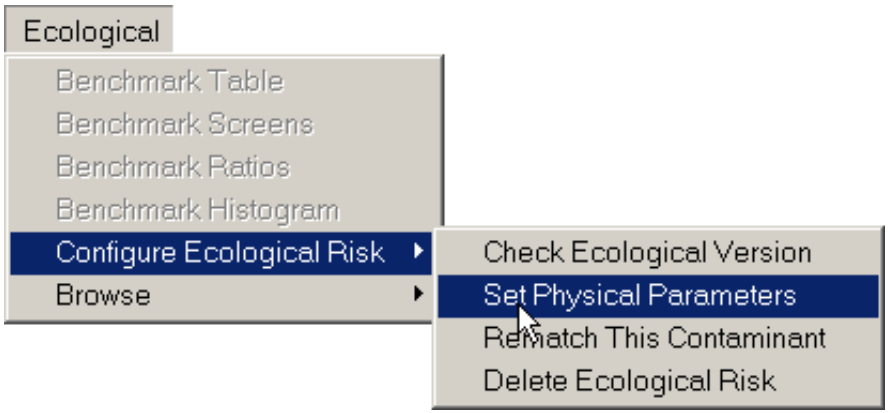
Spatial Analysis and Decision Assistance

Setting Physical Parameters (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Ecological -> Configure Ecological Risk -> Set Physical Parameters**



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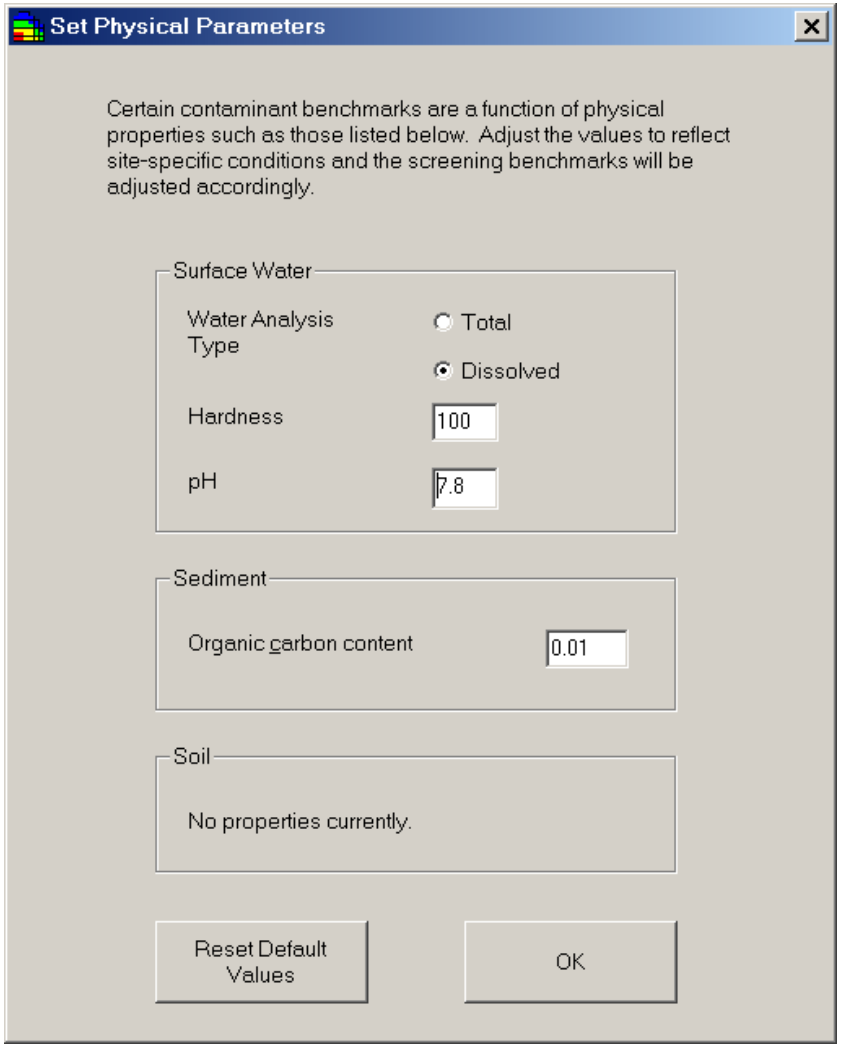
Setting Physical Parameters (3)



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Exposure Area Result Screens (1)

- Provides a Yes-No result for whether the maximum value exceeds the benchmark for a selected area
- User selects the benchmarks to be screened

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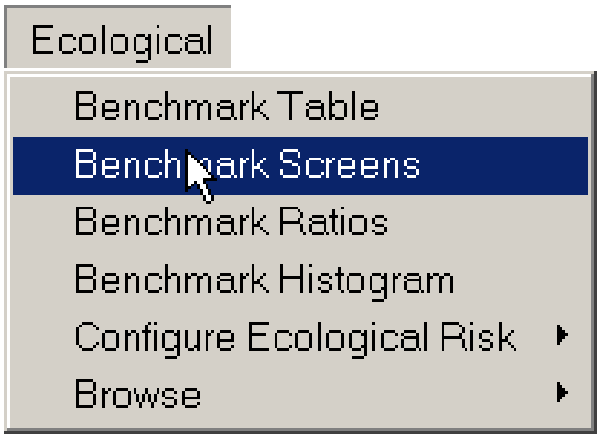
Exposure Area Result Screens (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Ecological** -> **Benchmark Screens**



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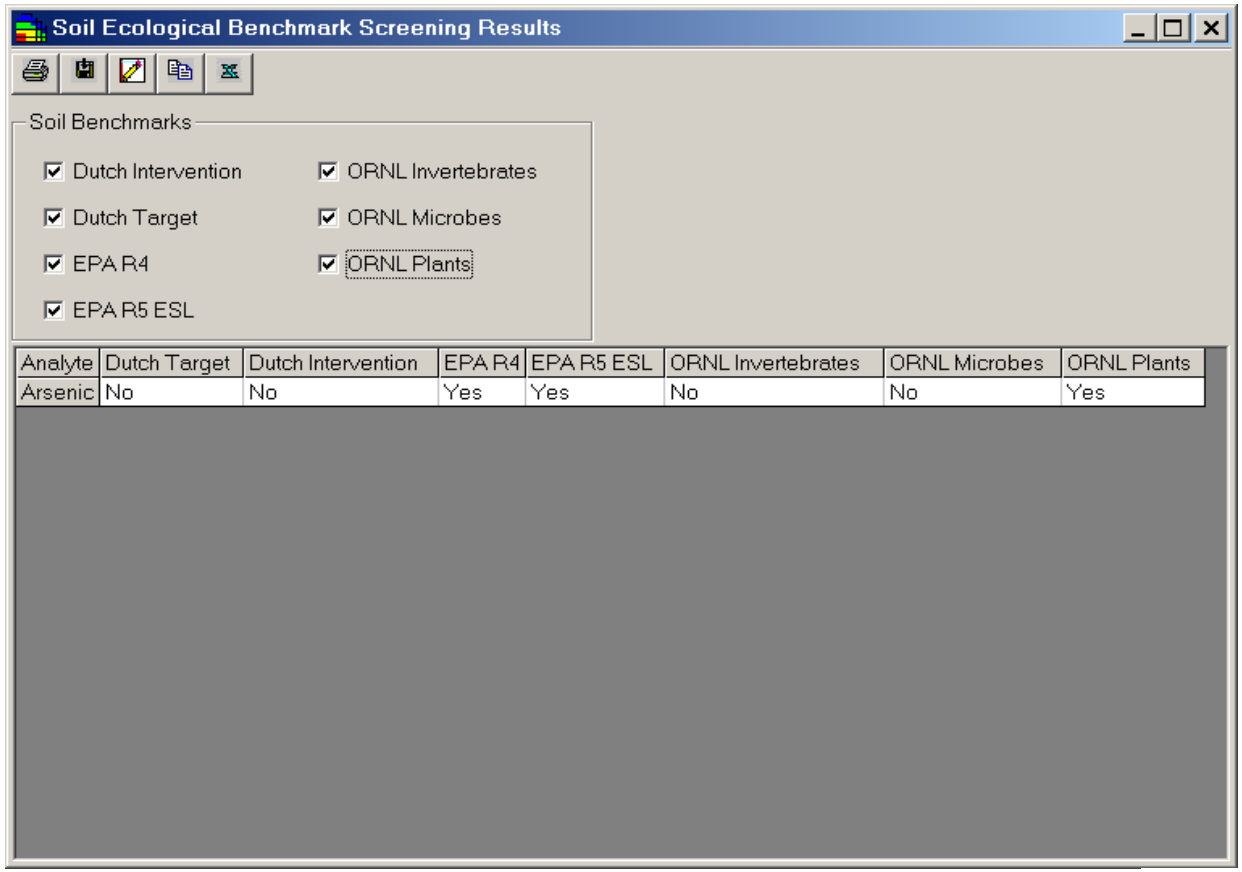
Exposure Area Result Screens (3)



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Exposure Area Result Ratios (1)

- Provides a concentration to benchmark ratio based on the min (UCL95, max) for the selected area
- User selects the benchmarks to be screened

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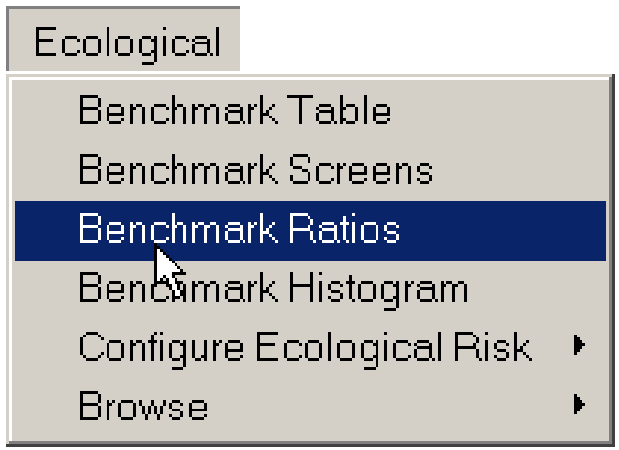
Exposure Area Result Ratios (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Ecological** -> **Benchmark Ratios**



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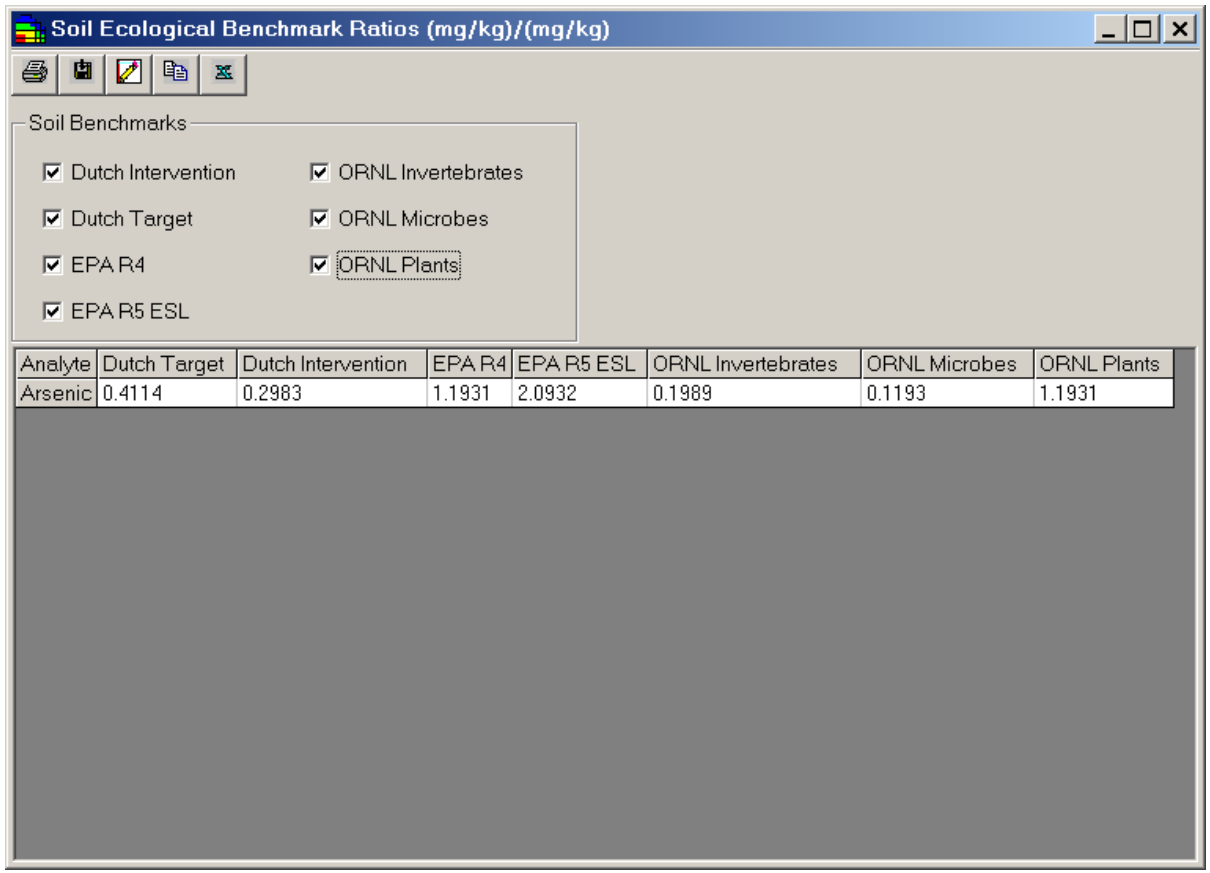
Exposure Area Result Ratios (3)



Analyte	Dutch Target	Dutch Intervention	EPA R4	EPA R5 ESL	ORNL Invertebrates	ORNL Microbes	ORNL Plants
Arsenic	0.4114	0.2983	1.1931	2.0932	0.1989	0.1193	1.1931

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Map Result Screens (1)

- Screens concentration against benchmarks at each sample location
- Places a box around locations that exceed benchmark
- Can use one benchmark source or establish a site-specific hierarchy

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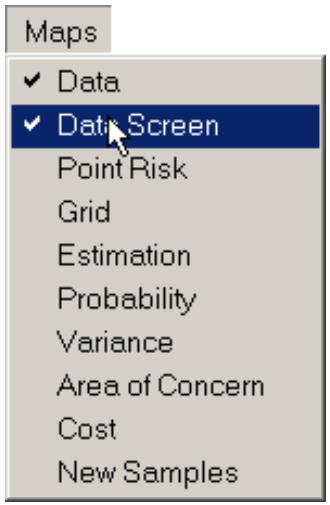
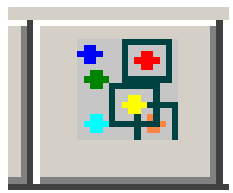
Map Result Screens (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Maps -> Data Screen**
  (or select Data Screen Button)





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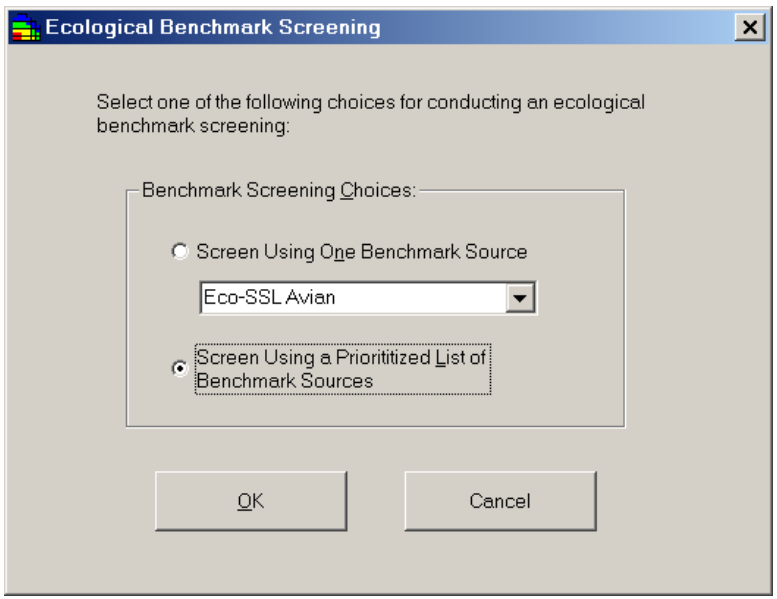
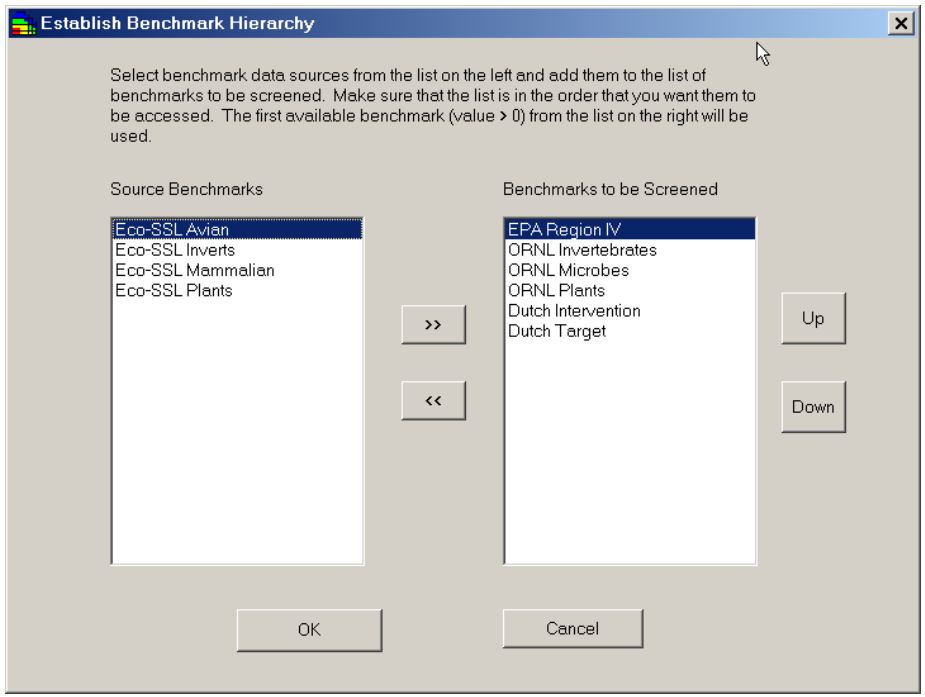
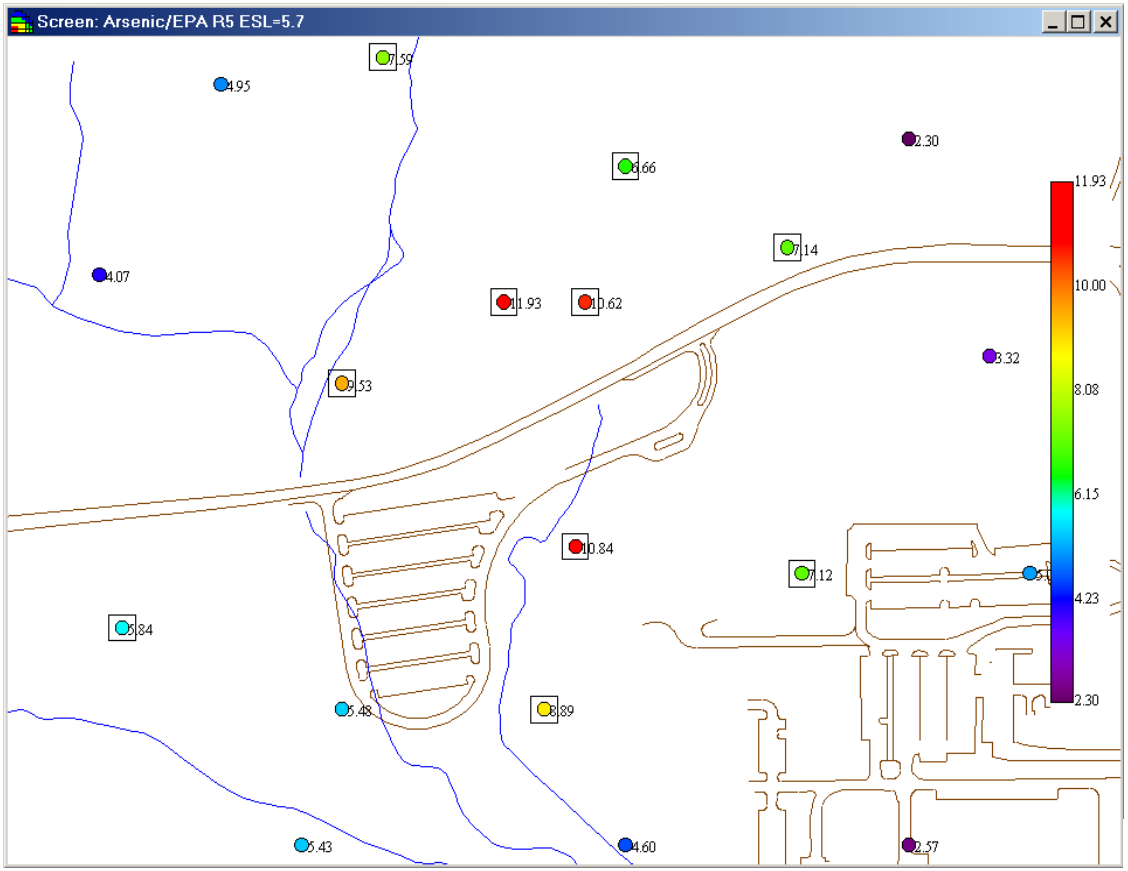
Map Result Screens (3)

- **Select Benchmarks to be screened against**





Map Result Screens (4)



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Map Result Ratios (1)

- Provides a concentration to benchmark ratio at each sample location
- Legend changes accordingly
- Can use one benchmark source or establish a site-specific hierarchy

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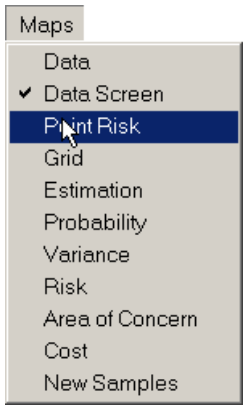
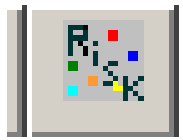
Map Result Ratios (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Maps -> Point Risk**
  (or select Point Risk Button)





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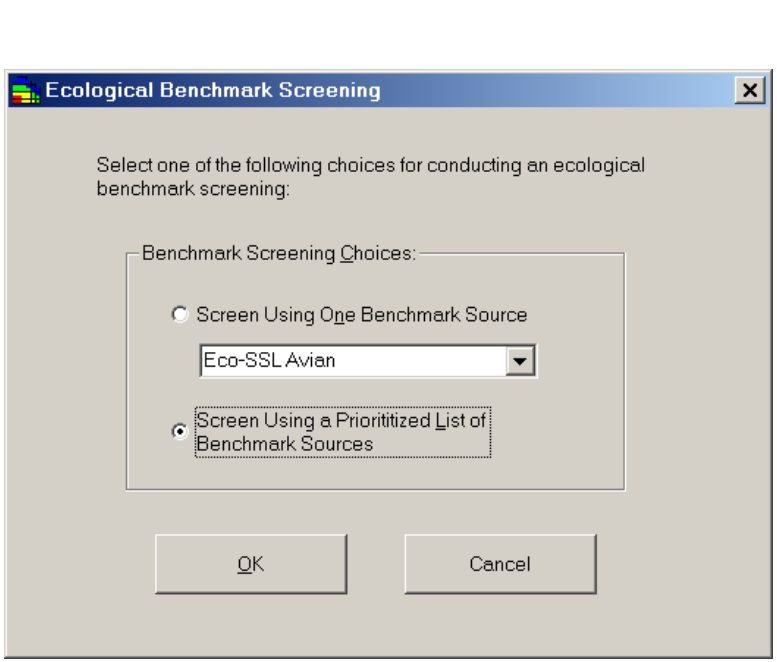
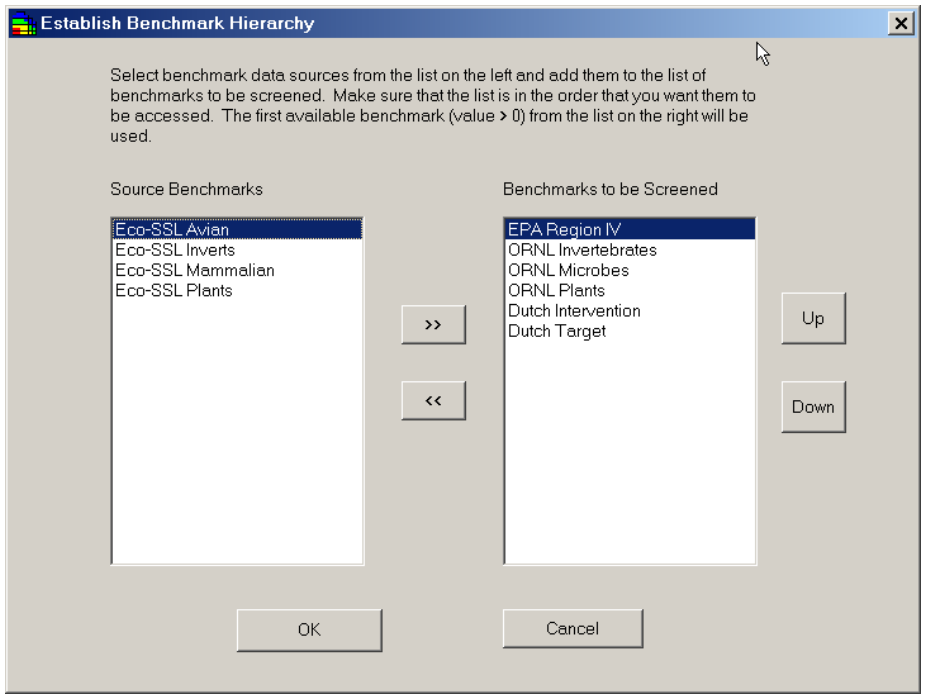
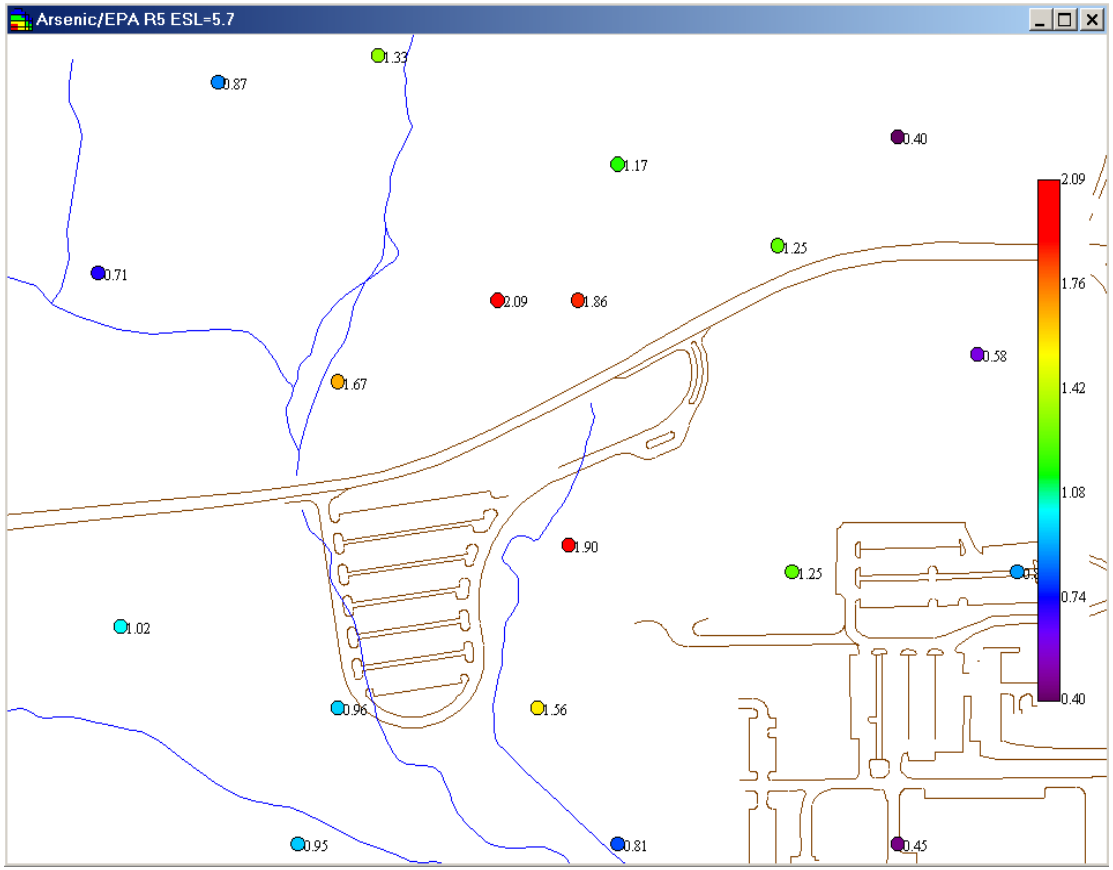
Map Result Ratios (3)

- **Select Benchmarks to be screened against**





Map Results Ratios (4)



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Rematch a Contaminant (1)

- Allows user to change the benchmark information that a contaminant is linked to
- Preferable to resetting up the entire file

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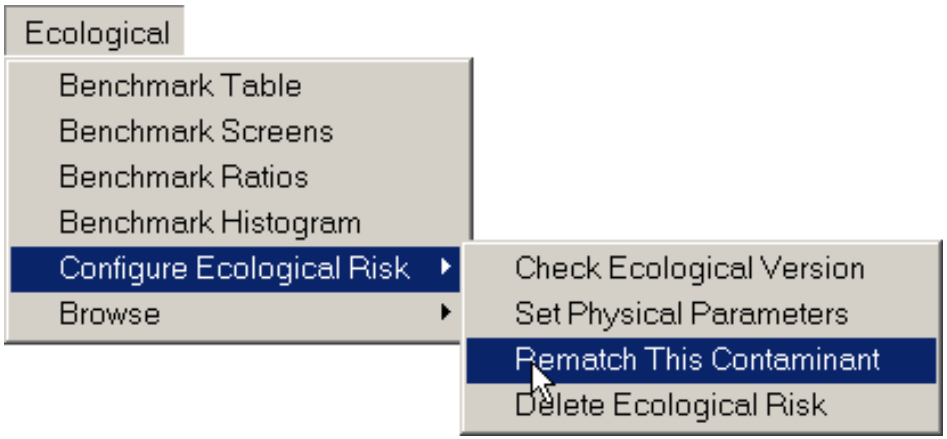
Rematch a Contaminant (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Ecological -> Configure Ecological Risk -> Rematch This Contaminant**



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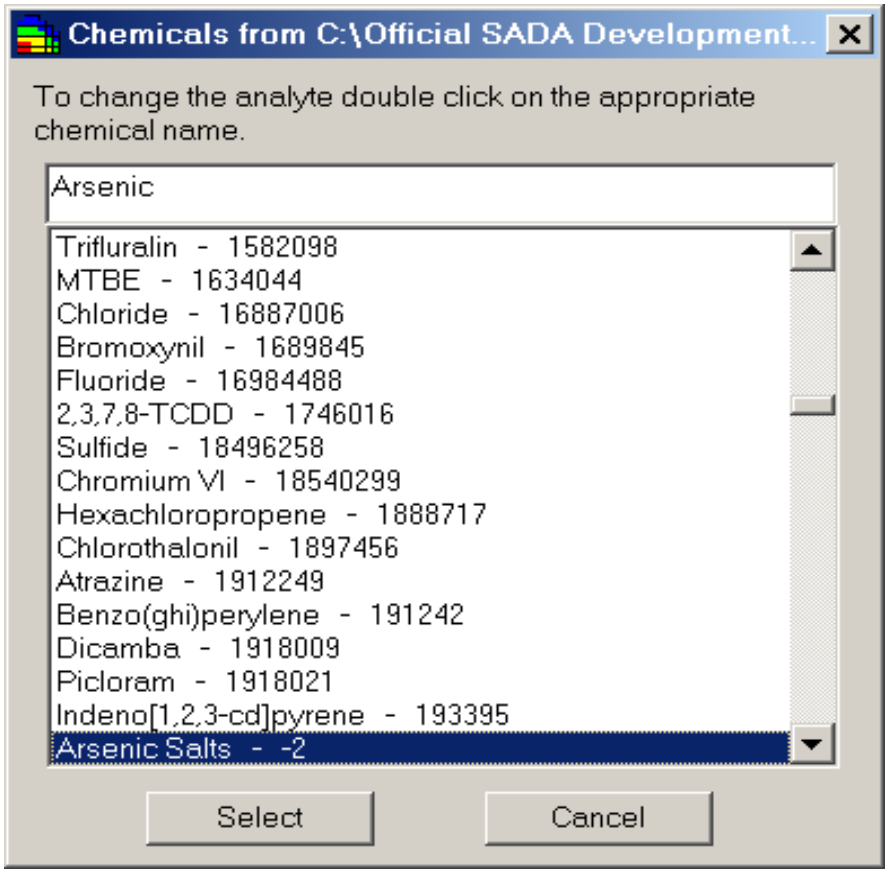
Rematch a Contaminant (3)



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Check Ecological Version (1)

- Allows user to see if ecological benchmark information has been updated since the file was initially created
- Version and date stamp
- Web address to get latest version

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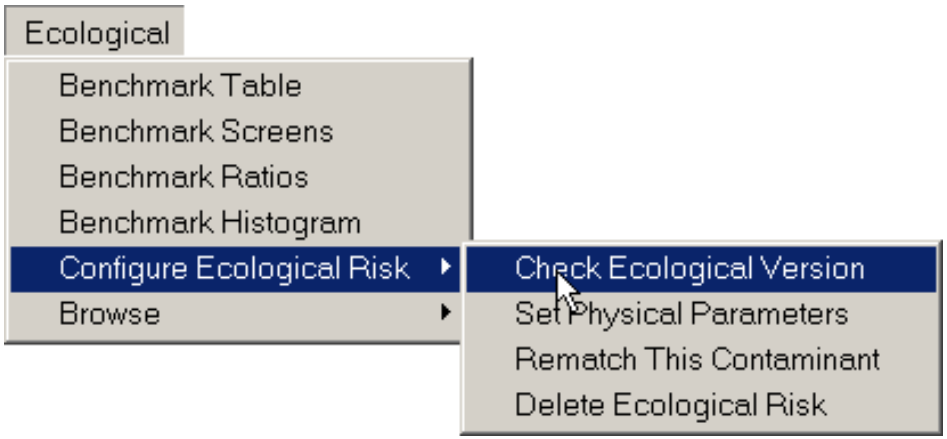
Check Ecological Version (2)

- Select **Ecological** on Analysis Drop Down List
- Select **Ecological** -> **Configure Ecological Risk** -> **Check Ecological Version**



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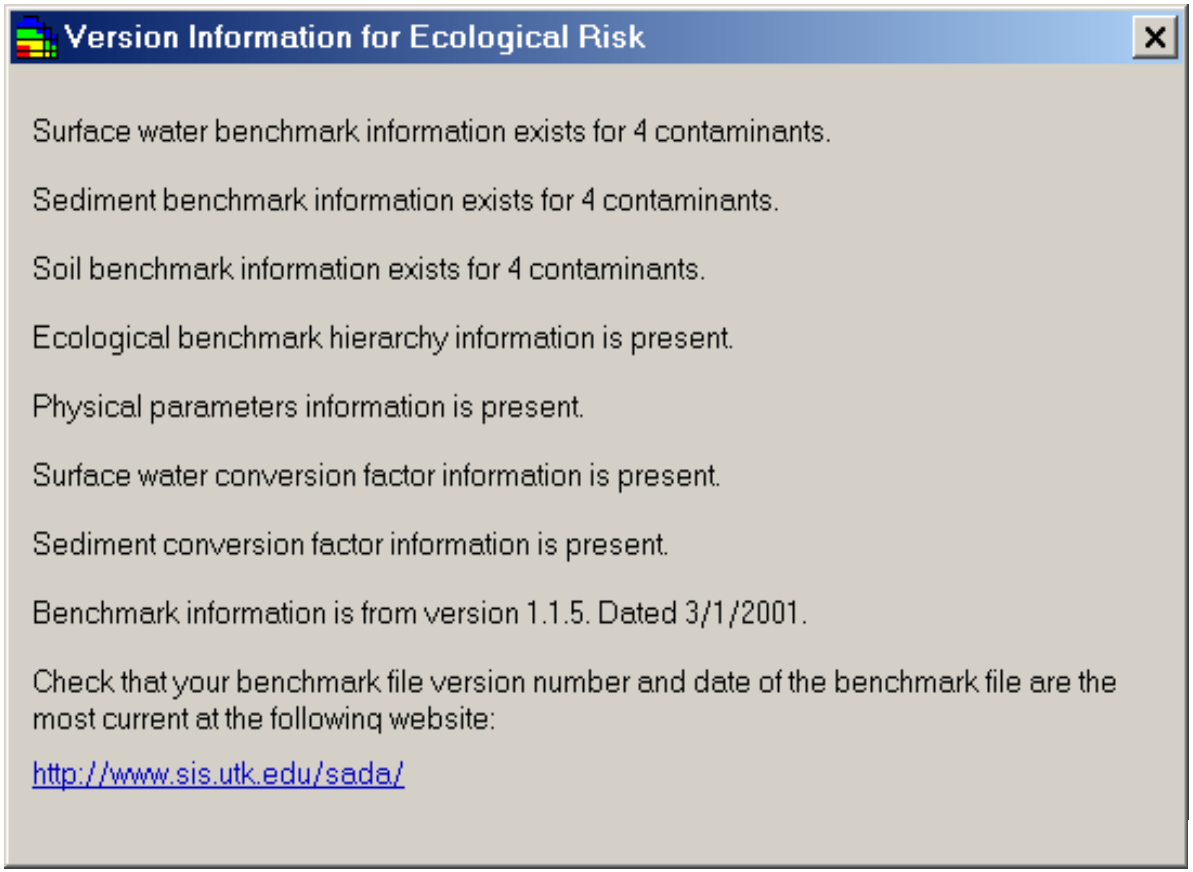
Check Ecological Version (3)



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Future Directions

- Prioritized by EPA Ecological Risk Assessment Forum
- Implement exposure assessment methods for variety of receptors (Eco SSL)
- Add tissue residue benchmarks
- Allow user to import tissue concentration data
- Eco Standard tables for auto-documentation output
- Allow user to import toxicity testing results

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Part 4: Custom Analysis

What is intended for Custom Analysis

Setting Up A Custom Analysis

Viewing Custom Values Table

Custom Value Screen Table

Spatial Custom Value Screen

Rematching a Single Contaminant

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Role Of Custom Analysis

Custom analysis refers to any outside values that can be imported into SADA.

Once imported into SADA, these values can be used to screen data, determine area of concern, and support sample design.

Custom analyses are imported into SADA the same fashion as ecological and human health.

One can have an unlimited number of custom analyses.

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Setting Up a Custom Analysis

- From the main menu, select Setup and then Custom.
- Choose Next.
- Select the file with the custom values you need. In this example, choose browse, select Microsoft Access Database as the file type and choose CustomCriteria.mdb.
- When you select a database, you are presented with the available recordset from that database. In this example, select Custom Analysis.
- Next choose the column from the recordset associated with contaminant names and CAS numbers.
- Accept or modify the contaminant matches and you're finished.

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Viewing Custom Values

- In the analysis list box, choose the custom analysis.
- You will now see the name of your custom analysis appear in the main menu.
- Choose this menu item, and then Custom Analysis Table.
- The custom decision values for the currently selected contaminant are presented in a table.

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Screening Custom Values (Tabular)

- In the analysis list box, choose the custom analysis.
- You will now see the name of your custom analysis appear in the main menu.
- Choose this menu item, and then Custom Screen Table or press the Screen Button.
- If a data value exceeds the custom criteria value, a Yes will appear in the corresponding box.

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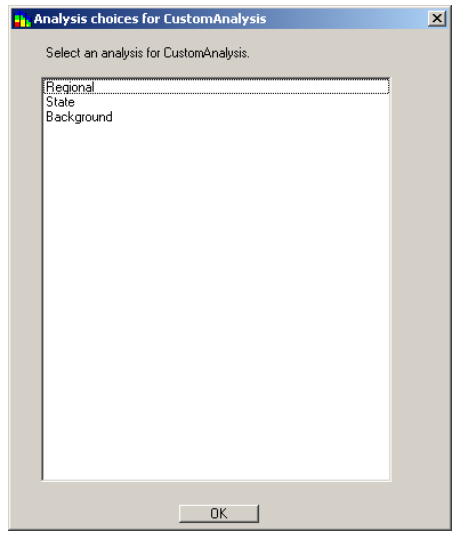
Screening Custom Values (Spatial)

- In the analysis list box, choose the custom analysis.
- On the Decision tab of the control panel under Decision Basis, make sure that the current custom analysis option is selected.
- Press the Data Screen Button.
- You will be presented with all the possible screening criteria in your custom analysis. Choose one.
- SADA responds with the result. If your choice has no value or has a non-numeric value, SADA will prompt you to use zero or just quit.



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Part 5: Geospatial Methods

- Overview of Geospatial Approaches
  - What is a geospatial analysis
  - What types of results can they provide
- Geometric Approaches
  - Nearest Neighbor
  - Natural Neighbor
- Geostatistical Approaches
  - Spatial Correlation
  - Search Neighborhoods
  - Inverse Distance
  - Ordinary Kriging
  - Indicator Kriging

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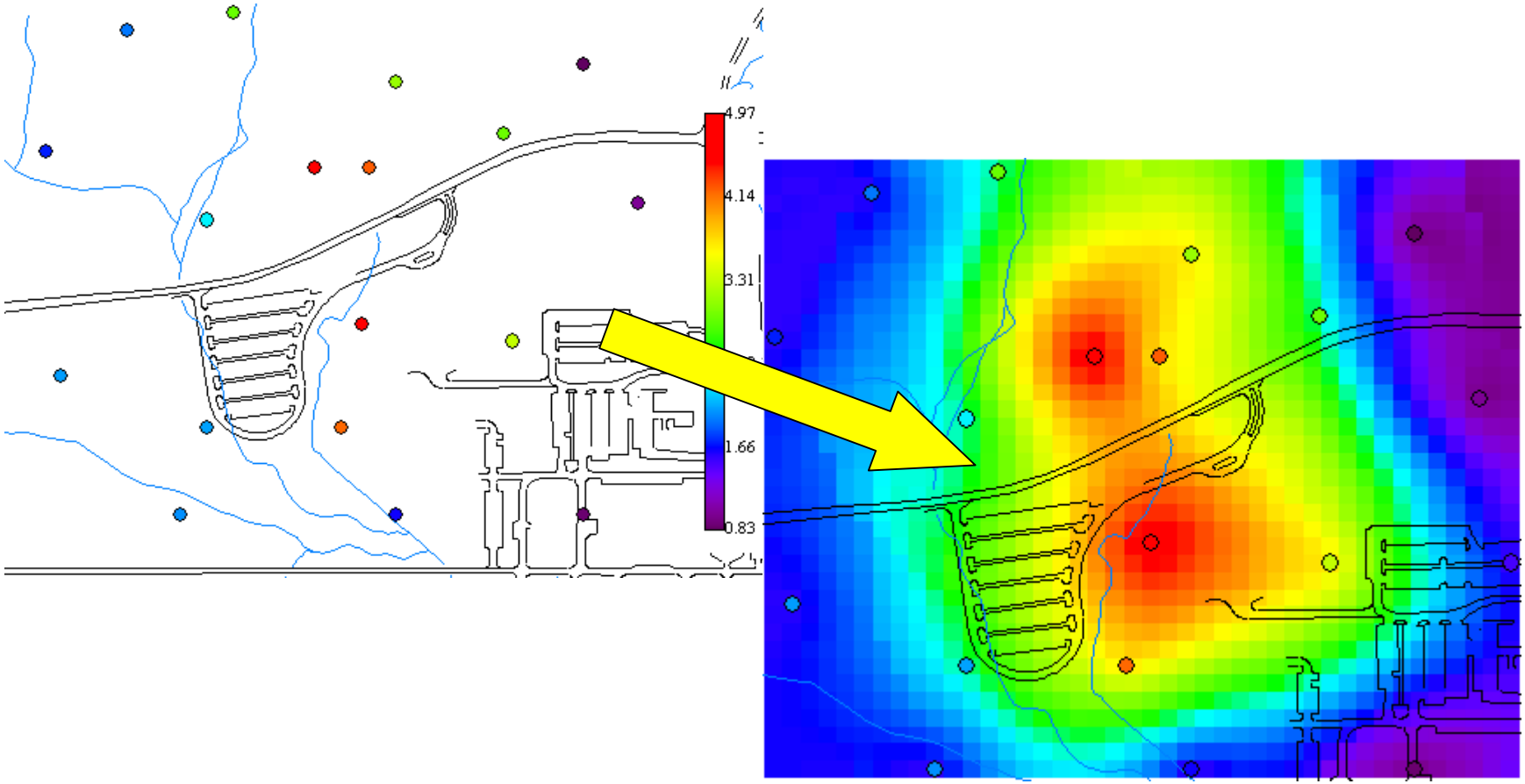
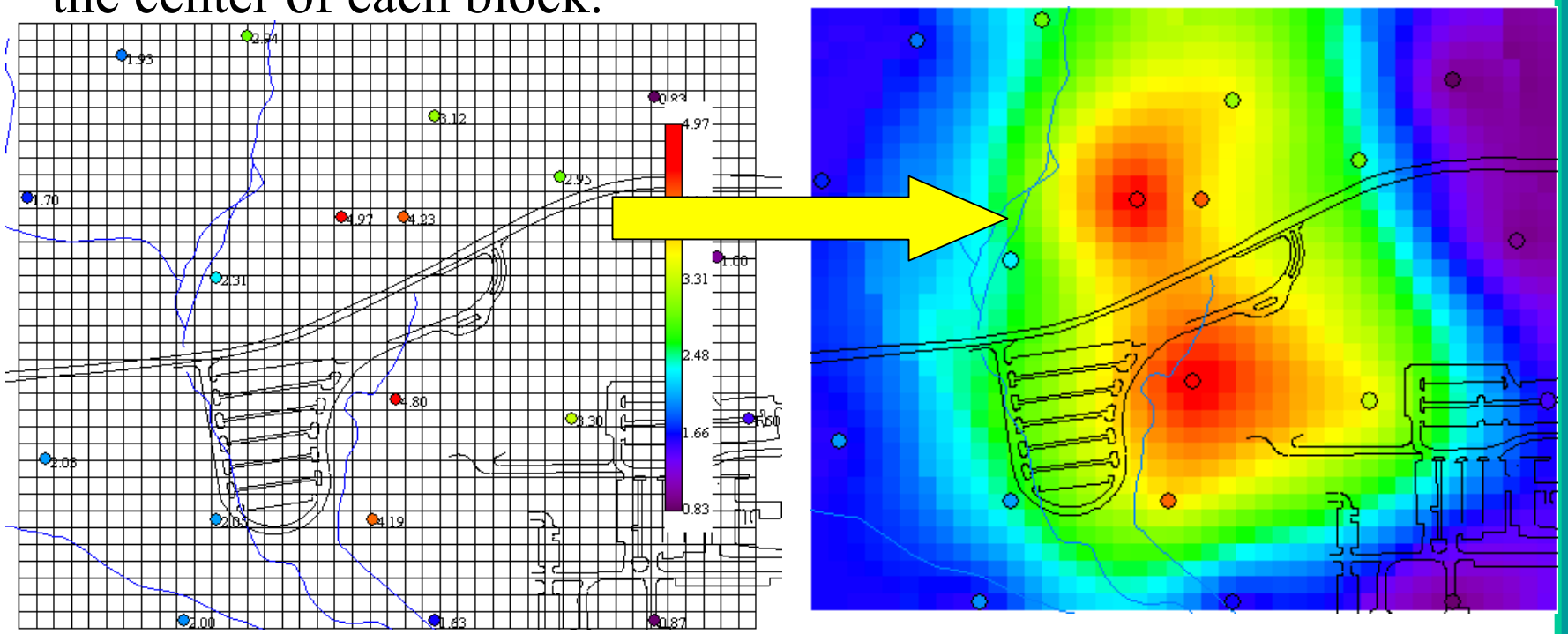
Review of Spatial Interpolation

Spatial interpolation is used to predict values between sampled locations.



Review of Spatial Interpolation

All spatial interpolators in SADA depend on a grid definition to function. A grid definition simply describes the number, size, and location of a uniform set of blocks. These blocks will be the focus of the interpolation schemes. SADA's interpolation schemes will estimate the concentration value at the center of each block.

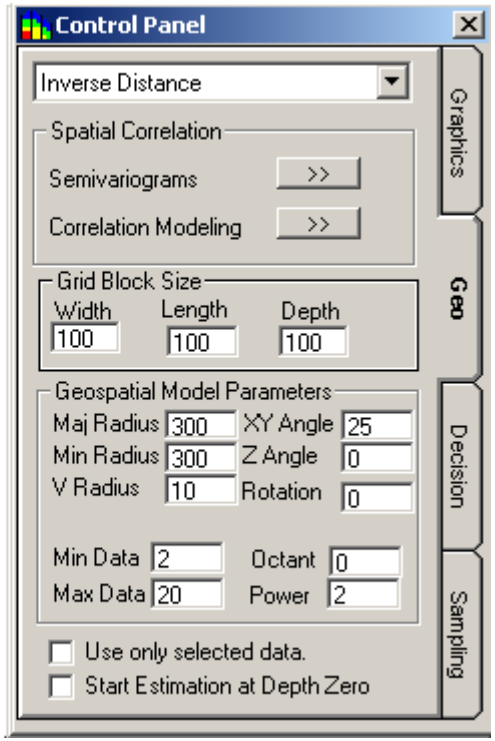


Search Neighborhoods

Inverse distance, ordinary kriging, and indicator kriging all require a neighborhood definition for estimating concentration values at a point. A neighborhood is defined as an area around the point in which data values will be used to estimate the concentration value. Data values outside the neighborhood will be excluded.

The neighborhood is always defined by a search ellipse that can be manipulated in shape and size to include or exclude various data. The parameters which control the shape and size of the search ellipse are entered in the Geo tab of the Control Panel.

Search Ellipse Parameters →



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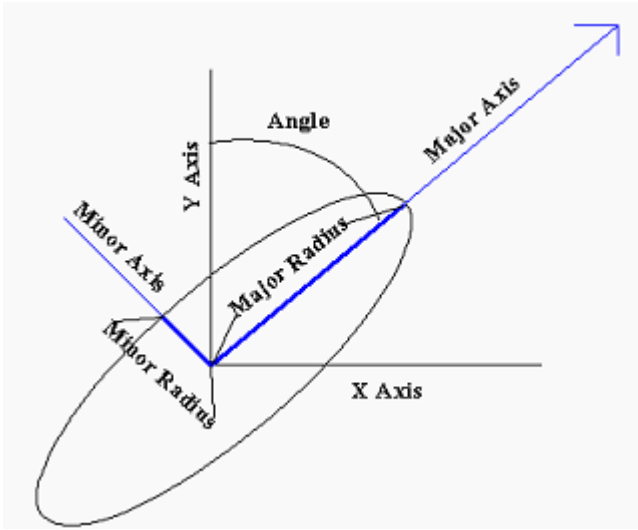
Search Neighborhoods

The parameters Radius, XY Angle, and XY Shape control the size and shape of the search ellipse.

Major Radius
The long radius of the ellipse.

Minor Radius
The short radius of the ellipse.

XY Angle
The angle or direction the long radius points. This angle is measured clockwise from the positive Y axis (0 deg is North). The minor elliptical axis is perpendicular to the major axis.



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Search Neighborhoods

For three-dimensional data, the ellipse becomes an ellipsoid. The following parameters, in addition to those listed above, describe the search ellipsoid in 3D space.

Z Angle

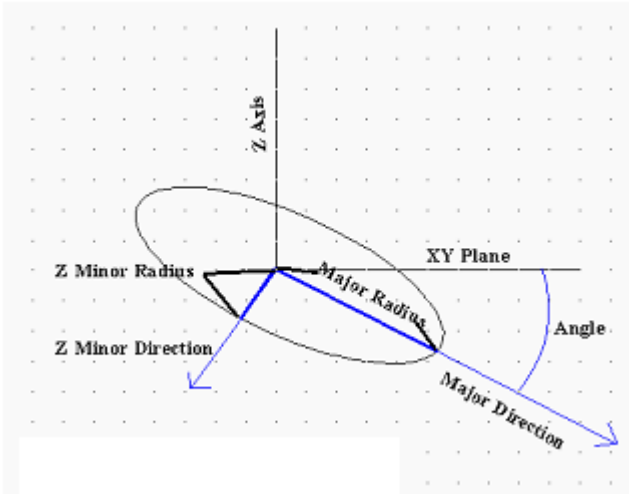
The angle or dip below the XY plane at the point of estimation. This angle is measured as negative degrees below the plane.

V Radius

Also referred to as Z minor radius, it is the radius of the ellipse in the vertical direction.

Rotation

The parameters described to this point fully form the body of the ellipsoid in 3D space. The rotation parameter then rotates this ellipsoid about the major axis the specified number of degrees.



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Search Neighborhoods

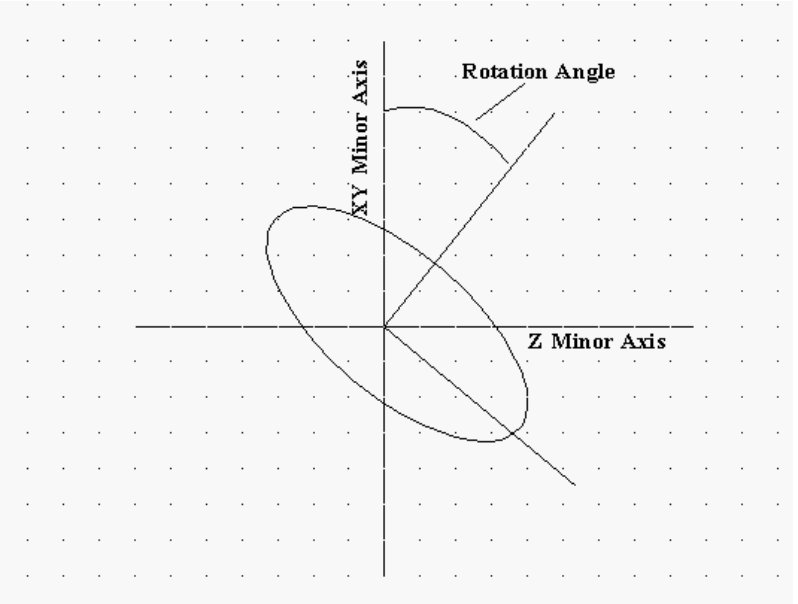
The following view shows the effect of the rotation parameter on the ellipsoid body. This view is along the major elliptical axis. The rotation angle rotates the two orthogonal directions clockwise relative to the major elliptical axis when looking toward the origin.

The following parameters define the search criteria within the search ellipse.

Min Data
The minimum number of data required before estimating the concentration. If this minimum is not met, SADA returns an unestimated value. You will be notified of the number of unestimated values. These values appear as empty spaces in the plot.

Max Data
The maximum number of data to use in estimating a point.

Octant
The ellipsoid is divided into quadrants, four if two-dimensional, eight if three-dimensional. If the Octant value is greater than zero and there are fewer data points than the octant value in each quadrant of the ellipsoid, then the point will not be estimated.



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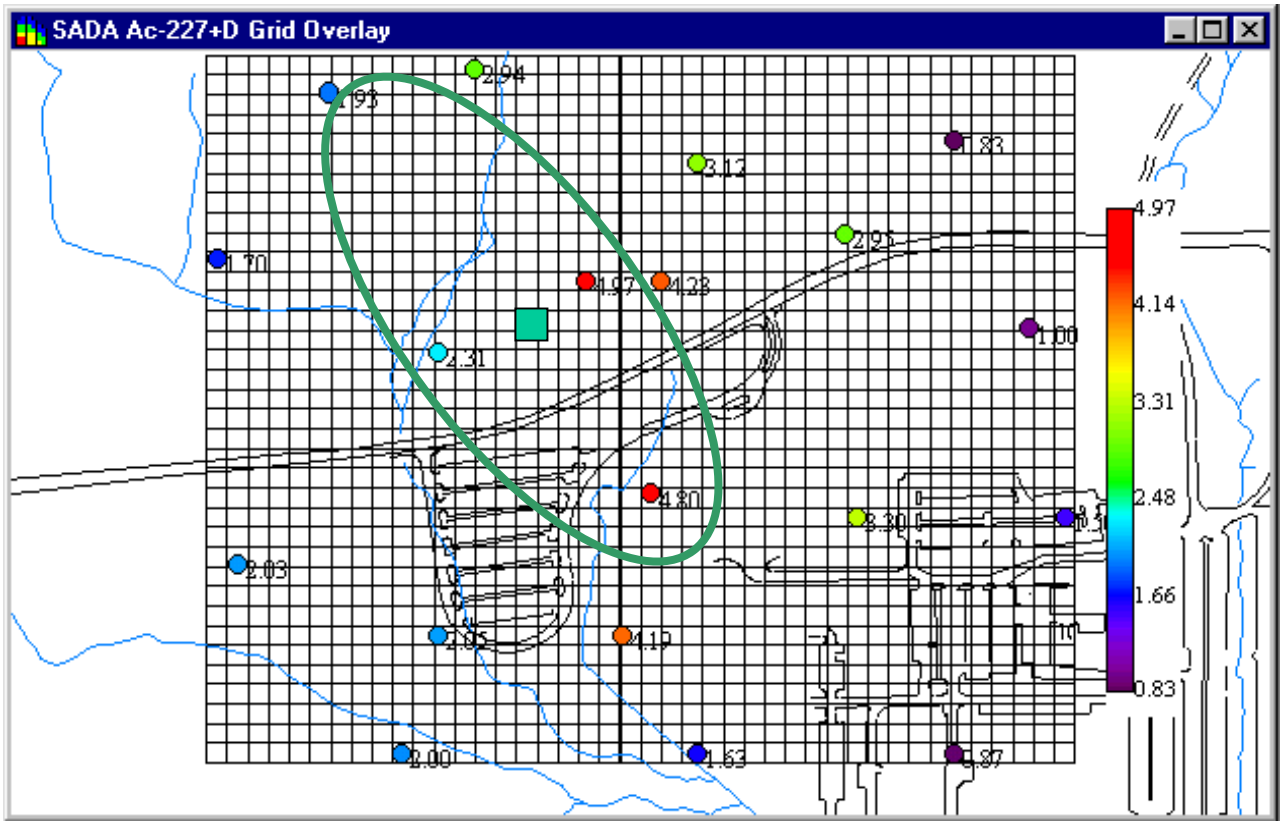
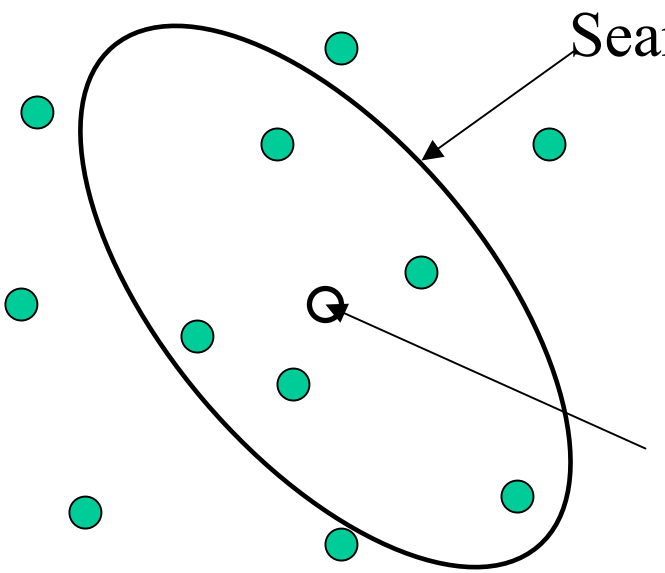
Search Neighborhood for an Single Unsampled Point



Inverse Distance

The estimated value V_o at an unsampled location is estimated as the weighted average of nearby values.



$$V_0 = \sum_{i=1}^{N} w_i V_i$$

Inverse Distance

$$w_i = \frac{1}{d_i^p \sum_{j=1}^{N} d_j^p}$$

w_i is the weight for the ith neighbor

d_i is the distance of the ith neighbor

p is the power

N is the number of neighbors within the search neighborhood

Inverse Distance in SADA

Select the contaminant of interest and define a grid.

Choose Inverse Distance from the list of available interpolants on the geo tab of the control panel.

Setup an appropriate Search neighborhood and specify the power parameters.

Press the Estimates map button.

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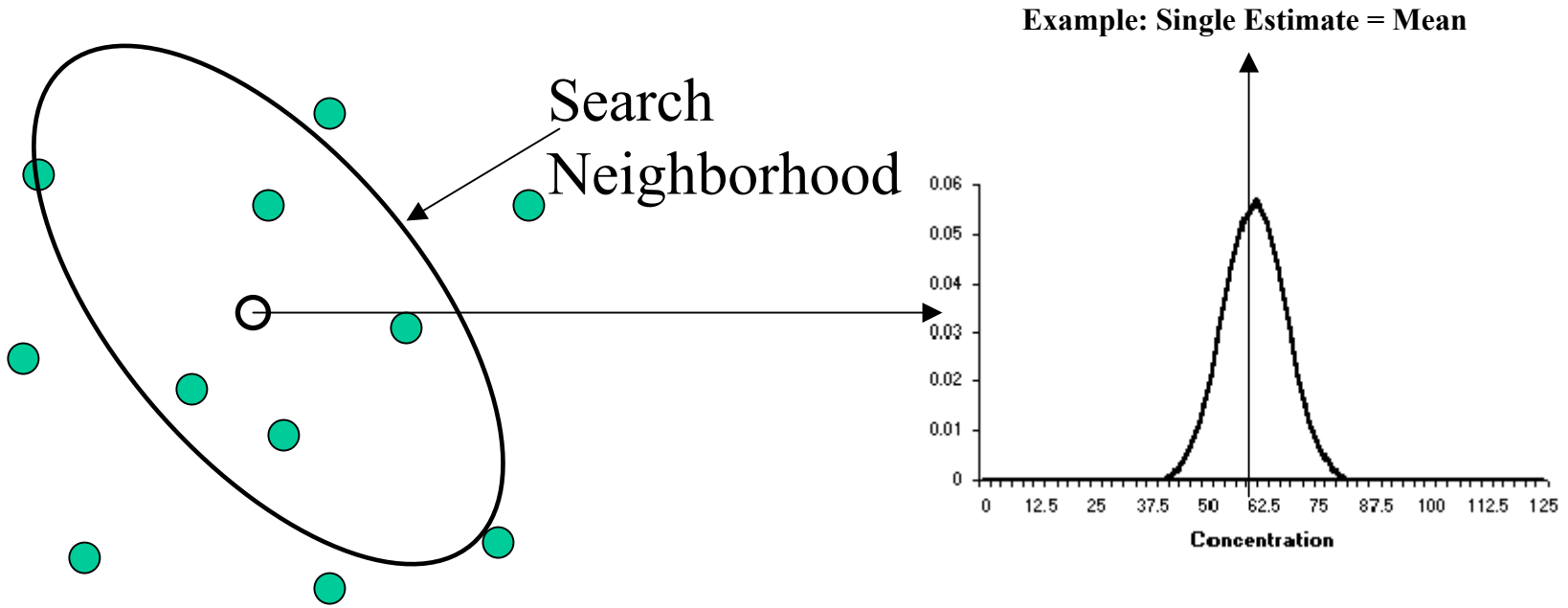
Ordinary Kriging and Indicator Kriging

Rather than producing a single estimate, a distribution of possible values is constructed. This permits a model of uncertainty about the true value. One can also choose a point of the distribution as a single estimate.



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Ordinary Kriging and Indicator Kriging

A full explanation of ordinary kriging and indicator kriging is beyond the scope of this training session. We will only cover the basic concepts and demonstrate how to set up such an interpolant in SADA.

In simple terms, geostatistical methods approach interpolation from a weighting of nearby samples. However, the influence of nearby samples is based on a covariance model rather than distance alone.

A covariance model describes how much data separated by various distances vary in magnitude.

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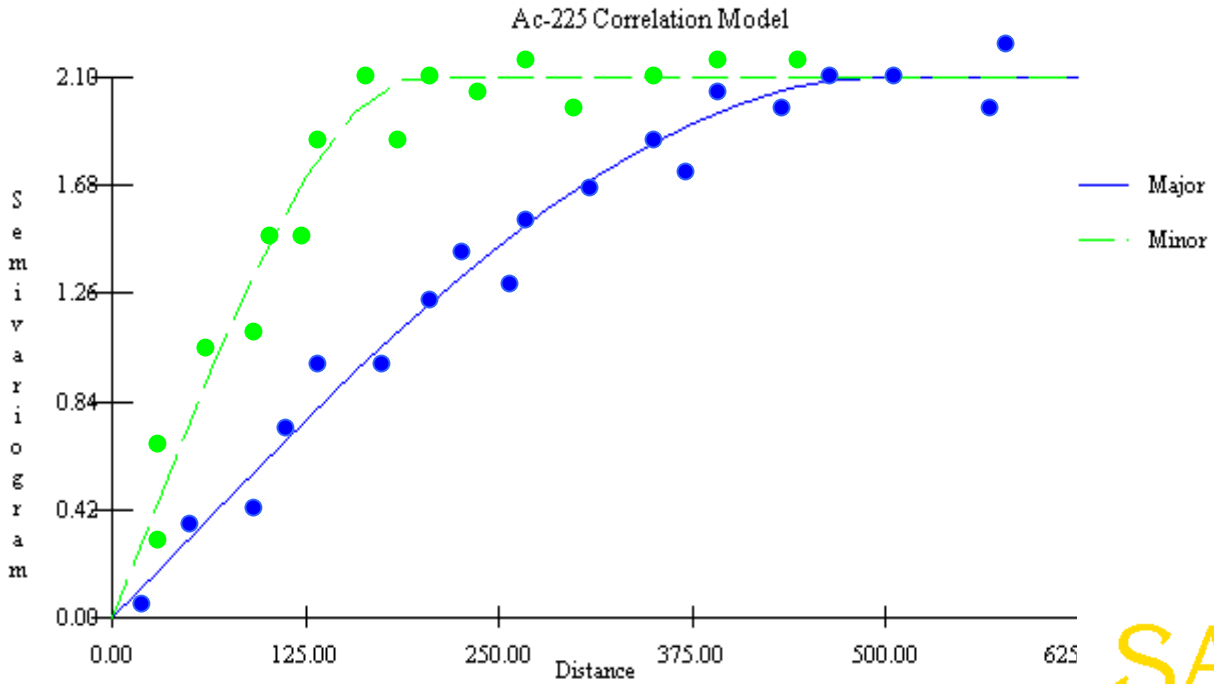
Spatial Covariance

Geostatistics are built upon a model of spatial variability. Spatial covariance models are used to describe how variable data are across space. (Data sampled closely together are more alike than samples taken farther apart)



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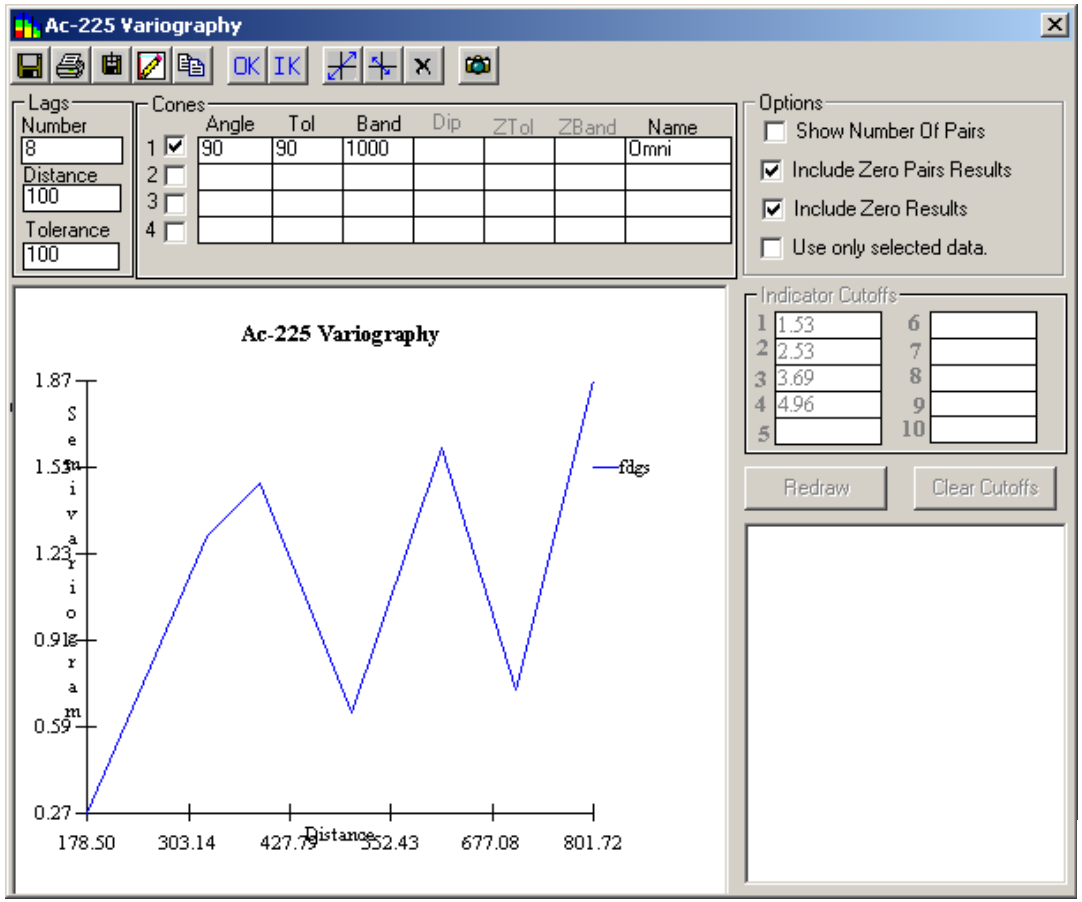
Setting Variography and Correlation Models

To open the experimental variography window, select the geo tab on the control panel. Select a single contaminant (not pooled). Press the Semivariograms Button.

A detailed explanation can be found in the help file.



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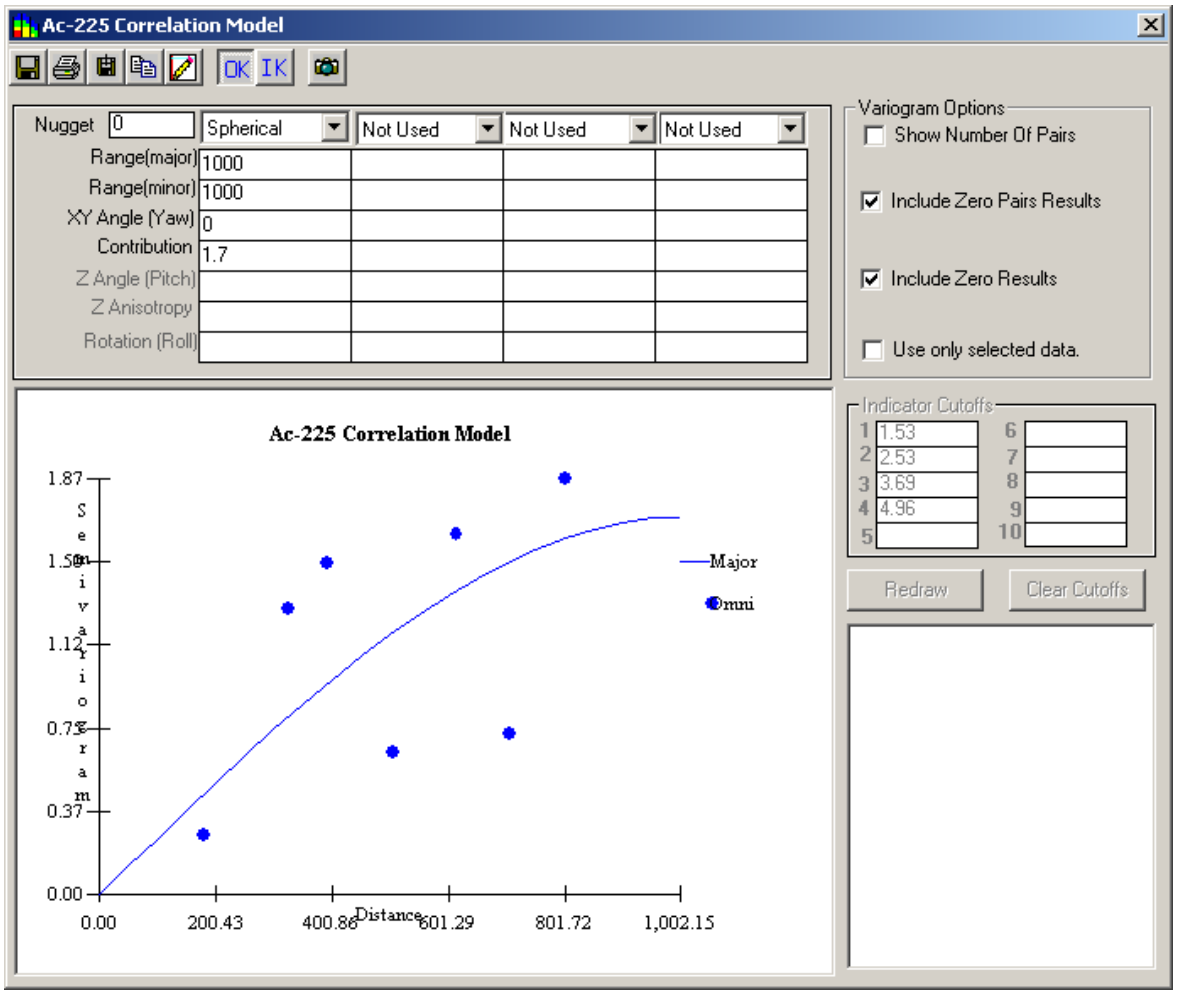
Setting Variography and Correlation Models

To model Spatial Covariance, press the Correlation Modeling Button. A detailed explanation can be found in the help file.



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Ordinary Kriging and Indicator Kriging in SADA

- Select the contaminant of interest and define a grid.
- Perform experimental variography.
- Fit experimental variography results with correlation model.
- On the geo tab, select Ordinary or Indicator from the list of available interpolants.
- Setup an appropriate search neighborhood.
- Press the Estimates map button (or any other spatial model map.)
- Under OK, variance maps, probability maps, block scale confidence maps, and uncertainty based secondary sample design become available.
- Under IK, probability maps, block scale confidence maps, and uncertainty based secondary sample design become available.

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Nearest Neighbor

This is the simplest of all interpolants in SADA. Any unsampled point is simply equal to the data point closest to it.

Select the contaminant of interest and define a grid.

Choose Nearest Neighbor from the list of available interpolants on the geo tab of the control panel.

Press the Estimates map button.

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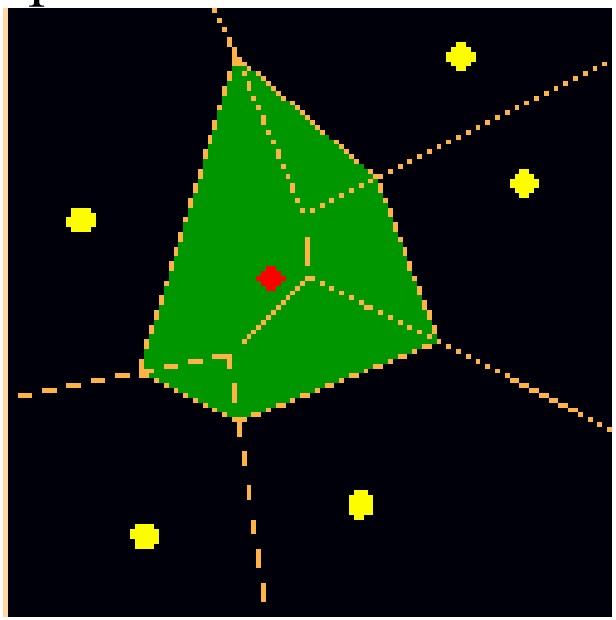
Natural Neighbor

Areas of influence for existing data points are overlapped with the area of influence for the unestimated point. The area of overlap with the sampled data's area of influence becomes the weighting factor.



Select the contaminant of interest and define a grid.

Choose Natural Neighbor from the list of available interpolants on the geo tab of the control panel.

Press the Estimates map button.

Part 6: Decision Analysis

- Probability Maps
- Area of Concern Maps
  - Block Framework
  - Site Framework
  - Volume
- Cost Benefit Analysis

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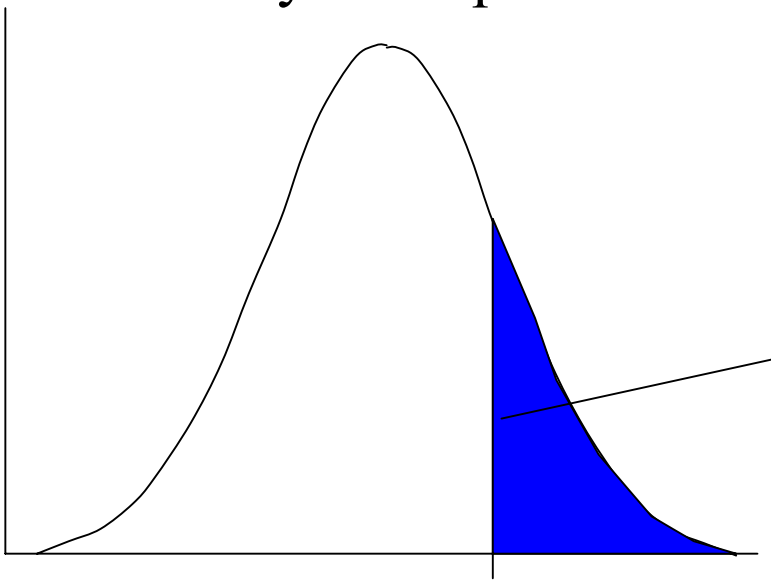
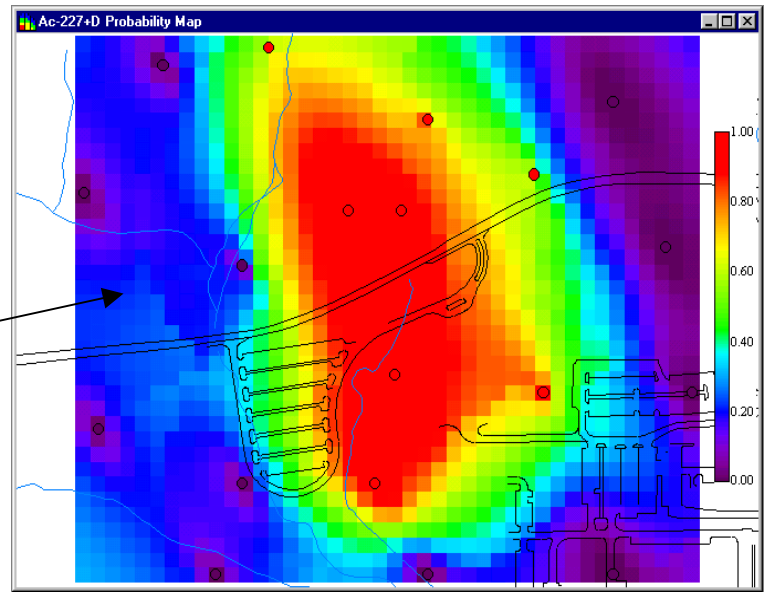
Probability Maps

- A probability map spatially delineates the probability of exceeding a specified threshold.
- The probability of the center of each block exceeding the threshold value is calculated.
- Probability maps can only be created when using ordinary kriging or indicator kriging.

Probability > 3.0 pCi/G

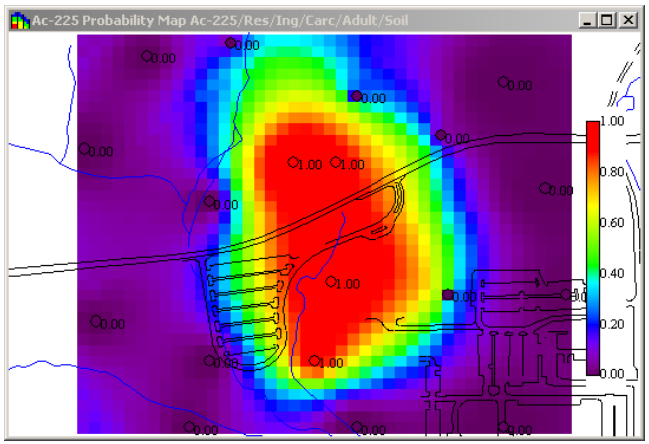


Probability > 3.0 pCi/G



Creating Probability Maps

- Setup ordinary or indicator kriging and select it in the list of available interpolants on the geo tab of the control panel.
- Define a grid.
- Choose a decision basis.
- Press the Probability Map button.
- If you use a decision basis other than concentration, then you will be prompted to choose a particular decision criteria from that analysis.



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Area of Concern Maps

- Draws the area of concern based on the modeled values, a threshold value, and a decision framework.
- Can be drawn with any of the five available interpolants.
- Threshold values can come from user defined concentrations, human health risk, ecological risk, or custom analysis.
- Three decision frameworks are available
  - Block Scale (Nearest Neighbor, Natural Neighbor, Inverse Distance)

    The decision criteria is applied to individual blocks.
  - Confidence Based Block Scale (Ordinary and Indicator Kriging)

    The decision criteria, which now includes a remedial confidence parameter, is applied to individual blocks.
  - Site Scale (All Five Interpolants)

    The decision criteria is applied to the site. Individual blocks are "remediated" until the site-wide model average satisfies the specified threshold.

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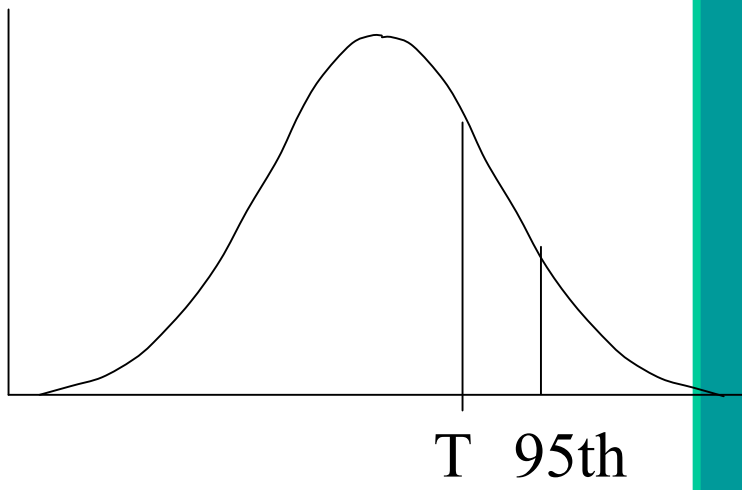
Decision Scales

Block Scale

If the estimated block value is above the threshold value, it must be remediated. For ordinary and indicator kriging, set the confidence parameter equal to .5.

Block Scale (Confidence)

Given a threshold value, if the 95th percentile is greater than the threshold value then remediation is required. Otherwise, there is at least a 95% chance the true value falls below the threshold.

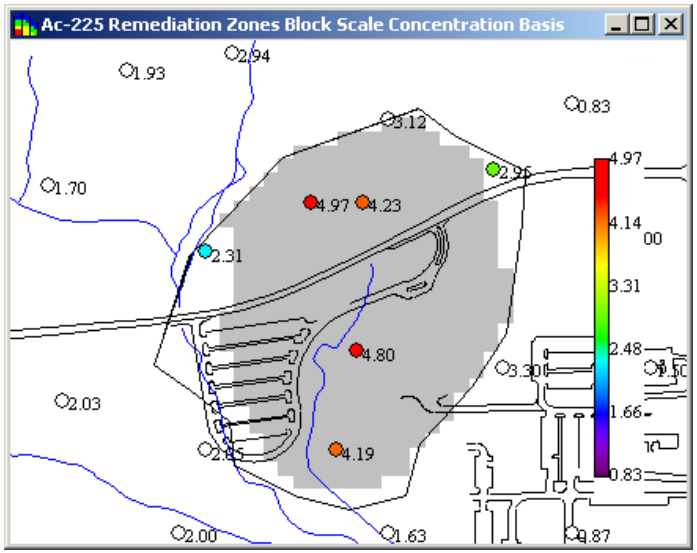


Site Scale

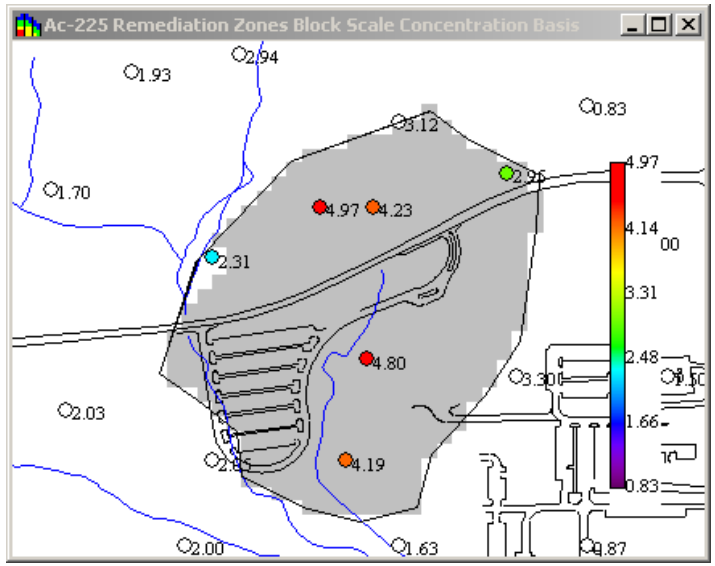
If the site-wide model average is above the threshold value, "remediate" the individual blocks from worst to least contaminated until the average, including post remedial concentrations, drops below the threshold value.

Decision Framework Results

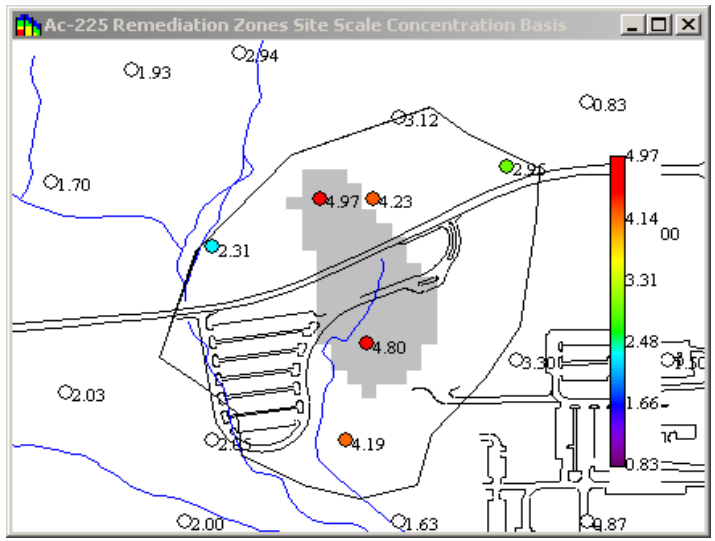
Block Scale



Block Scale Confidence (90%)



Site Scale



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Creating Area Of Concern Maps

- On the geo tab, select an appropriate interpolation scheme and define a grid.
- Select the decision basis and decision framework on the decision tab.
- Press the Area Of Concern button
- If you choose an analysis basis rather than concentration, you will be prompted to make a choice for the decision criteria.

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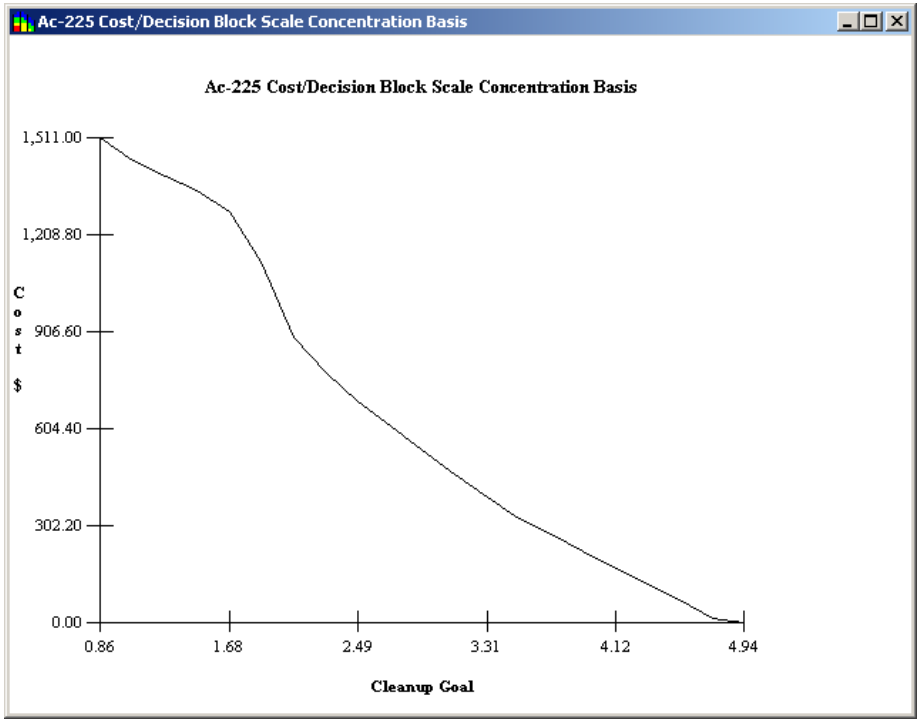
Cost Benefit Analysis

- The decision framework (block, block confidence, site) determines the associated cost for a range of cleanup goals.
- Cost is calculated by determining the area of concern (or volume for 3d) for a threshold value, then multiplying the number of blocks in this area by the remedial cost per block.
- The threshold value range is calculated, and then cost is calculated for each incremental value in this range.



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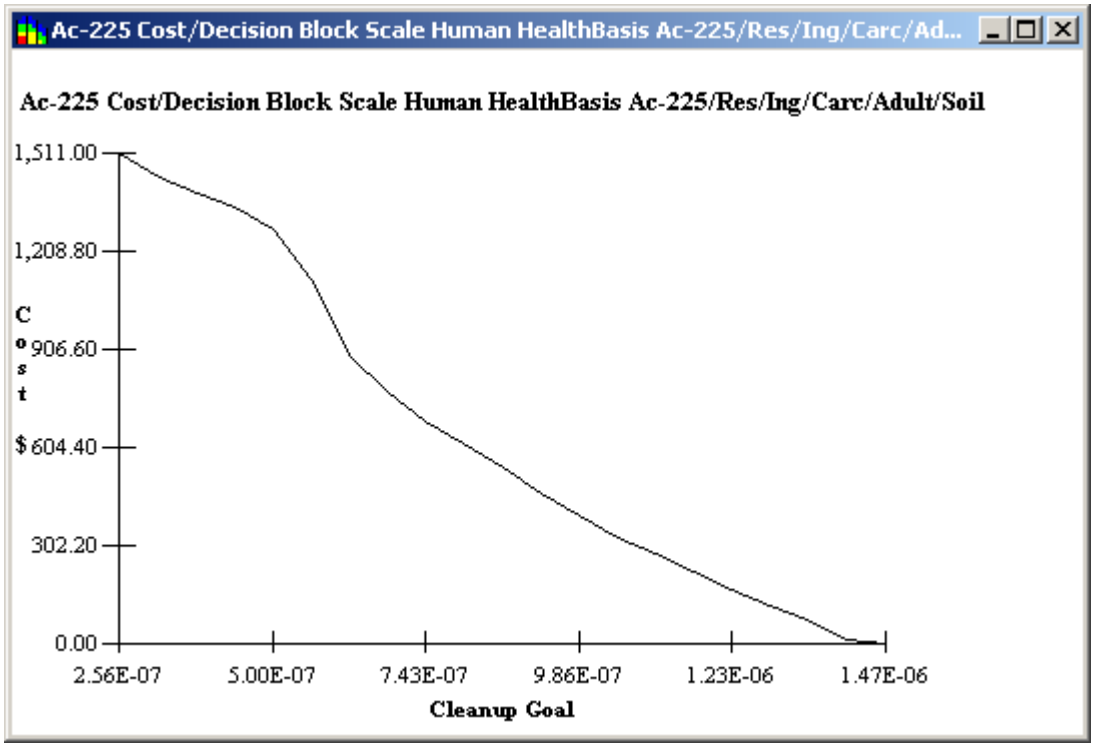
Performing A Cost Benefit Analysis

- Select an appropriate interpolation method and set all needed parameters.
- Select a decision basis and decision framework.
- Enter the cost per block.
- If using site scale, enter the post remediation value.
- Press the cost button



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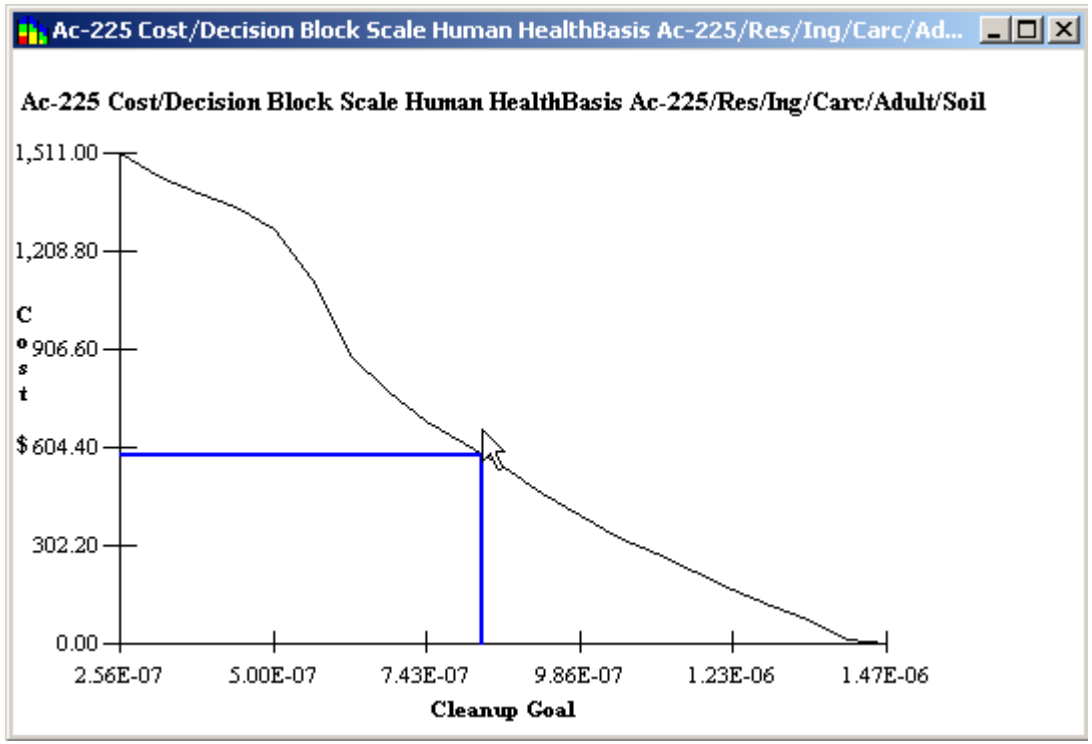
Performing A Cost Benefit Analysis

Cost Lines

Right mouse click over the picture and a popup menu will appear. Select Cost Line Pointer On. You will now see two blue lines which will help guide you as you interpret the graph. On the bottom Status bar, the actual XY's are displayed.



Right mouse click and deselect this option to turn it off.

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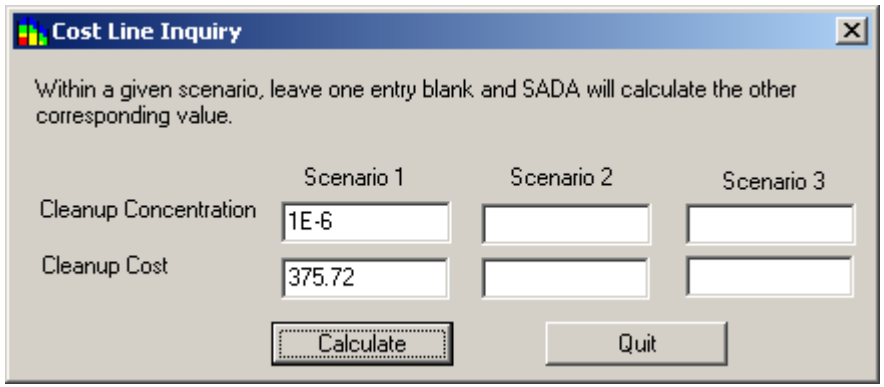
Performing A Cost Benefit Analysis

Cost Line Query

Right mouse click over the picture and a popup menu will appear. Select Cost Line Query. The following window appears. Type a specific cleanup concentration into one of the top boxes and leave the corresponding cost box below it empty. Press the Calculate button. SADA reads the cost value from the graph. Conversely, by leaving the concentration box empty and entering a cost value, SADA will report the cleanup concentration.



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Part 7: Sample Design

- Judgmental
- Adaptive Fill
- Estimate Rank
- Minimum Separation Criteria
- Variance Rank
- Percentile Rank
- Uncertainty Rank

All sample designs, with the exception of Judgmental, are based on a specified grid definition. Within this grid, the center of each block becomes a candidate for a new sample location.

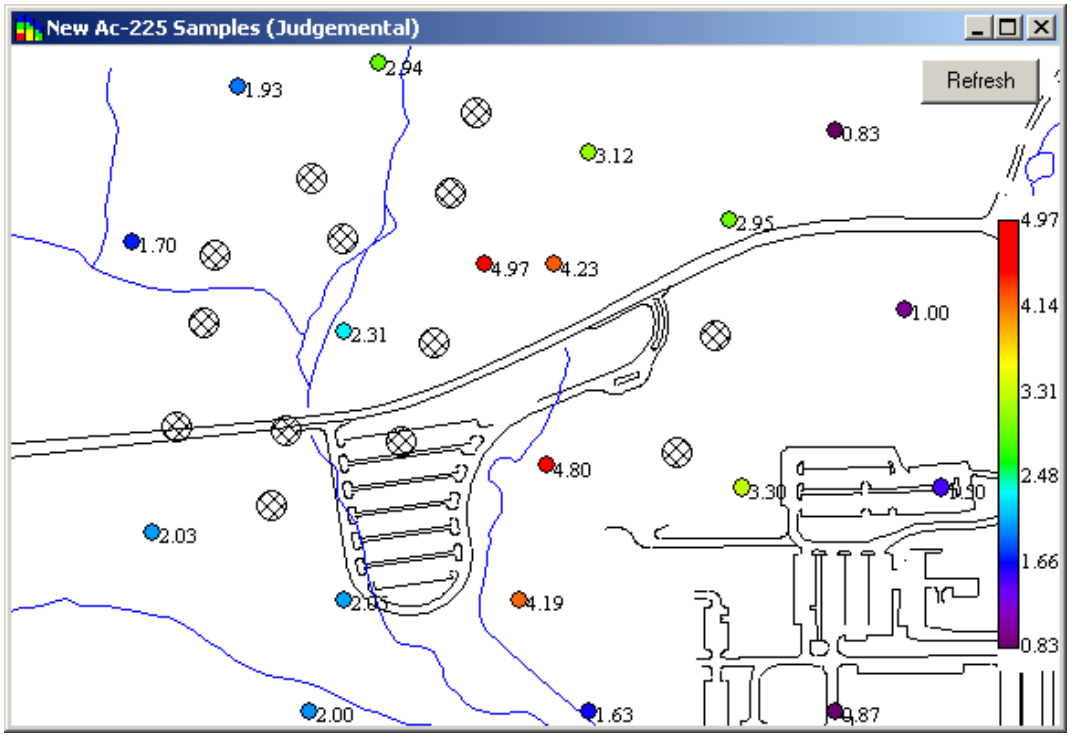
Judgmental

Goal

- Allows users to directly add new sample locations by hand.

Benefits

- Permits direct incorporation of professional expertise.



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Adaptive Fill

Goal

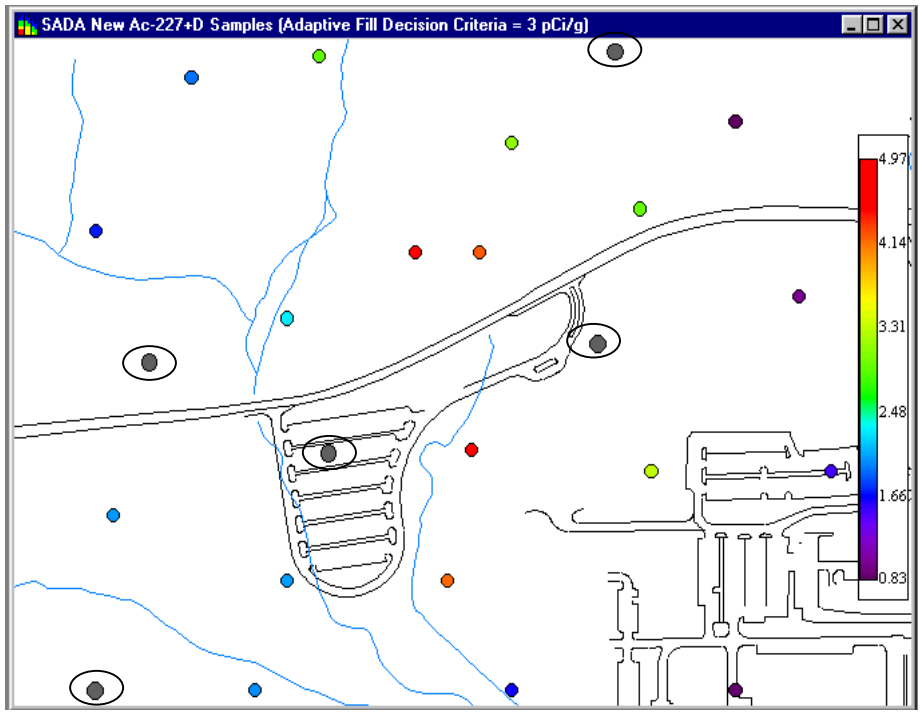
- To fill spatial data gaps.

Benefits

- Quickly fills in spatial data gaps for exploratory sampling.
- Not connected to a geospatial analysis tool and therefore easy to use.

Warning

- Does not consider previous sample results.



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Estimate Rank

Goal

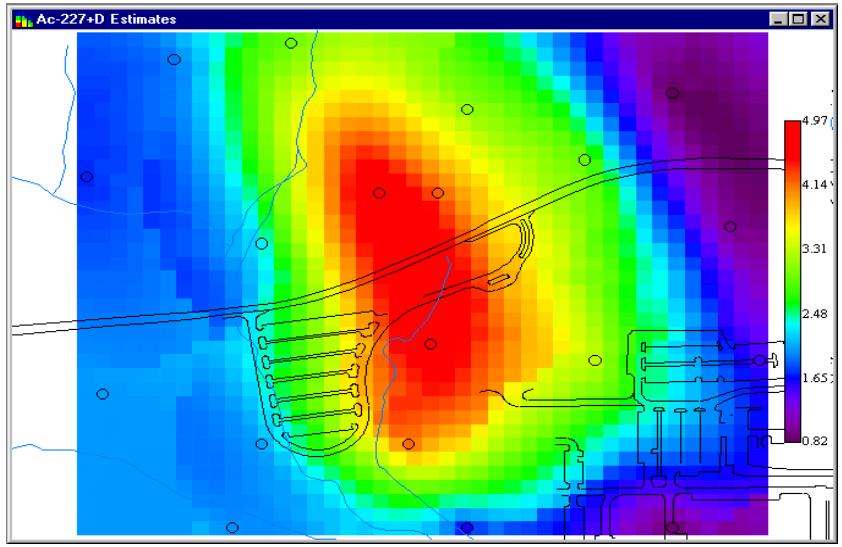
- To place new samples where modeled values are highest

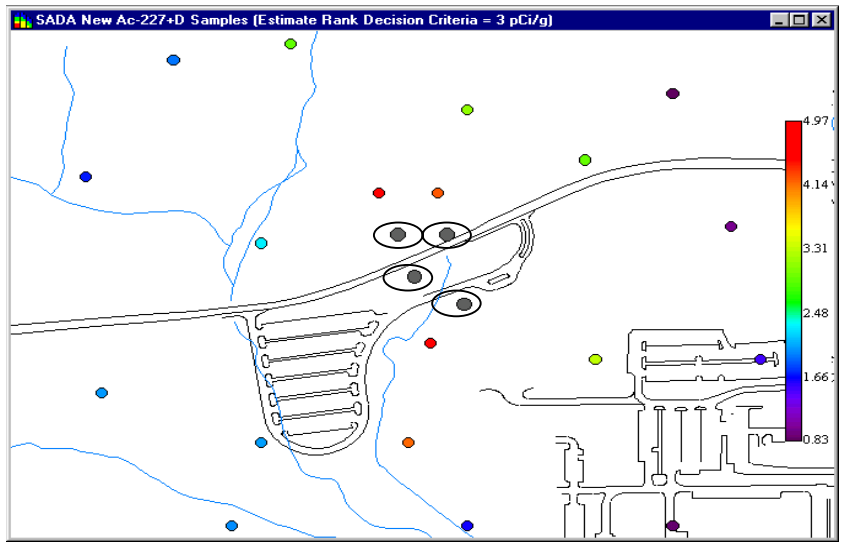
Benefits

- Good for confirming the extent of hot spots.

Warning

- Does not consider model variance and may place points in a well characterized hot spot.
- A secondary minimum distant constraint is often needed to prevent clustering.

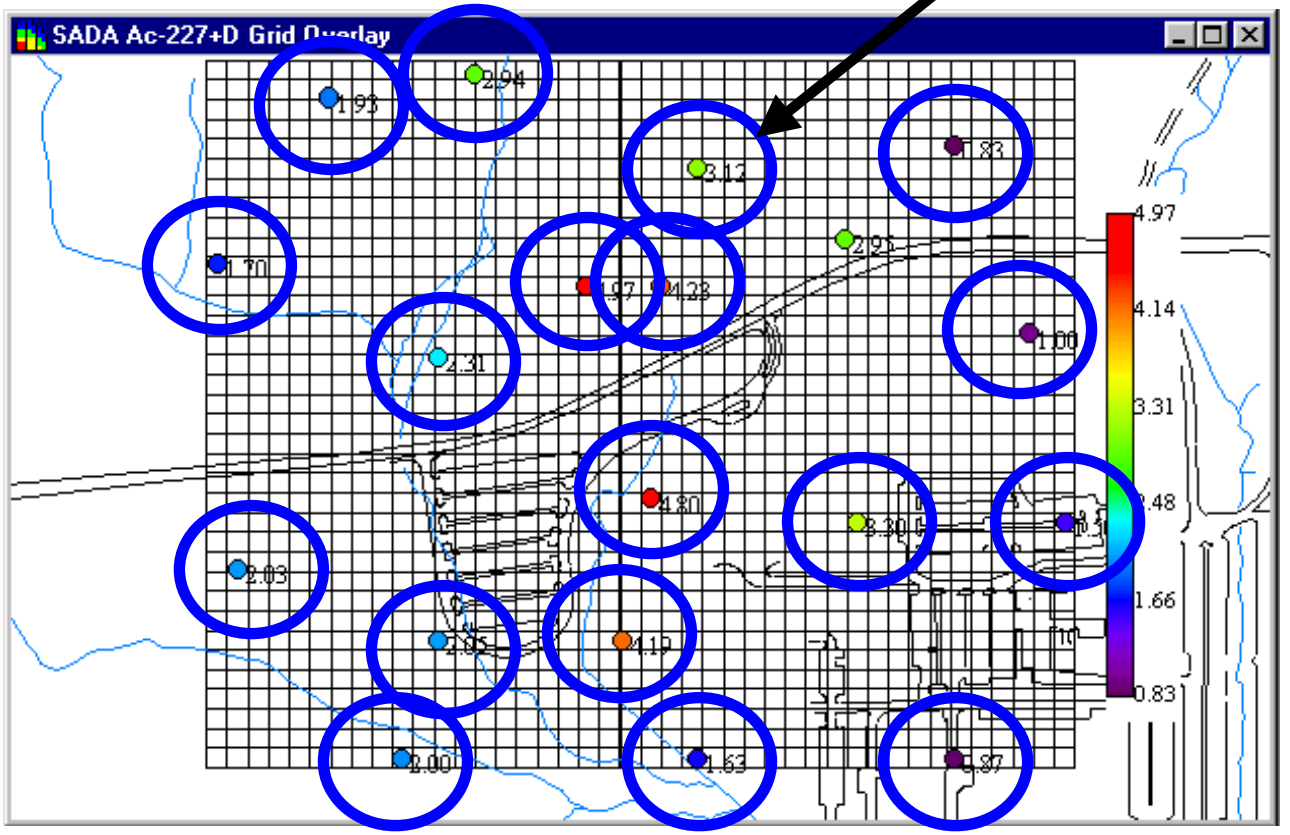




Secondary Minimum Distance Constraint

This constraint sets the minimum distance a new sample point can exist from an existing new or actual sample point through a limiting sphere. All nodes within the sphere are eliminated from consideration as a new sample candidate.

Limiting Spheres



Variance Rank

Goal

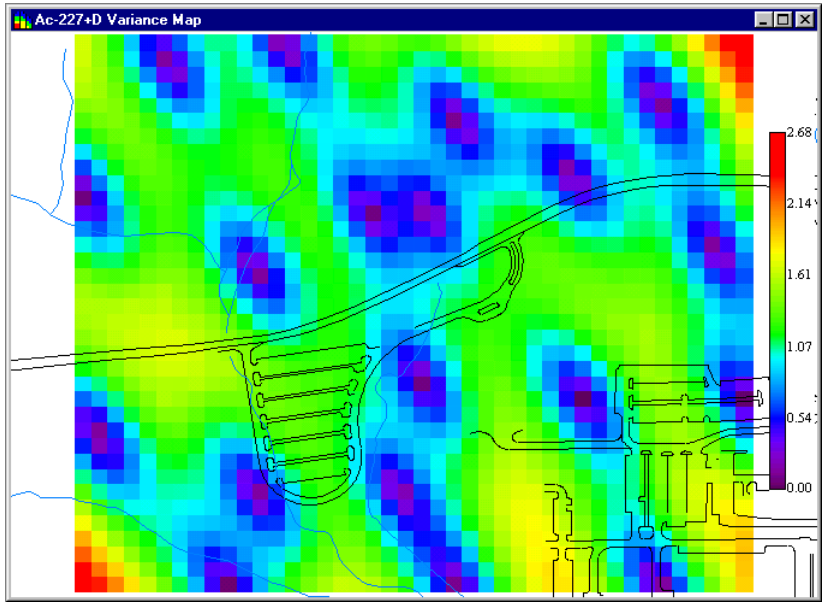
- Places new samples where model variances are highest.

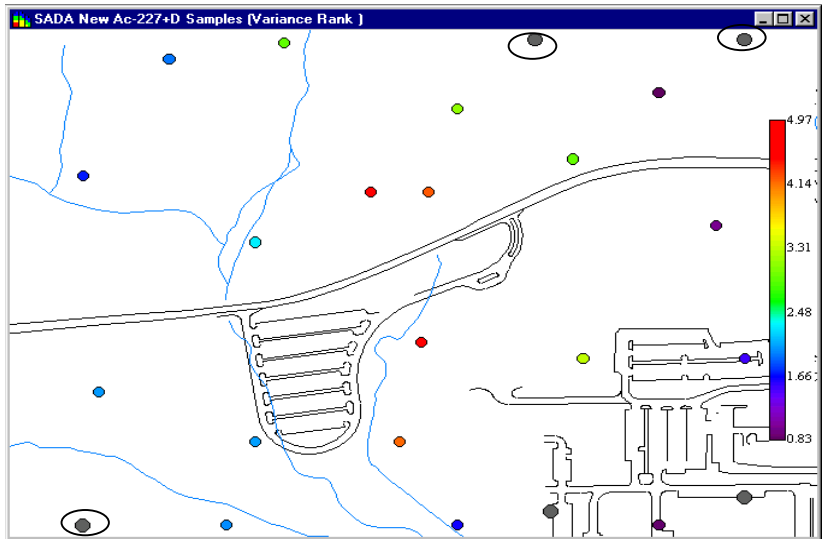
Benefits

- Good for reducing large variances across the site.

Warning

- Does not consider concentration magnitude and may place new samples in sparse areas with values low relative to a decision goal.





Uncertainty Rank

Goal

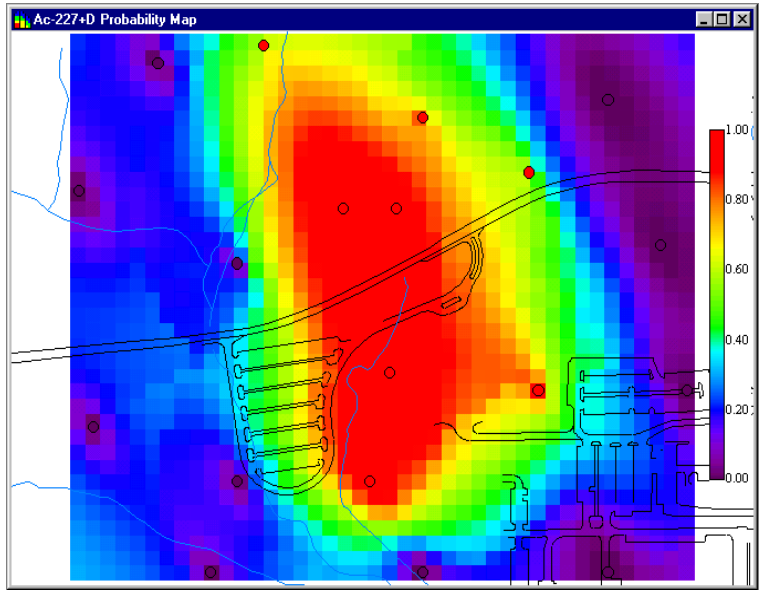
- Places new samples where the model is most uncertain about exceeding a specified criteria.

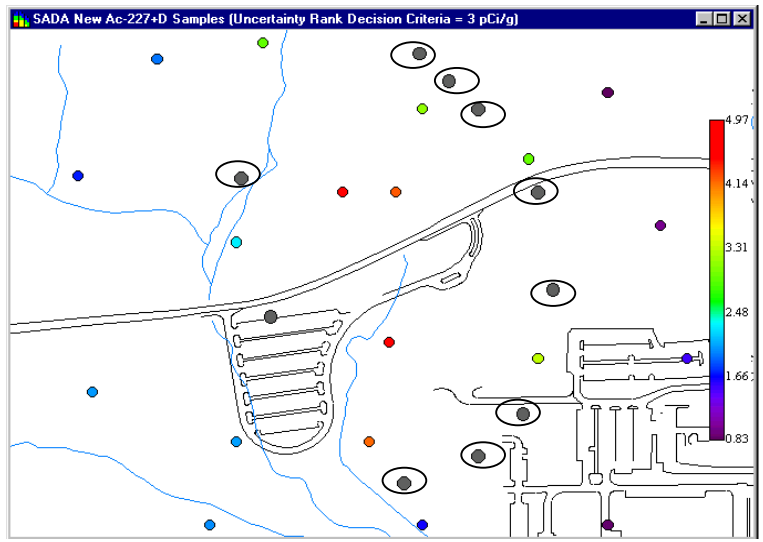
Benefits

- Explicitly connected to a cleanup criteria.
- Useful for delineating area of concern boundaries.

Warning

- Secondary minimum distance constraint may be needed in some cases.





Percentile Rank

Goal

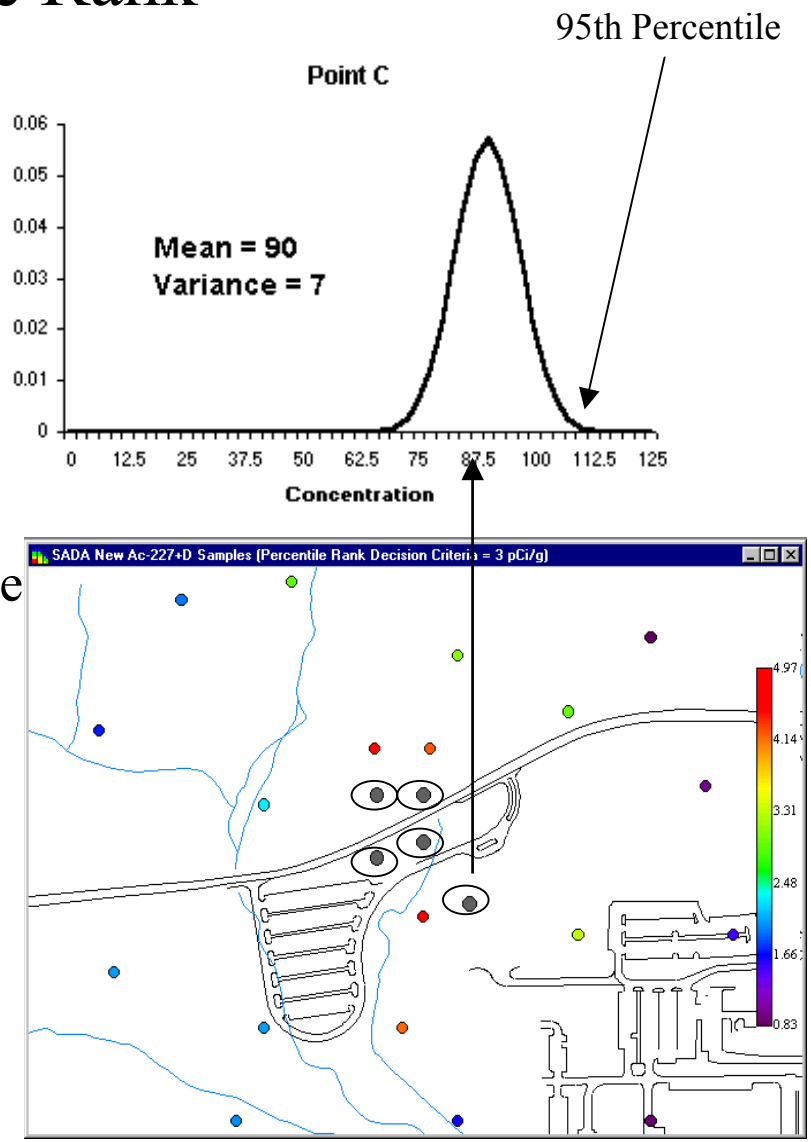
- Places new samples where a specified percentile is highest

Benefits

- Considers both magnitude and variability, providing a tool for reducing uncertainty across the site while at the same time giving precedence to hot areas.

Warning

- Secondary minimum distance constraint may be needed in some cases.



Implementing Sample Designs In SADA

Before you start . . .

If you are using anything other than Judgmental, you will need to define a grid.

If you are using estimate rank, have an interpolation scheme ready to go.

If you are using variance rank, you must have ordinary kriging setup and selected.

If you are using percentile rank or uncertainty rank, you must have either ordinary or indicator kriging setup and selected.

If you are using estimate, variance, percentile, or uncertainty rank, you will probably need to use the Minimum separation criteria.

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Judgmental Design

Select the Sampling tab on the control panel.

Select Judgmental and press the sample design button.

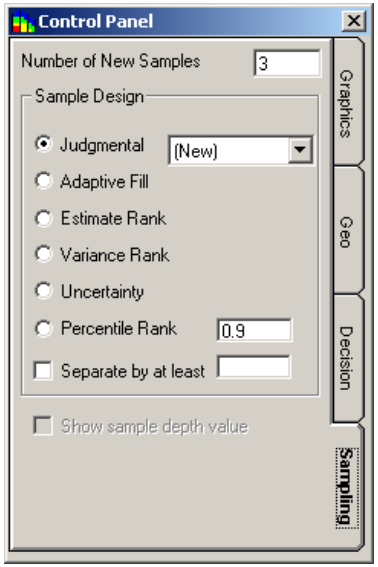
A Refresh button appears in the graphics window. When you add new points, you'll need to press this button to update the design and enable the other functions. If you have a new design, the first time you press this button, SADA will ask for a name for this design. Later, you can recall this design from the list box next to the judgmental option

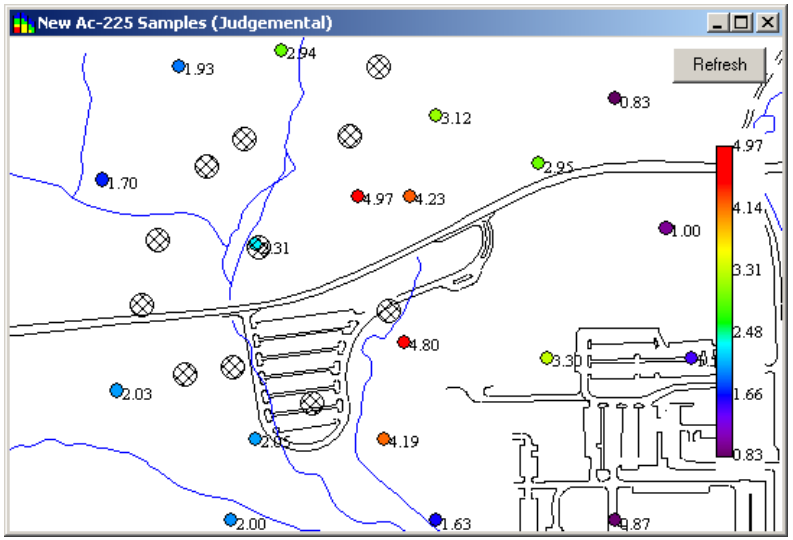
Simply left mouse click onto the site where you want to add new contaminants.

To move a new sample point, left click onto the point and drag it.

To delete a new sample point, left click once onto the point and press the delete key.

To get out of this design mode, press the Refresh button. Then proceed on with the next result you want.





All Other Designs

All other designs are automatic and sample locations are determined by SADA.

To use any of the other methods

Select the method on the control panel Sampling Tab

Enter the number of new samples you want to distribute.

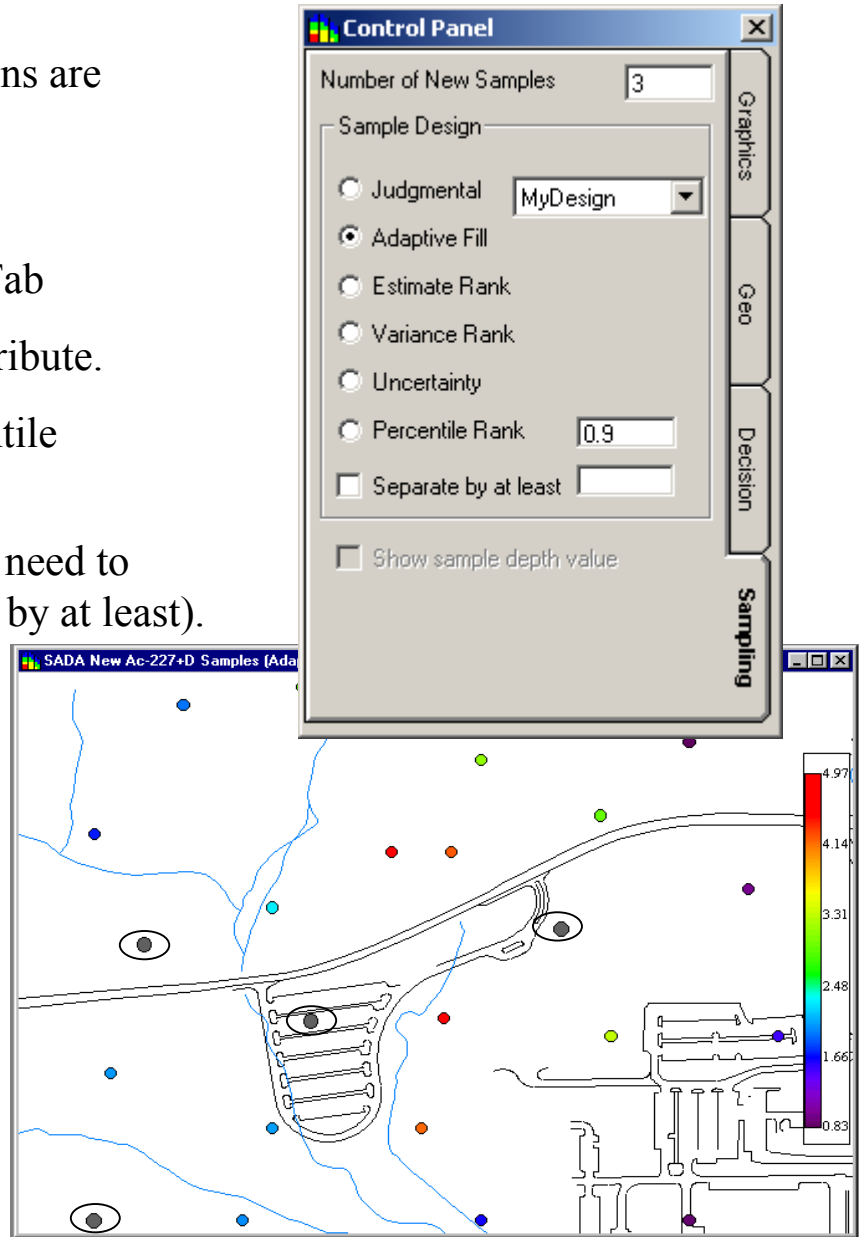
For percentile rank, you'll need to enter the percentile parameter.

Depending on the method you've chosen you may need to choose the minimum distance constraint (Separate by at least).

For 3d designs, the Show sample depth value will also be enabled. Check this and SADA will place the depth label next to the new sample design point.

Press the sample design button.

Note that in SADA new sample points for these methods are showed as larger gray dots. (The second circle around them will not be seen.)



Part 8: Working In Three Dimensions

- Setting and Changing Data Levels
- Changing Views
- Polygonal Reconciliation
- The 3d Viewer
  - Isoclines
  - Blocks
  - Basic Viewer Functions
- Sample Designs in 3d

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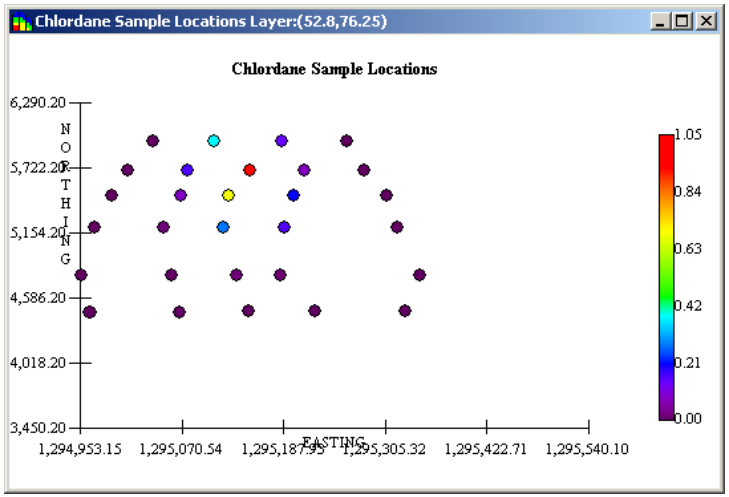
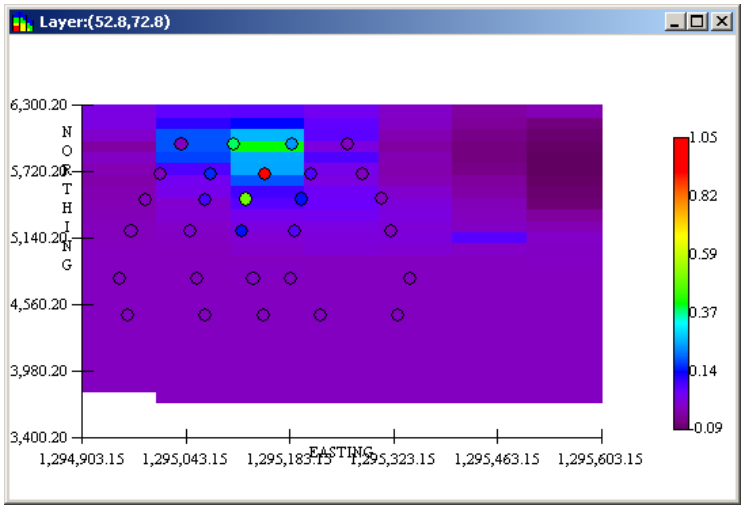
3D Overview

- SADA shows 3d information by layer and in a true 3d representation.
- 3D data can be viewed by layers only.
- 3D models can be viewed by layer or in true 3d. If viewed in 3d, the blocks may be viewed or the isoclines of values within the data range.
- SADA by layer has two views in 3D: data layer view and model layer view. Data layers are set by the users explicitly. Model layers are determined by the depth of data and the vertical size of the grid definition.
- Polygons are directly tied to an exact layering scheme. If the layering scheme changes, SADA must ask the user to help determine where the polygon layers should now be distributed.

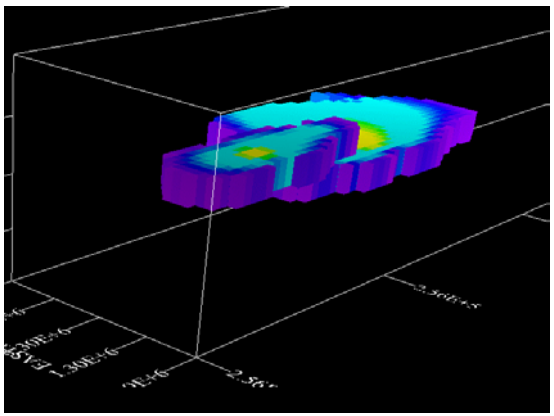
3D Overview

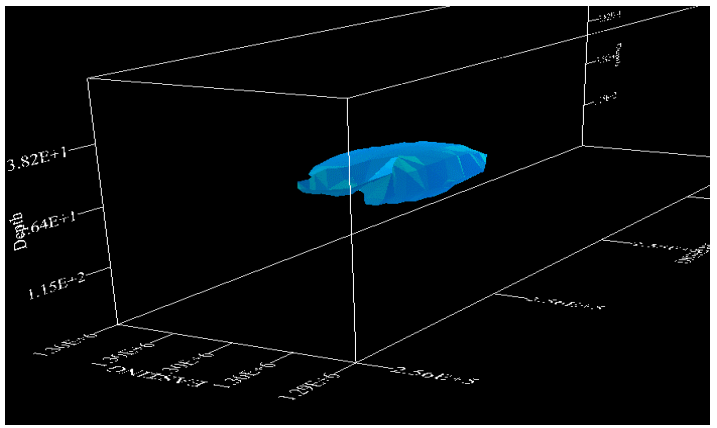
Layer Views: Data and Model





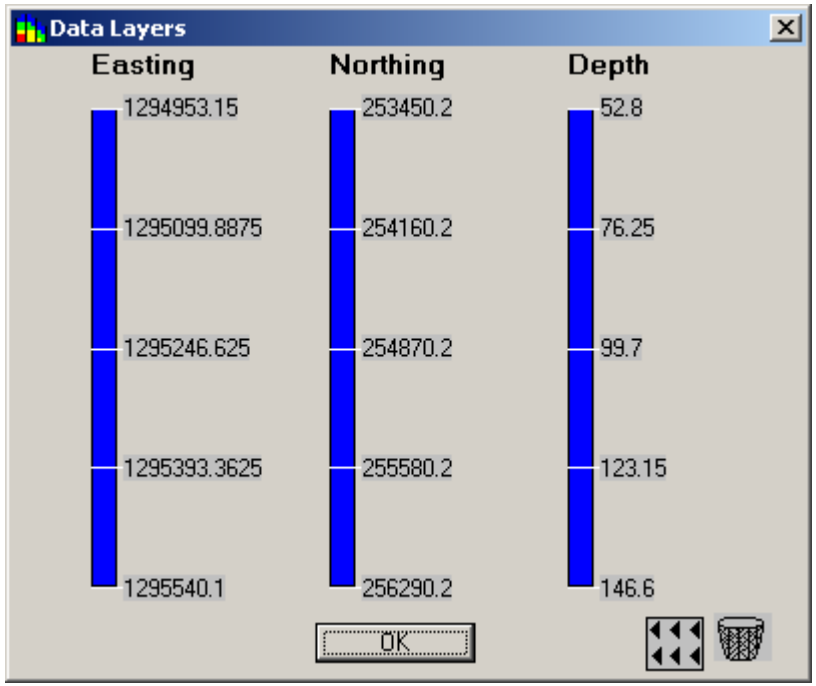
True 3d Views: Blocks and Isoclines





Setting Layers for Data View

To set the layers for the data view, select Graphics from the main menu, then Set Data Intervals. The following window appears.



To move a data layer, left click on the layer. Then drag or right mouse click on the number and type the exact layer value you want. Press enter to apply the value you typed and remove the text box.

To delete a layer, drag the layer into the trash can.

To add a layer, drag an arrow from the arrow box and drop it on the range where you want to make a new interval.

Press OK to apply the changes.

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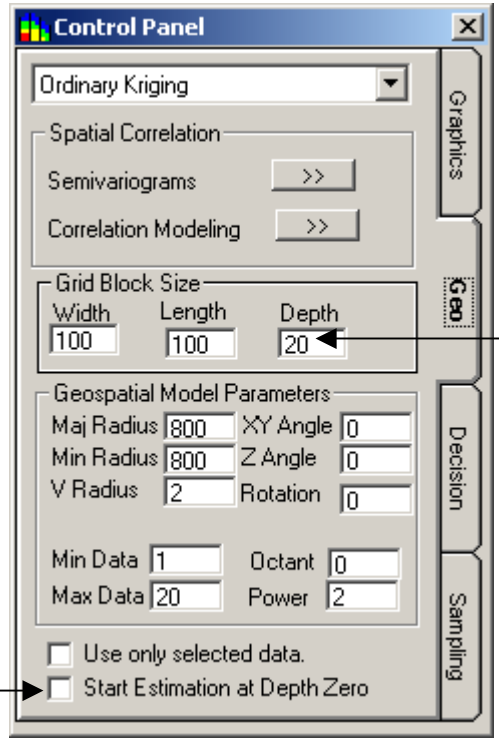
Setting Layers for Model View

Layers for the Model View are defined by the Grid Block Depth value on the geo tab.



Determines Vertical Layering

Insures that interpolation begins at depth zero.

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Changing Layers, Using Polygons

Increase or decrease the layer for data or model views by pressing the buttons.

Drawing polygons in 3d is the same as in 2d. Within each layer, draw your polygon and then press the buttons to go to the next layer. If you intend to use the same polygon on every level, draw the first polygon, copy it with a right mouse click, and then choose Copy Polygon. Change to the next level, right mouse click, and choose Paste Polygon.

When a polygon is on, SADA disables the grid definition to prevent a change in layering. If you build a space definition under a one layering scheme and try to apply it later to a different scheme, SADA cannot determine how you want to apply the polygonal layers.

SADA responds by bringing up the Polygonal Reconciliation Window.

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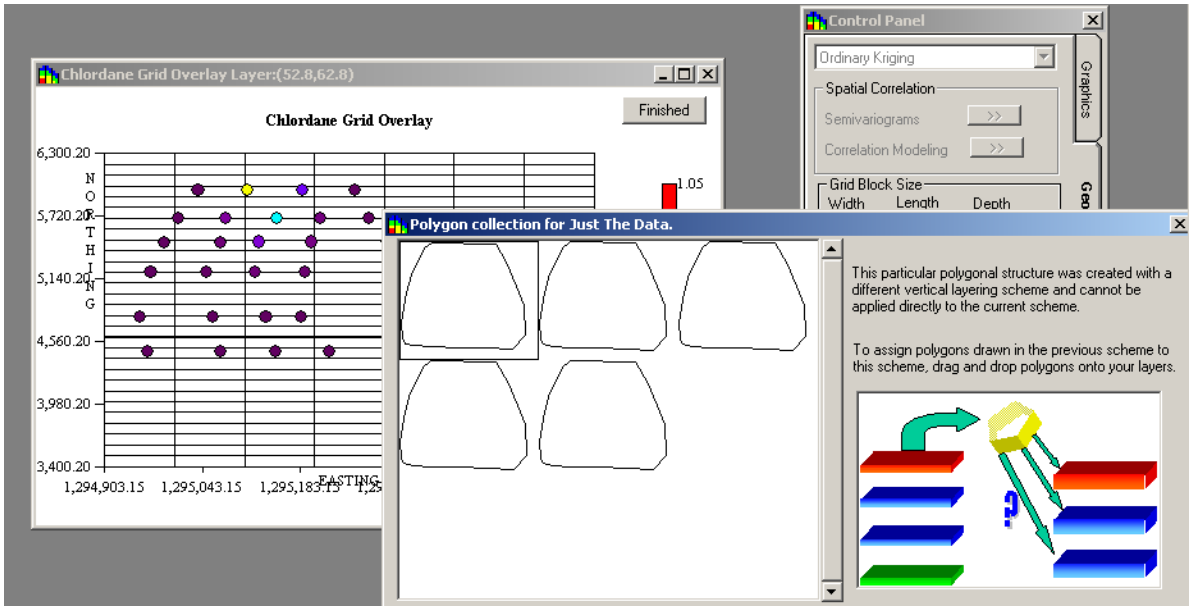
Polygonal Reconciliation

When you see this window, simply drag the polygonal structures onto the spatial map one at a time. SADA will automatically place them where they should go. Press the buttons on the main tool bar to go to the next level. Drag and drop the next polygon. In the example below, all the polygons are the same. This depends on the users intent with polygonal definitions and may not always be the case.



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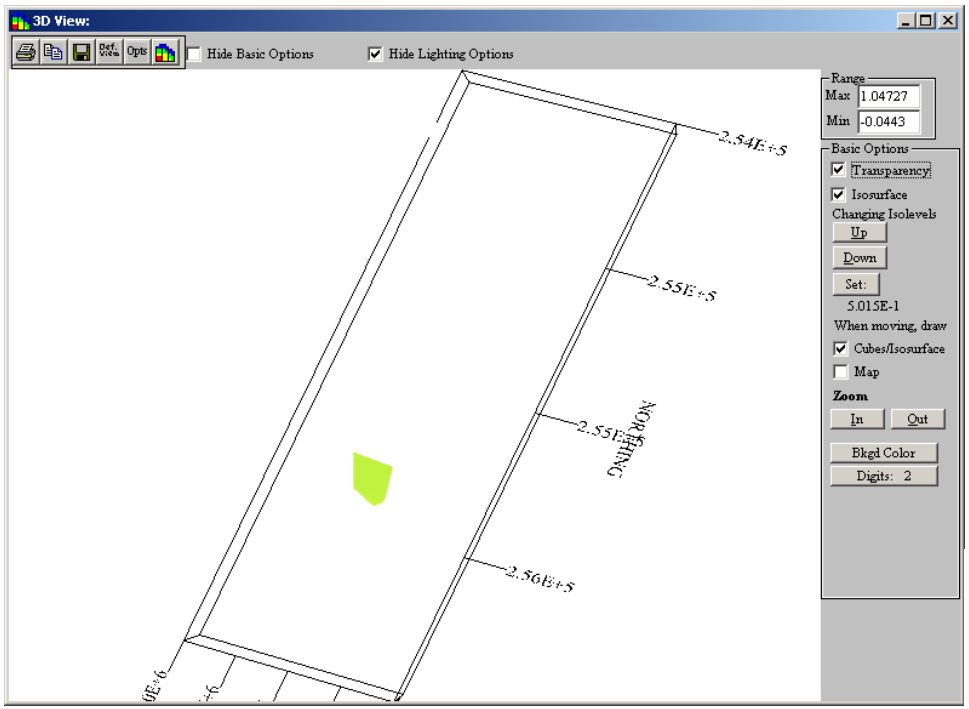
True 3D

To see the results of a spatial modeling in true 3d, select View from the main menu and then View True 3d Model.

Reapply your model by pressing the associated button (e.g. Probability map)

SADA responds with the 3d viewer. The viewer is designed to set isoclines as the default view with an isocline value set in the middle of the total data or model range. If little or no modeled values appear in this range, the result may appear blank. Change the isocline level to view results.



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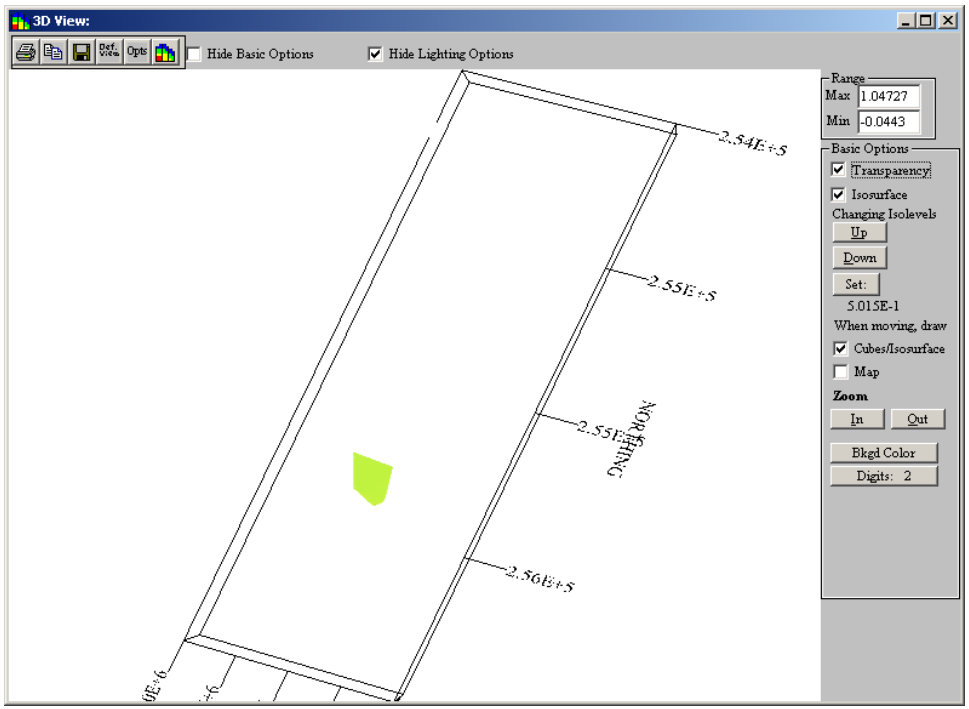
True 3D

The number of ways to adjust your 3d view are beyond the scope of this training. See the the help file for details. We will address the basic functions that can help you get a good 3d view of your results.

SADA comes up with the default view. It is an isocline view. It may appear better with a black background. To change the background, click on the Bkgd Color button and select a new one. Sometimes isoclines are hard to see on dark background if the Transparency option is selected. Deselect this under these circumstances.



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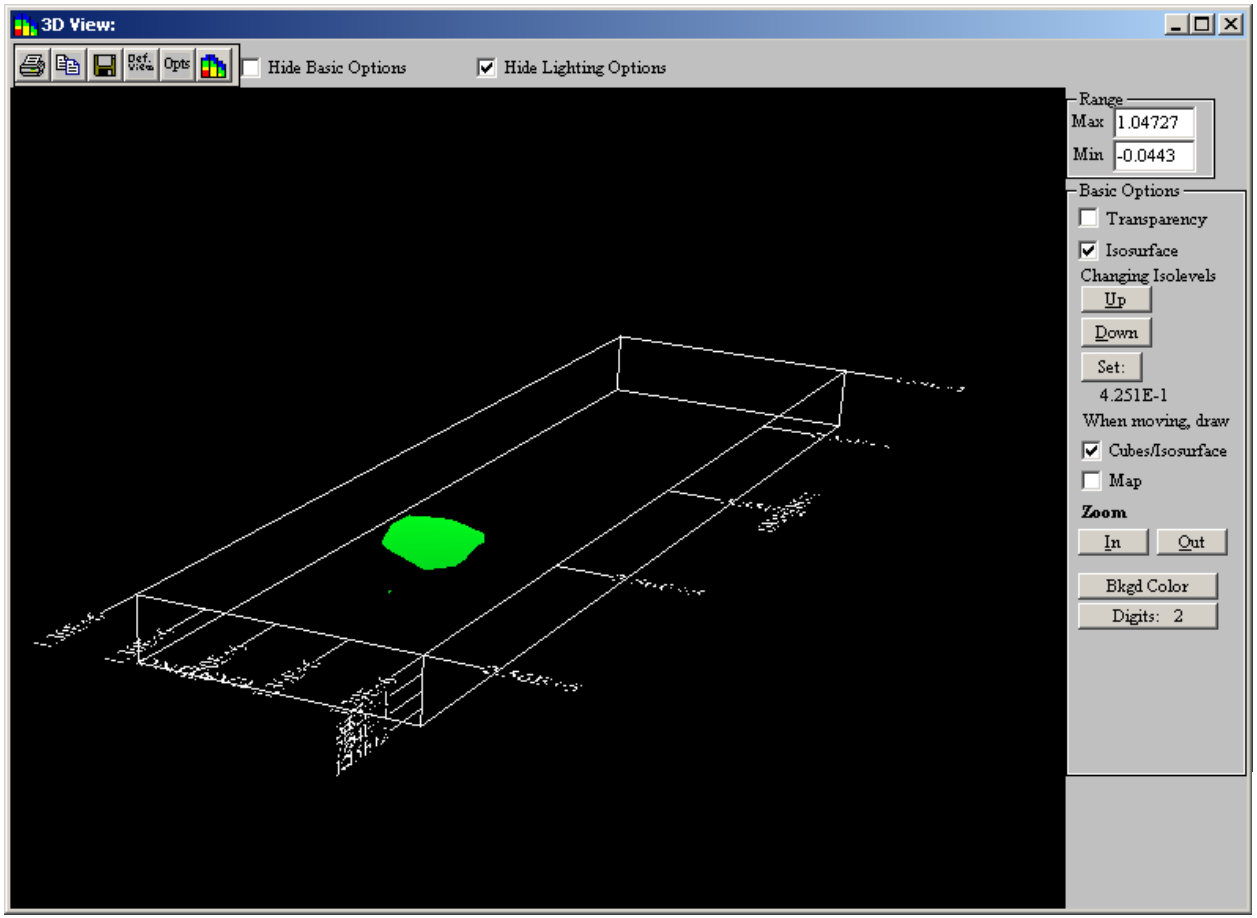
Spatial Analysis and Decision Assistance

True 3D

In the following view, we have changed the background to black and have rotated the picture up. To rotate a picture, left click on the image and move it while holding down the mouse. The image will rotate in a “trackball” style. Also, the isocline value was reduced slightly in this image.



SADA™

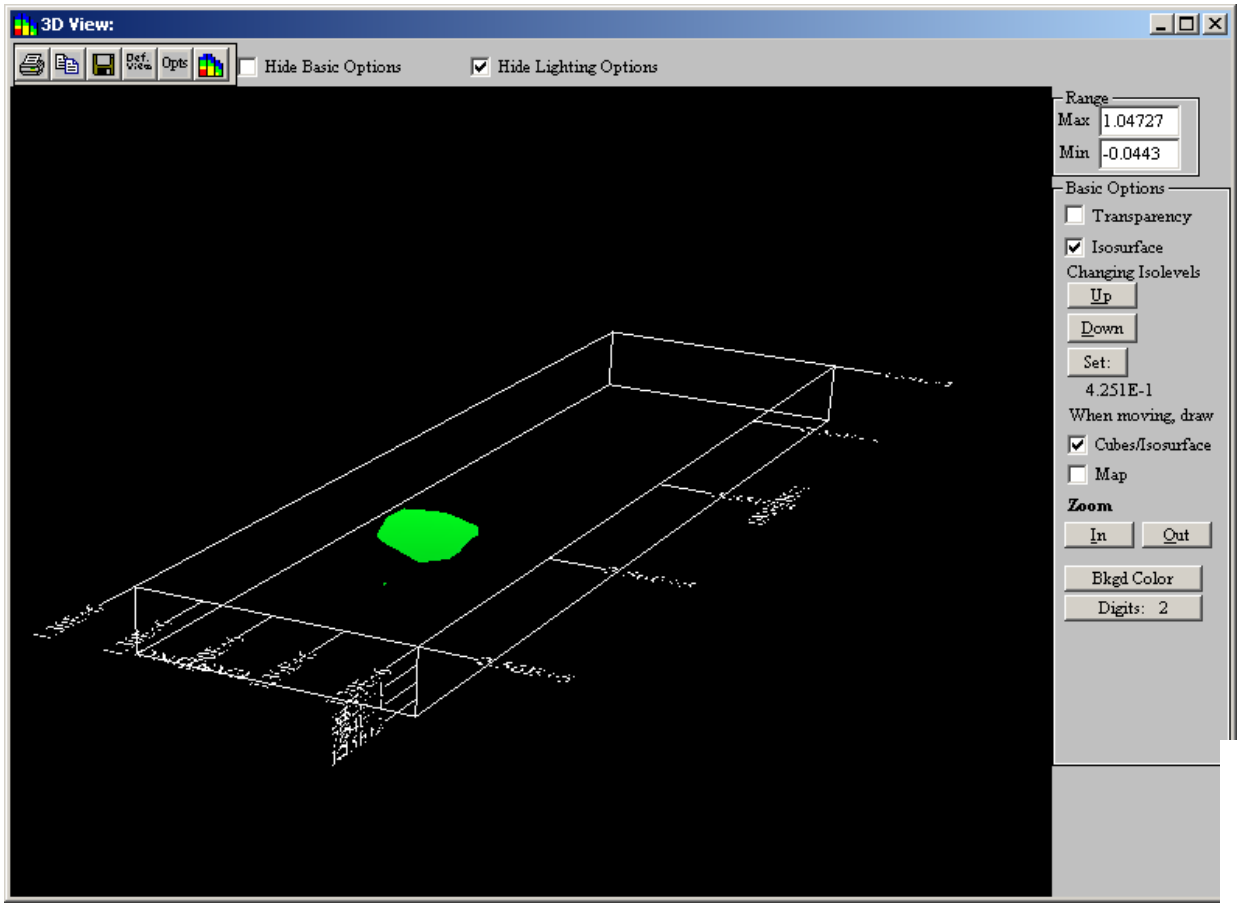
Spatial Analysis and Decision Assistance

True 3D

You can shift the picture left or right by right mouse clicking (not near an axis) and dragging the image.

You can zoom in and out with the In and Out buttons

Anytime you want to update your view, press the camera button.



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True 3D

To obtain a view of the block values on which the isoclines are based, deselect the Isosurface options. If transparency is deselected, the blocks are “solid” and you cannot see the center of the plume.

Select transparency with blocks, and those with low values will appear more transparent than those with higher values. This can help you to “see through” the low concentration volumes into the higher values.

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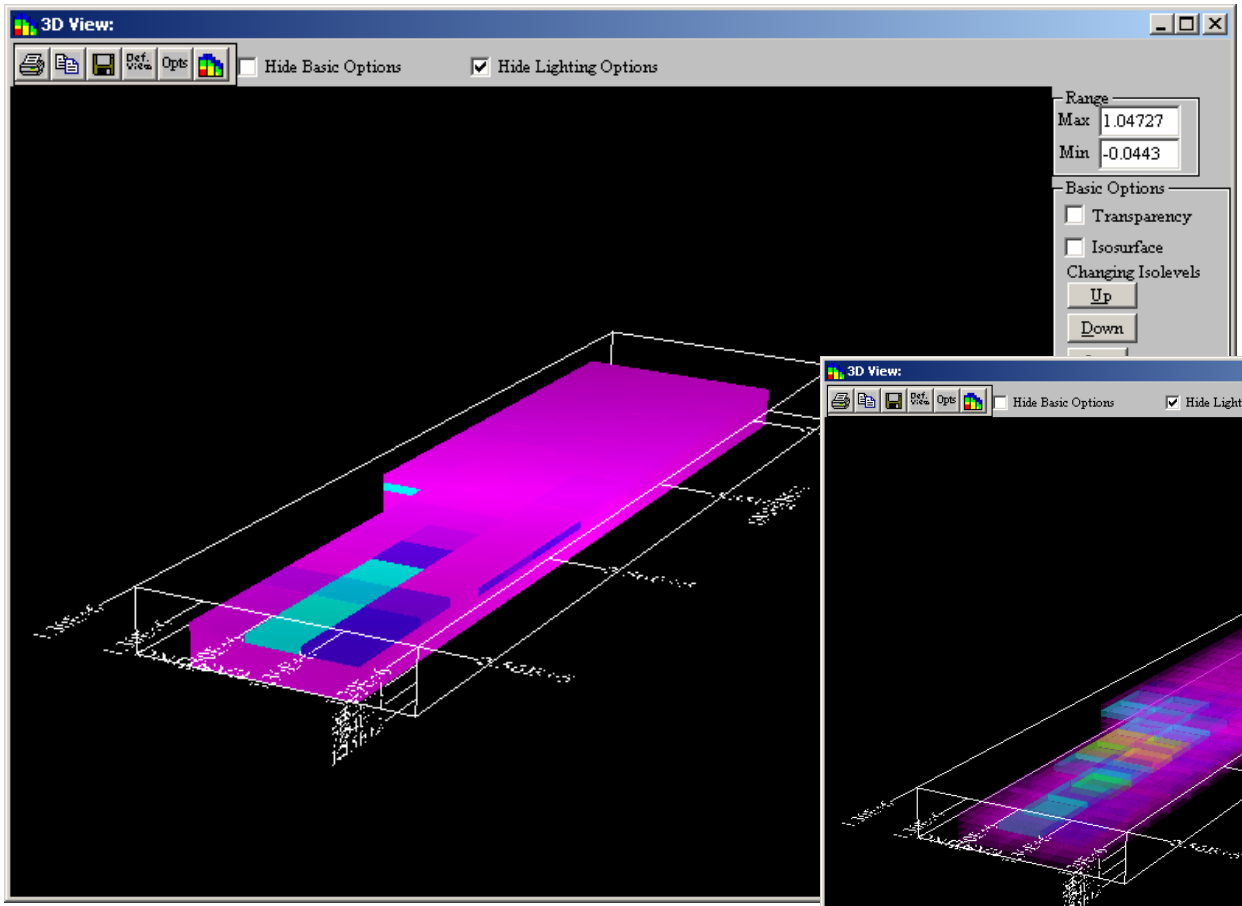
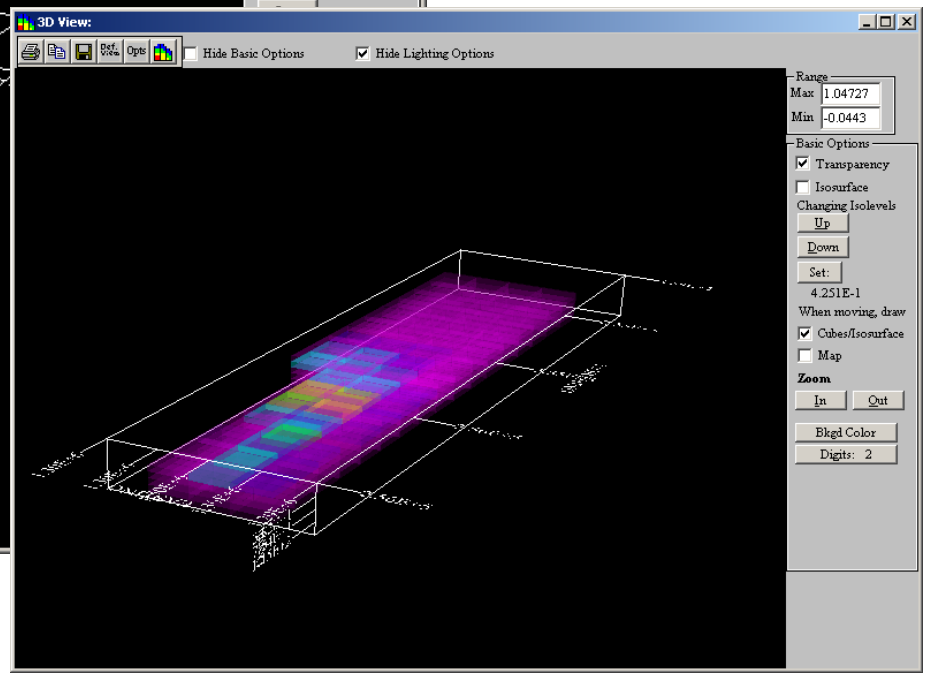
Spatial Analysis and Decision Assistance

True 3D

Transparency Off



Transparency On



To turn axis values on and off, right mouse click on them.