Decision Management Tool Version 5 User's Manual, Rev. 0

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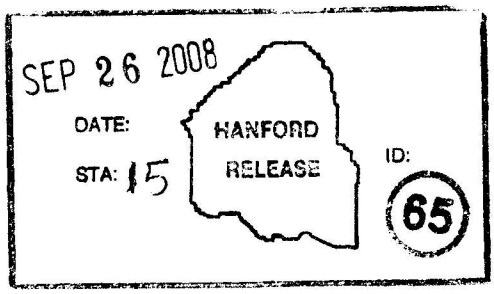

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DECISION MANAGEMENT TOOL VERSION 5 USER'S MANUAL

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TERMS

DMT	Decision Management Tool
STOMP	Subsurface transport over multiple phases
HISI	Hanford Information Systems Inventory
HTWOS	Hanford Tank Waste Operations Simulator
IDMS	Integrated Document Management System

1.0 INTRODUCTION

Decision Management Tool (DMT) is a software application designed to rapidly produce analyses (plots, tables and excel spreadsheets) for risk assessments. It integrates various data and model results from multiple and disparate sources to produce tank farm risk assessment analyses. Contaminant sources, inventories and transport results used in the analysis are configured through the software user interface.

1.1 HANFORD INFORMATION SYSTEMS INVENTORY REGISTRATION

Decision Management Tool is registered in the Hanford Information Systems Inventory (HISI), with registration number 2048. HISI contains contact information for the application owner and authorized users. Contact the DMT owner to obtain the installation package (section 2.0) for the most recent DMT build.

1.2 USER MANUAL PURPOSE

This manual explains how to perform risk assessment calculations using DMT. Someone using DMT for risk assessment will be referred to in this document as a “user” or “end-user”. DMT incorporates and catalogues for the end-user contaminant inventory data, model results, including sensitivity analyses, and contaminant properties, risk factors, and metrics into discrete packages referred to as data sets. In order to maintain data set integrity, DMT restricts end-users from performing some software administrative functions. A separate manual (RPP-39235) describes these administrative functions, including instructions on how to generate and catalogue new data sets when new inventory and contaminant data, model results, or risk parameters become available. DMT users who configure DMT and its data sets for end-users are referred to in this manual as “administrators”. This document will also refer to a “risk assessment scenario” simply as a “scenario”, which means the combination of contaminant sources, inventories and transport results used to produce a set of results in the interface.

1.3 USER MANUAL STRUCTURE

The user manual begins by describing how to obtain and install DMT and it’s data sets, then presents a series of case studies to show how DMT’s most commonly used features can be implemented. These case studies are narratives written at a generic level and will not explain how to use the features they describe. The narratives will call out the sections describing each feature in detail, allowing the reader to choose which features to learn how to use. After the narratives, the purpose and use of each menu item and tab in DMT is described in detail. The manual ends with a detailed description of the data directory structure. The data directory structure section is intended to provide insight into how DMT works, but only DMT administrators can make changes to the data directories.

1.4 INTRODUCTION TO DMT INPUT DATA

A basic risk calculation starts with an initial contaminant inventory from a source (e.g., the quantity of Tc-99 remaining after retrieval in tank 241-C-101 located in Waste Management Area C [WMA-C]). Vadose zone contaminant fate and transport simulation results, describing how the contaminant moves through the vadose zone and impacts groundwater, are used to estimate the travel time and dilution of the analyte between its source and a pre-defined end point (e.g., the WMA-C fenceline). The resulting contaminant groundwater concentration may be further modified to account for certain contaminant physical properties, such as the radioactive decay of Tc-99. Finally, the contaminant concentration is multiplied by a contaminant specific risk- or dose-factors which encapsulate a set of conditions by which a receptor may be exposed. For example, dose factors are used to calculated the cancer risk from Tc-99 to a farmer associated with the ingestion of crops irrigated with groundwater. These risk- and dose-factors and the associated methods are described in HNF-SD-WM-TI-707. The final DMT numerical result is usually reported in a risk assessment or performance assessment document, such as *Initial Single-Shell Tank System Performance Assessment for the Hanford Site* (DOE/ORP-2005-01).

As shown by the preceding description, input data from four broad categories are used in a DMT risk analysis (Figure 1): contaminant inventory data, vadose zone contaminant fate and transport model output, analyte physical properties and human health risk dose factors. Data are further broken down into descriptive categories (e.g., inventory data could be subdivided into categories such as “post retrieval inventories”, “past leak inventories” or “current inventories”). DMT allows any number of data categories and also allows them to have any name. DMT Users can only install data sets (section 2.3) configured and assembled by DMT administrators.

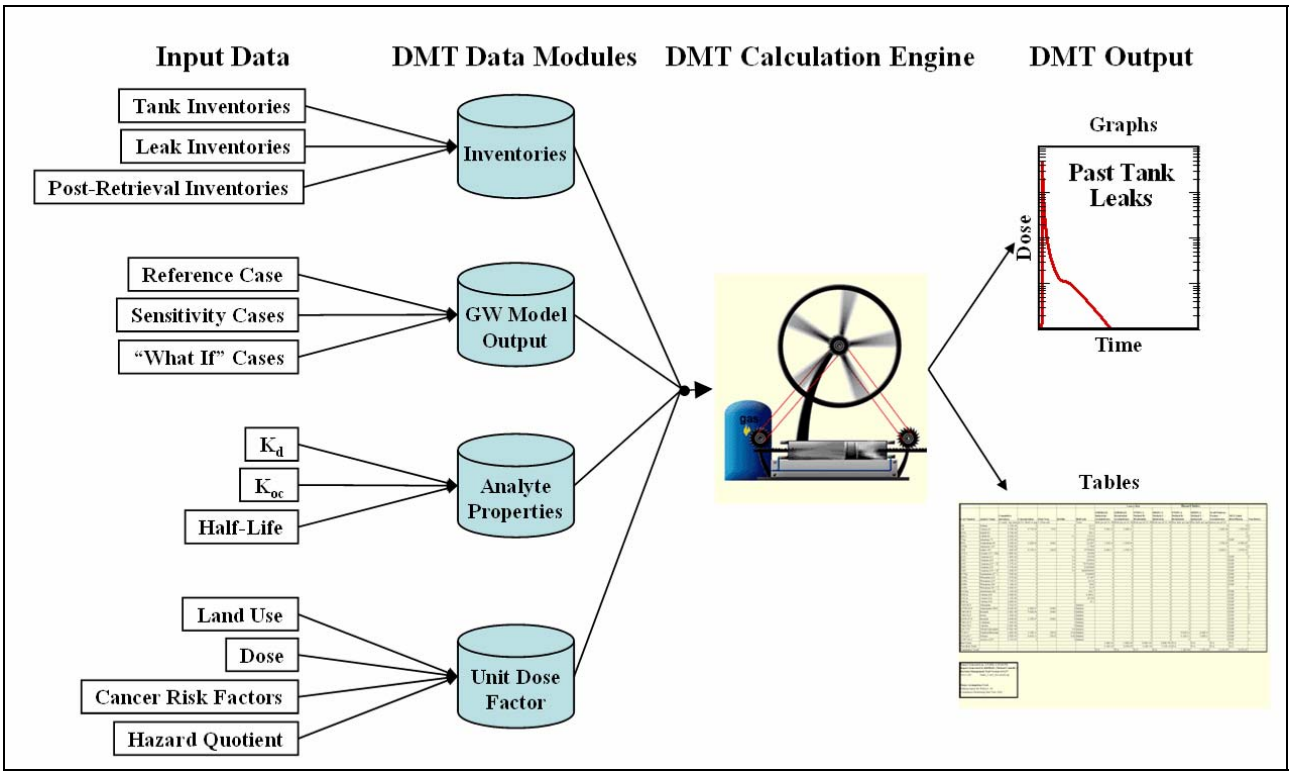


Figure 1. Schematic illustrating how DMT integrates data to produce risk assessment analyses.

DMT is highly configurable and allows inclusion of inventories, dose factors and analyte physical properties from a wide variety of sources. This allows DMT to utilize data as they become available. For contaminant transport simulation, DMT is currently configured to only use output (specifically "surface" files as described in PNNL-14478) from Subsurface Transport Over Multiple Phases (STOMP)[1].

Data are organized into data sets (section 2.3) for maintaining data integrity and traceability. A new data set is created when any of the values in an existing data set has changed (e.g., new inventory estimates for a tank or new STOMP model results become available). Data set configuration control and cataloging ensures consistency and reproducibility of DMT results across the user community and for future use. Only administrators can assemble and catalogue data sets.

2.0 INSTALLATION

Since Decision Management Tool is a self-contained executable, there is no installation procedure other than extracting the program files from the distributable package to a directory on the DMT User's computer hard drive.

[1] Subsurface Transport Over Multiple Phases (STOMP) is copyrighted by Battelle Memorial Institute, 1996.

The distributable package does not contain data. Data are packaged as data sets, any number of which can be installed within the DMT directory structure (section 2.3).

2.1 EXTRACTING DMT FROM THE DISTRUBUTABLE PACKAGE

Contact the DMT owner to obtain the latest distributable package. It will be a compressed file in gzip format (with a ".tar.gz" extension). Extract the application files from the distribution package from within WinZip by double-clicking the file, then clicking the "Extract" button at the top of the WinZip user interface. In the window that appears, ensure that the "Use folder names" option is checked, locate and choose the directory containing the DMT executable, and click the "Install" button. Since DMT requires a rigid directory structure to function, the "Use folder names" option ***must*** be checked for DMT to work correctly.

2.2 MINIMUM SYSTEM REQUIREMENTS

- MS Windows 2000 or XP
- 2 GHz CPU
- 512 MB RAM
- 3 MB minimum disk space (required disk space depends on number of data sets included and whether data sets include original ASCII STOMP files)

2.3 INSTALLING DATA SETS

Data set packages are compressed files in gzip format designed to install the data set with the required directory structure (section 12.0). Rigid directory structure requirements ensure that DMT can find directories necessary for formatting the user interface and establishing the complete data structure at start-up. DMT will not run if these requirements are not met. Contact the DMT owner for instructions on obtaining data set packages from IDMS.

Extract the data set from the data set package from within WinZip by double-clicking the file, then clicking the "Extract" button at the top of the WinZip user interface. In the window that appears, ensure that the "Use folder names" option is checked, choose the directory containing the DMT executable, and click the "Install" button. Since DMT requires a rigid directory structure to function, the "Use folder names" option ***must*** be checked for correct DMT operation.

3.0 STARTING DMT

Double click the DMT program executable (DMT.exe) to start DMT. The program executable will be located in the directory that was chosen in WinZip when the distributable package was uncompressed (section 2.1). DMT will run if no data-sets are installed, but no risk assessment calculations can be performed in this mode.

DMT has a multi-step startup sequence requiring some user input. Once the user double-clicks the executable a data selection window (section 5.0) will appear allowing the user to choose which data to load. As DMT loads the data, some informational messages may be displayed (section 5.2), requiring user confirmation to continue the loading process. The user interface (section 6.0) appears once data loading is complete.

4.0 USING DATA SELECTION TREES

Data selection trees are fundamental controls within DMT. While a tree-based interface may be familiar to users of Windows-based operating systems, DMT trees are slightly different. Understanding how to use DMT trees is vital to run DMT efficiently and effectively. Section 10.0 provides details about the different trees in DMT, while the following discussion describes how to manipulate the trees.

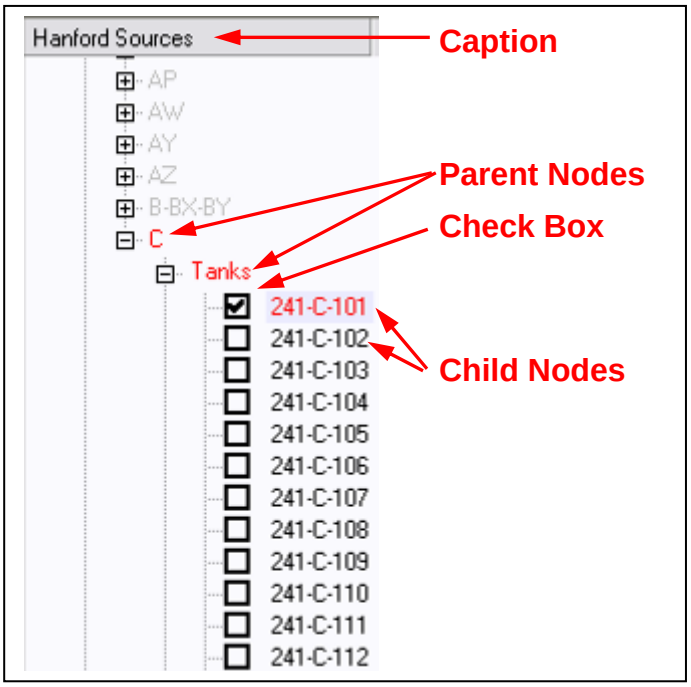


Figure 2. Annotated screen capture of a data selection tree.

Each data selection tree (Figure 2) is comprised of parent nodes and child nodes. Parent nodes do not have check boxes next to them and often contain subordinate nodes (child nodes). Child nodes have check boxes and are owned by a parent node. Checking a child node check box will activate it and it's data for use in subsequent calculations. To check or uncheck the boxes all of the children of a parent node, click on the parent node's name while holding down the "ctrl" key on the keyboard.

Clicking the '+' symbol to the left of a node will expand it and expose all the child nodes it contains.

4.1 CHECKING AND SELECTING NODES

A critical distinction used in this manual is the difference between a *checked* node and a *selected* node (Figure 3). A checked node is one whose text appears in red and has a check in its checkbox (if present). A checked node and it's data are flagged for use in subsequent calculations. A selected node is one whose name is surrounded by a blue-gray box. Selecting a node is useful for identifying it for a certain function without including it in the calculations. A node's checked and selected states are independent of one another.

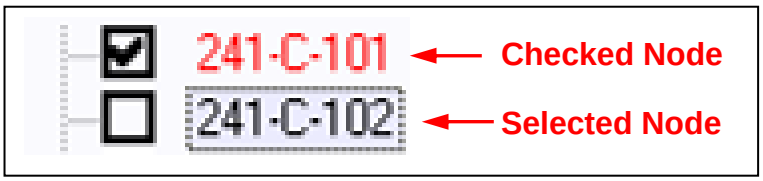


Figure 3. Appearance of a checked node verses a selected node

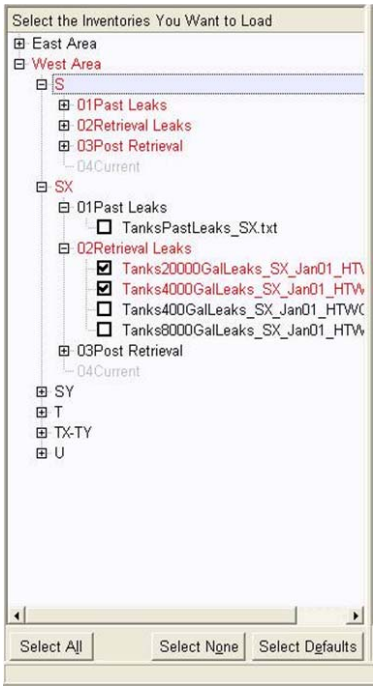


Figure 4. Sample data selection tree. The node in the gray box is *selected* while nodes in red are *checked*. Nodes with checkboxes are *child nodes* while nodes without checkboxes are *parent nodes*.

5.0 DATA OPTIONS START UP SCREEN

The data options start up screen appears when the program executable is double-clicked. The DMT User chooses which data set (section 1.3) to use in the DMT session using this screen. The

user can also choose which source inventory and STOMP simulation data to load from the selected data set for use in the DMT session. Choosing which data to load can slightly speed up the program start-up time and can also simplify analyses by minimizing the number of choices in the interface.

When the program executable is double-clicked, the data set selection menu (Figure 5, number 3) is populated with a list of all the data sets found in the DMT directory. The first data set in the list is automatically selected and the inventory (Figure 5, number 1) and simulation (Figure 5, number 2) trees are populated with the names of the data files available in the data set. Selecting another data set from the menu re-loads both trees to reflect the selected data set's contents. Data is selected for loading by checking individual nodes in each tree (section 4.0), using a saved configuration file (section 5.1), clicking the "load last selected" button (section 5.1) or clicking the "Select All" button beneath each data selection tree (Figure 5, number 11).

When the desired data has been selected for loading, clicking the "go" button (Figure 5, number 10) starts the data loading process and displays the software's user interface. A splash screen will appear, graphically illustrating the data loading progress. Clicking the "abort" button (Figure 5, number 9) exits DMT.

Figure 5 is a screen capture of the data options window, with each feature annotated with a number for the following discussion.

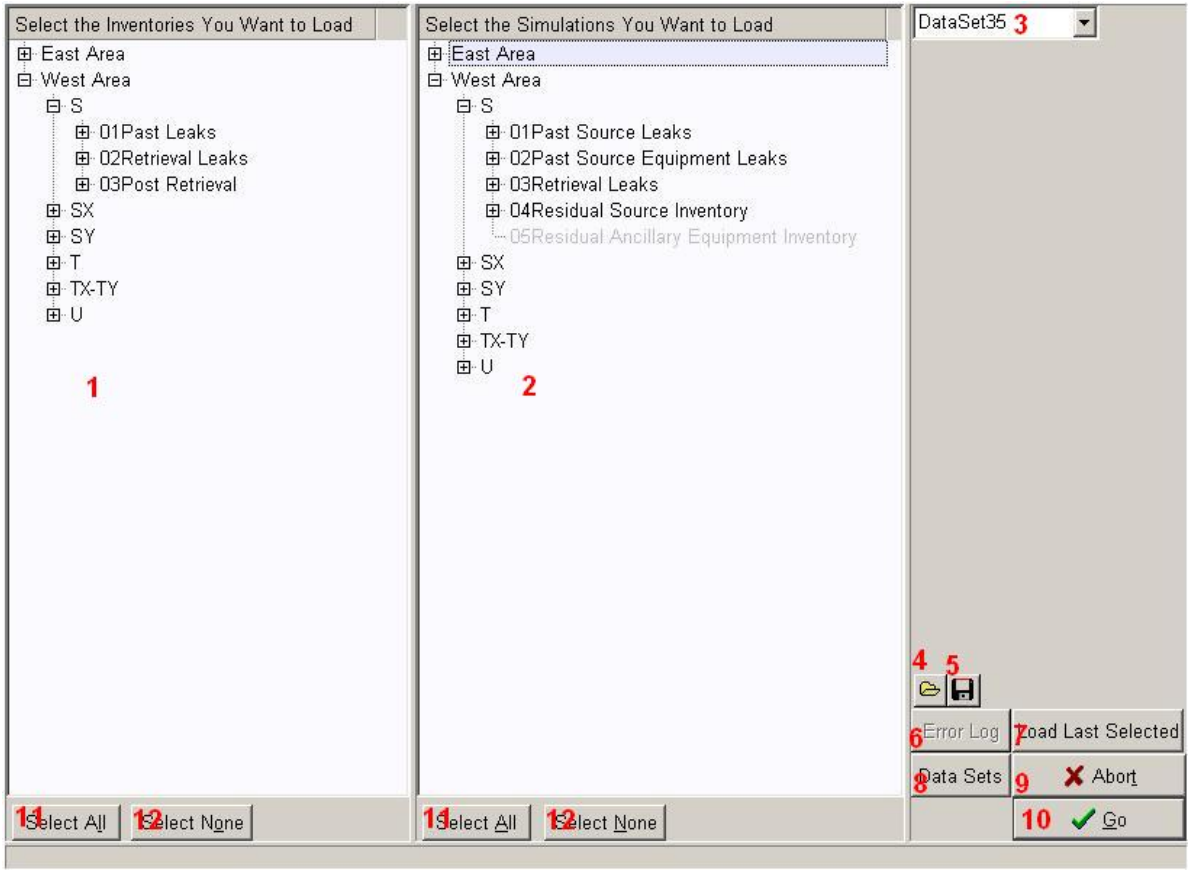


Figure 5. Annotated data options window. The red numbers do not appear in the software.

1. **Inventory Tree**: For selecting which inventory files to load
2. **Simulations Tree**: For selecting which STOMP result files to load
3. **Data Set Menu**: Selects the data set
4. **Open Selection**: Opens a previously saved set of tree selections
5. **Save Selection**: saves the current tree selections
6. **Error Log**: Displays missing or added data files in a separate window if the data on disk do not match those listed in the metadata file.
7. **Load Last Selected**: checks the tree nodes that were used in the last DMT session
8. **Data Sets**: Lists available data sets with descriptions.
9. **Abort**: Exit DMT
10. **Go**: Start DMT with selected inventories and simulations
11. **Select All**: select all nodes in the tree
12. **Select None**: deselect all nodes in the tree

5.1 SAVING AND LOADING SELECTIONS

Inventory and simulation tree selections in the data options start up screen can be saved to file to quickly load them for a subsequent DMT session. The tree selections will be saved in a file with a ".setup" extension. Clicking the "save" button on the data selection window (Figure 5, number 5) opens a standard Windows save dialog box, allowing the user to select where to save the file.

Clicking the "open" button (Figure 5, number 4) opens a standard Windows dialog box allowing the user to select a saved "*.setup" file. Opening a setup file will automatically select the data set and check the nodes in the tree based on the saved settings. No errors will result if the setup file contains a selection that does not exist in a tree. This extremely rare occurrence could only occur if the data set had been changed by an administrator and reinstalled after the setup file was saved.

Clicking the "Load Last Selected" button (Figure 5, number 7) automatically selects the data set and checks the inventory and simulation trees with the tree selections from the last DMT session.

If the data set recorded for the "Load Last Selected" feature or .setup files has been removed, DMT will use the inventory and simulation trees of the data set currently selected in the data set selection menu (Figure 5, number 3). In this case DMT attempts to check the nodes of the currently shown trees with the saved values, but will only check nodes whose names match the recorded values.

Clicking the "Select All" button under a tree in the data options start up screen (Figure 5, number 11) will check all the nodes in that tree. All checked nodes in a tree can be cleared by clicking the "Select none" button (Figure 5, number 12) under it.

5.2 OTHER STARTUP WINDOWS

5.2.1 Data Set Error

To ensure data set integrity, DMT checks the data on disk against a binary metadata file when a dataset is selected. The binary metadata file lists all the files and directories in the data set. If the data is mismatched or is incomplete, a warning will appear (Figure 6), and a different data set must be chosen to start DMT. Clicking the "Error Log" button on the start up screen (Figure 5, number 6) produces a window listing the files that have been removed or added and their directory paths. A DMT administrator can use this information to correct the problem. This error will only occur if a user has added, removed or renamed files in the data set's directories, or if the user has deleted or renamed the metadata file.

Figure 6. Data set loading error message

5.2.2 Analytes Converted from Mass to Activity

Risk calculations involving radionuclides use activity estimates for inventory input. Occasionally, radioisotope inventories may be reported as mass values (such as an inventory from a lab analysis). DMT will convert any radionuclide inventory value from mass (i.e., kg) to activity (e.g., Ci) during data loading using the radionuclide's specific activity value found in DMT's specificactivity.ini configuration file.

If any inventory values in an inventory file are converted, a window will appear (Figure 7) listing the original and converted inventory values, along with the inventory file name, affected source, affected analyte, and affected waste phase. This window informs the user that a conversion was made and what the conversion results are. DMT start up pauses until this window is closed. The window can be recalled at anytime from within the interface by selecting "Help | Converted Analyte Inventories" (section 9.4).

Analytes converted from Mass to Activity

Inventory File	Source	Analyte	Original Inventory	Units	Converted Inventory	Units	Waste Phase
Tanks_C103.txt	241-C-103	228Th	2.66E-10	Kg	0.0002180368205232	Ci	Supernatant
Tanks_C103.txt	241-C-103	228Th	0.000199729	Kg	163.715323783001	Ci	Sludge
Tanks_C-103upper.txt	241-C-103	228Th	0.0002368226	Kg	194.120476436232	Ci	Sludge
Tanks_C-103upper.txt	241-C-103	228Th	7.9834080707697E-10	Kg	0.000654389816800707	Ci	Supernatant
TanksCFarm_Jan01_HTWOS.txt	241-C-106	230Th	4.89E-5	Kg	0.0010081094904	Ci	Total

Figure 7. "Analytes converted from mass to activity" dialog box

5.2.3 Conditions of Use

A window outlining the conditions for use (Figure 8) appears when data loading is complete. Clicking the "Start" button acknowledges the message and displays the program's user interface. This message can be recalled at anytime from within the interface by selecting "about" in the help menu (section 9.3.1).

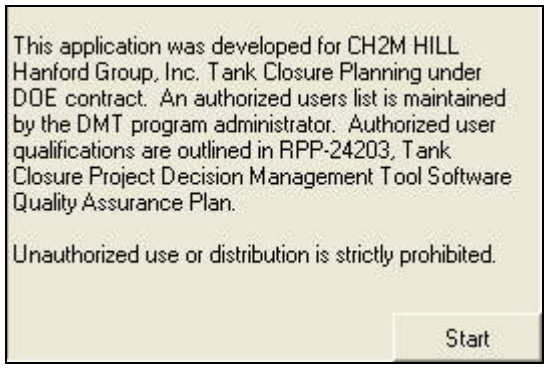


Figure 8. Conditions of use window

6.0 DMT USAGE EXAMPLES

This section describes examples of common DMT uses. Each example is a broad overview and contains references to the sections that fully describe how to use each feature of the software.

6.1 RISK ASSESSMENT

DMT was primarily designed to quickly and efficiently produce risk estimates based on various risk assessment scenarios, eliminating many of the laborious methods previously used. DMT has been used for Tank Closure Retrieval Data Report risk assessments and the *Initial Single-Shell Tank Performance Assessment* (DOE/RL-2005-01). The following examples show how DMT is used for producing analyses for risk assessment documents.

6.1.1 Generating Risk tables

A user must prepare a risk assessment for assessing risks from tank residuals to finish a closure retrieval data report (RDR) upon completion of retrieval work at a tank. The user will use DMT to generate cancer risk and non-cancer health risk results tables for the document from post-retrieval inventory sample results.

A post retrieval sample of the residual sludge is sent to a lab for analysis and the results forwarded on to the user as a spreadsheet. The spreadsheet contains both average inventories and 95% confidence interval inventories based on the lab instruments' statistical error. The user contacts a DMT administrator to create a DMT data set containing the lab inventory results, and instructs the administrator to match the inventories to a particular set of STOMP contaminant fate and transport simulation results.

The administrator converts each inventory in the spreadsheet to its own input file formatted for DMT. The two files are combined with the requested STOMP results, packaged as a data set

package (section 1.1) and loaded into IDMS. The administrator sends the link to the new data set back to the user.

After downloading and installing the data set package (section 2.3), the user starts DMT, selects the retrieved tank from the source data selection tree (section 4.0) and finds the two new inventories activated in the Inventory data selection tree. Selecting the average inventory in the inventory tree and choosing a corresponding STOMP simulation in the simulation tree, the user looks at the summary table (section 11.1.6) and immediately sees the cancer risk posed by Technecium-99 in the current scenario is below the regulatory limit.

The user selects the dosimetry result table option from the main menu. The resulting pop-up window (section 8.1.1) reports the cancer risk and hazard quotient posed by every analyte for the selected scenario and for every risk metric's exposure scenario. The user filters the table to show only non-zero fenceline concentrations (Section 8.1) and exports the report to a spreadsheet (Section 8.1).

Once in Excel, the table is imported directly into the risk assessment portion of the RDR. After formatting the table, the user wonders why the cancer risk from a particular contaminant is higher than expected. The risk results can be quickly inspected to identify contaminants or pathways that are risk drivers. After selecting some exposure pathways in the pathway tree (section 11.1.1), the user generates a pathways report (section 8.1.2) and sees that the drinking water pathway is the risk driver for the contaminant in question.

6.1.2 Generating Risk figures for a document

Figures depicting the overall risk from a row of tanks in a Waste Management Area were a prominent feature of the *Initial Single-Shell Tank Performance Assessment* (SST-PA [DOE/OPR-2005-01]). A total of 297 plots were created for the document representing various combinations of risk metrics, analytes and tanks.

A user who had previously installed the SST-PA data set package (section 1.1) and saved the tree selections comprising risk analyses for each Waste Management Area (section 5.1) will use DMT to batch produce the plots for the SST-PA and export them to a file format used by a plotting program.

After starting DMT and opening the first scenario file (section 5.1) to populate the data trees, the user uses the "Export Results" tab in the DMT to pre-configure the analytes and risk metrics (section 8.2). The user is then able to systematically open the saved scenario files for each WMA, and click 2 buttons to run and save the plots to disk (section 8.2) for formatting in an outside plotting application. In this way, the 297 required plots for the document can be produced in only a few minutes.

6.2 RISK COMMUNICATION

DMT can be used during meetings to display risk assessment results and facilitate discussion and respond to stakeholder or regulator questions. Sensitivity analyses (changing the value of a single input parameter, then re-running DMT) can be performed in real time and be used to identify the key assumptions that have the greatest effect on risk assessment results.

A user is projecting DMT onto a screen during a conference with a regulator. The user will use DMT to show the regulator in real time how sensitivities in a couple key parameters affect analytical results used in a document.

The regulator is concerned that the partitioning coefficient (K_d) used for a key risk contributor in a document is too high, and artificially minimizing the risk posed by that contaminant. The user selects a source, inventory and transport simulation result combination used in the document (section 4.0) and plots the incremental lifetime cancer risk (ILCR) to a residential receptor over time from the contaminant onto the screen (section 8.3). The user then examines the results sensitivity to K_d by changing the contaminant's K_d (section 8.4.2) and overlaying the residential ILCR results over the previously produced plot (section 8.3.2). Overlying the two plots shows how the risk over time is affected by the K_d change and provides a visual reference as the user explains the science behind the results.

Another question about the sensitivity to an interim barrier is asked and the user selects a different transport simulation result in the simulation tree (section 8.4.5) corresponding to contaminant transport affected by an interim barrier. The user can then overlay another plot onto the existing plots to show the difference in risk with and without an interim barrier over the tank.

Finally, the regulator asks how removing 30% of the contaminant from the tank would affect overall risk. The user changes the multiplier for the contaminant from 1 to 0.7 in the "Inventory Scaling" tab (section 8.4.1) and recalculates the plot to show the difference in risk over time from the original plot.

6.3 DETERMINING RISK FROM WELL DATA

A user wants to estimate risk over time using water sample data collected from a well since 1957. Using DMT and well data retrieved using Hanford's *Virtual Library*, the user can estimate the risks for all the metrics and exposure scenarios in DMT for all the retrieved sample values.

This manual will not describe how to retrieve data from the Hanford *Virtual Library* and assumes that the user has retrieved the data from the *Virtual Library* and saved it in the default comma separated values (*.csv) format (which is the only format available to save *Virtual Library* results to). *Virtual Library* data is different from other source inventory data because it is not included in data sets, nor is DMT designed to create data sets using *Virtual Library* data.

After starting DMT, the user clicks on the "VL Import" tab and loads the *Virtual Library* data file (section 8.5.1). The user then selects from the well list which wells to include in the subsequent calculations.

Switching to the “graphs” page, the user checks the “VLData” check box (section 8.5.2), which activates the well selection drop down list and filters the analyte drop down menu for contaminants found in the loaded *Virtual Library* data file (section 8.5.2). The user is then able to examine the risks over time from the different contaminants analyzed in the selected wells.

The user produces plots to format in an outside plotting application by checking the “Use virtual library data” checkbox on the “Export Results” page (section 8.5.3) , then configuring the plots, running them and saving them to disk (section 8.5.3).

7.0 DMT INTERFACE

The DMT interface has five main parts (Figure 9): an information window, a data selection tree panel, a main menu, a status bar, and a tab control.

The information window displays different pages, which are controlled by the tab control. The tab control consists of buttons whose captions indicate which page (also called a “tab”) they will expose. Clicking a button will expose the page. The pages serve different functions and will contain controls (e.g., buttons, menus, etc.) applicable to that page. Two pages are hidden by default to avoid clutter. Expose these pages by right clicking on the tab control and selecting the desired page from the menu that appears. Hide the pages again using the same method.

The data selection tree panel (Figure 9, number 1) allows selection of source inventory data and contaminant fate and transport simulation results for inclusion in analyses. Section 4.0 describes how to use data selection trees. Data selection trees remain the same for each tab except for “Exposure Pathways” (one of the hidden tabs). The settings contained within the data selection trees remain, even if the tree is not visible.

The main menu (Figure 9, number 2; section 9.0) provides access to many software functions which are applicable to several pages or to the whole interface.

The status bar (Figure 9, number 3) will display information that needs to be seen regardless of which page is exposed.

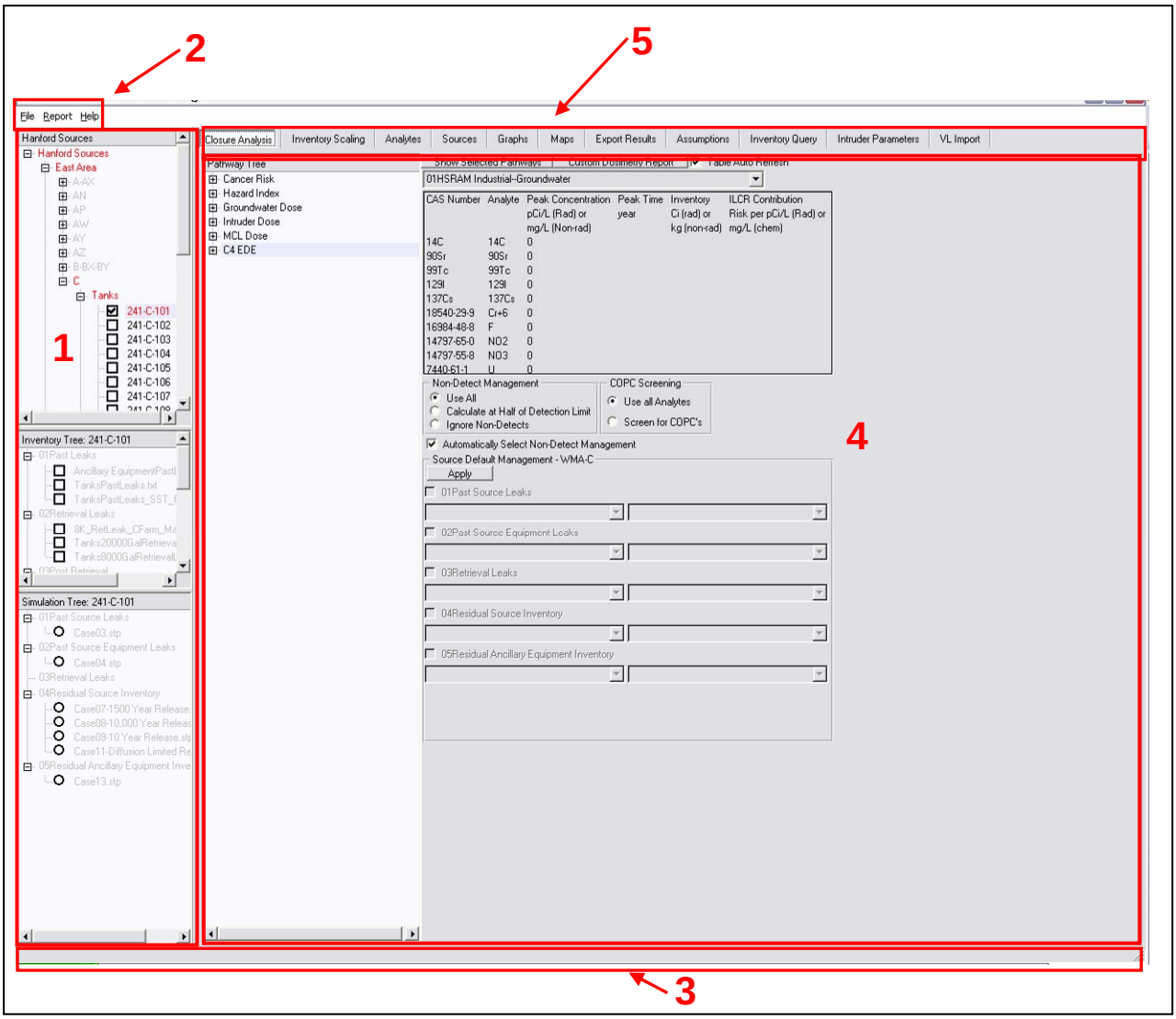


Figure 9. Annotated screen capture of DMT interface. The red lines and numbers do not appear in the software

1. **Data selection tree panel**
2. **Main menu**
3. **Status bar**
4. **Information window**
5. **Tab control**

8.0 DMT FEATURE DESCRIPTION

The following sections are feature-oriented descriptions of DMT functions and how to use them. A complete reference of menu items is located in section 9.0 and a complete reference to DMT pages and their controls is located in section 11.0

8.1 RISK REPORTS

DMT has several risk report options that are all accessible from the main menu (section 9.2). The following sections describe each of the risk reports in the order they appear in the menu.

Each risk report appears in a pop-up window which has a right-mouse-click menu. Clicking the right button on the mouse while positioning the cursor anywhere over the main body of the table will produce a pop-up menu with several options:

- **Export to Excel:** If Excel is installed on the computer DMT is running on, DMT will open Excel, export the table to a new page in a new workbook and format the page. If DMT has already exported to a workbook, the report will be added as a new page to that workbook.
- **Hide Zero Inventories**: This option will hide any entry that has a zero in the inventory column. This feature is not available in the "Top 10 Report".
- **Hide Zero Concentration**: This option will hide any entry in the concentration column that is zero or less than the effective zero defined on the "Assumptions" page (section 8.4.3). This feature is not available in the "Top 10 Report".
- **Sort**: Selecting "sort" opens a new window for configuring the data sort (Figure 10). The sort function allows sorting by up to two columns. The configuration window also has options for sorting the data in ascending or descending order and treating the data as character strings, numbers or dates. Clicking the "OK" button sorts the report using the specified parameters, while clicking "Cancel" will close the sorting configuration window and leave the report unchanged.

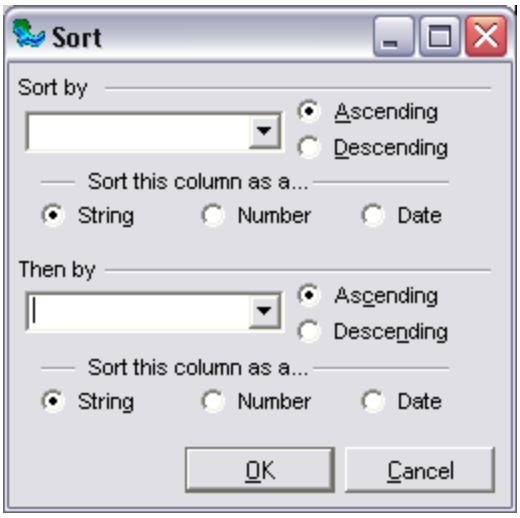


Figure 10. The sorting configuration window

- **Find**: Selecting “Find” opens a new window to set the parameters for the search (Figure 11). A find can also be initiated by pressing the “CTRL” and “F” keys on the keyboard simultaneously. The find function will attempt to match exactly what is typed in the edit box of the configuration window. The search is case insensitive, but checking “Match Case” will make the search case sensitive. The search function will match what is typed in the edit box to partial words by default. If the “match whole word only” check box is selected, DMT finds only complete words (for example, searching for "invent" will not return "inventory").

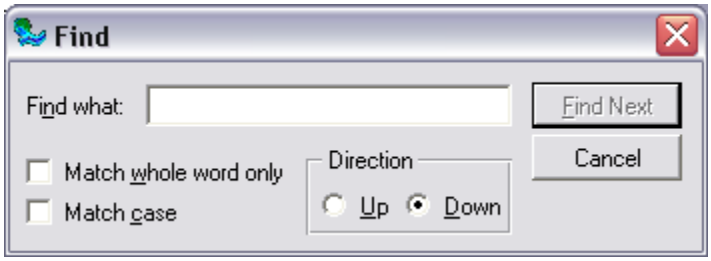


Figure 11. Find configuration window

- **Non-Detection Report**: Inventory data from a lab could have entries flagged with a “U” (“undetect” or “non-detect”) qualifier. In these cases, the reported inventory is actually the detection limit of the instrument used to make the analysis at the lab. If the inventory is contains “U” qualifiers (such as a post-retrieval lab sample inventory), this option will produce a pop-up window containing a list of currently selected inventory entries which are flagged as non-detects. The report lists the affected analyte, the inventory file, the inventory value and units and the waste phase. This feature is not available in the “Top 10 Report”.

8.1.1 Complete risk report

A complete risk report can be obtained after configuring a risk assessment scenario by selecting the menu item “Report | Dosimetry results table”. This menu item generates a detailed dosimetry table of all analytes found in the DMT database with risk factors estimates based on the selections in the data selection tree. The estimated peak year is indicated for each reported risk

metric and analyte. Filtering, sorting, export and search functions are available as described in section 8.1.

For lab reported results with non-detect entries, DMT color codes report rows which contain results using inventories with one or more non-detect entries for those analytes (Figure 12). Brown colored entries indicate non-detects in the sludge phase, blue colored entries indicate non-detects in the supernatant phase and red colored entries indicate non-detects in both phases. Section 11.1 explains how to configure DMT to handle non-detect values in its calculations.

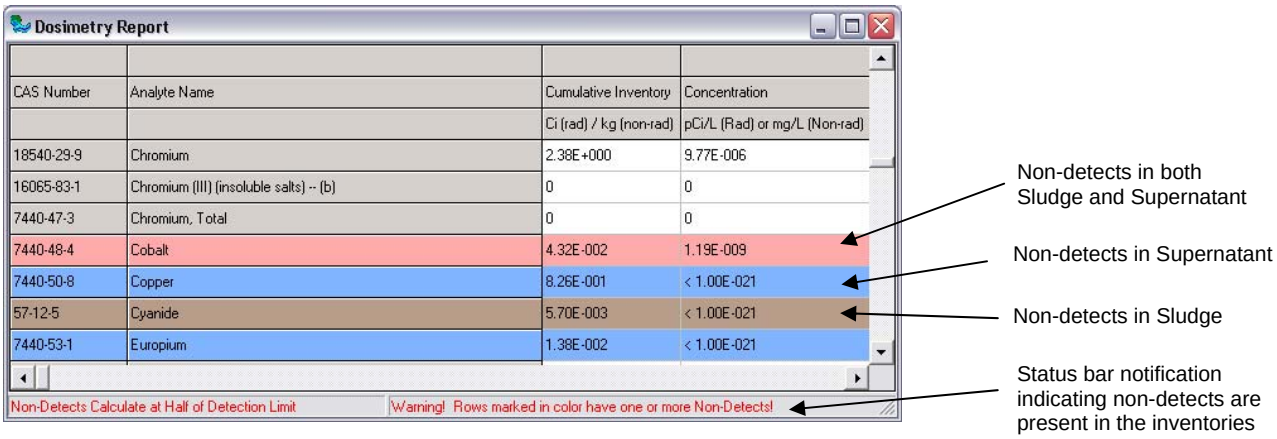


Figure 12. Sample Dosimetry report showing color coded non-detect entries

The dosimetry report is also available without peak years next to each result. This version of the report is accessible through the menu item "Report | Dosimetry results table (no years)".

8.1.2 Pathways report

The pathways report is a detailed report of risk results contributions from specific user selected exposure scenario pathways. Choosing "Report | Pathways report" from the main menu creates the report. Select pathways for inclusion using the Pathway Selection tree on the Closure Analysis tab (section 11.1.1). Filtering, sorting, export and search functions are available as described in section 8.1.

For lab reported results with non-detect entries, DMT color codes report rows which contain results using inventories with one or more non-detect entries for those analytes (section 8.1.1).

The pathways report is also available without peak years next to each result. This version of the report is accessible through the menu item "Report | pathways report (no years)".

8.1.3 Intruder Reports

8.1.3.1 Detailed Intruder Report

The detailed intruder report displays the dose to an inadvertent intruder at up to 10 specific years. Clicking “Report | Detailed Intruder Report” ultimately produces an Intruder Summary Report containing all radionuclides and their contribution to intruder dose. Prior to report generation, a pop-up window allows the user to configure the report (section 9.2.6.1). Underlying assumptions for the intruder scenarios can be changed on the “Assumptions” (section 11.10) and “Intruder parameters” (section 11.12) tabs. Only the checked source with the highest overall dose is displayed in the report.

Filtering, sorting, export and search functions are available as described in section 8.1.

8.1.3.1.1 Configuring the detailed intruder report

The configuration window (Figure 13) allows the user to select the exposure scenario and years to be included in the report.

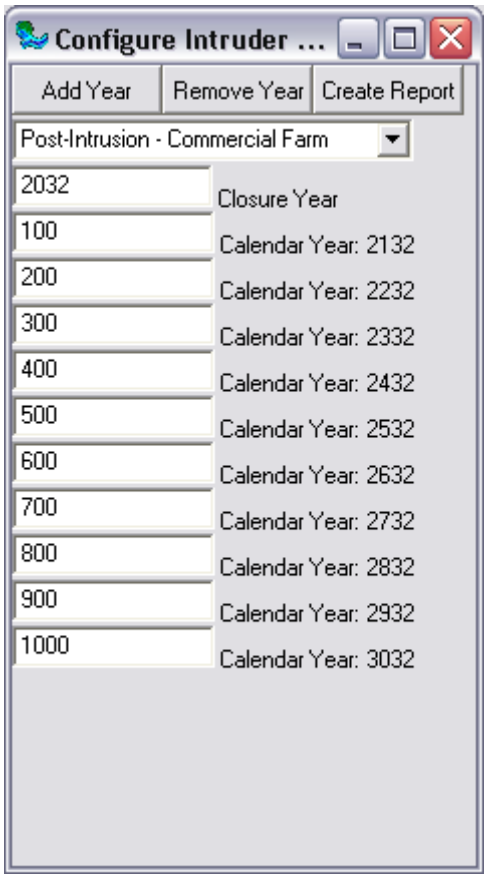


Figure 13. Detailed Intruder report configuration screen

Up to 10 years can be added to the report using the “Add year” button, while years can be removed down to 1 entry using the “Remove year” button. Enter the number of years after

closure in the edit boxes. The years do not have to be in sequential order and the software automatically updates the label to the right of the box to show the calendar year corresponding to the year in the edit box.

Similarly, the closure year can be entered, however DMT does not ensure that the year entered in the box is greater than or equal to the earliest year in the inventories. If the entered year is too early, running the report will cause a fatal exception and the program will close.

8.1.3.2 Intruder Dose Summary Report

An Intruder Dose Summary Report simply lists peak total intruder doses for each exposure scenario, separated by source and further subdivided by inventory. Two report options are available on the menu: on reports the doses at the compliance monitoring start year as shown (configured on the Assumptions Tab [section 11.10]), while the "Peak Year" option reports the doses at the year of maximum dose and provides the calculated peak year in the title bar of the report.

Filtering, sorting, export and search functions are available as described in section 8.1.

8.1.4 Top 10 report

The Top 10 report ultimately lists the 10 sources with the highest total risk in descending order. Clicking "Report | Top 10 Report" in the main menu brings up a configuration screen (Figure 14) with drop down menus for selecting the performance objective, exposure scenario and exposure pathway to be calculated. The number of sources to show can be specified in the configuration window. If the number of sources specified is greater than the number that are checked in the source data tree, the report will only show the checked number.

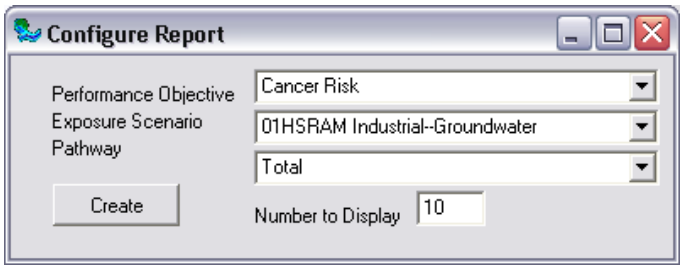


Figure 14. Top 10 Report configuration window

8.2 BATCH RESULT EXPORT

The Export Results tab batch calculates and exports risk or concentration results. Calculations can be configured for individual or multiple analytes and risk metrics. Data export options include Excel and Tecplot formats. Using the Export Results tab significantly speeds up the generation of figures for risk assessment documents.

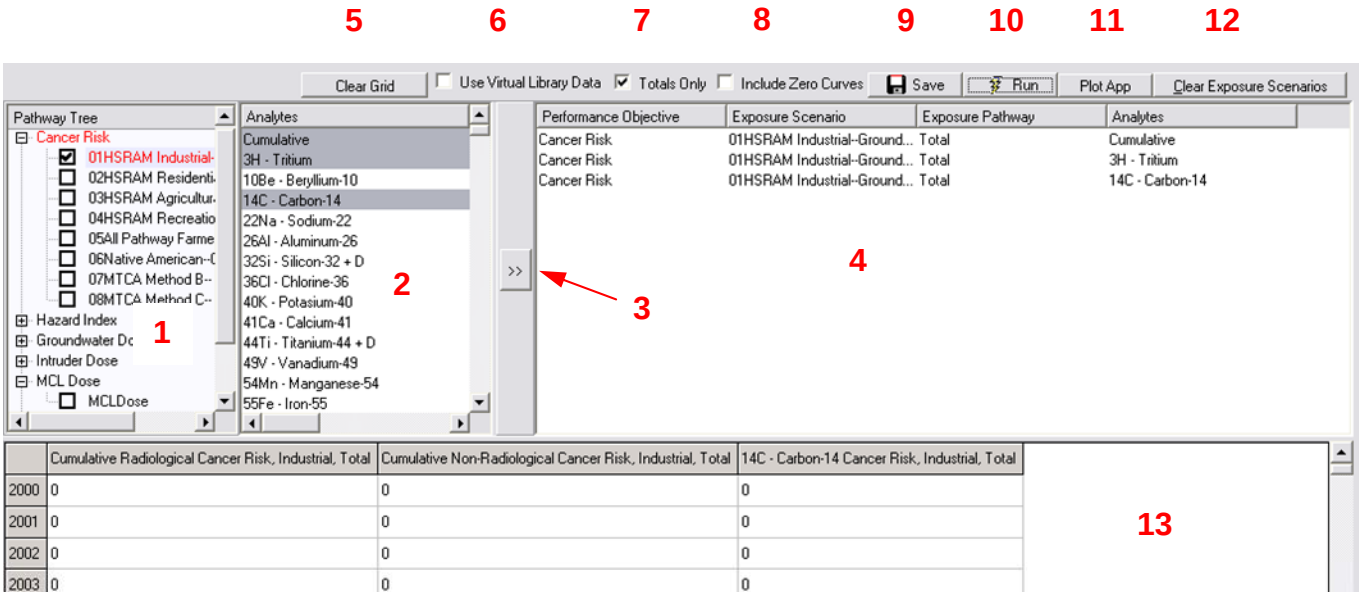


Figure 15. Annotated screen capture of the "Export Results" tab. The red numbers and arrow do not appear in the interface.

1. **Pathway Tree Selection Box** — used to select the risk metrics and exposure pathways to include in the analysis
2. **Analytes Selection Box** — used to select the analytes to include in the analysis
3. **"Add" Button** — Adds the selected metrics and analytes to the batch analysis. The configured metrics and analytes will appear in the Selected Performance Objectives box (4) when this button is clicked
4. **Selected Performance Objectives Box** — Displays the metric/pathway/analyte combinations to be included in the batch analyses on this page
5. **"Clear Grid" Button** — clears the grid (13)
6. **"Use Virtual Library data" checkbox** — flags loaded Virtual Library well sample data for batch analysis and reconfigures the analytes selection box (2) to only display the analytes in the loaded Virtual Library data
7. **"Totals Only" Checkbox** — if checked, configures the Pathway tree (1) to only use the total pathway. Unchecking this box will populate the Pathway tree with exposure pathways
8. **"Include Zero Curves" Checkbox** — Will display all results in the results grid. Default is to not display result curve which have a maximum of 0
9. **"Save" Button** — Saves the results in a TecPlot file format. The user can specify the location to save to
10. **"Run" Button** — performs the batch analysis as configured in the Selected Performance Objectives box (4)
11. **"Plot App" Button** — Opens TecPlot (if installed) and exports the results to it
12. **"Clear Exposure Scenarios" Button** — clears the Selected Performance Objectives Box (4)
13. **Results grid** — Displays the results of the batch analysis

8.2.1 Pathway Tree Selection

All loaded risk metrics and exposure pathways can be selected in this tree for inclusion in the batch analysis. Section 4.0 describes how to use data selection trees. Checking the "totals only" box (Figure 15, number 7) displays only exposure scenarios representing the "total" pathway in the data selection tree. This can eliminate visual clutter if individual pathway analysis is not required. Unchecking the box populates the data selection tree with each risk metric's exposure pathways for use in a pathway analysis.

8.2.2 Analytes Selection and Add Button

Select an analyte to add to the batch analysis by clicking on the it's name in the analytes selection box (Figure 15, number 2). Multiple analytes can be selected by holding the "CTRL" button down on the keyboard while clicking the desired analytes.

When the desired risk metrics/exposure pathways and analytes are selected, click the "add" button (Figure 15, number 3) to add them to the batch analysis. When the "add" button is clicked the selected performance objectives box (Figure 15, number 4) will list all the selected risk metric/exposure pathway/analyte combinations that will be included in the batch analysis.

8.2.3 Selected Performance Objectives Box

All the risk metric/exposure pathway/analyte combinations that will be included in the batch analysis are listed in this box. To remove a single entry, click on the row containing it, under the "Performance objective" column and then press the delete key on the keyboard. To clear the entire list, click the Clear Exposure Scenarios button (Figure 15, number12).

8.2.4 Totals Only Checkbox

Checking this box includes only the "total" exposure pathway for each checked performance objective in the pathway tree in the batch analysis. The box is checked by default, but unchecking the box repopulates the Pathway Tree with individual exposure pathway nodes under each risk metric node. Checking the "totals only" box eliminates visual clutter in the pathway tree, while un-checking it allows an analysis of each pathway's contribution to total dose.

8.2.5 Include Zero Curves Checkbox

Checking this box will show all results including those analytes whose fence line concentration does not exceed zero during the simulation timeframe. Leaving this box un-checked (default) will include only non-zero results in the table.

8.2.6 Save button

The “Save” button (Figure 15, number 9) is enabled when the batch analyses have been performed. Clicking this button opens a standard Windows save dialog allowing the user to choose a name and location to save the file to. The saved file will be in Tecplot format. When the file name and location is selected, a "Zone Title" window will appear allowing a Tecplot zone name to be specified. Closing this window completes the file save.

8.2.7 Run Button

Clicking the “Run” button (Figure 15, number 10) performs the analyses listed in the selected performance objective box (Figure 15, number 4). The results grid (Figure 15, number 13) displays the analysis results organized by columns of analytes and rows of years when the analysis is complete. Results can be exported to Tecplot (Section 8.2.6) or to Excel (Section 8.2.12). Running an analysis enables the “Save” button (Figure 15, number 9). Clicking the “Run” button will overwrite the results grid with the current results.

8.2.8 Plot App Button

Clicking this button opens Tecplot (if installed) and exports the analysis results data directly to it. Prior to exporting the data, a window prompt for a TecPlot zone title will appear. DMT will display a warning message if Tecplot is not installed.

8.2.9 Clear Exposure Scenarios

Clear all queued analyses from the selected performance objective box by clicking the “Clear Exposure Scenario” button (Figure 15, number 12). The results grid will not be cleared and any data left there can still be exported to Tecplot or Excel.

8.2.10 Clear Grid Button

Clear the results from the results grid by clicking the “Clear Grid” button Once the grid is cleared, the “Save” button will be disabled and the cleared results are lost.

8.2.11 Use Virtual Library Data checkbox

The “Use Virtual Library Data” checkbox will be disabled (gray color) until *virtual library* data has been loaded (section 8.5). Checking this box flags *virtual library* data for use in subsequent batch analyses. Items checked in the data selection trees (section 4.0) will *not* be used in

subsequent batch analyses, but can still be used in analyses in other tabs. To enable batch analysis of selected data section tree items, un-check the “Use virtual library data” checkbox.

8.2.12 Export to Excel

Results shown in the results grid can be exported to Excel by clicking the “Report | Export to Excel” main menu item (section 9.2.9).

8.3 GRAPHS

Analytical results are graphically displayed on the “Graphs” tab. The graph tab is configurable, allowing display of groundwater concentrations of, and risks presented by, analytes either individually or cumulatively. Analytical results are displayed with appropriate regulatory limits, where applicable.

Graphs allow comparison of effects from parameter changes, show trends over time and provide an alternate communication of risk to a number or table of numbers.

The following sections describe the features of the graphs tab in detail.

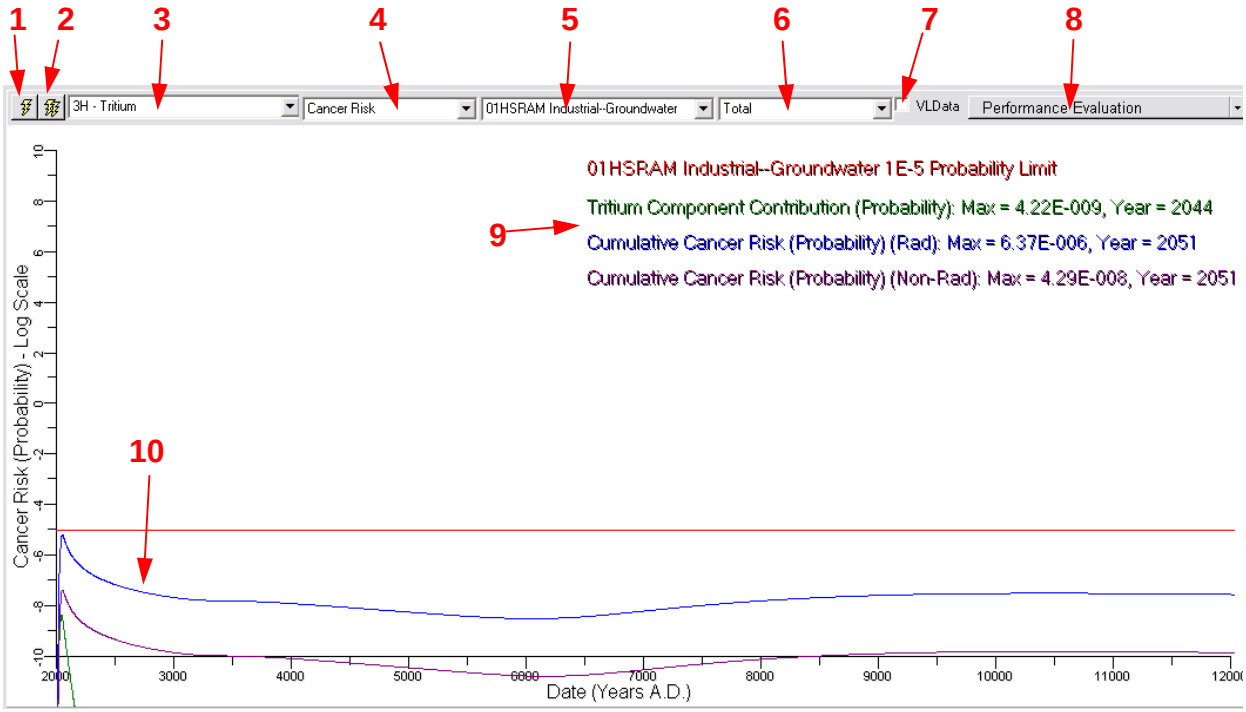


Figure 16. Annotated screen capture of the Graphs tab. The red numbers and arrows do not appear in the interface.

1 "Create Graph" Button
2 "Add to Graph" Button
3 Analyte Drop-down menu
4 Risk Metric drop-down menu
5 Exposure scenario drop-down menu
6 Exposure pathway drop-down menu
7 Use Imported Virtual Library Data
8 Graph Type Drop-Down Menu
9 Graph legend
10 Graph

8.3.1 Create Graph Button

Clicking the "Create Graph" button (Figure 16, number 1) will recalculate the selected risk assessment scenario and draw the results of the risk calculation configured in the drop-down menus along the top of the page (Figure 16, numbers 3, 4, 5, and 6) as a plot of risk versus time. Any plot displayed when this button is clicked will be overwritten. To superimpose one plot over another, click the "Add to Graph" button (Section 8.3.2).

8.3.2 Add to Graph Button

Clicking the "Add to Graph" button (Figure 16, number 2) superimposes a new plot over the current plot. The new plot's color will be different from the currently displayed graph, and this will be noted in the legend.

The "Add to Graph" button is disabled (gray colored) when the existing plot cannot be directly compared with a new plot using the configuration at the top of the page (e.g., if the displayed plot is Cancer Risk and the selection in the Risk Metric drop down menu is now Hazard Index).

Superimposing plots provides a direct comparison of how parameter changes affect risk or groundwater concentrations.

8.3.3 Graph Type

Graphs are subdivided into 6 broad categories, which can be selected using the Graph Type Drop-down menu (Figure 16, number 8). The graph type categories are:

- **Performance Evaluation**: Graph types that show effects to human health (e.g., ILCR, Hazard Index, Intruder dose)
- **MCL Factors**: Graph types comparing analyte concentrations against regulatory limits.
- **Concentration (Included Sources) and Concentration (Unit Curie)**: Fence line concentrations of analytes resulting from either the inventory in the user-chosen scenario or a unit curie of a radionuclide..
- **STOMP output and Dilution Attenuation Factor**: Graphical representation of the STOMP simulation files. Provided as additional information only.

The following sections describe each of the graph type categories.

8.3.3.1 Performance Evaluation

The Performance Evaluation graph type provides the option of plotting any of the currently loaded human-health risk metrics versus time.

Figure 17. Drop down menus for the Performance Evaluation graph type

1. **Analyte Drop-Down Box** contains all analytes in the DMT analyte database
2. **Risk Metric Drop-Down Box** contains all loaded risk metrics
3. **Exposure Scenario Drop-Down Box** contains exposure scenarios related to the risk metric selected in box 2. This drop down menu will refresh when a new risk metric is selected.
4. **Exposure Pathway Drop-Down Box** Contains Exposure pathways related to the selectionin box 3. This drop down menu refreshes when a new risk metric is selected.

8.3.3.2 MCL Factors

The MCL Factors graph type plots analyte concentration over time versus a specific concentration of that analyte that can cause known health effects.

1. **Analyte Drop-Down Box** contains all analytes in the DMT analyte database
2. **Concentration Scale Selection** selects the concentration limit to compare results against.

8.3.3.3 Concentration (Included Sources)

The Concentration (Included Sources) graph type plots analyte concentration over time for the scenario selected in the data selection trees (section 4.0). Plots can be superimposed for comparison by clicking the "Add to graph" button (Figure 16, number 2).

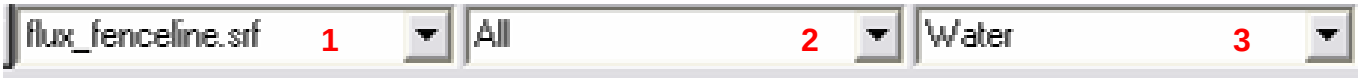
8.3.3.4 Concentration (Unit Curie)

This graph type overrides the data tree selections and replaces them with an inventory of one unit curie. Although the data tree selections are ignored, there has to be at least one tank/inventory/transport simulation combination selected for the plot to work. The calculation will use all checked sources in the source selection tree, and will apply one unit curie per checked inventory. For instance, if a past leak inventory and a tank residual inventory are both checked for a single source, then one curie will be used for calculating the impacts from the past leak and one curie will be used for calculating the impacts from the tank residuals.

8.3.3.5 STOMP Output

The STOMP output graph type displays the contaminant flux results from the output of the STOMP simulation results case selected in the Simulation tree. See section 4.0 for a discussion of a checked data selection tree node versus a selected data selection tree node.

When the STOMP Output plot type is chosen from the graph type drop-down menu, the drop down menus at the top of the tab are populated with the variable parameters within the selected Simulation Results Case.



1. **STOMP Surface File** Selects the contaminant transport results file to plot
2. **STOMP Layer File** Selects the layer (depth below ground) of the results to plot
3. **Kd Bin Selection** Selects the diffusion coefficient (Kd) within the selected file and layer to plot

Figure 18. Drop down selection menus for the STOMP output plot type

The STOMP output plot type is useful for comparing the effects of Kd on contaminant transport. The plot type can also be used to confirm successful importation of STOMP results into DMT and experienced modelers can use the plot type to help confirm successful STOMP model runs.

8.3.3.6 Dilution Attenuation Factors

Dilution Attenuation Factors (DAF) are an intermediate step in the contaminant fate and transport calculation process. DAFs are STOMP contaminant flux divided by STOMP water flux at a given time step. This plot is configured using the drop down boxes shown in Figure 18.

8.3.4 VL Import

Importing *virtual library* (VL) data into DMT activates this check box. When checked, the check box allows plotting the imported virtual library data. Virtual library data importation and usage is detailed in section 8.5.

8.3.5 Graph

The graph can contain any number of plot lines, each of which will have a unique color. If too many plots are overlain on the graph, some colors may become indistinguishable. All graphs' X-axis variable is the date in years A.D. The Y-axis variable changes with plot type and is in log scale by default.

The graph contains a legend (section 8.3.5.2) and is configurable through a right-click menu (section 8.3.5.1).

8.3.5.1 Pop-up configuration menu

This menu is accessible by clicking the right mouse button while positioning the cursor over any part of the graph. The following sections describe each menu item.

8.3.5.1.1 Show Plot Data

This feature is deprecated and inaccessible (grayed-out). To examine plot data, click "Report" on the main menu, then click "Export to Excel". Excel will open automatically (if installed on the host computer) and each plot's data points and caption will be exported from DMT to a new Excel workbook and formatted.

8.3.5.1.2 Grid Mode

This feature is deprecated and is inaccessible (grayed-out).

8.3.5.1.3 Include Decay

When checked, this feature enables radioactive decay in plot calculations. All radionuclide concentrations will be decayed based on individual radionuclide half-life values, which will then be input into risk calculations. When un-checked, decay will not be calculated. This menu item's default value is checked.

8.3.5.1.4 Linear Left Y Axis

When checked, this menu item enables plotting the y values on a linear scale. The "create graph" button (section 8.3.1) must be clicked again to change the graph after selecting this menu item.

8.3.5.1.5 Log Left Y Axis

When checked, this menu item enables plotting the y values on a logarithmic scale. The "create graph" button (section 8.3.1) must be clicked again to change the graph after selecting this menu item. All graphs are plotted in log scale by default.

8.3.5.1.6 Zoom X Axis

This feature is deprecated and is inaccessible (grayed-out).

8.3.5.1.7 Set Custom Axes Scales

X-axis and y-axis scales on a graph can be customized using this menu item. When clicked, the menu item produces a dialog box (Figure 19), allowing the user to specify the x- and y-axis scales. Clicking "OK" in this dialog box will immediately implement the changes and re-draw the graph. Clicking the "Defaults" button in the dialog box will reset the x- and y-axis scales to their original, default values. Changes will not be implemented to the graph if the entries conflict (e.g., the minimum value is greater than the maximum).

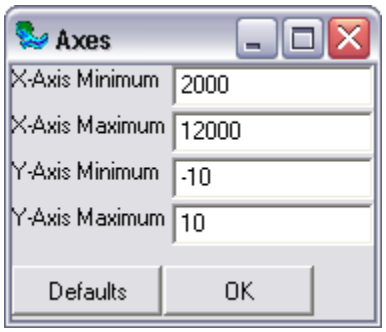


Figure 19. Custom Axes scale dialog box.

8.3.5.1.8 Show Individual Sources

Checking this menu item includes plots of each checked source in the source tree on subsequent graphs based on the current plot configuration options. This option allows the user to determine the contribution of each checked source to the overall risk.

8.3.5.1.9 Show Single source

Similar to the "Show Individual Sources" selection, this menu item includes a plot of the selected source in the source tree in subsequent graphs based on current plot configuration options. See section 4.1 for the difference between a checked and selected node in the source tree.

8.3.5.2 Graph Legend

The graph legend is located by default at the top right of the graph. The position may change to avoid overlapping the plots. The legend contains a color matched entry for every plot on the graph. Each entry contains the plot type, units, peak value and peak value year. Items will be added at the bottom of the legend if plots are overlain on the existing graph (section 8.3.2) and the entire legend will be replaced if a new graph is created (section 8.3.1).

8.3.6 Export to Excel

Selecting "Export to Excel" from Report under the main menu while the Graphs tab is active will open an instance of Excel (if installed) and export the data points and caption for each displayed plot from DMT to an Excel workbook. Section 9.2.9 details the export to Excel option.

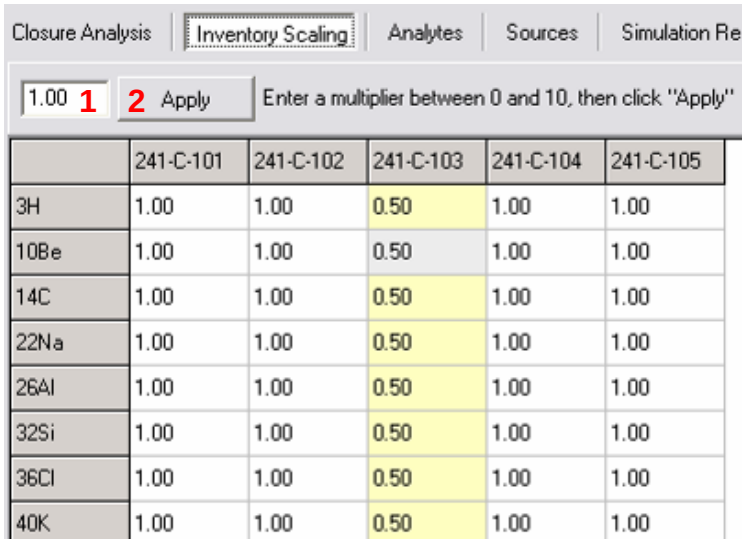
8.4 SENSITIVITY ANALYSIS

A large number of user-configurable variables within DMT allows for a wide range of sensitivity analyses. Sensitivity analyses illustrate how sensitive the analytical results are to variations of input parameters. The following sections explain how DMT parameter configuration can be used to perform sensitivity analysis.

8.4.1 Inventory Scaling

Inventory scaling factors can be applied to every analyte in a checked source, or to an individual analyte in a checked source through the Inventory Scaling tab. Inventory scaling can illustrate the effects of varying the analyte inventory parameter on the overall results. Multiplication factors entered in the Inventory Scaling tab represent a fraction of the inventory, so 0.5 is 50% of the inventory value and 1.1 would be 110% of the inventory value. Inventory scaling will be applied to all subsequent calculations and exported reports will note that inventory scaling was applied in the analysis.

The inventory scaling tab contains a grid of multiplication factors organized by sources and analytes (Figure 20). Only checked sources in the source tree are shown in this tab and the grid is automatically updated as sources are checked and unchecked. Clicking any cell in the grid highlights it's column in yellow. Entering a multiplier between 0 and 10 in the text box (Figure 20, number 1) and clicking the apply button (Figure 20, number 2) applies the multiplier value to every analyte in the highlighted column. Only one column can be changed at a time and the status bar will show a reminder (Figure 21) once a multiplier is applied.



	241-C-101	241-C-102	241-C-103	241-C-104	241-C-105
3H	1.00	1.00	0.50	1.00	1.00
10Be	1.00	1.00	0.50	1.00	1.00
14C	1.00	1.00	0.50	1.00	1.00
22Na	1.00	1.00	0.50	1.00	1.00
26Al	1.00	1.00	0.50	1.00	1.00
32Si	1.00	1.00	0.50	1.00	1.00
36Cl	1.00	1.00	0.50	1.00	1.00
40K	1.00	1.00	0.50	1.00	1.00

Figure 20. Inventory scaling tab. The column for source 241-C-103 is selected (yellow), while the inventory for analyte Be-10 in source 241-C-103 is highlighted (gray). Note that the red numbers do not appear in the interface.

Figure 21. Status bar warning

To apply a multiplier to an individual analyte in a specific source click the cell containing the multiplier for the analyte row and source column, press “F2” on the keyboard (or double click the cell), type the desired entry and press “enter” on the keyboard. A highlighted cell will be gray colored. Once an individual multiplier is changed, a reminder will appear in the status bar (Figure 21).

While it is not possible to globally apply a multiplier greater than 10 to a source using the edit box, there is no upper limit to a multiplier applied individually to an analyte in a source by typing the value into its cell.

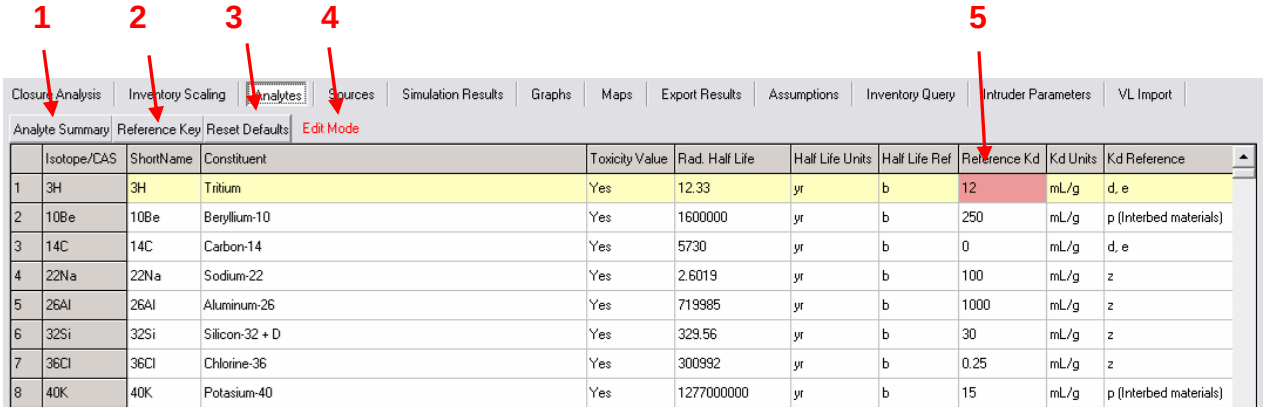
The edit box on the Inventory Scaling page will not allow non-numeric numbers to be added and will revert to 1.00 when a value greater than 10 and less than 0 is entered.

8.4.2 Analytes tab

All analyte physical properties used in DMT calculations are editable. Editing analyte physical properties as a sensitivity analysis may be appropriate if the property’s value is disputed. For instance, if the distribution coefficient (K_d) of uranium is not an accepted value, then the value can be changed and graphs overlain to illustrate the effect of the two values on overall risk.

Editing analyte physical properties is done through the Analytes tab (Figure 22) and requires a key combination to activate the editing feature. By default, the physical properties are not

editable, but pressing the “ctrl”, “alt” and “e” keys simultaneously will activate the edit mode. When the analytes tab is in edit mode, a new button—labeled “Reset Defaults”—and red text saying “Edit Mode” will appear at the top of the tab (Figure 22, numbers 3 and 4).



	Isotope/CAS	ShortName	Constituent	Toxicity Value	Rad. Half Life	Half Life Units	Half Life Ref	Reference Kd	Kd Units	Kd Reference
1	3H	3H	Tritium	Yes	12.33	yr	b	12	mL/g	d, e
2	10Be	10Be	Beryllium-10	Yes	1600000	yr	b	250	mL/g	p (Interbed materials)
3	14C	14C	Carbon-14	Yes	5730	yr	b	0	mL/g	d, e
4	22Na	22Na	Sodium-22	Yes	2.6019	yr	b	100	mL/g	z
5	26Al	26Al	Aluminum-26	Yes	719985	yr	b	1000	mL/g	z
6	32Si	32Si	Silicon-32 + D	Yes	329.56	yr	b	30	mL/g	z
7	36Cl	36Cl	Chlorine-36	Yes	300992	yr	b	0.25	mL/g	z
8	40K	40K	Potasium-40	Yes	1277000000	yr	b	15	mL/g	p (Interbed materials)

1. **Analyte summary button** produces a pop-up window containing the analyte’s physical properties formatted for easier reading
2. **Reference key button** produces a pop-up window containing the references used to compile the values in the tab
3. **Reset Defaults button** resets all changes back to default values; only appears when Edit Mode is engaged
4. **Edit Mode indicator** indicates that values can be edited; only appears when Edit Mode is engaged
5. **edited value** cells containing user-edited values will turn red

Figure 22. Analytes tab. Note that red numbers and arrows do not appear in the interface

Other features of the analytes tab are described in more detail in section 11.3.

8.4.3 Assumptions tab

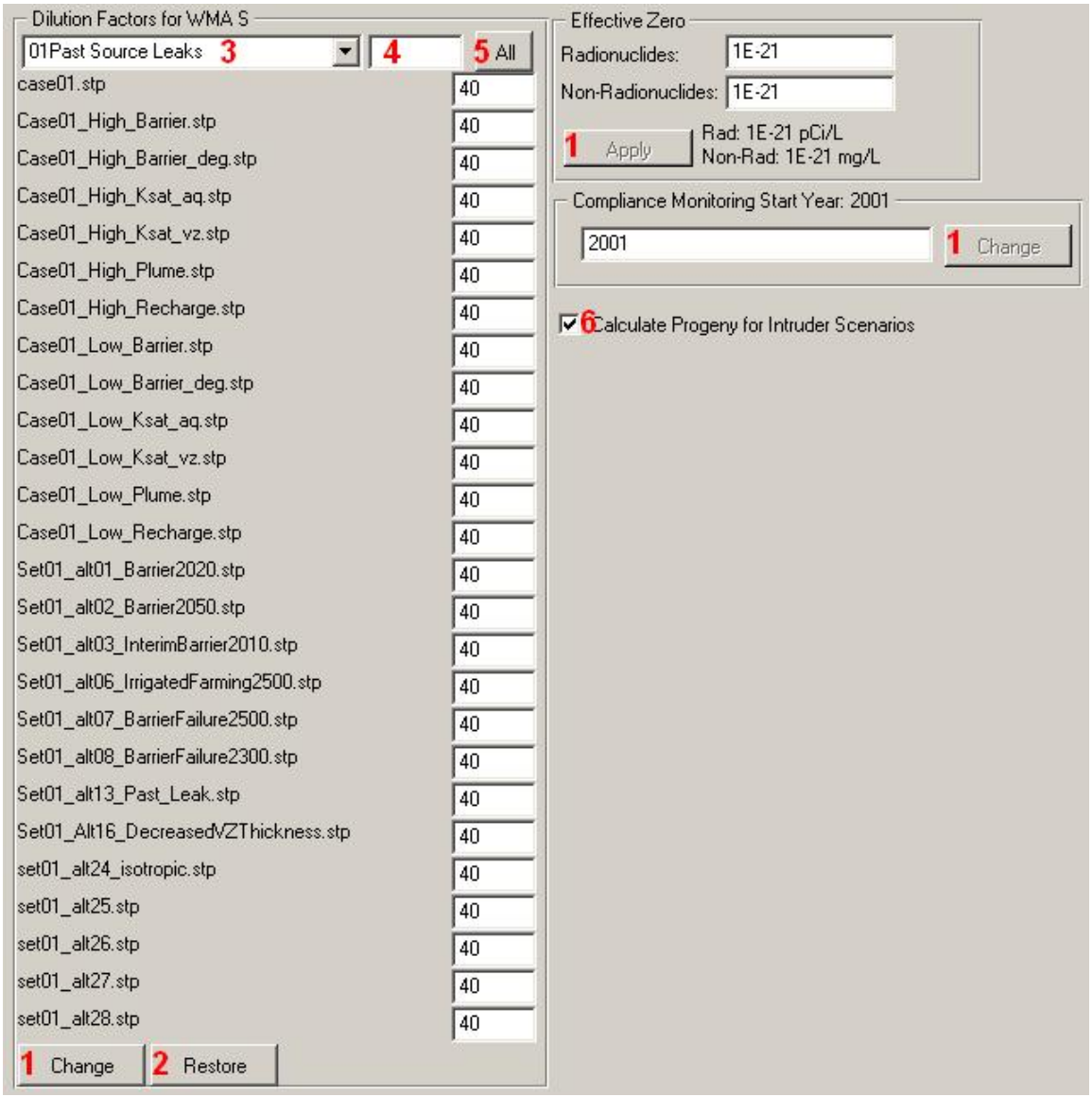
Global assumptions used in DMT calculations are listed on this tab and are user-editable. Editable values are grouped into 3 group boxes:

- Dilution factors: allows editing the 2-d to 3-d conversion factors for each loaded contaminant transport simulation. Sensitivity of the results to the dilution factors can be tested by changing these values as outlined in section 8.4.3.1 .
- Effective Zero: Allows editing of the “Effective Zero” value. The “Effective Zero” value is the concentration at which radionuclides and non-radionuclides will be reported as zero. When used in cumulative calculations, any analyte concentration result below “Effective Zero” will be converted to zero prior to being added to the cumulative total. These values can be changed to reflect lab detection limits to avoid a long list of infinitesimal concentration results. Section 8.4.3.2 describes how to change “Effective Zero” values.

- Compliance monitoring start year: This allows the user to define the year in which compliance monitoring starts. DMT calculations assume human exposure will be zero up to the date selected in this box. Changing this value is outlined in section 8.4.3.3 .

Radionuclide Progeny exposure can also be toggled on the "Assumptions" tab. Checking the "Calculate progeny for Intruder Scenarios" tab includes progeny ingrowth for radionuclides in all Intruder Scenario dose calculations. For radionuclides whose progeny are used, the daughter products and in-growth factors can be obtained, added or changed by contacting the DMT owner.

Figure 23 is an annotated screen capture of the "Assumptions" tab.



1. **Change/Apply buttons** These buttons apply changes to their respective group boxes
2. **Restore button** Restores all dilution factors back to default values
3. **Simulation category select menu** This drop-down menu populates the dilution factor group box with a

		list of loaded simulation files for the chosen category and their respective dilution factors.
4.	**Global dilution factor edit box**	This edit box is used to enter a dilution factor to replace all the dilution factors shown in the dilution factors group box.
5.	**Global dilution factor apply button**	Clicking this button applies the value in the "Global dilution factor edit box" to all the edit boxes in the Dilution Factors group box.
6.	**Include progeny check box**	When checked, this enables the calculation of progeny ingrowth and related dose in intruder dose calculations.

Figure 23. Assumptions tab. Note that the red numbers do not appear in the interface.

8.4.3.1 Dilution Factors

Dilution factors are numerical factors applied to the two dimensional STOMP results to approximate three dimensional STOMP results. The defaults were developed by running a single, representative STOMP run using three dimensional analysis and comparing the results with the results of a two dimensional run with the same parameters.

Individual dilution factors can be changed by typing the desired value into the edit box to the right of the name of the STOMP results file. Clicking the "Change" button at the bottom of the dilution factors group box will apply the values in the edit boxes to the listed STOMP results. There is no indication within the interface that these values have been changed. When results are exported to Excel (section 9.2.9), the report stamp lists the STOMP run(s) used in the analysis and their dilution factors.

To change all the visible dilution factors to the same value at one time, type the desired value into the "global dilution factor" edit box (Figure 23, number 4), click the "all" button (Figure 23, number 5) to fill all the edit boxes with the number, and click "Change" (Figure 23, number 1) to apply the dilution factors to all the visible STOMP results files.

Clicking the "Restore" button (Figure 23, number 2), will change the displayed dilution factors back to default values.

8.4.3.2 Effective Zero

Effective zero is a user-defined concentration limit for individual analytes, below which the results are converted to zero before calculating cumulative or risk results. The default value is 1×10^{-21} pCi/L for radionuclides and 1×10^{-21} mg/L for non-radionuclides. Change the default values by entering the desired concentration in the appropriate edit box in the "effective zero" group box then clicking the "Apply" button directly below the edit boxes. The label to the right of the "Apply" button will change immediately to indicate that the effective zero value has been successfully changed. The edit boxes prevent entering non-numeric values (except "E" and "-").

8.4.3.3 Compliance Monitoring Start Year

The compliance monitoring start year is the year below which all results are changed to zero. Enter the desired year into the edit box in the "Compliance Monitoring Start Year" group box

and click the “Change” button to the right of the edit box. If the year is before 2001, the value in the edit box will automatically revert back to 2001, otherwise, the group box caption will change to reflect the new compliance monitoring start year. The edit box prevents entering non-numeric values (except “E” and “-“).

8.4.4 Intruder Parameters Tab

All default parameters used in the intruder scenario dose calculations can be edited from this tab. Changing values in this tab allow examination of inadvertent intruder dose sensitivity to these parameters.

Three group boxes on the tab organize the parameters into global, source and past leak intruder scenario parameters. The data in the edit boxes of the source and past leak intruder scenario parameter group boxes will reflect the selected source in the source tree. These boxes captions will contain the name of the selected source. Selecting a new source in the source tree will refresh the group boxes with the selected source’s data. If there is no data for a source (i.e., the selected source has no past leak), the group box caption will read “N/A” and the edit boxes will be blank.

Each group box contains several edit boxes, a “restore” button and a change “button”. To change a parameter value, type the desired value in the appropriate edit box and click “change”. The “restore” button is activated (not grayed-out) at the first parameter change. The “restore” button reverts all the parameters in that group box back to their default values.

The parameter values are in metric units, but the non-metric equivalent is shown in the label to the right of every edit box. This non-metric value is updated in real time as the number is typed in the edit box.

The edit boxes prevent entering non-numeric values (except “E” and “-“).

When an intruder parameter value is changed, the status bar will report “Intruder Parameters Changed!” in red text. Additionally when inadvertent intruder dose results are exported to Excel (section 9.2.9), the report stamp will indicate global intruder parameter changes as well as highlighting source and past leak intruder parameter changes in red.

8.4.5 STOMP Simulation Results

Sensitivity to subsurface transport parameters can be examined by changing selections in the simulation tree. If a series of contaminant transport simulations were performed for various sensitivities, then the simulation result files can be changed and the resulting graphs overlain to observe the effects on risk or concentration.

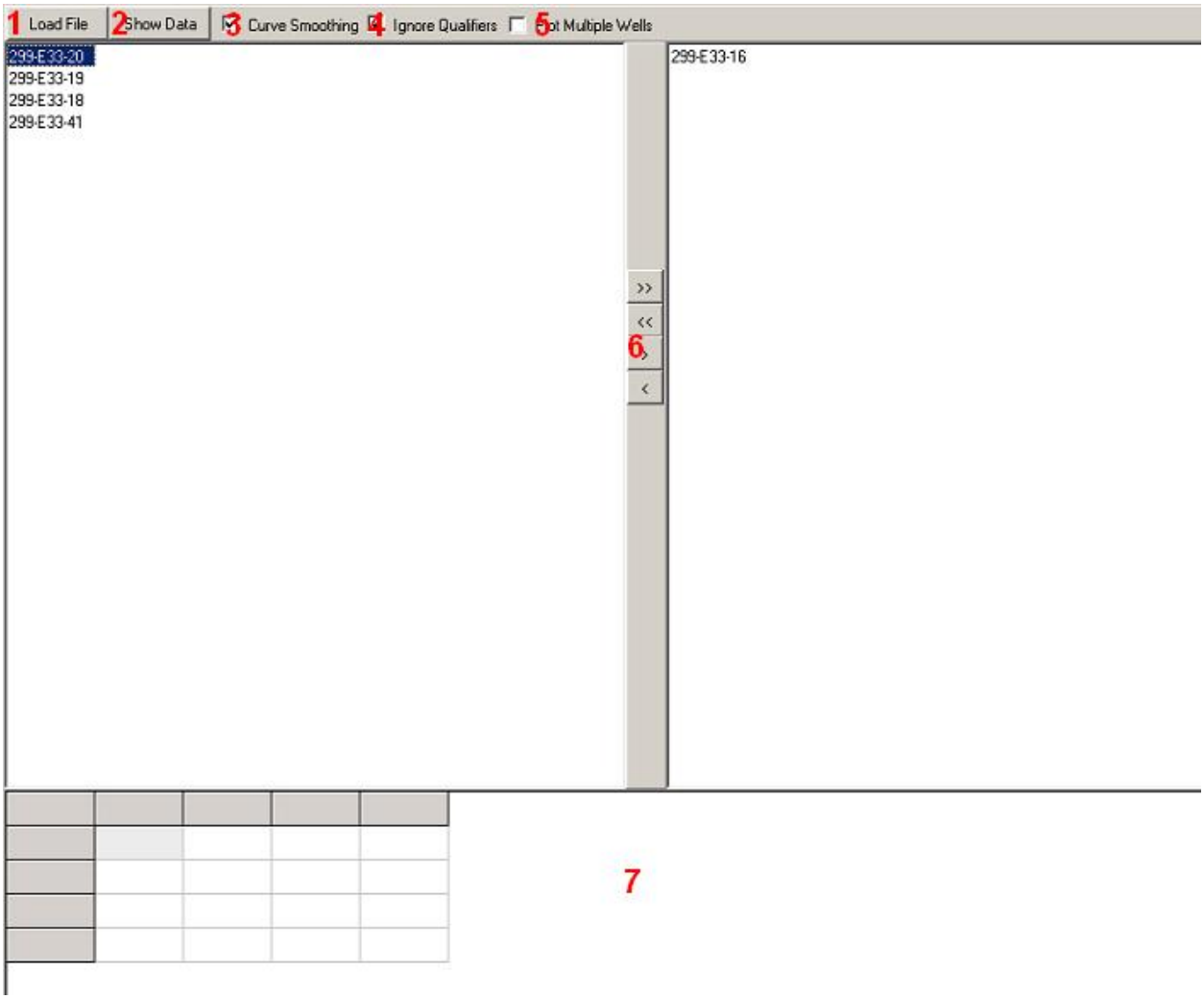
8.5 USING VIRTUAL LIBRARY DATA

DMT can use data extracted from the "Environmental Monitoring" module of the *Virtual Library* to perform human health risk calculations on well sampling data. It is outside the scope of this document to explain how to configure the *Virtual Library*. DMT is designed to import the comma delimited (*.csv) files produced by the *Virtual Library* using the "Location+Constituent Extraction" or "Sample+Constituent Extraction" links in the "Data Extraction" box of the *Virtual Library*'s "Environmental Monitoring" portal.

Warning: Do not open files from the *Virtual Library* in Excel before importing them into DMT. Excel changes the dates to a format incompatible with DMT resulting in an error and a failure to load data.

8.5.1 Importing data

Virtual Library data is imported using the "VL Import" tab. Figure 24 is an annotated screen capture of the "VL Import" tab.



1. **"Load File" Button** — Opens a standard Windows dialog for selecting and importing *Virtual Library* data
2. **"Show Data" Button** — populates the data display grid with information contained in the imported file(s)
3. **"Curve Smoothing" Checkbox** — smoothes curves on the "Graphs" tab by connecting data points that do not have "U" qualifiers when the "ignore qualifiers" option is checked.
4. **"Ignore Qualifiers" Checkbox** — Rejects "non-detect" results when plotting
5. **"Plot Multiple Wells" Checkbox** — Plots results for all loaded wells at once when checked.
6. **Load/Unload Buttons** — moves selections back and forth between the list of available wells (left pane) to the list of wells for analysis (right pane)
7. **Data Display Grid** — Displays all loaded *Virtual Library* data when "Show Data" is clicked

Figure 24. VL Import tab. The red numbers do not appear in the user interface.

Click the "Load File" button to import *Virtual Library* data. The button brings up a standard Windows open dialog for selecting and importing virtual library data. Loading multiple files

through the open dialog by holding down the “ctrl” key on the keyboard while clicking on the desired files. When loading multiple files, DMT does not filter out identical data points in different files.

The left pane of the “VL Import” tab will be populated with well names from the *Virtual Library* file(s) when importing is complete.

8.5.2 Configuring data

Once *Virtual Library* data is loaded, analyses can be configured using the “VL Import” tab. The left pane on the tab contains a list of wells for which data is available. The right pane contains wells selected for inclusion in subsequent calculations. To move a well from one pane to the other, click the name of the desired well, then click the single arrow button (“>” or “<”) pointing in the appropriate direction. Single arrow buttons move singly selected wells, one at a time. Double arrow buttons (“>>” or “<<”) move all wells in the list regardless of whether or not they are highlighted.

8.5.3 Risk Analysis tables using Virtual Library data

One risk assessment report is available when *Virtual Library* data is used. Clicking “Report | Virtual Library Data Dosimetry Results Table” in the main menu produces a pop-up window containing a report based on the Dosimetry Results table (section 8.1.1). The report presents the cancer risk, hazard index and groundwater dose results for the highest concentration of each analyte in each selected well on the “VL Import” tab. The report has the same right-click menu options described in section 8.1.

8.5.4 Risk analysis graphs using Virtual Library data

In order to plot risk results using *Virtual Library* data in the “Graphs” tab, the “VLData” check box (Figure 16, number 7) must be checked. The “Graphs” tab is designed to use either tank data or *Virtual Library* exclusively; the two data types cannot be used simultaneously.

A drop down menu of available wells appears to the left of the “VLData” check box when it is checked. The other controls on the “Graphs” tab remain the same and graphs are plotted as described in section 8.3.

There are four unique features of graphing *Virtual Library* data:

- The X-axis (year) scale is re-set for the current plot, therefore if a data-set is being overlain and has a date range that is smaller than the previous plots, the smaller date range will be used for the x-axis scale and some data points on the previous plots will be hidden. The

hidden data points can be shown by re-setting the axis scale using the “Set custom axis scales” right-click menu option (section 8.3.5.1.7).

- Only the well selected in the drop-down menu of available wells can be plotted unless the “plot multiple wells” option is checked on the “VL Import” tab. If the “plot multiple wells” option is checked, then all wells in the right hand pane of the “VL Import” tab (wells selected for inclusion) will be plotted when the “create graph” button is clicked.

- The analyte drop down list contains only analytes for which sampling data is available. The drop-down list is re-populated when a new well is selected from the drop-down menu of available wells. If the “plot multiple wells” option is checked on the “VL Import” tab, the analyte drop down list will contain all the analytes in the data sets of the wells selected for inclusion.

- Some lab results are negative values, which are converted to the “Effective Zero” value (section 8.4.3.2) in the calculation. Since the well sampling data represent discreet points in time, the curve could have a spiked appearance. There are a couple graphing options on the “VL Import” tab to make the curves a little more readable. Checking “Ignore Qualifiers” changes all “non-detect” values to effective zero. “Curve Smoothing” eliminates any effective zero values by replacing them with the value of the previous data point resulting in a smoother looking curve. “Curve Smoothing” only works in conjunction with “Ignore Qualifiers” and will have no effect when “Ignore Qualifiers” is not checked.

9.0 MENU COMMAND REFERENCE

This section describes the main menu items and their functions in detail.

9.1 FILE

9.1.1 Load Closure Analysis

This menu item loads previously saved tree selections. The menu item opens a standard Windows open dialog box allowing selection of a “closure analysis” file. “closure analysis” files are ASCII text files in ini format with the extension “.scn”. Loading a “closure analysis” file will clear the currently selected tree nodes.

Closure analysis files can be opened and edited with a text editor, however this should be done with caution. Invalid entries will be ignored by DMT and result in different results than the originally saved closure analysis.

Closure analysis files are data set specific. Loading a closure analysis file from a different data set than the one currently loaded will result in a warning dialog listing the affected files and sources. DMT will load all the data possible from the file and the caption of the interface will say “Missing Data” to alert the user that not all data was loaded.

9.1.2 Save Closure Analysis

This menu item saves the current data selection tree selections in a “closure analysis” file. If the current closure analysis has not been saved yet, a standard Windows save dialog window will appear for selecting a name and a location to save to.

9.1.3 Save Closure Analysis As

This menu item opens a standard Windows save dialog window for selecting the name and location for the Closure Analysis file to be saved to.

9.1.4 Load Pathway Selections

This menu item loads previously saved exposure pathways data selection tree selections. The exposure pathways data selection tree is found on the closure analysis tab (section 11.1.1). The menu item opens a standard Windows open dialog box to select a pathways (“.pth”) files. The tree selections are read from an ASCII text ini file with the extension “.pth”. Like the .scn files used for saved closure analyses, the .pth file can be opened for viewing or editing with a text editor.

9.1.5 Save Pathway Selections

This menu item opens a standard Windows save dialog box to save the exposure pathways data selection tree (section 11.1.1) selections.

9.1.6 Exit

This exits the DMT. **Note:** There is no prompt to save the current closure analysis.

9.2 REPORT

9.2.1 Export to Plot App

This exports the data in the "Graphs" tab as a file readable by certain plotting applications. The file is in ASCII text format and can be opened an manipulated by a variety of editors, including Microsoft Excel.

9.2.1.1 Export and Open Plot App

If certain plotting applications are installed, this menu item will open the plotting application directly export the data to it. Otherwise, a dialog will appear, warning that a proper plotting application is not installed.

9.2.1.2 Export Only

This menu item saves the data as a file for use by certain plotting applications. A dialog box will appear allowing text entry for each curve to be used as metadata. Once the text is entered, clicking the OK button will either re-open the same dialog box for another curve, or open a standard Windows save dialog to choose the file's name and location.

9.2.2 Dosimetry Results Table

This menu item generates a detailed dosimetry table of all analytes found in the DMT database with risk factors estimates based on the selections in the data selection tree. The estimated peak year is indicated for each reported risk metric and analyte. Reported risk metrics estimates include: cancer risk, hazard index, groundwater dose, and C4 EDE.

Note: A table containing all zeros will result if no items are selected in the data selection tree, or if incorrect inventory / simulation combinations are selected.
Note: This table features a right click menu with find, sort and export functions as described in section 8.1.

9.2.3 Dosimetry Results (No Years)

This menu item creates the same table as listed in section 9.2.2, except without the peak year columns for every risk metric.

9.2.4 Pathways Report

This menu item generates a detailed report of risk results contributions from specific, user selected exposure scenario pathways. Select pathways for inclusion using the Pathway Selection tree on the Closure Analysis tab (section 11.1.1).

This function only works when a valid risk assessment scenario is configured (section 9.3.2). The resulting table features a right click menu with find, sort and export functions as described in section 8.1.

9.2.5 Pathways Report (No Years)

This menu item produces the same report as described in section 9.2.4, but without the peak year column.

9.2.6 Detailed Intruder Report

Clicking this menu item ultimately produces an Intruder Summary Report containing all radionuclides and their contribution to intruder dose. Prior to report generation, a pop-up window allows the user to configure the report (section 9.2.6.1). Underlying assumptions for the intruder scenarios can be changed on the “Assumptions” (section 11.10) and “Intruder parameters” (section 11.12) tabs. Only the source with the highest overall dose is displayed in the report. The report features a right click menu with find, sort and export functions as described in section 8.1.

9.2.6.1 Configuring the detailed intruder report

The configuration window (Figure 25) allows the user to select the exposure scenario and years to be included in the report.

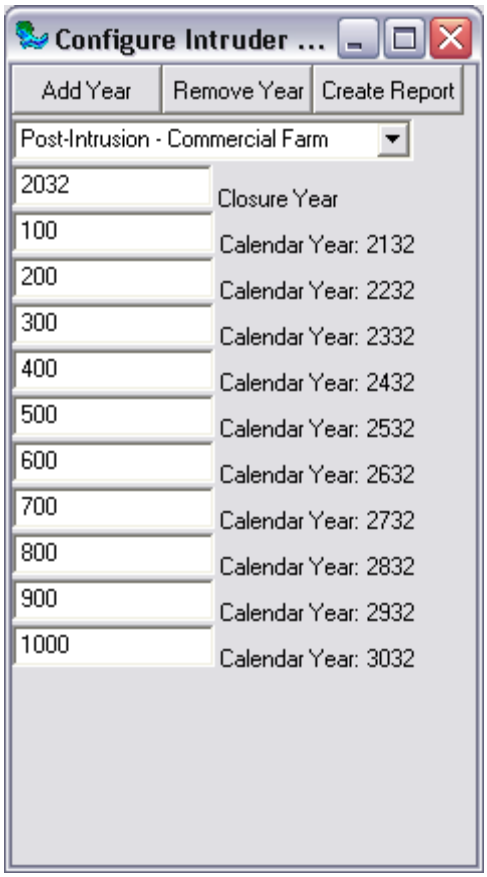


Figure 25. Detailed Intruder report configuration screen

Up to 10 years can be added to the report using the "Add year" button, while years can be removed down to 1 entry using the "Remove year" button. Enter the number of years after closure in the edit boxes. The years do not have to be in sequential order and the software automatically updates the label to the right of the box to show the calendar year corresponding to the year in the edit box.

Similarly, the closure year can be entered, however there is DMT does not ensure that the year entered in the box is greater than or equal to the earliest year in the inventories. If the entered year is too early, a fatal exception will result and the program will close.

9.2.7 Intruder Dose Summary Report

An Intruder Dose Summary Report lists total intruder doses for each exposure scenario, separated by source and further subdivided by inventory. Two report options are available on the menu: one reports the doses at the compliance monitoring start year as shown (configured on the Assumptions Tab [section 11.10]), while the "Peak Year" option reports the doses at the year of maximum dose and provides the calculated peak year in the title bar of the report.

This report features a right click menu with find, sort and export functions as described in section 8.1.

9.2.8 Virtual Library Data Dosimetry Results Table

Section 11.13 describes the DMT virtual library functions.

9.2.9 Export to Excel

The Export to Excel menu item opens Microsoft Excel (if installed) and exports formatted data from the active tab directly into a new workbook. Tabs supporting export to Excel are: Closure Analysis, Analytes, Simulation Results, Graphs and Export Results.

Each Excel worksheet of DMT data will contain a "report stamp" listing the parameters used to generate the report. This report stamp insures the repeatability of results. The stamp includes the date, time, user ID, DMT version information, data set information, STOMP files used and major assumptions used.

9.3 HELP

9.3.1 About

This displays the application owner, name, version number, data set number, and the usage message shown in Section 5.2.3.

9.3.2 Tree Selection Summary

This produces a report of valid source / inventory / simulation result combinations selected in the data selection tree. Inventories and simulation results are correlated by category (e.g., Past leaks, Residual Source inventory) and selecting an inventory / simulation combination from dissimilar categories would lead to a result of “0”. Since DMT does not prevent selecting these incorrect combinations, the Tree Selection Summary report confirms that proper combinations have been made (Figure 26). The number of simulations and inventories listed in the report should match. If not, either an incorrect inventory / simulation combination was made or a simulation was not selected for one of the inventories.

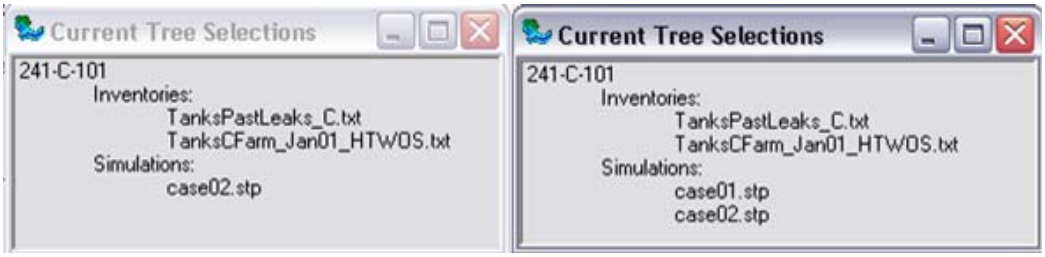


Figure 26. Incorrect inventory / simulation combination (left) and correct combination (right). The left report does not have a simulation for every inventory, so there is either a mismatch, or no simulation has been chosen for one of the inventories.

Pre-selecting the inventory/simulation categories to be applied to subsequent source selections using the "Source Default Management" control (section 11.1.9) will ensure that inventory/simulation mismatches will not occur.

9.3.3 Version History

This gives a detailed version history of the DMT program.

9.3.4 Data Set History

The data set history lists available data sets with short descriptions of what data they contain. This report is also accessible using the Data Set button on the loading page (Section 5.0).

9.3.5 Source Code

This menu item produces a window listing the Delphi source code modules that were compiled to create the DMT executable. This source code listing is a QA requirement.

9.3.6 Unknown Analytes

This menu item produces a detailed list, by inventory file, of entries whose CAS number could not be matched to a CAS number in the DMT analytes database (analytes.dat). These individual inventory entries have not been loaded into DMT and are not used in risk calculations. Each line of this report lists the source file (and directory path), the CAS number and common analyte name found for the entry. Contact the DMT owner to resolve any issues presented by these missing analytes.

9.3.7 Pathway Mismatches

The pathway mismatches report is structured identically to the unknown analytes report (Section 9.3.6), and displays a list, by file, of performance pathways file entries that do not have a match in the analyte database. As with the unknown analyte report, the entries listed in this report were not loaded by DMT and are not available for calculation.

9.4 CONVERTED ANALYTE INVENTORIES

Clicking this menu item displays a list of radionuclide inventory entries converted from mass to activity as described in section 5.2.2.

10.0 DATA SELECTION TREES

Three data selection trees are available on the left hand side of the interface (Figure 9): the source tree (top), the inventory tree (middle) and the simulation tree (bottom). Section 4.0 describes how to use the trees, while section 4.1 describes the difference between "checking" and "selecting" nodes. This distinction is critical for understanding the following sections. A tree selection summary can be viewed by clicking the menu item "Help | Tree selection summary" (section 9.3.2).

The data selection trees allow the user to configure which sources, inventories and transport simulations to use in the risk analysis. The trees focus on sources (e.g., tanks, past leaks, cribs, pipes, etc.) with inventories and transport simulations linked to specific sources. The following sections describe each data selection tree in more detail.

10.1 SOURCES TREE

Sources are marked for inclusion in subsequent calculations by checking them in the Sources Tree. Sources in the source tree are populated from a file at startup. Contact the DMT Owner to add or remove sources from the sources tree.

Sources in the tree are divided into source categories (e.g., tanks, cribs, trenches). The number of categories and their names are configurable by DMT administrators.

DMT is not designed to analyze risks associated with potential releases from multiple WMAs. Checking the first source in a waste management area will deactivate the other waste management area nodes (Figure 27). This restricts the user from selecting sources from multiple waste management areas. Checking or selecting a source will populate the Inventory and Simulation trees with data for that source. Checking the source will activate the inventory and simulation trees for data selection.

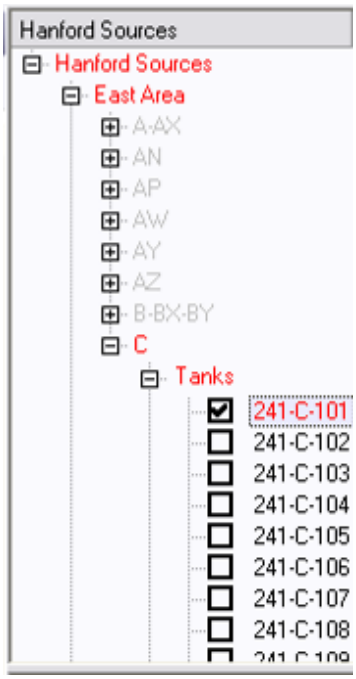


Figure 27. Sources tree. A source in WMA C has been checked, disabling the other WMAs in the tree. Note that source 241-C-101 is both checked and selected.

10.1.1 Inventory Tree

Inventories for a selected source (or sources) can be marked for inclusion in subsequent calculations by checking them in the inventory tree. The inventory tree is enabled by selecting a source in the sources tree and individual inventories are activated by checking a source. If the inventory tree is disabled, all tree text will be gray colored and the tree will not respond to user clicks.

Inventories for single or multiple sources can be checked with one click. The caption in the panel at the top of the inventory tree indicates which source the inventory tree applies to. If multiple sources are selected, the tree caption will say “multiple sources selected” and inventories checked will apply to all selected sources in the sources tree (Figure 28).

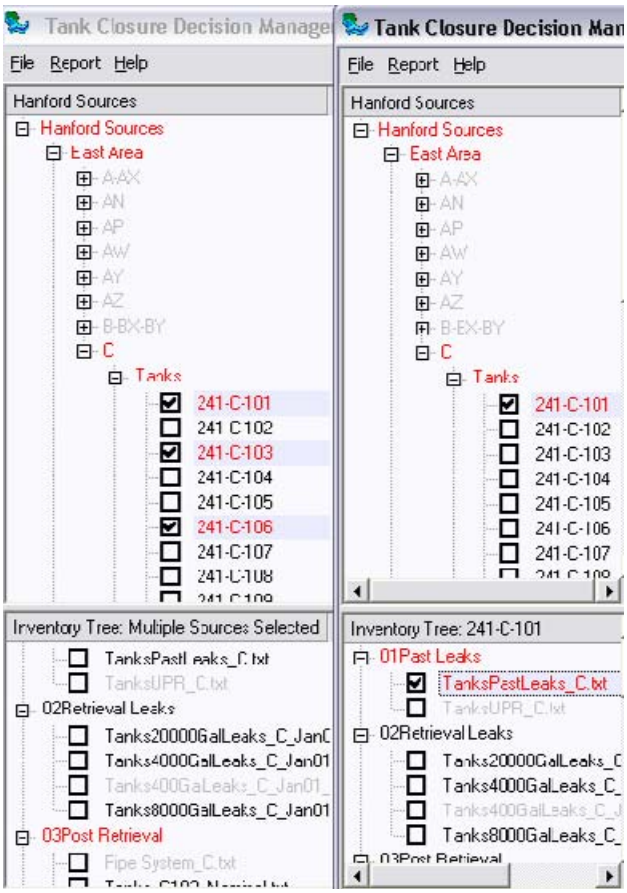


Figure 28. Selecting inventories for a single source (right) and multiple sources (left). Note that any inventory checked in the left example will apply to sources 241-C-101, 241-C-103 and 241-C-106.

The inventory tree structure is determined by the directory structure of the data set's inventory directories. DMT creates the tree at program startup, based on the directory structure. Individual nodes in the tree have the name of the inventory file (in *.txt format) that their data was read from. If a particular file did not contain data for the checked node, that inventory node will be grayed out and cannot be checked.

Inventories are divided into inventory categories, which are determined at startup by the data set's directory structure. The number of inventory categories or their names are not limited, and must be configured by a DMT administrator. **DMT does not restrict the user from checking several inventories under an inventory category as there are instances where this can be appropriate. Since multiple inventory selection is inappropriate in most instances, analysts using DMT must be aware of their analyses parameters. It is imperative that users understand the relationships between the source inventories and corresponding simulations.**

10.1.2 Simulation Tree

STOMP simulation results can be marked for inclusion in subsequent calculations through the simulation tree. The simulation tree is loaded and configured at startup in the same fashion as the inventory tree, based on the data set directory structure. Also like the inventory tree, simulation tree selections can apply to a single checked source or multiply selected sources in the sources tree.

Unlike the inventory tree, the simulation tree restricts the user to one simulation selection per simulation category. The simulation tree is also unique in that it has a right click menu for selecting the types of simulations to be shown in the tree (Figure 29). This allows the user to remove clutter in the case that the simulation tree has numerous entries. A checked node will remain checked when hidden through a menu selection. The node must be exposed in order to un-check it. Contact the DMT owner if a different menu configuration is desired.

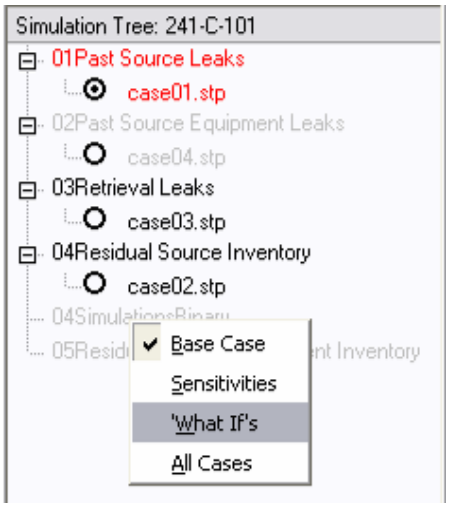


Figure 29. Simulation tree with right-click menu.

10.1.3 Closure Analysis Files

Current tree selections can be saved for future use by using the “Save Closure Analysis” option in the main menu (Section 9.1.2).

10.2 TAB CONTROL

Navigate between DMT pages (section 11.0) by using the tab control at the top of the interface. The tab control consists of buttons whose captions indicate which page they will expose (Figure 30). Clicking a button will expose the page.

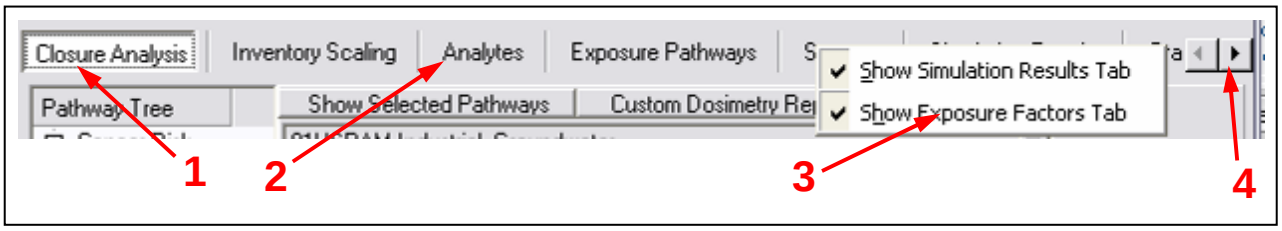


Figure 30. Annotated screen capture of DMT tab bar. The red lines and numbers do not appear in the interface

1. Active Tab
2. Tab button (inactive)
3. Right-click menu
4. Tab navigation buttons

Two seldom used tabs are hidden, but can be exposed by right clicking the tab bar and choosing the hidden tab's name from the subsequent menu (Figure 30, number 3). A check mark next to the tab name in this menu indicates that that tab is exposed. Click the menu item a second time to hide an exposed tab.

Left and right arrow buttons appear at the right of the menu bar when there are too many buttons to show across the screen (Figure 30, number 4). Clicking these buttons will shift the tab buttons to the left and right. The DMT pages controlled by the tab bar are described in section 11.0.

11.0 DMT PAGES

Each page controlled by the tab bar (section 10.2) has a specific function. These pages help organize DMT's features into logical divisions. The following sections describe each page and its features in the order that the pages appear on the tab bar from right to left.

11.1 CLOSURE ANALYSIS

Basic and general analysis settings are controlled by the Closure Analysis page. This page also contains a table summarizing the contribution of common analytes to the overall risk represented by the current tree selections. The Closure Analysis page is the default page for DMT. Figure 31 is an annotated screen capture of the Closure Analysis page providing the name and location of each feature which can be used in the subsequent sections describing them.

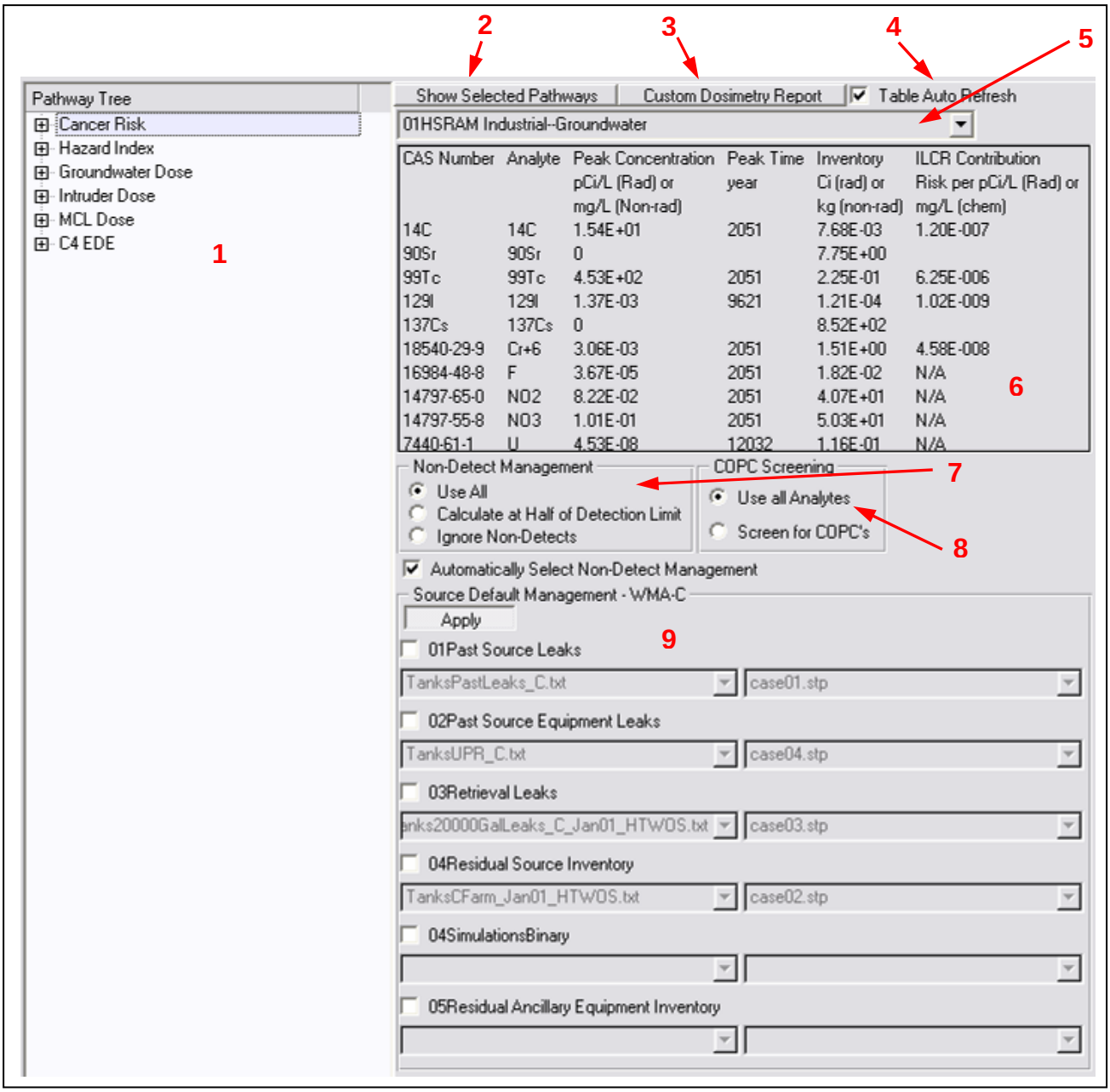


Figure 31. DMT Closure Analysis page. Red numbers and arrows do not appear in the interface.

1. Pathway Tree
2. Show Selected Pathways Button
3. Custom Dosimetry report button
4. Table Auto Refresh Toggle
5. Incremental Lifetime Cancer Risk (ILCR) Scenario Select
6. Summary Results Table
7. Non-Detect Management Toggle
8. Contaminant of Potential Concern (COPC) Screening Toggle
9. Source Default management box

11.1.1 Pathways Tree

The pathways report (section 9.2.4) is configured using the pathway tree (Figure 31, number 1). The pathway tree lists the loaded performance objectives, exposure scenarios and exposure pathways in a hierarchical tree. Checking individual exposure scenarios flags them for inclusion in the pathways report.

Pathway selections can be saved for future use using the "File | Save pathway selections" menu option (section 9.1.2). Load previously saved pathway tree selections using the "File | Load pathway selections" menu option (section 9.1.1).

Section 4.0 describes how to use data selection trees in the DMT interface.

11.1.2 Show Selected Pathways button

This button (Figure 31, number 2) opens a window displaying a summary of currently selected exposure pathways. This summary is designed to be faster and easier than expanding each Pathway Tree node to find the selected pathways.

11.1.3 Custom Dosimetry Report button

This button (Figure 31, number 3) opens a window (figure) allowing the user to enter any desired inventory or concentration value. One drop down menu contains all the analytes in the DMT analyte database, while the other lists all loaded contaminant transport modeling results files. Enter a year in the "Year (optional)" edit box to calculate results for a specific calendar year. When the "OK" button is clicked, selections in the drop-down menus and edit boxes will be applied to the inventory or concentration to produce a results table for every risk metric/exposure scenario combination currently loaded in DMT. A right click menu in the table enables the results to be exported to Excel if loaded on the computer DMT is being run on (section 8.1).

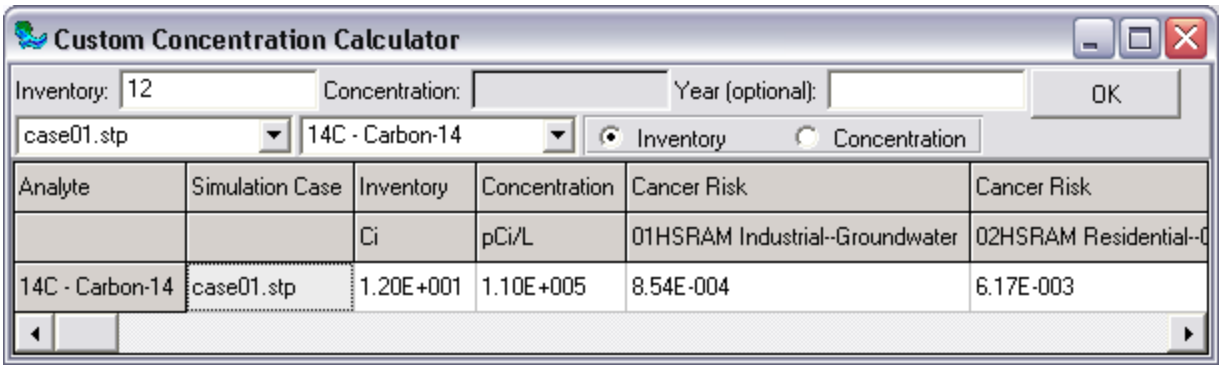


Figure 32. The custom concentration calculator pop-up window.

11.1.4 Table Auto Refresh Toggle

When the Table Auto Refresh toggle (Figure 31, number 4) is checked, the summary results table (section 11.1.6) will refresh with updated results every time a change is made in any data selection tree. Un-checking the table auto refresh toggle exposes a "calculate" button that must be clicked to manually refresh the table. In this mode, the text on the "calculate" button will turn red to indicate that the table no longer reflects the selections in the data selection trees. Clicking the button will refresh the table and turn the button text black. Un-check the Table Auto Refresh toggle if making changes to the data selection trees causes the program to "freeze" while calculating.

11.1.5 Incremental Lifetime Cancer Risk (ILCR) Scenario Select

Select the ILCR exposure scenario for use in the "ILCR Contribution" column of the summary results table (section 11.1.6). Changing the value of the ILCR scenario select box automatically recalculates the ILCR contribution results regardless of whether the Table Auto Refresh Toggle (section 11.1.4) is checked.

11.1.6 Summary Results table

The Summary Results Table (Figure 31, number 6) displays a summary of results based on ten analytes historically found to be risk drivers. Peak concentrations, peak times, inventories and ILCR contribution for these ten analytes are displayed. The results are based on the current tree selections and will automatically refresh with every tree change if the Table Auto Refresh toggle (section 11.1.4) is checked. The Summary Results Table was designed to be an overview of common risk drivers and as a way to observe the effects of changing parameters in real time.

11.1.7 Non-Detect Management Toggle

Inventory data from a lab could have entries flagged with a “U” (undetect) qualifier. In these cases, the reported inventory is actually the detection limit of the instrument used to make the analysis at the lab. The non-detect management toggle (Figure 31, number 7) provides 3 options for handling inventory entries flagged as undetects: they can be used in the analysis as reported, completely excluded from the report, or replace the entry in every calculation with half the reported detection limit of the lab instrument (which is common with some analytical methods). Using half the detection limit for “U” flagged entries is the default setting. The Non-Detect toggle will automatically default to “Use All” if the Contaminant of Potential Concern (COPC) Screening Toggle (Section 11.1.8) is set to “screen for COPCs”.

11.1.8 Contaminant of Potential Concern (COPC) Screening Toggle

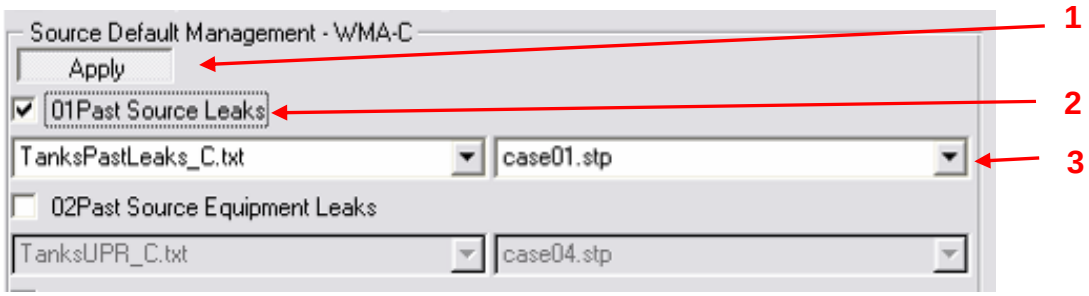
This box defines how contaminants of potential concern (COPC) are treated in the calculations (Figure 31, number 8). Contaminants of potential concern are analytes that must be considered in a risk analysis. Contact the DMT owner for a COPC configuration file tailored for a particular data set.

The COPC screening toggle has two options: “use all analytes” and “Screen for COPCs”. All analytes in the selected inventories are used in the risk calculations when "Use all Analytes" is checked. Checking “Screen for COPC's” will only include inventories of analytes listed in the COPC configuration file. Additionally, inventory entries with a “U” qualifier will be calculated at one-half the detection limit when the analyte is listed in the COPC configuration file. Section 11.5 describes how to check the COPC configuration file.

COPC screening cannot be used in conjunction with the non-detect management toggle (Figure 31, number 7) and the user interface will set the non-detect toggle to “Use All” when “Screen for COPC’s” is selected in the COPC screening toggle..

11.1.9 Source default management box

The source default management box (Figure 31, number 9) allows the user to pre-select the inventories and simulations applied to all subsequent source selections. When enabled, tank sources that are checked in the sidebar will automatically have the specified inventories and simulations selected, if applicable. Changes made to the selections in the source default management box are applied only to subsequently checked sources and do not affect currently checked sources.



1. **"Apply" button** — Click to activate or de-activate the default management box. When de-activated the checkboxes and drop-down menus will not be selectable (grayed out).
2. **Check boxes** — Check to activate the inventory and simulation drop-down menus directly below the check box. Check boxes only work when the "Apply" button is in the "Down" position (as shown).
3. **Drop down menus** — The left drop-down menu in a pair contains all loaded inventory files pertaining to the category represented by the check box. The right drop down menu contains all loaded simulation results files pertaining to the check box category.

Figure 33. Source default management box. The red numbers and arrows do not appear in the interface.

To use the source default management box, click the "apply" button (Figure 33, number 1) to activate it. Then, check the check boxes that represent the inventory types to be applied (e.g., past source leaks ("01Past Source Leaks") and tank residuals ("04Residual Source Inventory") . When a check box is checked, the drop-down menus below it will be activated. Select the desired inventory file and contaminant transport model result file from these menus. Note that these selections will not affect currently selected tree selections. The configuration in this box only applies to all following source tree selections.

11.2 INVENTORY SCALING

Inventory scaling factors can be applied to every analyte in a checked source, or to an individual analyte in a checked source through the Inventory Scaling tab. Section 8.4.1 describes this tab and its functions in detail.

11.3 ANALYTES

Section 8.4.2 contains a description of the analytes tab in the context of sensitivity analysis. The following sections provide additional details of features not mentioned in that discussion.

11.3.1 Analyte Summary

Clicking the Analyte Summary Button opens a pop-up window containing the selected analyte's physical properties formatted for easier reading. Analytes can be selected in the grid by left-clicking on the name of the analyte. Selected analytes are indicated by highlighting their grid row yellow. The Analyte Summary window remains on top, allowing the user to scroll through the analytes in the table and view the summary for each analyte.

11.3.2 References

Clicking on the References Button produces a pop-up window containing the references used to compile the values in the tab. Each row on the analyte grid has a alpha numeric "reference number" corresponding to an entry on in the reference key.

11.3.2.1 Finding and Sorting

The Analyte Data table has finding and sorting capabilities as outlined in section 8.1.

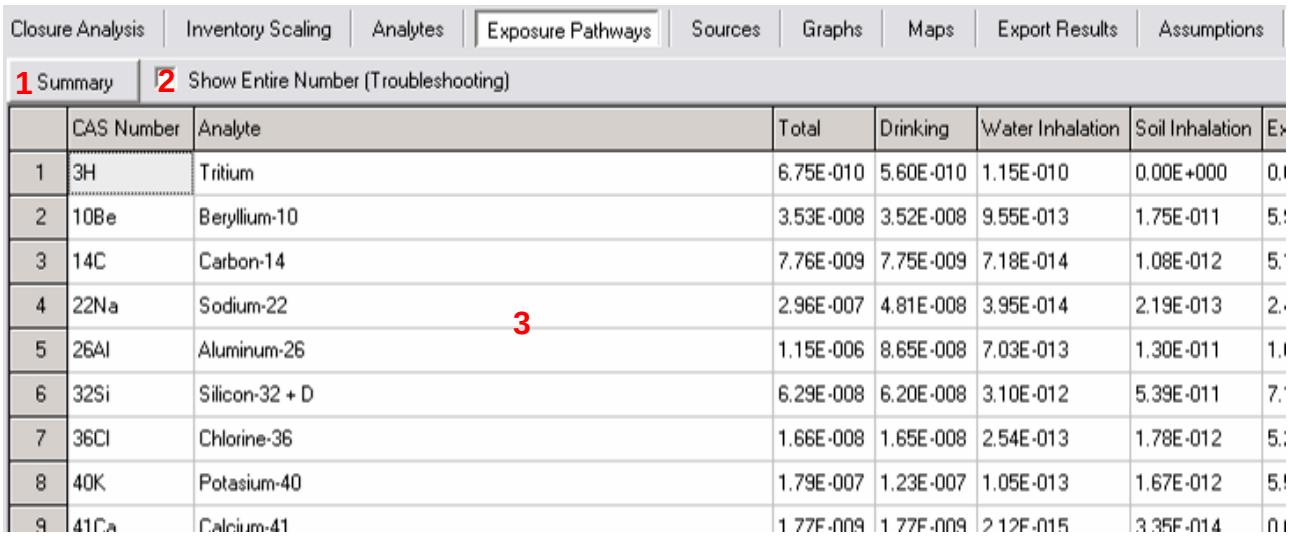
11.3.3 Edit Mode

The Edit Mode is detailed in section 8.4.2.

11.4 EXPOSURE PATHWAYS

The exposure pathways tab is hidden by default but can be exposed by right-clicking on the tab bar along the top of the interface and selecting "Show Exposure Pathways" from the resulting menu.

This tab displays all loaded dose conversion and risk factors. This tab is controlled with a data selection tree on the left, which organizes the loaded risk and dose scenarios. Clicking the name of the desired risk scenario (e.g., HSRAM industrial cancer risk) repopulates the analyte data grid with the dose factors for the selected scenario. Figure 34 is an annotated screen capture of the Exposure Pathways tab.



	CAS Number	Analyte	Total	Drinking	Water Inhalation	Soil Inhalation	Ex
1	3H	Tritium	6.75E-010	5.60E-010	1.15E-010	0.00E+000	0.
2	10Be	Beryllium-10	3.53E-008	3.52E-008	9.55E-013	1.75E-011	5.
3	14C	Carbon-14	7.76E-009	7.75E-009	7.18E-014	1.08E-012	5.
4	22Na	Sodium-22	2.96E-007	4.81E-008	3.95E-014	2.19E-013	2.
5	26Al	Aluminum-26	1.15E-006	8.65E-008	7.03E-013	1.30E-011	1.
6	32Si	Silicon-32 + D	6.29E-008	6.20E-008	3.10E-012	5.39E-011	7.
7	36Cl	Chlorine-36	1.66E-008	1.65E-008	2.54E-013	1.78E-012	5.
8	40K	Potasium-40	1.79E-007	1.23E-007	1.05E-013	1.67E-012	5.
9	41Ca	Calcium-41	1.77E-009	1.77E-009	2.12E-015	3.35E-014	0.

1. **Summary Button** — opens a window containing a summary of all of the exposure pathway information on the currently selected analyte
2. **Show Entire Number Checkbox** — displays all values in their native formatting, rather than in scientific notation.
3. **Analyte Data Table** — displays all dose conversion factors and risk factors for the scenario selected in the tree.

Figure 34. Exposure Pathways tab. The red numbers do not appear in the interface.

11.4.1 Performance Objectives Summary

Clicking the “Summary” button in the “Exposure Pathways” tab (Figure 34, number 1) opens the performance objectives summary pop-up window. Hovering over a scenario name in the Performance Objectives Summary turns the text blue, indicating a clickable link (Figure 35).

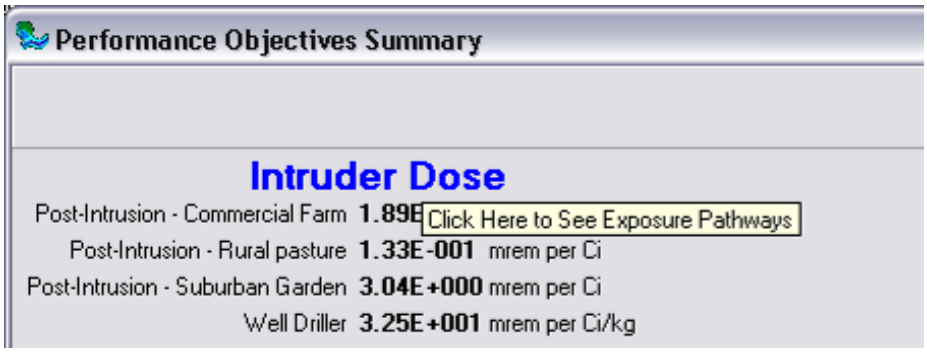


Figure 35. Top left corner of the Performance Objectives Summary window, illustrating the "Intruder Dose" clickable link.

Clicking on a blue colored risk factor name opens a pop-up window containing the exposure pathway factors for the selected exposure scenario and analyte (Figure 36).

Intruder Dose Exposure Pathways for 3H - Tritium

	Total	External	Internal	Soil Inhalation	Soil Ingestion	Milk	Garden Produce
Post-Intrusion - Commercial Farm	1.89E-003	0.00E+000	1.89E-003	1.89E-003	2.69E-007	N/A	N/A
Post-Intrusion - Rural pasture	1.33E-001	0.00E+000	1.33E-001	2.15E-002	3.49E-005	1.12E-001	N/A
Post-Intrusion - Suburban Garden	3.04E+000	0.00E+000	3.04E+000	1.52E-001	1.74E-003	N/A	2.89E+000
Well Driller	3.25E+001	0.00E+000	3.25E+001	4.65E-001	3.20E+001	N/A	N/A

Figure 36. Summary window listing all exposure pathway factors for a selected exposure scenario/analyte combination.

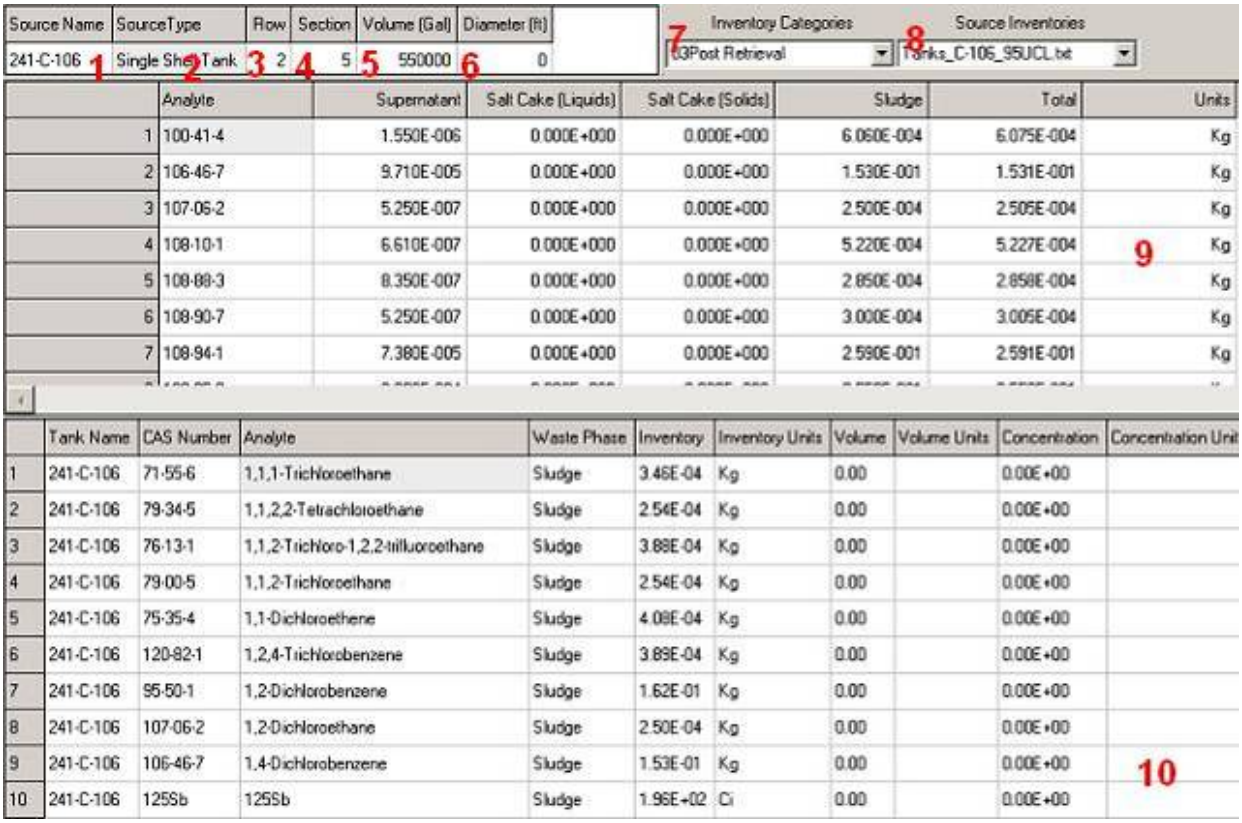
11.4.2 Analyte Data table

The Analyte Data table contains the dose conversion and risk factors each analyte based on the exposure scenario selected in the pathway tree. The default for this table is to display all analytes in the DMT analyte database and replacing missing dose factors with "N/A". The table's right-click menu provides the option to remove analytes that have no dose conversion or risk factors. The right-click menu also provides a find function as described in section 8.1.

Clicking "Report|Export to Excel" in the main menu (Section 9.2.9) opens Excel (if installed) and exports the visible data table to a new workbook.

11.5 SOURCES

The Sources tab displays the analyte inventory data for the first selected source in the source tree (see section 4.1 for a discussion of selected versus checked sources). Inventory files can often have multiple inventory entries for the same analyte/source combination. The tab displays the data as it appears in the source file, as well as providing a summary of inventory by analyte. Figure 37 is an annotated screen capture of the "sources" tab.



Source Name	SourceType	Row	Section	Volume (Gal)	Diameter (ft)
241-C-106 1	Single Shell Tank 2	3 2	4 5	5 550000	6 0

7 Inventory Categories: 03Post Retrieval

8 Source Inventories: Tanks_C-106_95UCL.txt

	Analyte	Supernatant	Salt Cake (Liquids)	Salt Cake (Solids)	Sludge	Total	Units
1	100-41-4	1.550E-006	0.000E+000	0.000E+000	6.060E-004	6.075E-004	Kg
2	106-46-7	9.710E-005	0.000E+000	0.000E+000	1.530E-001	1.531E-001	Kg
3	107-06-2	5.250E-007	0.000E+000	0.000E+000	2.500E-004	2.505E-004	Kg
4	108-10-1	6.610E-007	0.000E+000	0.000E+000	5.220E-004	5.227E-004	Kg
5	108-88-3	8.350E-007	0.000E+000	0.000E+000	2.850E-004	2.858E-004	Kg
6	108-90-7	5.250E-007	0.000E+000	0.000E+000	3.000E-004	3.005E-004	Kg
7	108-94-1	7.380E-005	0.000E+000	0.000E+000	2.590E-001	2.591E-001	Kg

9

	Tank Name	CAS Number	Analyte	Waste Phase	Inventory	Inventory Units	Volume	Volume Units	Concentration	Concentration Unit
1	241-C-106	71-55-6	1,1,1-Trichloroethane	Sludge	3.46E-04	Kg	0.00		0.00E+00	
2	241-C-106	79-34-5	1,1,2,2-Tetrachloroethane	Sludge	2.54E-04	Kg	0.00		0.00E+00	
3	241-C-106	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	Sludge	3.88E-04	Kg	0.00		0.00E+00	
4	241-C-106	79-00-5	1,1,2-Trichloroethane	Sludge	2.54E-04	Kg	0.00		0.00E+00	
5	241-C-106	75-35-4	1,1-Dichloroethene	Sludge	4.08E-04	Kg	0.00		0.00E+00	
6	241-C-106	120-82-1	1,2,4-Trichlorobenzene	Sludge	3.89E-04	Kg	0.00		0.00E+00	
7	241-C-106	95-50-1	1,2-Dichlorobenzene	Sludge	1.62E-01	Kg	0.00		0.00E+00	
8	241-C-106	107-06-2	1,2-Dichloroethane	Sludge	2.50E-04	Kg	0.00		0.00E+00	
9	241-C-106	106-46-7	1,4-Dichlorobenzene	Sludge	1.53E-01	Kg	0.00		0.00E+00	
10	241-C-106	125Sb	125Sb	Sludge	1.96E+02	Ci	0.00		0.00E+00	

10

1. **Source name** — The name of the source selected in the source tree
2. **Source type** — The selected source's type
3. **Row** — The row of the selected source. This is a deprecated feature and currently has no meaning or function.
4. **Section** — The section of the selected source. This is a deprecated feature and currently has no meaning or function.
5. **Volume** — The total waste capacity of the selected source; this value does not reflect the volume of waste currently in the source
6. **Diameter** — The diameter of the selected source
7. **Inventory categories** — A drop-down menu of applicable inventory categories for the selected source
8. **Source inventories** — A drop-down menu of applicable inventories for the selected source; this menu is repopulated when a new selection is made in the inventory categories drop-down
9. **Inventory summary table** — Presents cumulative inventory values broken down by analyte and waste phase. These values are summaries of the individual values in the inventory table (10).
10. **Inventory table** — analyte inventories from the selected source as found in the inventory input file as selected in the "source inventories" drop down box (8)

Figure 37. Sources tab. Note that the red numbers do not appear in the interface.

The tables and drop down menus on the "sources" tab contain data specific to the first selected source in the source tree. Selecting another source will repopulate the menus and data on the tab. The data in the tables are specific to the inventory file indicated in the source inventories drop-

down menu (Figure 37, number 8). Selecting a new inventory file from this drop down list will re-populate the tables. Changing the inventory category in the inventory categories drop-down (Figure 37, number 7) menu will repopulate the source inventories drop-down menu with inventory file names applicable to the selected category.

The sources tab can also display an entire inventory input file. To do this, check a source in the source tree, then select any active (not grayed out) inventory file name in the inventory tree. The menus and tank information in the top bar disappear and are replaced with the name of the selected inventory file. The inventory table lists the entire contents of the selected inventory file and the inventory summary table provides the cumulative total for each analyte in the file.

While the tables in the "sources" tab features the same sort and find functions as other DMT Tables (section 8.1), these functions are divided between the inventory and inventory summary (rollup) tables. Therefore, "sort rollup data" will only operate on the inventory summary table while "sort inventory data" only sorts the inventory table.

If a COPC screening file (section 11.1.8) exists for the selected inventory file, clicking on the right-click menu option "Show COPC list" will produce a pop-up window listing the COPC analytes. If the COPC screening file doesn't exist, clicking on this menu item will result in a pop-up message saying that there is no COPC screening file for the selected inventory file.

11.6 SIMULATION RESULTS

The Simulation Results tab tabularizes the simulation results for the contaminant transport simulation results file selected in the simulation tree. Data is arranged descending by time step and only the time steps read by DMT are displayed; if the original simulation results file was filtered to produce the DMT simulation file, the missing time steps are not displayed here. Selecting any active (not grayed out) simulation results case in the simulation tree will populate the tab's table with the file's data. These results can be exported to Excel by selecting "report|export to excel" from the main menu.

The right click menu provides a find function—as described in section 8.1—and a "read input file" option. Selecting the "read input file" option will open a pop-up window displaying the STOMP input card used to produce the results in the table. If no input card is available, a warning message will appear.

11.7 GRAPHS

Analytical results are graphically displayed on the "Graphs" tab. The graph tab is configurable, allowing display of groundwater concentrations of and risks presented by analytes, either individually or cumulatively. Analytical results are displayed with appropriate regulatory limits, where applicable.

Graphs allow comparison of effects from parameter changes, show trends over time and provide an alternate communication of risk to a number or table of numbers.

Section 8.3 describes the features of the graphs tab in detail.

11.8 MAPS

The maps tab shows a map of the current WMA, highlighting the currently selected sources. Checked sources will have a bright red outline, and un-checked sources will have a light red outline. Moving the mouse over a source will display the name of that source and any selected inventories and simulations for that source. Each inventory shown in the pop-up should have a bulleted simulation name under it. If not, then either an incorrect simulation or no simulation at all is checked for the given inventory. In this case, the inventory will not be used in subsequent concentration calculations.

11.9 EXPORT RESULTS

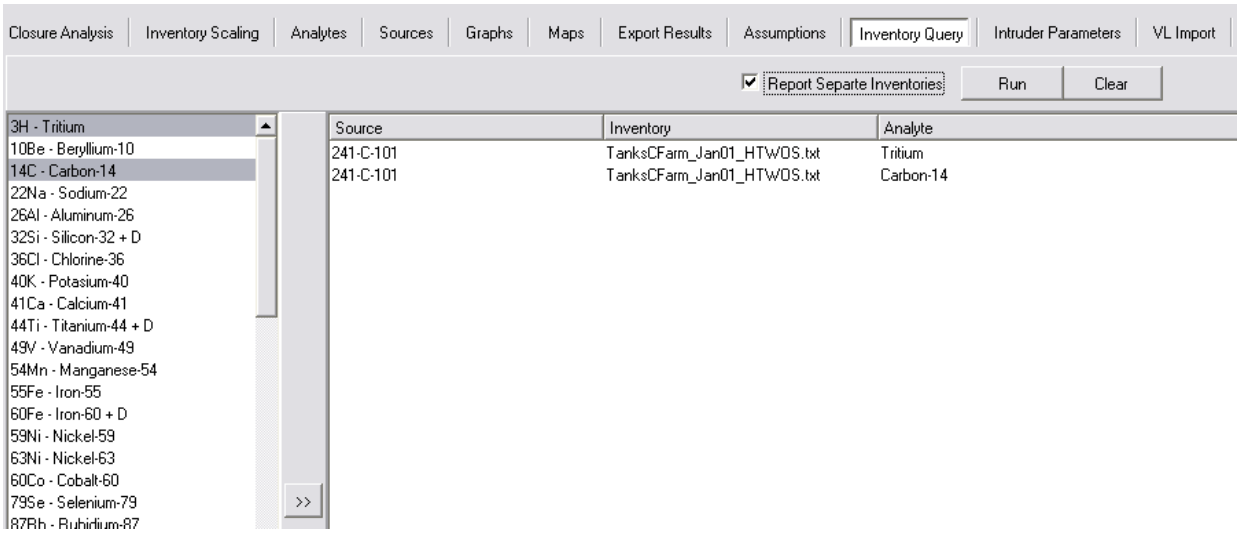
Batch calculations and risk or concentration result exports can be configured and performed on the “Export Results” page. Calculations can be configured for individual or multiple analytes and risk metrics. Data export options include Excel and Tecplot formats. Using the Export Results tab significantly speeds up the generation of figures for risk assessment documents. Section 8.2 details this tab’s functions.

11.10 ASSUMPTIONS

Global assumptions used in DMT calculations are listed on this tab and are user-editable. Section 8.4.3 describes this tab in detail.

11.11 INVENTORY QUERY

This tab generates a table summarizing the inventories of user-selected analytes based on checked nodes in the data selection trees. Changes in the data selection trees will automatically update the Selected Analytes Listing. The inventory query provides a concise report of the total inventory selected in the data selection trees for any analyte . Figure 38 is an annotated screen capture of the “Inventory Query” tab.



1. **Analyte Selection** lists all the analytes in the DMT analyte database
2. **Add Analyte Button** adds an analyte into the selected analytes queue for analysis
3. **Report Separate Inventories checkbox** when checked, subsequent reports will separate the results out by inventory file
4. **Run Button** creates a report based on the entries in the selected analytes queue
5. **Clear Button** clears the selected analytes queue
6. **Selected Analytes Queue** lists the analytes and inventories included in subsequent reports

Figure 38. Annotated screen capture of the "Inventory Query" tab. Note that the red numbers do not appear in the interface.

To configure the Inventory Query report, click on the inventory name in the analyte selection list, then click the "add analyte button" to add the analyte to the selected analyte queue. Multiple analytes can be selected by holding the "ctrl" key on the keyboard down while clicking the names of the desired analytes. Inventories are automatically configured based on checked sources in the data selection trees. Clicking the "run" button will create a report in a pop-up window based on the selections in the selected analytes queue. The resulting report has the same right-click menu options as described in section 8.1.

11.12 INTRUDER PARAMETERS

All default parameters used in the intruder scenario dose calculations can be edited from this tab. This tab is described in detail in section 8.4.4.

11.13 VIRTUAL LIBRARY DATA

DMT can use data extracted from the "Environmental Monitoring" module of the *Virtual Library* to perform human health risk calculations on well sampling data. Section 8.5 describes how to use *Virtual Library* data for risk calculations in DMT.

12.0 SOURCE DATA DIRECTORY STRUCTURE

DMT uses the directory structure within the DMT directory as a template for formatting parts of the user interface during program startup. Data selection trees (section 10.0) within the user interface allow the user to select which data to use in an analysis. DMT creates these trees by reading data in prescribed directories within the source data directory structure, requiring all data sets to contain certain directories having specific names. The following sections describe the required components in the source data directory structure.

12.1.1 Metadata file

The metadata file (e.g., <DMT Directory>/01Config/DataSet50.bin) lists the files and directories contained within the data set. A DMT administrator will create this file while assembling a data set.

DMT ensures data set integrity by checking the directory structure against the metadata file during startup and preventing program startup if data is missing or has been added. A mismatch between the metadata file and the data on disk will trigger an error message (Figure 39) and DMT will not start. In case of such a mismatch, clicking the “error log” button on the DMT startup screen displays the differences between the directory structure and the metadata file. This report can be used by a DMT administrator to repair the data set.

Mismatches between data on disk and the metadata file can be caused by incorrectly installed data sets, incorrectly assembled data sets, or inadvertent deletion or insertion of files into the directory structure by an end user. Contact the DMT owner for other startup issues.

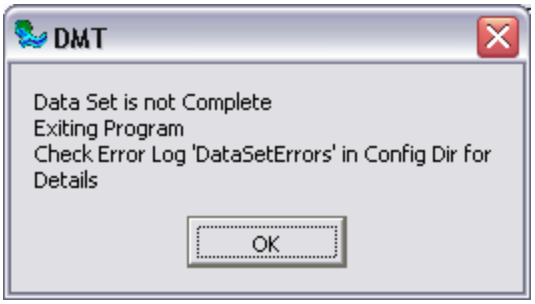


Figure 39. Error message displayed when metadata file and data on disk do not match

12.1.2 Global Data Directory

The global data goes in a directory labeled with the data set number under the global data directory (e.g., <DMT Directory>/03GlobalData/DataSet50/). Two directories are required within the data set directory: 01Analytes and 02Performance.Additionally, three files are required: Assumptions.ini, DecayChains.ini and specificactivity.ini. Changes to the Assumptions.ini file can be made within the interface (section 8.4.3).

12.1.2.1 01Analytes

Table 1 lists the required files in this directory. Absence of any of these files will result in an unrecoverable error during DMT startup.

Table 1. "01 Analytes" directory required files

File	Contents
Analytes.dat	Analyte physical parameters shown in "Analytes" tab of DMT
PerformanceParameters.dat	C4, C4EDE, MCL and state contaminant limits shown in "analytes" tab of DMT

12.1.2.2 02Performance

Sub-directories in the 02Performance directory are designed to represent different risk metrics (e.g., "01Cancer Risk", "02Hazard Index", etc.), although in practice they can have any desired name. The sub-directory name *must* be prefixed with a 2 digit number.

12.1.2.2.1 Scenario Limits File

_ScenarioLimits.txt is read by DMT to obtain the units, regulatory limit and regulatory limit units for various exposure scenarios of the performance metric defined by the directory name. The software doesn't look for the name specifically, but rather for the first file, so any name with an underscore before it will be recognized as the scenario limits file. This file is required for every scenario directory (e.g., 02Hazard Index): DMT will exit with an error during startup without it.

12.1.2.2.2 Exposure factor files

There can be any number of factor files within a risk metric directory (e.g., 01Cancer Risk). These files contain numeric dose or risk factors organized by analyte, and each file represents an exposure scenario within the risk metric (for instance, the file <DMT Directory>/01Cancer Risk/ 01HSRAM Industrial--Groundwater.txt represents the risk factors for the HSRAM Industrial Groundwater exposure scenario of the cancer risk performance metric). These factors can be viewed in the "Exposure Pathways" tab of the interface (section 11.4).

12.1.3 Source Data Directory

The source data directory is a subdirectory of the directory containing the DMT executable and is labeled "04SourceData". Data sets are separated into subdirectories under the source data directory. Each data set subdirectory contains tank farm specific inventory and vadose zone transport data separated into east area and west area directories. The area directories are further sub-divided into WMA directories (e.g., A-AX, B-BX-BY, C, etc.). Figure 40 shows a typical directory structure for a source data directory.

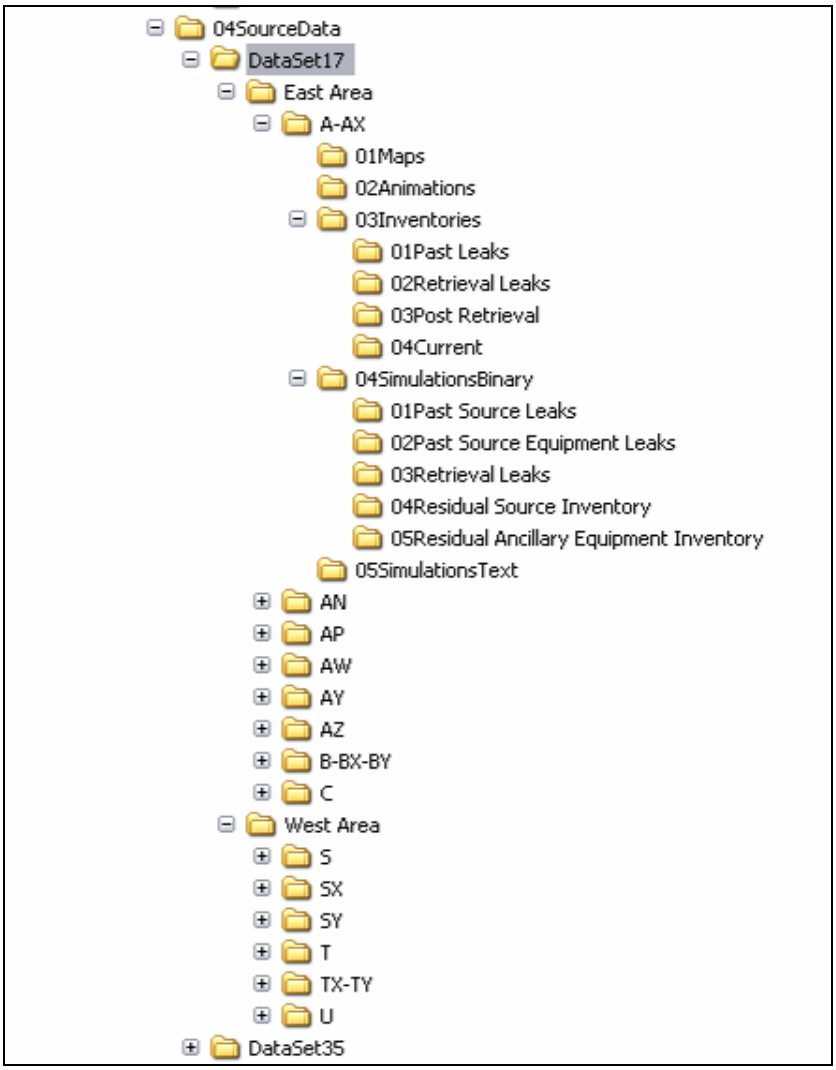


Figure 40. Sample directory structure for a source data directory

At startup, DMT reads the directory structure in the 04SourceData directory and constructs the user selection trees from it. The subdirectory structure within each WMA directory must be maintained for DMT to start properly.

12.1.4 Directory Structure Within a WMA directory

Five directories are allowed within a WMA directory, of which only 2 are required. The sub-directory names must be retained for DMT to start correctly. Table 2 shows the sub-directories within a WMA directory and their attributes.

Table 2. Sub-directories wtihin a WMA Directory and their attributes

Directory name	Required (yes / no)	Notes
01Maps	No	Deprecated; from an earlier DMT version
02Animations	No	Deprecated; from an earlier DMT version
03Inventories	Yes	If this directory is missing, then the WMA will be grayed out in the user interface. These data can be viewed in the "Sources" tab of the interface (section.11.5)
04SimulationsBinary	Yes	This directory is crucial for creating the data structure of DMT during startup. A DMT subroutine will re-create this directory if it is missing. Directories re-created by DMT are empty, and DMT will not have data to use for calculations for the WMA. DMT will exit with an error on start up if starting from a read-only media (e.g., CD-ROM) and this directory is missing. These data can be viewed in the "Simulations Results" tab of the interface (section. 11.6)
05SimulationsText	No	Can contain ASCII text STOMP model results

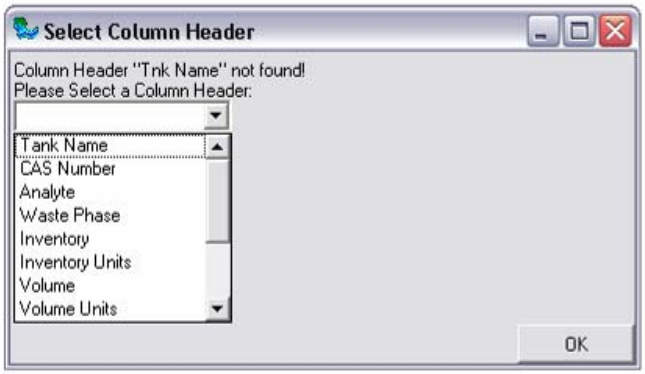


Figure 41. User column header selection screen

13.0 REFERENCES

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