



DUMPStat 2.1.8

groundwater detection monitoring statistics

DEMONSTRATION GUIDE

DUMPStat.

Demonstration Guide

Version 2.1.8

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DUMPStat Overview 1

What is DUMPStat?

Thinking 'green' is becoming a daily occurrence; however, despite our best efforts, the need for waste disposal continues to grow. Of primary concern is the impact of leakage from waste disposal facilities on groundwater. Thus, hazardous, municipal, and private waste disposal facilities are all required to follow a groundwater monitoring program.

Statistical methods have been, and continue to be, the basis for investigating potential environmental impact. Determining which statistical methods to use and performing hundreds, or perhaps thousands, of statistical comparisons required for each monitoring event can be daunting to say the least. It is important that an appropriate site-specific plan be developed for each facility which includes effective verification resampling plans, selection of constituents and appropriate statistical methods (*e.g.*, parametric and nonparametric prediction limits, or control charts for intra-well comparisons) that detect contamination when it is present and do not falsely conclude that the site is contaminated.

All statistical modules were written by Dr. Robert Gibbons.

DUMPStat is an easy-to-learn system for performing state-of-the-art statistical analysis of groundwater monitoring data. Its methodology is based on *Statistical Methods for Groundwater Monitoring*, Gibbons (1994), Wiley. Its statistical procedures balance both false positive and false negative rates for the entire facility and offers complete consistency with USEPA Subtitle C and D regulations, and all USEPA guidance and ASTM D6312-98 guidance.

DUMPStat can manage data sets of any size, and it maintains the information in a site-specific database. When subsequent monitoring events occur, data are simply appended to the database and analyses can be performed at a click of your mouse.

DUMPStat can perform traditional inter-well (upgradient versus downgradient) comparisons; however, the upgradient wells must accurately characterize the natural spatial variability that is observed in the downgradient wells. As an alternative, if the site has not been impacted by the well, DUMPStat can perform intra-well comparisons. These are preferable as they eliminate the spatial component of variability; thus the uncertainty in measured concentrations is decreased making intra-well comparisons more sensitive to real releases. DUMPStat offers two forms of intra-well analyses; you may use either Shewhart-CUSUM control charts or well-specific prediction limits.

Why use DUMPStat?

- Users need not understand the complexities of groundwater monitoring statistics in order to produce a statistically rigorous analysis of routine detection monitoring data.
- Both site-wide false positive (indicating contamination where there is none) and false negative (missing contamination when it is present) rates are optimally balanced at minimal levels.
- Site-wide false positive and false negative rates are directly computed via Monte Carlo simulation of 10,000 monitoring events from the facility based on existing site-specific conditions. They are displayed on a simple-to-understand graphical Statistical Power Chart.
- DUMPStat also features distributional testing, treatment of nondetects, trend analysis, outlier detections, and automatic generation of prediction limits.

DUMPStat helps avoid costly site assessments due to common misapplication of statistical methods to groundwater monitoring

data. However, if your site should require corrective action, it is often necessary to compare samples from a potentially impacted well to a groundwater quality protection standard. DUMPStat's assessment monitoring module performs these comparisons with tests of increasing and decreasing trend and comparison of the standard to the upper 95% normal confidence limit applied to the last 4-16 samples.

Questions?

Call DSI toll-free at
1-877-374-7744,
or visit our website at
www.DiscerningSystems.com

It is essential that you obtain the participation of your state regulating agency in the creation and approval of your plan, in order to ensure that you will meet the necessary requirements both in the statistical analyses performed and the various forms of reporting. To that end, we encourage you to use the 30-day trial program to determine if DUMPStat will meet your needs.

DUMPStat Analyses

Upgradient vs. Downgradient

Prediction Limits

If you choose the Up vs. Down Prediction Limits button, DUMPStat will perform traditional upgradient versus downgradient comparisons using the current database. During analysis, DUMPStat will:

- ▶ Automatically screen for outliers
- ▶ Test distributional assumptions
- ▶ Compute detection frequency
- ▶ Select optimal form of prediction limit

After the analysis is complete, the results are available in tabular, graphical and worksheet forms.

Statistical Power

If you choose the Statistical Power (for Up vs. Down) button, DUMPStat will compute the statistical power for your site as a whole, based on upgradient versus downgradient comparisons. It is necessary to run the Up vs. Down Prediction Limits analysis

After the analysis is complete, a line function derived from the six points is displayed on the statistical power chart.

first as this analysis creates the input file required for the statistical power. During analysis, DUMPStat will:

- Determine the site-wide false positive rate (*i.e.*, the percentage of failures when the upgradient versus downgradient true mean difference equals zero).
- Determine the false negative rates for effect sizes ranging from 1 to 5 standard deviation units over the upgradient mean.

Intra-Well

After the analysis is complete, the results are available in tabular, graphical and worksheet forms.

Control Charts

If you choose the Intra-Well Control Charts button, DUMPStat will compute intra-well comparisons by means of a combined Shewhart-CUSUM control chart using the current database. During analysis, DUMPStat will:

- Compute combined Shewhart-CUSUM control charts automatically screening for outliers.
- Detect historical trends (optional).
- Compute detection frequency.
- Determine whether the new sample represents a verification of a previous exceedance.

Prediction Limits

As an alternative to the combined Shewhart-CUSUM Control Chart methodology, DUMPStat can compute intra-well prediction limits using the current database. To do so, choose the Intra-Well Prediction Limits button. During analysis, DUMPStat will:

- Automatically screen for outliers.
- Compute detection frequency.
- Detect historical trends (optional).
- Select optimal form of prediction limit.

You must run the appropriate Intra-Well analysis before running its corresponding statistical power analysis.

Statistical Power

If you choose the Statistical Power (for Intra-Well Control Charts or Prediction Limits) button, DUMPStat will compute the statistical power for your site based on either the intra-well control chart comparisons or the intra-well prediction limits analysis, respectively. During analysis, DUMPStat will:

- Determine the site-wide false positive rate (*i.e.*, the percentage of failures when the background versus current true mean difference equals zero).
- Determine the false negative rates for effect sizes ranging from 1 to 5 standard deviation units over the background mean.

After the analysis is complete, a line function derived from the six points is displayed on the statistical power chart.

Sublist Analyses

DUMPStat offers additional intra-well analyses that are performed on specific combinations of sample points and constituents. Before running the analysis, you need to specify a sublist to DUMPStat; that is, group certain constituents with the appropriate sample point(s).

Time Series

Time Series graphs will also display significant increasing and/or decreasing trends if you select the Identify Historic Trends checkbox in Statistical Options.

If you choose the Time Series button, DUMPStat will generate a series of graphs plotting the results over time, from the records matching:

- Constituents specified in the Select Constituents item of the Constituents Menu. **AND**
- Sample points specified in the Select Intra-Well item of the Sample Points Menu.

Analytical Data Summary

If you choose the Analytical Data Summary button, DUMPStat will provide you with a series of tables based on the sample points, constituents and dates, you have selected. You can easily change how the table will be ordered by selecting Data Summary Layout from the Settings Menu. DUMPStat will show you a preview of the tables (displaying a sample of real data) and you can alter your column or row heading choices if you wish.

VOC Detections

If you choose the VOC Detections button, DUMPStat will generate a table showing all detections of selected volatile organic compounds in all selected wells in the current database. On the Constituents Menu, choose Select VOCs to select the compounds you wish to be shown in VOC Detections.

Confidence Limits (Assessment)

If you select the Confidence Limits (Assessment) button, DUMPStat will perform the analysis required when a site fails detection monitoring or is in corrective action.

During analysis, DUMPStat will:

- ▶ Compare hazardous constituents that are detected at the facility to state agency specific standards (concentration limits).
- ▶ Determine if the remediation efforts are making the situation better or worse by testing for increasing or decreasing trends in the measurements over time.

Surface Water or Air Monitoring

If you select either of these buttons, DUMPStat will compare paired (*i.e.*, taken on the same day) upstream vs. downstream or upwind vs. downwind measurements using the nonparametric Wilcoxon test. In addition, upstream/downstream and upwind/

downwind sample locations are tested for increasing trends using Sen's test. Finally, upper confidence limits for the mean concentration at upstream/downstream or upwind/downwind sample locations are computed. These limits can be compared directly to regulatory standards if required.

Hardware & Software Requirements

To run DUMPStat you must have certain hardware and software installed on your computer.

- An IBM®-compatible machine with a Pentium® processor or higher.
- A hard disk with at least 30 megabytes of available space. More may be required if your system does not already have Microsoft® database access components installed.
- A CD-ROM drive is recommended.
- Windows® 95, 98, NT 4.0, 2000, or XP.
- A mouse or other pointing device is recommended.
- A Windows-compatible printer is recommended.

Installation

Removing DUMPStat

If you wish to remove DUMPStat from your computer, use the Add/Remove Programs item from Control Panel (found in the Settings option from the Start Menu).

DUMPStat is installed on your computer using the program INSTALL.EXE, from the CD-ROM; or DUMPWEB.EXE, from the Discerning Systems website. The install program installs DUMPStat itself, the statistical processing modules, the support files, and the online help system to your hard disk.

To download & install DUMPStat from the Discerning Systems website:

1. Click on the Download Demo link.
2. Fill out the download form and click on Submit.
3. Save DUMPWEB.EXE to a directory on your hard drive.
4. Shut down all running Windows applications.
5. From the Start Menu, choose Run.
6. Click on Browse and select DUMPWEB.EXE from the directory in which you've saved it. **OR**
Find DUMPWEB.EXE in Windows Explorer and simply double-click on it.

Important

Windows requires that two additional components be available for DUMPStat work properly. If the installation program detects the absence of one or both of these components, it will install them for you. Simply follow the instructions provided on the screen during the installation process—and be patient! Do not reboot your computer until you are told to do so. Leave the CD-ROM in the drive while the system reboots, and if the installation program doesn't continue on its own after the reboot, just start it again and it will pick up where it left off.

To install DUMPStat from the CD-ROM:

1. Shut down all Windows applications that are running.
2. Insert the CD in your CD-ROM drive (in this case we assume it to be Drive D).
3. From the Start Menu, choose Run.
4. Type **d:\install** and follow the instructions on the screen.

In addition to DUMPStat itself, the installation program can install:

- DUMPStat file converters. These programs, DUMPMate and GritCony, convert DUMPStat site files to a format readable by GRITS/STAT and vice versa.
- Adobe® Acrobat® Reader. Acrobat Reader is required to view the User's Guide PDF and, once you've registered, the Statistical Guide PDF. These are both accessible from DUMPStat's Help Menu.

If you do not have Acrobat Reader installed on your computer, the box will be checked automatically. However, both of these components are optional, and you may proceed with both boxes unchecked if you wish.

Using DUMPStat

Starting the Program

To start DUMPStat, choose 'DUMPStat' from the DUMPStat Folder in the Programs Folder in the Start Menu.

Please keep in mind that this booklet merely outlines the basic information required to use DUMPStat. For more details, consult the online help system or the User's Guide PDF. Both of these reference all aspects of DUMPStat, and can be accessed through the Help Menu. Within the Help Menu, you may search for specific topics with the Help Search tool or you may press F1 to get context-sensitive help in DUMPStat or its viewers.

Help Contents

For information on Help topics choose Contents from the Help Menu or press F1 and click on the Contents button. You can use the Contents screen to jump to items in the DUMPStat menus.

Help Search

If you need help on a topic, but don't know specifically what menu it falls under, you can find it by searching for its keywords.

1. Click on the Search button from any Help topic window or choose Search for Help On from the Help Menu.
2. In the Search dialog box type a keyword or select one from the list by scrolling up or down. Press ENTER or click on Show Topics (or Display) to display a list of topics related to the word(s) you specified.
3. Select a topic name and then press ENTER or click on Go To (or Display) to view the topic.

Context-Sensitive Help (F1)

All the menu items, dialog screens and some of the entries on those screens contain context-sensitive help. Context-sensitive means you can get help on topics directly without having to go

through the Help Menu. For example, if you want further information on an item listed in a menu, highlight the menu item and press F1. Information on that menu item will be displayed immediately. If you open Help topics in this manner you still have access to the Help functions listed above.

Loading the Demonstration Site

DUMPStat comes with a predefined demonstration site that allows you to become familiar with some of its features. A complete set of analyses has already been prepared for this site, and you may view the output by opening any of the companion viewers.

To load the demonstration site:

1. Click on Load Another Site from the Site Menu.
2. Click on Predefined Demo Data.
3. Click on OK.

You may now view the various settings for this site by accessing the different menu items. You may also view the analysis results that have been prepared for this site.

Viewing Output

DUMPStat comes with four related companion applications which allow you to view and print the results of statistical calculations. The Graph, Table, Worksheet, and Statistical Power Chart Viewers can be accessed through DUMPStat itself, or independently through the Windows desktop.

Viewer buttons



Graph Viewer



Table Viewer



Worksheet Viewer



Power Chart Viewer

If one of the analyses listed is grayed out, then that particular analysis has not been run since your settings were altered.

Starting a viewer:

- ▶ Select the type of viewer from the Functions Menu of DUMPStat. **OR**
- ▶ Click on the viewer button on the DUMPStat toolbar. **OR**
- ▶ Click on the desired viewer in the DUMPStat Folder under Programs on the Start Menu (depending on your version of Windows). **OR**
- ▶ Double click on the viewer button beside an analysis on Perform Analyses to directly open the viewer with the results for that analysis.

The analyses' results remain available for viewing even after you exit DUMPStat or a viewer. However, some operations in DUMPStat will result in your output being automatically cleared. Merging new data, editing your data or changing any of the statistical settings are examples of such operations.

Using a viewer:

- ▶ Selecting Open from the File Menu of any viewer allows you to choose which analysis result you want to view. You may have the results for several analyses open at a time in any viewer.
- ▶ The appearance of the output, both on screen and on your printer, can be controlled through options found in the File Menu of each viewer.
- ▶ Some analyses produce many pages of output. You can move through these pages either by using the scroll bars displayed on screen or by using items found on the Navigate Menu.
- ▶ If you have opened multiple results within the same viewer, you can use items found on the Window Menu to display all the results.
- ▶ To close the active analysis results, select Close from the File Menu. This will not shut down the viewer itself.
- ▶ To shut down the viewer, select Exit from the File Menu.

Graph Viewer

You may choose to restrict the display and printing to 'interesting' graphs (labeled Significant Differences). These include, but are not limited to, exceedances, verified exceedances, and trends in background.

A graph is a pictorial representation of the concentration of a constituent over time, or as part of a group, which may be compared to a standard or limit. Also represented on the graph is the time period over which the background characteristics of the concentrations were determined if applicable. Exact values for points and lines on graphs can be found in the appropriate tables.

Table Viewer

A tabular analysis result may contain a single table or a series of tables which give detailed results based on statistical calculations and/or queries of the database. The rows of the table may be grouped by bands of color to indicate related items.

Worksheet Viewer

A worksheet is a series of calculations with accompanying explanations which describes which statistical methods were applied, which equations were used, and any constants or values 'looked up'. All intermediate calculations are shown so that you can follow along the process by which limits and other important values are determined.

Statistical Power Chart Viewer

Typically, an increase for a single constituent is accompanied by an increase in other constituents and/or locations making it easier to detect exceedances than would be expected from the values on the curve.

A statistical power chart indicates the **site-wide** expected false positive and false negative rates for a facility. The false positive rate (*i.e.*, for a comparison to background analysis the percentage of failures when the background versus onsite true mean difference equals zero) is the 'power' where the curve intersects the y-axis. The false negative rate indicates the chance of missing contamination at a single location for a single constituent, *i.e.* missing a needle in a haystack, for effect sizes ranging from 1 to 5 standard deviation units from background. That is, if the

concentration of a single constituent in a single location were to become elevated by two standard deviations above background how likely would you be to 'miss it'. This is shown on the chart as 100% minus the 'power', where power represents the probability of detecting the contamination.

The error rates depend on the number of locations, constituents and background measurements, type of analysis, distributional form and detection frequency of the constituents, and the individual comparison false positive rate of the statistic being used. A desirable curve is one that starts low and rises quickly thus protecting human health and the environment while not unduly penalizing a facility.

Print Pre-Analyzed Output

You may print any analyses output which exists when you load the demonstration site. Analysis results that you create cannot be printed until you register the program. To restore the original output of the demonstration site, simply choose Restore Current Site from the Site Menu.

Test-Driving DUMPStat 3

To try out DUMPStat with your own data, you should first clear the current data from the DUMPStat database and then add in (or merge) your own data. At any time, you may reinstate the original demonstration site settings by selecting Restore Current Site from the Site Menu, or by loading the Predefined Demo Data site again.

To clear the database:

1. Choose Clear Database from the Database Menu.
2. DUMPStat will ask for confirmation twice before proceeding. At each prompt, click on Yes.

Now you are ready to add your own data.

Adding Your Own Data

Initially, you must have an ASCII file of the site's historical data. The structure, or data format, of this file is defined to DUMPStat, and then the file is merged into the database. Future samplings will be added to the database simply by merging each new ASCII file.

Included with the program are the files DEMO.DAT, PH.DAT, and SURFAIR.DAT, which are samples of a site's historical data and have been used to create the demonstration database. These files have been prepared in fixed column format. This format has been defined to DUMPStat via the Merge Data item on the Database Menu.

To merge data files:

1. Choose Merge Data from the Database Menu.
2. Click on Select File to choose the file to merge.

If the file is not present in the scrollable list, try looking in other directories, or use the list box to show additional file types.

3. Click on the name of your data file and click on OK to display the file.
The name of the selected file (including the path) is displayed in the Merge Data window. If the text exceeds the length of the field, you can scroll to the end of field using the arrow keys.
4. Look at the flow of your data to determine its format, and click on the appropriate radio button to set the segmentation style:
 - ▶ delimited
 - ▶ fixed columns

Delimited data

1. In a delimited data file each field in a record will be separated from surrounding fields by the use of one unique character.
 - a. Find the delimiting character within the data.
 - b. Choose that character from the delimiter box, or type it in if it does not appear in the selection.
2. Make sure the column headers are ordered correctly. You may change the order one of two ways:
 - ▶ By clicking and dragging the headers. **OR**
 - ▶ By entering the correct sequence in the Format Details dialog.
3. Select the correct date format from the Date Format box.
4. Choose the correct qualifier.
5. Select Ignore 'TBK' Records if necessary.
6. Scroll through the syntax check column to search for error messages, and check those records that have been flagged. Most errors are self-explanatory, and can be easily fixed.
7. Click on Merge when you are satisfied with the format of your records. DUMPStat informs you of events as they occur during the merge; *e.g.*, if any new constituents or sam-

Syntax check

The syntax check column checks each record's format.

- ▶ 'OK' and 'nondetect' statuses appear in black.
- ▶ Error messages appear in red. These indicate a formatting problem in one or more of the data fields.

ple points are encountered, or if some records are invalid, *etc.*

8. If any action is required following these events, *i.e.*, setting aliases, enter unit equivalences, or reviewing leftover records, DUMPStat will prompt you accordingly.
9. When the merge process is complete, click on Close to leave the dialog box.

Fixed columns

1. Click on the black bar between the data window's horizontal scroll bars and drag it to the right. This allows more room to view all of the column headings.
2. The column headers can be moved to fit the corresponding columns by clicking in the heading area, holding, and dragging.
3. The column borders can be moved to the left or right by clicking on top of them, holding, and dragging.
 - a. Starting on the leftmost column, scroll down to find the widest entry in that column. This is how wide that column must be.
 - b. Widen the column (that is, drag the column border) to accommodate this entry.
 - c. Repeat for the rest of the columns, working from left to right.
4. The Qualifier column should be as wide as possible.
 - The qualifiers themselves can be quite short, and it may not be readily apparent that there are any qualifiers if the column is not wide enough to 'catch' them.
 - Scroll through as much of the datafile as possible to look for any qualifiers, and adjust your columns accordingly.
 - Choose the correct qualifier.

5. Select the correct date format from the Date Format box.
6. Select Ignore 'TBK' Records if necessary.
7. If you have adjusted your column widths correctly, all or most of the records should be labeled 'OK' in the syntax check column, with the nondetects and ignores indicated. Scroll through the syntax column to search for error messages. Generally, these should be correctable by adjusting the column widths.
8. Click on Merge when you are satisfied with the format of your records. DUMPStat informs you of events as they occur during the merge; *e.g.*, if any new constituents or sample points are encountered, or if some records are invalid, *etc.*
9. If any action is required following these events, *i.e.*, setting aliases, enter unit equivalences, or reviewing leftover records, DUMPStat will prompt you accordingly.
10. When the merge process is complete, click on Close to leave the dialog box.

Invalid records are saved to an automatically-named leftover records file.

The Database

The contents of the database can be viewed in two ways depending on your needs. Both allow you to choose the order in which records are shown and search for records based on either specific or general criteria. However, View Database shows (read-only) records individually while Edit Database provides a grid view of all records which can be edited as required.

However, if you wish to look at your records while using other dialogs, View Database can be left open.

Since Edit Database allows you to alter records, you cannot leave this dialog open on your desktop. You must complete your actions before moving on to other areas of DUMPStat.

View Database

To view or search the contents of the current database, select View Database from the Database Menu.

Using the data scroll control (labeled Lab Results) to view records:

- ▶ Click on the left or right inside arrow buttons to move backward or forward one record at a time.
- ▶ Click on the buttons at the extreme ends of the data scroll control to move directly to the first or last record.
- ▶ To change the order in which records are displayed use the list box to indicate which field should be the major key (*i.e.*, sorted first). Then reset the middle and minor keys as required.

Searching for specific records:

- ▶ Enter the first few letters of the item you want search for in the Search Filter boxes. When entering dates, DUMPStat will provide a sample of what format the date should be entered in, *e.g.*, mm-dd-yyyy
- ▶ Click on Update.

The records corresponding only to the search criteria will be selected by DUMPStat and can be viewed using the data scroll control.

Viewing all records after performing a search:

Click on Defaults. All records can now be viewed as before.

Edit Database

The database editor is displayed in tabular form. Element headings are displayed at the top of the table, and, horizontal and vertical scroll bars will appear as needed.

All changes to the column display of records are in effect only for that session of the grid viewer.

To view or edit the contents of the current database, select Edit Database from the Database Menu. Note that the database editor cannot be minimized and left on the Windows Desktop. If you choose Edit Database, you must complete your editing actions before DUMPStat will allow you to move on.

Using the grid viewer:

- To change the order in which records (rows) are displayed use the list box to indicate which field should be the major key (*i.e.*, sorted first). Then reset the middle and minor keys as required. The table is automatically reordered when changes are made to the ordering options.
- To change the order in which the elements (columns) are displayed, place the cursor over the element heading, depress the left mouse button, and drag the column to its new position.
- To change the width of a column, place the cursor anywhere on a vertical line on either side of the column. The cursor will become a double-sided arrow. Depress the left mouse button and drag the column boundary to its new width. If you make the column too small, it will 'disappear' from the grid. The column still exists, but you must exit and re-open the grid viewer to view it.

Using the editor:

- To find a specific record or area in the database enter the first few letters of the item you want search for. Pressing the Find button will take you to the first record which matches or exceeds any combination of constituent, well or date.
- To edit a record, including marking or un-marking a manual outlier, highlight the record and then click on Edit.
- To add a record, click on Add.

- To delete a record, highlight the record and then click on Delete.
- To display the log of all changes made to the database, click on Log.

Data Export/Print

DUMPStat allows you to export data from the database for use with other programs or for conforming with electronic reporting regulations in some states. You may choose a subset by constituents, sample points, a date range, or any combination of these. The data are output in a fixed column width ASCII text format, which is easily read into most spreadsheets. You may also choose to print the selection of data in a format similar to the tabular output. Choose Print/Export Records from the Database Menu.

The Well Network

Before you begin running your analyses, you must define the parameters for each well network. These consist of the constituents you wish to analyze, the wells in which you will be analyzing the constituents, and the types of analyses you will be performing.

If you must run the same type of analysis with a different well network at the same site, save each network as a zone and restore it when necessary. See Save Zone As on the Site Menu.

Constituents

We have provided an outline of the steps required to run intra-well or inter-well, comparisons.

The same series of steps can be followed when you are choosing constituents for VOC Detections, Data Summary, Surface Water, and Air Monitoring. Simply select the appropriate item on the Constituents Menu.

In order to operate, DUMPStat needs to know which constituents you want to use in your analyses. Your selections will remain intact for that site until you choose to change them.

1. Choose Select Constituents from the Constituents Menu.
2. A constituent can be moved from the Available List to the Selected List by clicking on the constituent(s) in the Available List and then clicking on Add.
3. A constituent can be moved from the Selected List to the Available List by the same method; click on the constituent(s) in the Selected List and then click on Remove.
4. When the Selected List is to your satisfaction, save the list by clicking on OK.

OR

If you have made changes to your Selected List and do not wish to save them, click on Cancel. A message will appear asking if you wish to save your changes. Click on No.

Assessment

The method of preparing for an assessment analysis differs slightly from that outlined above. DUMPStat needs to know which constituents are to be assessed **and** what standard to use for each constituent (as defined by your state or other regulatory agency).

The Assessment Constituent List reflects the status of the constituents as either unselected, selected with a standard, or selected without a standard. Selected constituents with no standard will have a red 'X' beside the constituent name. Selected constituents with a standard will have a green disc beside the constituent name.

1. Choose Select for Assessment from the Constituents Menu.
2. A constituent can be selected for analysis by clicking on the desired constituent in the Constituents List and then clicking on Select.
3. A constituent can be deselected by the same method; click on the desired constituent in the Constituents List and then clicking on Deselect.
 - a. Define the standard for each selected constituent:
Click on the constituent and then click in the Standard box.
 - b. Type the number, then press the ENTER key.
4. When all desired constituents have been selected, save the list by clicking on OK.

OR

If you have made changes to your list and do not wish to save them, click on Cancel. A message will appear asking if you wish to save your changes. Click on No.

Sample Points

Up vs. Down

If you wish to perform an upgradient vs. downgradient analysis, DUMPStat needs to know which sample points you want to use in your analysis and whether they reflect upgradient wells, downgradient wells, or both. Your selections will remain intact for that site until you choose to change them.

Unlike some of the other Available Lists, the items are not physically removed from the list once selected. Instead, the Available List reflects how a sample point has been defined by placing an indicator beside its name. A sample point name in the Available List is marked with the designation of [U] if it is included in the Upgradient Wells List, [D] for the Downgradient Wells List, [B] for both, or [] for neither.

1. Choose Select Up & Down from the Sample Points Menu.
2. Move the desired sample points to the Upgradient Wells List or the Downgradient Wells List by clicking on the sample point(s) in the Available List and click on Add Up or Add Down respectively.
3. A sample point can be removed from either the Upgradient Wells List or the Downgradient Wells List by the same method: click on the sample point(s) in either list and click on Remove Up or Remove Dn respectively.
4. When the lists are defined to your satisfaction, save them by clicking on OK.

OR

If you have made changes to your lists and do not wish to save them, click on Cancel. A message will appear asking if you wish to save your changes. Click on No.

Intra-Well

If you wish to perform an intra-well analysis DUMPStat needs to know which sample points you want to use in your analysis. Your selections will remain intact for that site until you choose to change them. Choose Select Intra-Well from the Sample Points Menu.

Surface Water Pairs

In order to perform a Surface Water analysis, DUMPStat needs to know which sample point pairs are to be assessed. DUMPStat also needs to know which sample points are upstream and which are downstream.

1. Choose Select Pairs for Surface Water from the Sample Points Menu.
2. In the Available List, click on a sample point that is to be designated as an upstream or downstream point.

Pairs for air monitoring are selected in the same manner as for surface water. Choose Select Pairs for Air Monitoring from the Sample Points Menu.

3. The Set as Upstream and Set as Downstream buttons will no longer be grayed out. Click on the appropriate button to designate the sample point as upstream or downstream.
4. Repeat steps (2) and (3) to complete the pair.

To modify an existing pair:

1. Choose Select Pairs for Surface Water from the Sample Points Menu.
2. Select the pair you wish to modify in the box labeled Upstream points and Downstream points. A bar going across the box will highlight the selected pair.
3. Click on the (newly) desired point in the Available list. The Set as Upstream and Set as Downstream buttons will no longer be grayed out.
4. Click on either the Set as Upstream or Set as Downstream button. The sample point will be placed on the appropriate side of the highlighted bar.
5. When you modify Set as Upstream, the highlighted bar will move to keep the Upstream points in proper sort order.

To remove a pair:

1. Choose Select Pairs for Surface Water from the Sample Points Menu.
2. Click on the pair you wish to remove from the Upstream/Downstream points box. A bar going across the box will highlight the selected pair.
3. Click on Remove Current Pair. You can remove any pair, even an incomplete pair.

To save or ignore changes:

When the Selected List is to your satisfaction, save the list by clicking on OK.

OR

The Upstream/Downstream Points list is sorted by upstream points. If you modify an upstream point on this list, the list will be automatically resorted.

If you have made changes to your Selected List and do not wish to save them, click on Cancel. A message will appear asking if you wish to save your changes. Click on No.

Set Time Windows

The time window has different meanings for different analyses.

- For Intra-Well comparisons, the time window is interpreted as the background time period—the time during which samples from the sample point are known to be contaminant free. Samples taken after the end of the background period are compared to those within the time window.
- For Up vs. Down comparisons, the time window is independent of time windows for the individual sample points. It is applied simultaneously to all the upgradient data to determine which data to include in the pool of 'uncontaminated' comparison data.
- For Assessment, the statistical calculations are based on samples taken from the start of the time window to the most current data. That is, trends are only calculated from the start of the time window to the end of the sampling.
- For Surface Water and Air Monitoring, the time window specifies the range of sampling dates that are used in the statistical analyses. Only samples taken between the start and the end of the time window are analyzed.

You can set the time window individually for each of the sample points, and have a separate window for the upgradient data. This allows intra-well and up vs. down well networks to co-exist. Furthermore, new sample points can be seamlessly incorporated into DUMPStat without disturbing settings for existing sample points.

You can choose to display pre-background data in your graphs should you wish to show samples excluded prior to background.

To set time windows:

1. Choose Set Time Windows from the Sample Points Menu.
2. Select the well(s) you wish to set the background time for by clicking on one or more of the wells in the Time Periods for Sample Points box, or click on Select All. The last well selected will appear on the detailed time bar.
3. To change the time for all the wells without changing Up vs. Down, click on Select All and then click on Up vs. Down.
4. Enter the Start Window, End Window, and Start Display month and year.
5. Click on Update Selected Wells to apply the changes displayed on the detailed time bar to the selected/highlighted wells in the Time Periods for Sample Points box.
6. You may want to ignore all data sampled past a particular month; *e.g.*, exclude the data from the most recent quarter. In this case click on the associated checkbox, and type in an appropriate date.
7. When the time windows are defined to your satisfaction, save them by clicking on OK.

OR

If you have made changes to any date settings and have not yet Updated Selected Wells, DUMPStat will ask if you wish to update the wells. If you do **not** want to save your changes, click on No.

Alternatively, you can use your ENTER key to leave each date field. This will apply the default button (Update Select Wells), ensuring that you save your date changes.

Statistical Options

DUMPStat's statistical options are found on the Settings Menu. You can alter these settings and rerun the analyses to see the effect of your changes. To illustrate the consequences of these options, there are some sample exercises to perform starting on page 37. Note that when you change the settings, DUMPStat will automatically erase all output. Thus, we recommend

reloading the demonstration site and following the exercises in order, as we have ensured that analysis results are available for viewing as required.

Detailed statistical information is available in the DUMPStat Statistical Guide which is provided when the software and license are purchased. However, the most comprehensive source on the specific statistical methodologies used and related statistical issues is Gibbons (1994) *Statistical Methods for Groundwater Monitoring*, John Wiley and Sons, New York, (ISBN 0-471-58707-9). To order, call John Wiley and Sons at (800) 225-5945. The ASTM D6312-98 guidance is available from ASTM at (610) 832-9585, or at <http://www.astm.org>.

Performing Analyses

A brief description of each analysis begins on page 29.

With DUMPStat you can perform analyses in two ways, either individually or by running a group of analyses together. You can choose which analysis or analyses to run from the Perform Analysis item of the Functions Menu. Each analysis type is represented by a button. To run an individual analysis, simply double-click on that button.

To set up a series of analyses to run and automatically activate the output viewers upon completion:

1. Choose Perform Analyses from the Functions Menu.
2. Depress (click on) the buttons of the analyses you wish to run. All buttons can be depressed, even if the title appears grayed out. If the green dot ● appears, all the necessary steps have been taken to run that particular analysis (*i.e.*, the well network defined, the setup options completed, *etc.*).
3. If the green dot does not appear on one of your selections, double-click on that button. DUMPStat will inform you why the analysis cannot be run at this time.
4. If you wish, choose the output you would like automatically displayed after the analyses are complete by selecting the

As the analyses are running, DUMPStat will show you which analysis in the sequence it is currently working on. If any event occurs that prevents an analysis from completing normally, the necessary status messages will be available for viewing upon completion of the sequence of analyses.

desired output button to the right of each analysis button. Output choices include graphical, tabular, worksheets and statistical power charts.

5. In the Comprehensive frame, select As Marked to ensure that the output choices you have made are automatically shown upon completion of the analyses.
6. Select the 'Do those with ●' button. All possible selected analyses will be run in sequence. Thus, if a selected statistical power analysis was unavailable at the time of selection, when its preceding analysis is performed, the statistical power analysis becomes available and will be performed.
Example: The statistical power chart for Intra-Well Control Charts can and will only be created after the Intra-Well Control Charts analysis has been completed.
7. Click on Close or Cancel to leave the Perform Analyses dialog. Close will automatically save your selections for the next time; whereas Cancel will give you the options of saving your selections or not.

At any time, you may reinstate the original demonstration site settings by selecting Restore Current Site from the Site Menu, or by loading the Predefined Demo Data site again.

Practice Exercises

4

Remember

When you alter any statistical settings in DUMPStat, all current output is erased.

Following are a few exercises that can be done with our sample database to illustrate some of DUMPStat's features and capabilities.

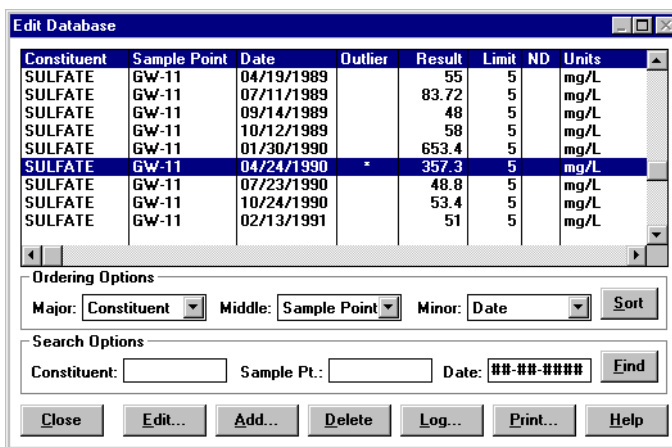
We recommend that you follow these exercises in order, as we have ensured that analysis results are available for viewing as required.

Manual Outliers

The manual outlier feature allows you to identify data in the database that are known to be invalid because of sampling or other external conditions. Outliers that are identifiable by their large deviation from typical values are statistically detectable and are already automatically identified by DUMPStat. A data point should only (and **always**) be identified as an outlier manually if the reading is known to be invalid.

Exercise

Choose Database > Edit Database.



Constituent	Sample Point	Date	Outlier	Result	Limit	ND	Units
SULFATE	GW-11	04/19/1989		55	5		mg/L
SULFATE	GW-11	07/11/1989		83.72	5		mg/L
SULFATE	GW-11	09/14/1989		48	5		mg/L
SULFATE	GW-11	10/12/1989		58	5		mg/L
SULFATE	GW-11	01/30/1990		653.4	5		mg/L
SULFATE	GW-11	04/24/1990	*	357.3	5		mg/L
SULFATE	GW-11	07/23/1990		48.8	5		mg/L
SULFATE	GW-11	10/24/1990		53.4	5		mg/L
SULFATE	GW-11	02/13/1991		51	5		mg/L

Ordering Options
Major: Middle: Minor:

Search Options
Constituent: Sample Pt.: Date:

If you scroll down the right-hand side to the Sulfate records, you will see that record for GW-11 on 04/24/90 has been flagged as being a manual outlier.

You can see a list of manual outliers by choosing View Manual Outliers on the Database Menu. You can see the effect on the analysis if you enable manual outliers in the Statistical Options dialog of the Settings Menu. For this data set, removing this background data point by making it an outlier changes the prediction limit algorithm from nonparametric to lognormal, which affects the up vs. down prediction limit enough to show that downgradient wells GW-24 and GW 26 are exceedances in sulfate.

1. With the manual outliers disabled (the default), use the Worksheet Viewer to make a note of the up vs. down prediction limit for sulfate, and the method of computation of the limit.
2. Using the Table Viewer, see Table 2 to determine which wells and constituents are in exceedance and make note of them.

In the File Menu, enable both **Display Footers** and **Display in Color** to help find the exceedances.

* Predefined Demo Data *
Table 2

Most Current Downgradient Monitoring Data

Constituent	Units	Well	Date	Result	Pred. Limit
Chloride	mg/L	GW-20	03/25/1993	20.5000	42.0000
Chloride	mg/L	GW-24	03/24/1993	45.0000 *	42.0000
Chloride	mg/L	GW-26	03/24/1993	59.2000 ***	42.0000
Sodium	mg/L	GW-20	06/08/1993	36.3000 **	36.9000

* - Current value failed - awaiting verification.
 ** - Current value passed - previous exceedance not verified.
 *** - Current value failed - exceedance verified.
 **** - Current value passed - awaiting one more verification.
 ***** - Insufficient background data to compute prediction limit.
 ND = Not Detected, result = detection limit.

3. In the DUMPStat main window, choose Settings > Statistical Options and check the Enable Manual Outliers box. Then click on OK.

4. Rerun the Up vs. Down Prediction Limits analysis by double clicking on that button on the Perform Analyses dialog of the Functions Menu.
5. Check the value for the prediction limit in the worksheet, and compare it to the value as noted in Step 1. Also review the wells and constituents that are now in exceedance in Table 2. Compare these to those noted in Step 2.

You can also use the Graph Viewer to quickly check for exceedances. After starting the viewer, enable the Display Significant Only option from the File Menu.

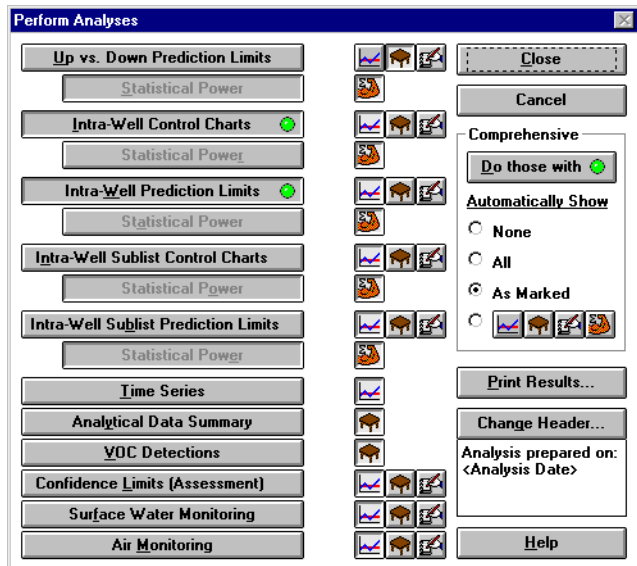
Running Multiple Analyses

In preparation for the next exercise, you must run two analyses to create output for viewing.

Exercise

This is an opportunity to define a custom 'batch' analysis run and have DUMPStat perform all desired analyses and open the appropriate viewers automatically upon completion.

1. Choose Perform Analyses from the Functions Menu.



If a 'go' sign does not appear, double-click that button. DUMPStat will tell you what steps need to be taken before that analysis can be performed.

2. Make sure the Intra-Well Control Charts and Intra-Well Prediction Limits buttons are pushed in. The 'go sign' (the green disc ●) should appear on the button.
3. Since we don't want to run any other analyses at this time, make sure that no other analyses buttons are selected (pushed in).
4. Make sure the graphical viewer output button is pushed in beside the Intra-Well Control Chart and Prediction Limit buttons. This means that these graphs will be automatically opened when the analysis is completed.
5. Make sure the other output buttons beside the Intra-Well buttons are **not** pushed in.
6. In the Comprehensive frame, click on As Marked to ensure that the output choices you have made are automatically shown upon completion of the analyses.
7. Click on the 'Do those with ●' button. The analyses will be run. DUMPStat will provide you with status messages during and after the performing of the analyses.

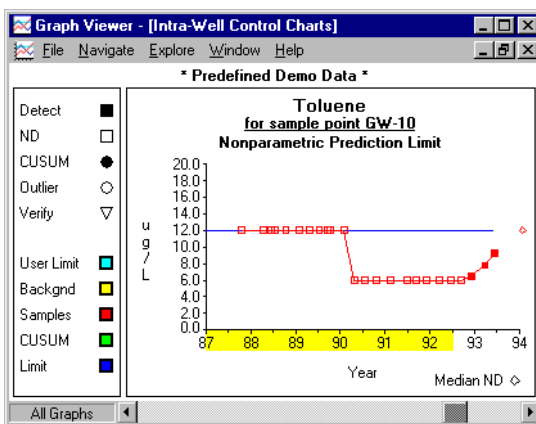
Manual Reporting Limits

Reporting limit values are ignored for detect samples, but are used for nondetect samples. The value supplied is used in the calculation of the nonparametric or Poisson prediction limits; for example, when all of the background samples for a given constituent and well are all nondetects. If the data for a particular constituent have different reporting limits for different samples, as can happen if you get data from two different labs, then the difference in reporting limits can adversely effect the resulting nonparametric or Poisson prediction limits. Note that extreme reporting limits are also screened as outliers automatically by DUMPStat or can be excluded from statistical analyses by setting them as manual outliers.

Exercise

Using Edit Database from the Database Menu, you can see that the data for toluene has two different reporting limits, reflecting a change in analytical labs in February 1990. The previous lab had a reporting limit of 12 $\mu\text{g}/\text{l}$ and the current lab reports 6 $\mu\text{g}/\text{l}$.

Using the Graph Viewer, look at the plot for toluene taken at GW-10 for either form of Intra-Well analysis.



As you can see, a nonparametric limit is used, and the limit is set to the median reporting limit because **all** of the background data are nondetects. It is reasonable, however, to set a manual reporting limit in this case because there are enough data points from the new lab to establish the limit based on these data alone.

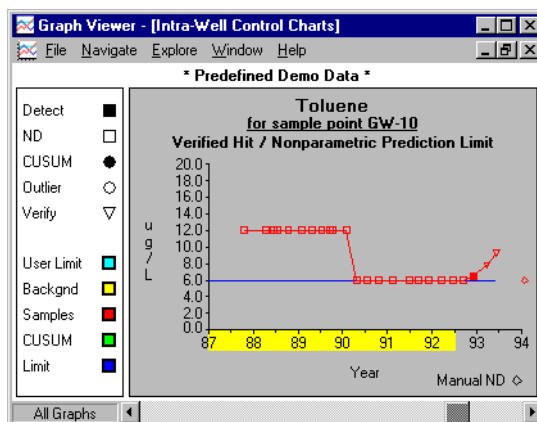
1. In DUMPStat, choose Set Manual Reporting Limits from the Constituents Menu. Note that toluene has a limit of 6 $\mu\text{g}/\text{l}$, the value of the most recent lab data. However, until this setting is enabled it has no effect.
2. In the same dialog, click on the Enable Manual Reporting Limits check box. This will make all of the nondetect points

for toluene behave as though they all had a limit of 6 $\mu\text{g}/\text{l}$ reported by the lab. Click on OK to exit the dialog.

3. Rerun the two Intra-Well analyses as you did on page 40.
4. Review the output. You will see that the control and prediction limits for toluene have dropped, revealing an exceedance for that constituent that was previously masked.

Note

The same effect could have been achieved by limiting the background time window for the GW-10 sample point to only the 6 mg/l limit samples, but this would have affected all constituents at that well, not just toluene. Also, this would not have helped if the unwanted reporting limit was interspersed with the desired one in the background data.



Sublist and Two-Sided Limits

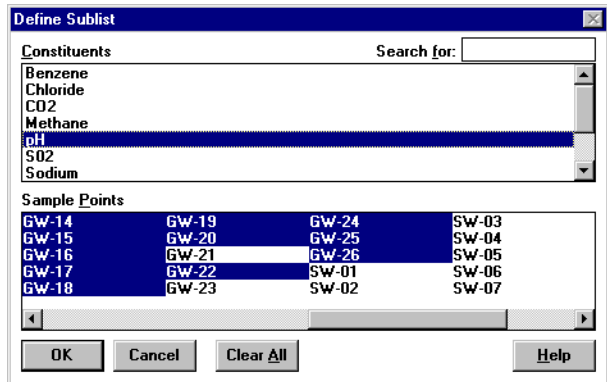
These two unrelated features are normally used independently, but for the purposes of this exercise they are featured together.

DUMPStat allows you to pick and choose an arbitrary sublist of wells and constituents for intra-well analysis. Only one such sublist is defined for each zone in a site, but you could have multiple sublists for a site by having multiple zones. To create a sublist, you explicitly pick which sample points are to be monitored for each constituent.

Exercise

1. Choose Define Sublist from either the Constituents or Sample Points Menu.
2. Confirm that for the demonstration site, there is only one constituent in the sublist—namely, pH. You can do this by highlighting each constituent and seeing if any associated

sample points are highlighted. Click on Cancel when you have finished.



3. Choose Select Constituents from the Constituents Menu. Note that pH is **not** included in the regular selected constituent list. The sublist constituents may be chosen from any constituents in the database, and need not be included in any other analysis.

If you run the Intra-Well Sublist Control Charts or Prediction Limits analyses, you will only see results for the constituent well selections in the sublist.

Set Up for Multiple Analyses

Once again, in preparation for the remaining exercises, you must run three analyses to create output for viewing.

Exercise

Set up DUMPStat to perform the only following analyses and have the specified output automatically displayed:

- Intra-Well Prediction Limits—graphs and worksheets
- Intra-Well Sublist Prediction Limits—graphs
- Analytical Data Summary—tables

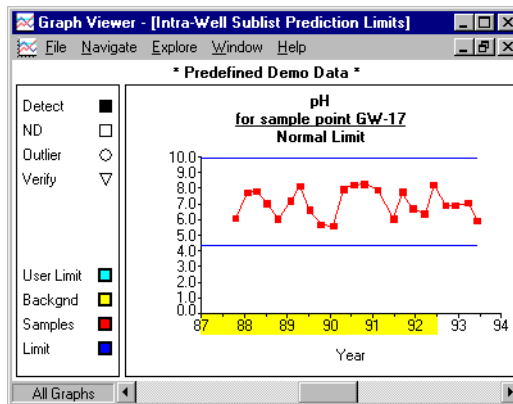
If you have any trouble setting this up, refer back to Running Multiple Analyses on page 39.

Two-sided Prediction Limits & pH

The pH measurement differs from concentration measurements in that there is a numerical maximum **and** minimum that a result must fall between to be considered acceptable. To account for this, the prediction limits (Up vs. Down and Intra-Well) treat the constituent pH differently from others and compute a two-sided limit.

Exercise

1. In the Graph Viewer, look at the output for Intra-Well Sublist Prediction Limits. If necessary, use the Window Menu to find it.



2. There are two prediction limit lines for pH—an upper and lower. This is one of the few places where prediction limits are more useful than control charts—the CUSUM measure on the control chart only accounts for significant increases; however, the Shewhart portion of the control chart does account for the two sided nature of pH.
3. To see how the prediction limits are calculated, go to the Worksheet Viewer.

Analytical Data Summary

You can decide what period of time you want to be considered the 'same' date. Choose Select Summary Dates from the Settings Menu.

This feature allows you to look at and print tables of your data sorted by constituent, date, or sample point. You can also restrict which constituents, sample points and dates you want to include in the summary.

The analytical data summary also allows you to group together samples taken shortly after one another together as though they were taken on the same date. This would be necessary if you had a large site and it took several days to collect samples from all of your sample points. Normally you would be sampling different wells on each day as you worked through your site, but if the same well were sampled twice in the period of interest, DUMPStat will take the arithmetic mean of the values, and put a footnote in the summary showing that this was done.

Exercise

Make sure that the footnotes are displayed and the display is in color. These options are set from the Table Viewer's File Menu.

The demonstration data set has an analytical data summary set up that shows all of the air and surface water readings for the entire site.

1. Using the Table Viewer, look at the results for the Analytical Data Summary. If necessary, use the Window Menu to find it.
2. Use the bottom scroll bar to choose the last table, TOC. Use the upper scroll bar to move to the right of the table. You will see that the entries for SW-01 and SW-02 have asterisks beside them, indicating that they are averages.

Table Viewer - [Analytical Data Summary]

File Navigate Window Help

* Predefined Demo Data *

Table 5

Analytical Data Summary for TOC (mg/L)

Dates	AIRO7	SW-01	SW-02
10/16/1984			
10/16/1985			
10/16/1987		6.6500	5.7000
1/27/1988 - 1/28/1988		7.8750*	4.9000
1/28/1988 - 1/29/1988		5.7500	4.9000*
4/13/1988			4.3500
6/15/1988			

* - The displayed value is the arithmetic mean of multiple database matches.

- Using Edit Database from the Database Menu, you can see that there are samples on successive days for TOC at sample points SW-01 and SW-02 at the end of January 1988.