GETTING STARTED WITH GENII VERSION 2

About the GENII Version 2

GENII Version 2 was developed for the U.S. Environmental Protection Agency, incorporating improved transport models, exposure options, dose and risk estimation, and user interfaces. Additions were made for both the U.S. Department of Energy and the U.S. Nuclear Regulatory Commission. GENII V.2 is specifically designed to function within the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), a framework that allows GENII to execute with, and provide inputs to, other related programs. GENII provides the full environmental radiation dosimetry capabilities with nearly all input parameters available the user.

How can I get help with understanding and running the code?

A full Users' Guide and a complete Software Design Document are provided electronically with the installation package.

For software technical support, please contact the software developer, Bruce Napier at Email: Bruce.Napier@pnl.gov Phone: (509) 375-3896.

**How to perform the initial installation of FRAMES and GENII**

GENII Version 2 installation package consists of a single file that will automatically install all the necessary FRAMES and GENII routines and support files.   The file is called GENIISetup2-10-x.exe (the exe suffix indicates that this is an InstallShield executable file). This file may be started directly if the program is being installed from a CD.
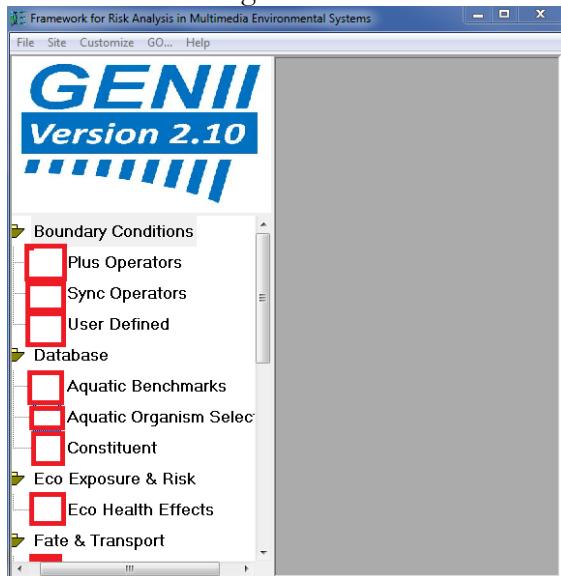
To install the package from the web site, copy GENIIsetup2-10-x.exe onto the user's computer. It may be copied into any temporary directory. Then, run the GENIISetup2-10-x.exe routine. One way to do this is to use the Windows START – RUN commands, with \{user's directory}\GENIIsetup.exe in the box, where {user's directory} is the location of the file that has been copied.   Alternatively, if the installation package is initially copied to the user's Windows Desktop, simply double-click on the icon. A series of options will be presented by the setup program. If the user selects the "Complete" setup, all installation steps are automatic – including the destination directory. If you want GENII to be installed in a directory other than C:\FRAMES, select "Custom". It is recommended that the installation occur in the \FRAMES\ directory suggested by the program - several of the example problems assume that this directory is in use and will not execute properly if another is selected. If the user selects "Custom" installation, the target drive and directory may be selected first. Please use relatively short names with no spaces. You have a selection of features to install: FRAMES is mandatory, and it is suggested that all of the GENII components be installed as well. A number of MEPAS modules will supplement GENII; the MEPAS code is also available if desired. The installation routine will install any required Windows drivers and controls, if they are not already present on your host computer. Upon completion of the installation, it may be necessary to reboot the computer to allow the operating system to update itself to these newer components.

It is recommended that users install FRAMES and GENII in the default location, C:\Frames. Other drives may be substituted for C: - but keeping the \Frames directory directly under the drive name is best to keep the path to various subdirectories from becoming excessively long. In addition, many of the modules are written in Fortran and do not handle path names with spaces or file names longer than 8 characters.

For non-U.S. users: Many non-U.S.-English language settings use words other than True and False as logical indicators (e.g., Vero and Falso). The Frames user interfaces are written for English and will not recognize these other logical notations. In addition, the settings for some countries use notations other than the dot (".") as a decimal. The GENII routines are compiled for U.S. English and will generate errors with these conditions. Therefore, it is recommended that the user's Control Panel > Region and Language (Windows 7) or Control Panel >Language (Windows 10) settings be consistent with "United States", either by selecting "United States" or by using the regional settings enhanced with the >Format/Additional Settings options. These may be returned to their normal settings after a Frames/GENII session is completed.

For Windows 8 and Windows 10 users: The Visual Basic controls used in Frames are sensitive to input methods. If upon initial entry into Frames the home screen with the TreeView panel on the left looks something like this:

The following has been found to resolve the issues.
- Access the Device Manager: In Windows 10, this is usually found using Control Panel > Administrative Tools > Computer Management > Device manager.
- Click on Human Interactive Devices
- Disable the capabilities for:
  - HID Compliant Touch Screen
  - HID Compliant Pen (if applicable, e.g. for Microsoft Surface computers).

This will allow the TreeView control to function normally. The settings may be returned to normal at the completion of a Frames/GENII session.

How do I set up a new calculation?

GENII provides great flexibility in setting up cases. The GENII and FRAMES systems allow nearly unlimited combinations of models to simulate the characteristics of the problem being evaluated. The step-by-step procedures for initially establishing a case's input file, assigning and positioning icons, entering user inputs, running the individual component models, and viewing intermediate and final outputs are detailed in the Users' Guide.

However, a series of pre-developed data-entry *Templates* are available with the Full Edition that greatly simplify routine calculations. To use the *Templates*,
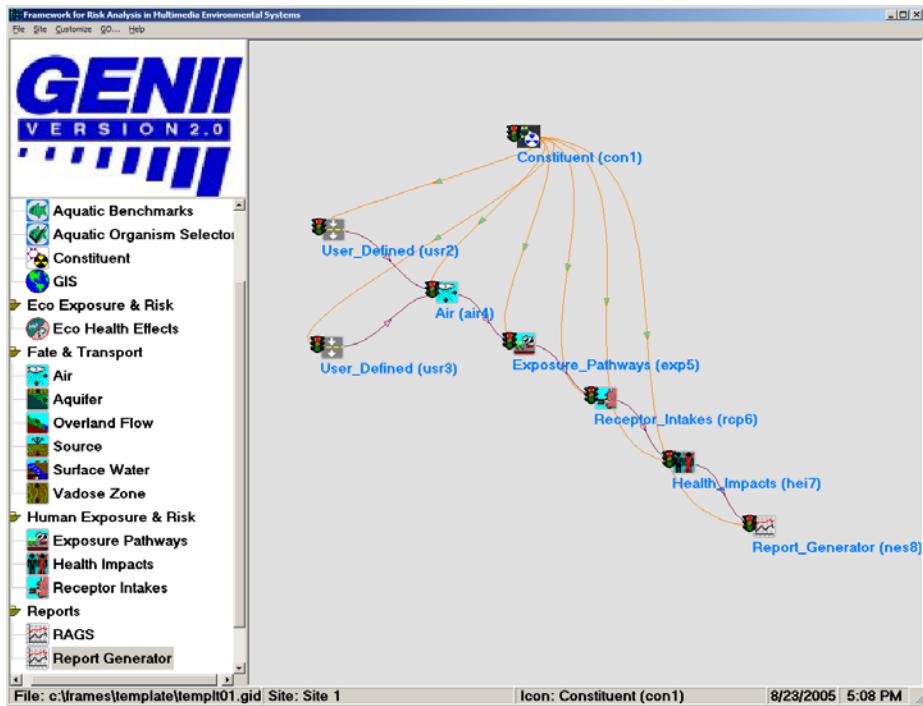
1st – Start the FRAMES system. This may be done using the Windows command sequence **Start\Programs\FRAMES\FRAMES 1.7.** (Note that is may be convenient to copy the FRAMES 1.7 icon to the computer desktop, or to the Windows Quick Launch toolbar, from which it may be launched using a click on the icon.)

2nd – Left click on the File\Open command sequence at the upper left corner of the FRAMES screen. This will open a selection menu as illustrated. A *Template* directory will be visible – *double click* on the *Template* directory.

3rd – Select one of the available templates by highlighting it and selecting *Open*. Several templates are pre-established for atmospheric chronic release sources and other common starting points.
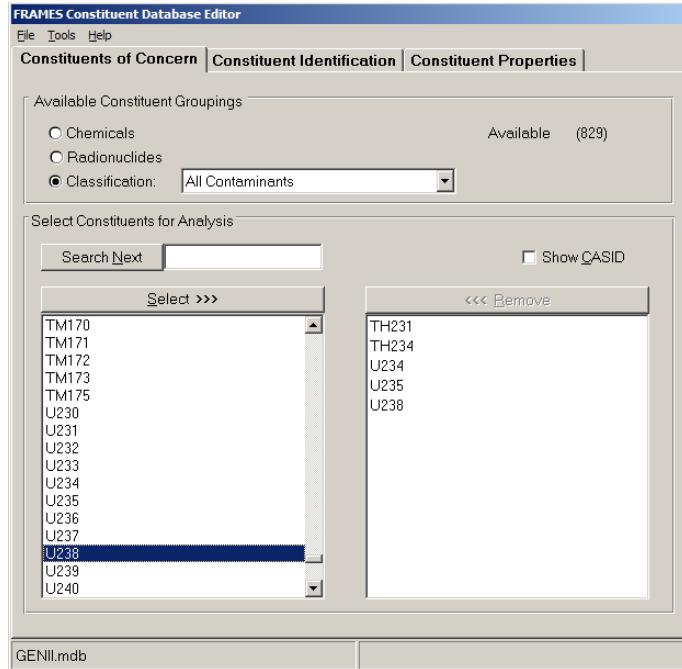
4th – The selected template will appear on the FRAMES screen. All module connections and model selections are now made; this is indicated on the screen as a series of icons, connected with colored lines, as shown below. It is recommended that the file now be saved using the FRAMES *File\Save As* command; the user should assign a new name to the file so that the *Template* is not inadvertently overwritten.
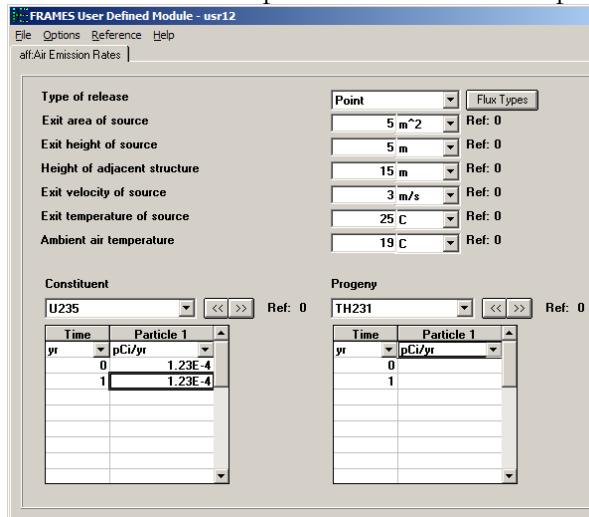
 Each icon will have a red "signal light". The user need only enter the minimal information necessary to define the case. This is done by sequentially completing the icons from right-to-left and top-to-bottom on the screen (each icon has an associated 3-character name followed by a number – follow the numbers beginning at 1). Begin with the Contaminant Database icon near the top of the screen (it will be labeled "*con1*"). *Right-click* on the icon. Select *User Input* (the *General Info* selection has already been made for the icon). This will open a screen for the FRAMES Constituent Database Editor. At this point, the user selects the radionuclides of interest in the source term. They may be selected by scrolling through the large screen on the lower left with the scroll bar, or by typing the radionuclide name in the *Search Next* box. Radionuclides are listed alphabetically in the database, by standard atomic symbol followed by a hyphen and the atomic mass (e.g. Ra-226). They may be selected with either a *double click* on the highlighted name, or by highlighting and using the *Add>>>* button. Note that decay progeny are automatically added to the list.
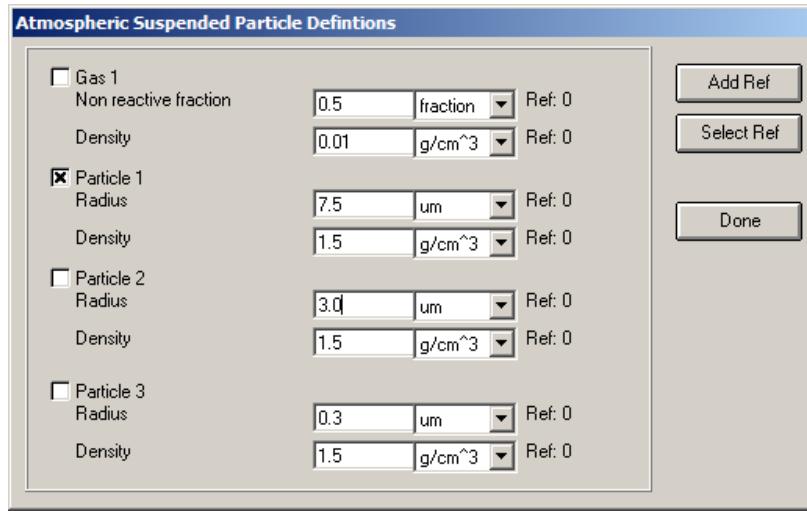
To complete the radionuclide selection, *left click* the *File* command and select *Save and Exit*. The window will close, and the contaminant icon on the FRAMES screen will now show a green "signal light" indicating that the data selection is complete.

5th – Assuming that an atmospheric transport template has been selected, complete the data entry for each of the individual atmospheric source term modules selected (the *Templates* allow from 1 to 5 of these). *Right click* on the icon and select *User Input*. This will open a screen similar to that shown below.
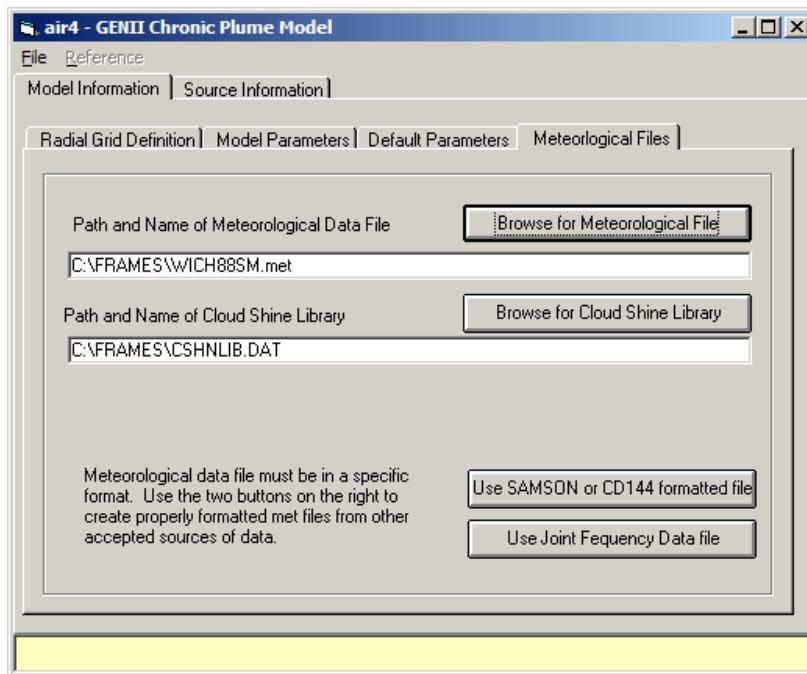
First *left click* on the *Flux Types* button, which will open a separate screen as shown on the next page: Identify the number of particle sizes desired by checking the boxes, and enter the desired particle sizes. If one or more of the radionuclides is a noble gas or iodine in a gaseous phase, also select the *Gas* check box. The *Non reactive fraction* is the portion of the release that is chemically inert (GENII sets noble gases to 1.0). Then left click on the *Done* box. This will allow the user to complete the source term input on the initial screen.
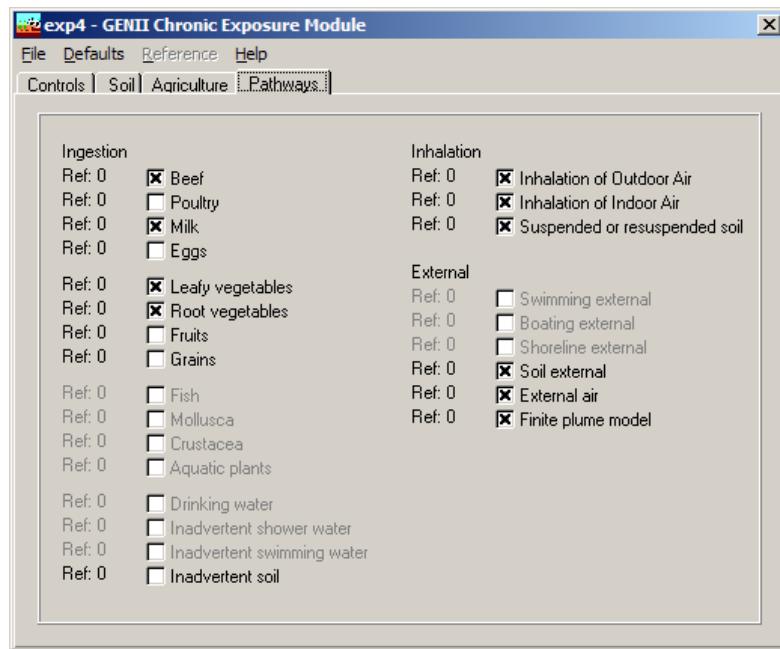
FRAMES allows input of time-varying source terms; note that GENII will integrate the variability into a constant annual average release rate. The input rates may be in various multiples of Ci or Bq and units of time. Thus, even for a uniform release, two values, one for the beginning and the other for the end of the period, are required (e.g., 0 and 1 year). If the Options/Release Multiplier selection is checked, the user may also supply a modification factor for the entire entered source, or selected portions. When data entry is completed, click on *File\Save and Exit*.

6th – **Right click** on the atmospheric transport icon and select *User Input*. The only required input beyond the defaults is the identification of the meteorological data file to use, which is on the Meteorological Files tab as illustrated.
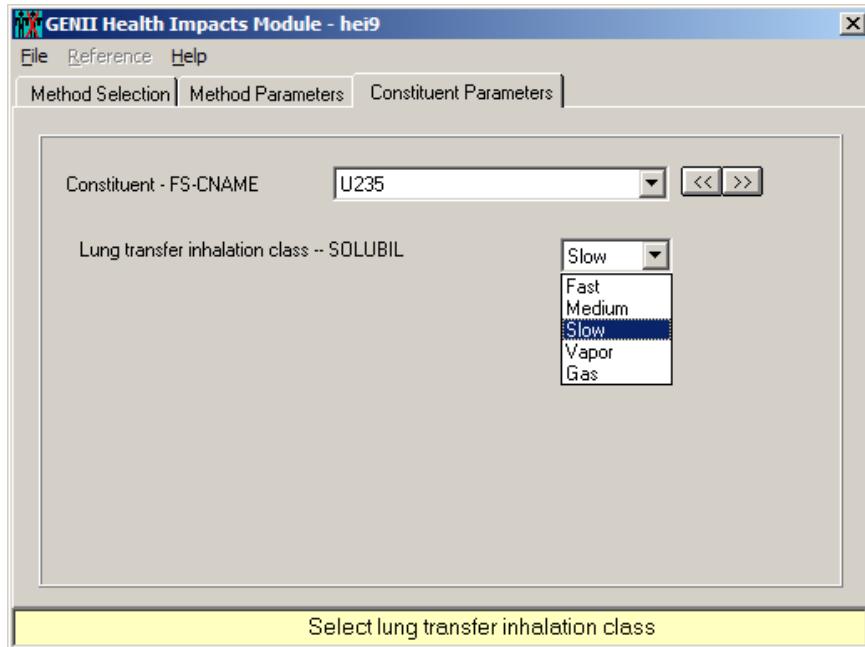
Use the *Browse for Meteorological File* button, highlight the desired file, and click on *Open* to select the input data. Sample files supplied with GENII end with the extension *.met. Then right click on *File\Save and Exit*. The Atmospheric transport icon should now show a yellow "signal light".

7th – *Right click* on the exposure pathways icon (the "cow") and select *User Input*. This will open the input screens for the GENII Chronic Exposure Module. This module has many input options, for which default parameters are provided. Select the *Pathways* tab and check those pathways appropriate for the scenario being calculated. Finish this module with the *File\Save&Exit* command.

8th – *Right click* on the icon for receptor intake and select *User Input*. This will open a screen requesting that the user select the number of individual *age categories* desired for the calculation. For regulatory purposes, this is generally 1 (adults). All individual parameters have defaults filled in, so finish this module with the *File\Save and Exit* command.

9th – *Right click* on the icon for Health Impacts estimates and select *User Input*. Select that the radiation doses be calculated using either ICRP Publication 30 methods or ICRP Publication 72 methods. Either selection requires an additional set of inputs, found under the *Method Parameters* tab. The ICRP-30 calculations need only selection of endpoints (dose, cancer fatality risk, cancer mortality risk); these calculations return only the effective radiation dose. The ICRP-60/72 calculations require selection of endpoints plus some additional radionuclide-specific information via the *Constituent Parameters* tab. The radionuclide specific information required specifically is the inhalation lung transfer classification of each radionuclide, as shown in the following figure. The category for each nuclide is selected from the drop-down box. Move between various radionuclides with the scroll boxes or by using the **<<** or **>>** buttons. More information concerning these categories is provided in *Help*. When data entry is completed, click on *File\Save and Exit*.

10th – Some of the templates include a prototype report generator module. The few inputs to this may be accessed using a *right click* on the icon and selecting *User Input,* if the module is included in the template. The report generator consists of a simple interface, which prompts the user for inputs and prepares a permanent ASCII file for viewing and/or printing when run. The report generator will provide either an overall summary of both individual doses or collective (population) doses, if a population distribution file is available (see the Users' Guide for format requirements).

11th– The final results may now be calculated. The individual modules may be run separately by *right clicking* on each and selecting *Run Model*. In this mode, the modules must be run in sequential order, so that subsequent modules have all of the necessary information. As each module is run, the indicator "signal lights" will turn green on the icons. Alternatively, the user may select the *GO* button from the FRAMES menu bar at upper right of the FRAMES screen. This button will run each module in order.

How do I access the results?

Each module has intermediate outputs that may be viewed by the user. To check any intermediate output file, *right click* on the icon of interest, and select *View/Print Module Output*. For some modules, there may be several options for viewing; some of these are simple text viewers, others involve various graphical ways of viewing the output.

To view the dose and risk results, *right click* on the Dose/Risk icon and select *View/Print Module Output*. The dose and risk files may be very large (for a multiple location site with several radionuclides and several exposure pathways, or several age groups), sometimes in excess of several tens of megabytes. The individual viewers may appear to react slowly, because they are summarizing so much information.
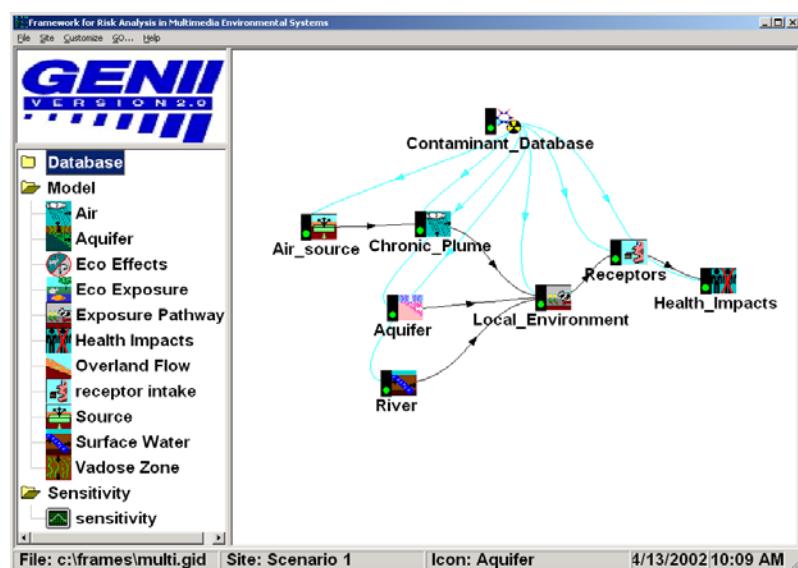
A special *report generator* has been prepared that summarizes information in a format suitable for printing. This is the *GENII Report Generator.* To view the dose and risk results, *right click* on the Report Generator icon and select *View/Print Module Output.* This output may also be viewed (with somewhat better formatting) with most text editors or word processing software. This particular portion of the GENII software is intended as an example; users are encouraged to develop additional specialized output formatting modules for individual uses.

Can I start a case from scratch?

Yes. The full procedure, including use of each of the individual modules, is described in the GENII Version 2 User's Guide. A brief summary is provided here.

It is necessary to begin with a Conceptual Site Model – akin to those provided in the Templates. The Conceptual Site Model is built by the user based on the conditions of the problem that is to be solved. The site is simulated on the screen by choosing icons to represent the various major environmental media or activities to be modeled and connecting lines that represent the real or potential flow of contamination.

This figure illustrates the conceptual model for a specific modeling exercise as represented on the FRAMES main screen. For the hypothetical case represented in this figure, three major routes of contaminant transport are acting at a single location. Contamination is being released from a source into the atmosphere, and groundwater and surface water also are contributing contaminants to the environment at the location of interest. Contaminants are entering the food chain, individuals are being exposed, and, in this case, the effects of the contaminants on their health are being evaluated. Each icon on the Conceptual Site screen represents a real entity. For example, the River icon represents a local source of surface water, and the Aquifer icon represents the groundwater at this location. The dark lines connecting the icons on the screen visually show the paths that the contaminants follow. The lighter lines indicate that each icon is connected with, and has access to, information in the contaminant database. After the site model has been built and the case has been run, the user can view the results by running intermediate data viewers for each icon.

Basic FRAMES Controls

There are five standard menu items on the FRAMES menu bar. These are File, Site, Customize, GO, and Help.

The **File** menu consists of five groupings, in standard Windows® format. The first grouping includes **New, Open**, and **Close**. These are the first options invoked in creating a new input Conceptual Site Model, in editing an existing Conceptual Model, or in finishing work with one. Upon first starting FRAMES, no new activities can be started without first selecting either **New** or **Open**; either of these options activates the FRAMES workspace. For a new case, the system will prompt for a file name before the user is allowed to enter data into the first module user interface. The **Save** and **Save As** options save the current contents of the workspace in global input data (GID) files of the user's choice. The **Print** command sends information about the case displayed in the workspace to the printer. There are numerous available sub-options for printing: the Conceptual Site Model picture may be printed along with a user-prepared summary description, and for each icon in the model, summary information about the model selected, the input data entered, and any user-supplied references may be optionally selected. The user has the option of adding references to model and data selection choices throughout FRAMES and GENII; the most generally accessible place to start these descriptive additions is with the **References** and **Project Description** menu selections. Each of these menu selections opens a window in which textual information may be entered for later retrieval; the information entered is saved in ASCII files associated with the project's GID file. Such entries are a useful method of documenting decisions and data sources used in establishing the basis for an analysis. FRAMES retains links to the four most-recently accessed GID files; clicking the mouse on one of these is equivalent to using the **Open** command. Finally, the **Exit** command shuts down all FRAMES operations, after first providing the option to save any changes or additions made during the work session.

FRAMES offers several ways to organize the Conceptual Site Model. If the user so desires, several Sites may be related and saved in the same Global Input Data file. This option is available using the **Site** menu. The Site currently active is shown in the FRAMES workspace; the name of this site is displayed in the second box on the bottom of the FRAMES window, as illustrated in the figure. The default Site name of *Site 1* is used. Clicking on the **Site** menu allows access to options to create a **New** Site, **Rename** the active Site, and switch between Sites. Use of multiple Sites within a single GID file may be an advantage to users with complex problems in simplifying data organization, reporting, or records holding.

The **Customize** menu provides the FRAMES user with the ability to control the overall look of the FRAMES window. Every icon in a Conceptual Site Model has an internal identifier used by FRAMES to control data flow to and from the component models. The **Show Object ID** option allows the user to see the actual identifier assigned by FRAMES. This identifier is the default identifier used in the **General Info** command described below, and is stored in the project GID file. If the user will be reviewing the GID file for any reason, this is useful information; however, the display by be suppressed to simplify complex Conceptual Site Model displays. The **Show Icons** option may be used to simplify the display in the left-hand FRAMES window. Use of this option will remove the display icons

from the selection window, leaving only the model type names displayed. The **Font** option allows the user to use any of the fonts available in Windows in the FRAMES display. The **Colors** option gives the user the ability to change the display colors of the FRAMES background and various types of connecting lines. This capability may be used to make viewing easier under various conditions, to highlight specific features of a Conceptual Site Model, or to simplify complex diagrams in the FRAMES window. The **Logo** option allows the user to display a model logo in the box at the upper left of the FRAMES window.

The **GO** command is a convenient way of running a computation after a Conceptual Site Model has been constructed. This single function starts FRAMES in completing all necessary steps in an analysis. All models are run in sequence; if data inputs are necessary, the data input is prompted before the models are run. This option will not run viewers or sensitivity/uncertainty modules. More is described about this below.

The **HELP** command will bring up a hypertext file summarizing useful, and usually context-specific, information.

Navigating the FRAMES Window

In order to build a Conceptual Site Model in the FRAMES workspace, the user must select the appropriate model icons, connect them in the desired order, and assign models and data to them.
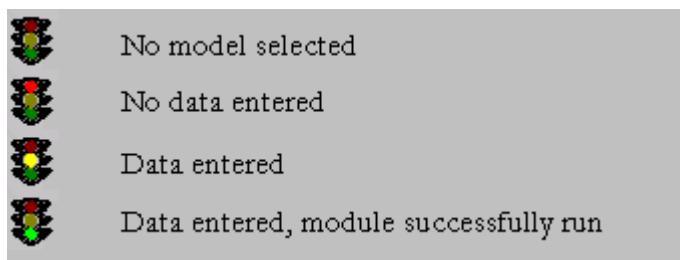
Icons are selected from those available in the left-hand window. To select an icon, place the mouse cursor over the icon or icon label in the left window and double click the LEFT mouse button. This will add an icon of the selected type to the FRAMES workspace. Repeat until the desired icons are all selected. The only icon type required for all analyses is the Contaminant Database icon; only one of these is allowed per Conceptual Site Model.

Icons may be moved about the screen and arranged in any order. It is usually desirable to place the icons in an order that is logical from the physical description of the system and flow of data from beginning to end of the calculation, and that results in clear lines of communication. The icons are moved by placing the mouse cursor over them, clicking and holding the LEFT mouse button, and dragging the icon to the desired location.

The icons must be connected in the way that data and intermediate results will proceed. To connect icons, the user must hold down the SHIFT key then LEFT-CLICK and drag the arrow from one Icon to the next. Alternatively, the user may highlight the icon, RIGHT-CLICK, and use the **Connect-Disconnect** feature. To remove connector lines, repeat the SHIFT, LEFT-CLICK, and drag used to connect the icons, tracing the same path, or use the **Connect-Disconnect** feature. Note, in FRAMES 1.7, all model icons must be connected to the Contaminant Database icon; the connecting lines for database connections will generally appear in a different color than the contaminant flow lines. Lines may be added and removed as often as necessary during the Conceptual Model construction.
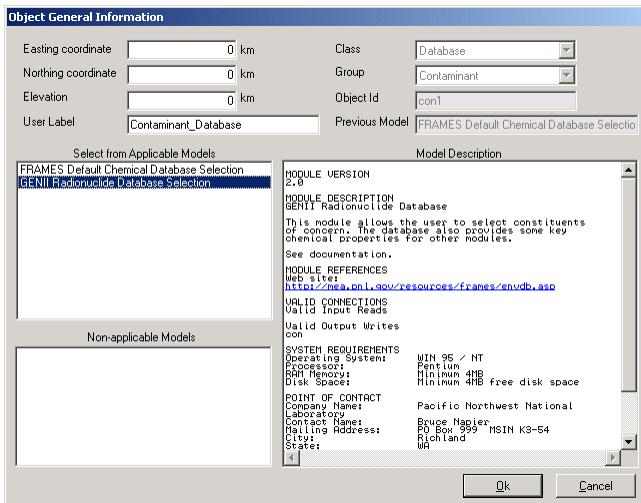
To delete an icon from the workspace, place the mouse cursor over the icon, click the RIGHT mouse button, and select the **Delete** option from the menu that appears. Removing an icon will simultaneously remove any connecting lines attached to it.

All icons have an associated status indicator attached in the form of a "traffic light." The status indicator appears as a solid black bar on the left side of the icon. The indicator will change appearance as actions are taken during the case construction. When the icon is first placed in the workspace, and after it is first connected to other icons, it will appear all dark. When a model has been selected and associated with the icon, it will display a red light. When data entry for the model has been completed, the indicator will display a yellow light. When the model has been successfully run, the indicator will display a green light. The various appearances of the status indicator are as illustrated.

When the overall design of the Conceptual Site Model is completed, individual computational models may be associated with the icons. To select a specific model from a module type icon, first ensure that all module connections are complete, then RIGHT-CLICK on the icon and choose **General Info**. The model selection screen will appear as shown. This screen will display the models that are applicable for assignment to this icon. The type of icon and the way that the connecting lines have been drawn will determine the models available. Two windows are shown on the left of the model selection screen, applicable and non-applicable models. The total number of models shown in both windows will be all those of this icon type available on the computer; the ones applicable to the situation as diagrammed will be listed as available. If the model desired is listed as non-applicable, it is usually because the connection lines have been drawn in such a way as to preclude its use, so the Conceptual Site Model may need to be reviewed or revised.

To select a particular model from the available list, highlight it with a LEFT click of the mouse cursor. This will place a summary description of the model in the large window on the right side of the screen. Note that default Object ID is listed on this screen and also used as the default for the User Label. This is the best time to name the icon in the User Label box if an identifier other than the default Object ID is desired to be shown on the FRAMES workspace. Other fields on this screen are associated with specific model inputs, and are described in their specific sections.

When the model has been selected, LEFT click on the OK button and the active window will return to the FRAMES workspace. If the model was selected correctly, the status light will be red.

The model selection activity should be repeated for all icons. This may be done manually for each, as described above, or the process may be speeded up using the **GO** menu.

Model selection must start with the first models in the connected string. Models available for the second, third, and subsequent icons in the chain may depend on those that have been selected earlier. Note that once a particular model has been selected, FRAMES then assumes that those further down the computational chain are dependent upon it. If, at a later time, changes are made to the **General Info** window, FRAMES will assume that subsequent modules also require review to ensure that the entire chain of calculations has not been altered. Thus, the sequence of status indicators will change from their prior state to a darkened state until the model selection and data entry have been reviewed.

Additional commands available with a RIGHT click of the cursor over an icon include **User Input** and **Run Model**. The User Input selection becomes available after a model has been selected. Selecting User Input will start the user interface for the specific model assigned to the icon. When all data have been entered, the Run Model selection will become available. This selection actually causes the model to run with the data input, creating whatever intermediate data it provides. Upon running the model, the Print/View User Input and Print/View User Output options are activated. These selections start FRAMES data viewers that allow review of the input and output information for each module. These viewers are specific to the type of data being examined and are described in more detail in the specific sections for which they are applicable.