Pacific Northwest
NATIONAL LABORATORY

PNNL-31150

# GENII Examples 5 & 7

April 2021

JA Bamberger
BA Napier

Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
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Pacific Northwest National Laboratory
Richland, Washington 99354

# Abstract

The GENII computer code was developed for the Environmental Protection Agency (EPA) at Pacific Northwest National Laboratory (PNNL) to incorporate the internal dosimetry models recommended by the International Commission on Radiological Protection (ICRP) and the radiological risk estimating procedures of Federal Guidance Report 13 into updated versions of existing environmental pathway analysis models. The resulting environmental dosimetry computer codes are compiled in the GENII Environmental Dosimetry System. The GENII system was developed to provide a state-of-the-art, technically peer-reviewed, documented set of programs for calculating radiation dose and risk from radionuclides released to the environment.

This document provides detailed instructions for setting up and running GENII Example 5 (genii_05.gid) and a summary of GENII Example 7 (genii_07.gid).

# Summary

The GENII computer code was developed for the Environmental Protection Agency (EPA) at Pacific Northwest National Laboratory (PNNL) to incorporate the internal dosimetry models recommended by the International Commission on Radiological Protection (ICRP) and the radiological risk estimating procedures of Federal Guidance Report 13 into updated versions of existing environmental pathway analysis models. The resulting environmental dosimetry computer codes are compiled in the GENII Environmental Dosimetry System. The GENII system was developed to provide a state-of-the-art, technically peer-reviewed, documented set of programs for calculating radiation dose and risk from radionuclides released to the environment.

This document provides instructions for setting up a model in Section 2, detailed step-by-step instructions for setting up and running GENII Examples 5 in Section 3, and a summary of GENII Example 7 in Section 4.

## Acknowledgment

The GENII computer code is a part of the US Nuclear Regulatory Commission Radiation Protection Computer Code Analysis and Maintenance Program (RAMP)[1] suite of computer models. GENII provides second-generation environmental dosimetry[2].

Updated contact information for GENII developer:
Bruce A. Napier
Pacific Northwest National Laboratory
PO Box 999
Richland, WA 99352
Bruce.Napier@pnnl.gov
509-375-3896

[1] US Nuclear Regulatory Commission Radiation Protection Computer Code Analysis and Maintenance Program (RAMP)[1]. https://www.nrc.gov/about-nrc/regulatory/research/ramp.html . Accessed 2021-03-20.
[2] GENII RAMP Website. https://ramp.nrc-gateway.gov/codes/genii . Accessed 2021-03-20.

# Acronyms and Abbreviations

| | |
|---|---|
| AC | air concentration |
| AFF | air flux file |
| ATO | atmospheric transport output |
| BBF | body burden file |
| CEDE | committed effective dose equivalent |
| EPA | Environmental Protection Agency |
| EPF | exposure pathway file |
| FRAMES | Framework for Risk Analysis in Multimedia Environmental Systems |
| FUI | FRAMES user interface |
| HT | tritiated gas |
| HTO | tritiated water |
| ICRP | International Commission on Radiological Protection |
| MEI | maximally exposed individual |
| MEPAS | multimedia environmental pollutant assessment system |
| OBT | organically bound tritium |
| PNNL | Pacific Northwest National Laboratory |
| RIF | receptor intake file |
| SCF | soil concentration file |
| WCF | water concentration file |
| WFF | water flux file |

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# 1.0 Introduction

The GENII computer code was developed for the Environmental Protection Agency (EPA) at Pacific Northwest National Laboratory (PNNL) to incorporate the internal dosimetry models recommended by the International Commission on Radiological Protection (ICRP)[1] and the radiological risk estimating procedures of Federal Guidance Report 13 (Eckerman et al. 1999) into updated versions of existing environmental pathway analysis models. The resulting environmental dosimetry computer codes are compiled in the GENII Environmental Dosimetry System (Napier 2012). The GENII system was developed to provide a state-of-the-art, technically peer-reviewed, documented set of programs for calculating radiation dose and risk from radionuclides released to the environment. Although the codes were initially developed at Hanford in 1988, they were designed with the flexibility to accommodate input parameters for a wide variety of generic sites.

The GENII Version 2 code has been documented in the following publications:

- Napier BA. 2012. GENII Version 2 Users' Guide. PNNL-14583, Rev. 4, Pacific Northwest National Laboratory, Richland, Washington.

- Napier BA, DL Strenge, JV Ramsdell, Jr, PW Eslinger, C Fosmier. 2012. GENII Version 2 Software Design Document. PNNL-14584, Rev. 4, Pacific Northwest National Laboratory, Richland, Washington.

- Snyder SF, CI Arimescu, BA Napier, TR Hay. 2013. Recommended Parameter Values for GENII Modeling of Radionuclides in Routine Air and Water Releases. PNNL-21950, Pacific Northwest National Laboratory, Richland, Washington.

This document provides instructions for setting up a model in Section 2, detailed step-by-step instructions for setting up and running GENII Examples 5 in Section 3, and a summary of example 7 in Section 4.

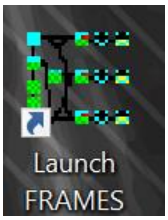
[1] ICRP website. https://www.icrp.org. Accessed 2021-03-20.

# 2.0 GENII Setup

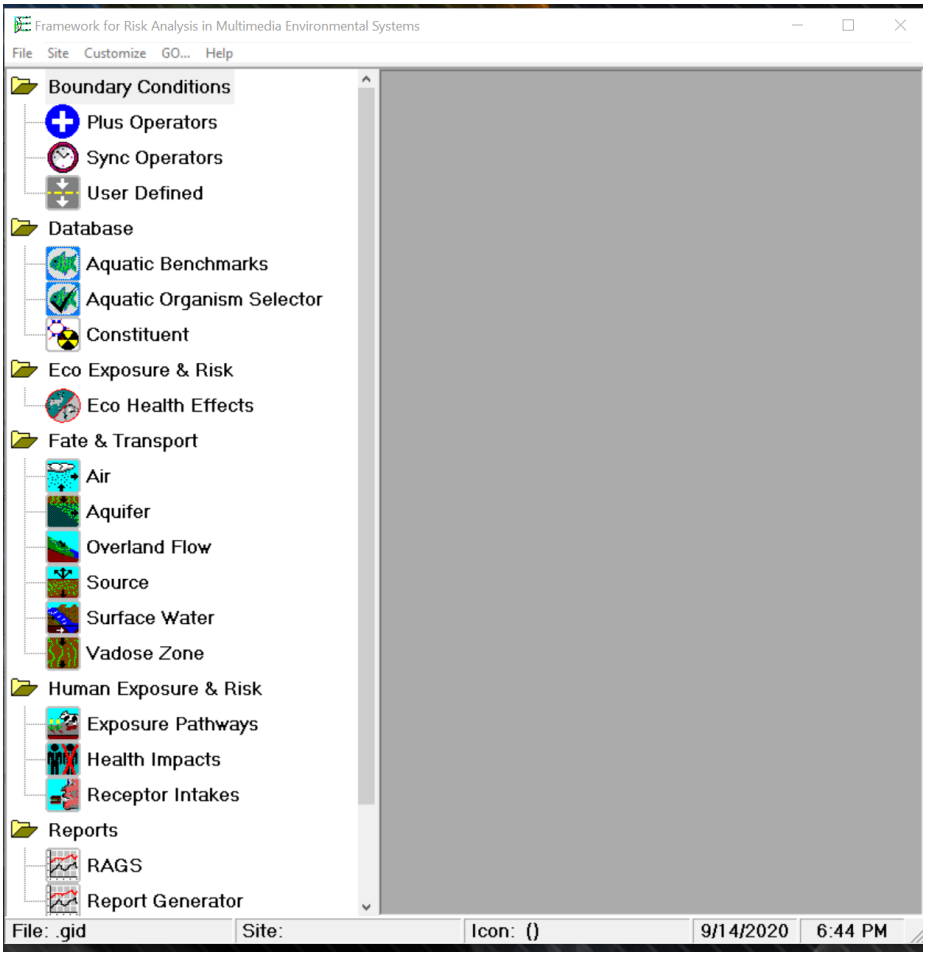
GENII runs using FRAMES. The code package provides interfaces, through the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) (Whelan et al. 1997), for external calculations of atmospheric dispersion, geohydrology, biotic transport, and surface water transport.

## 2.1 Starting and Customizing

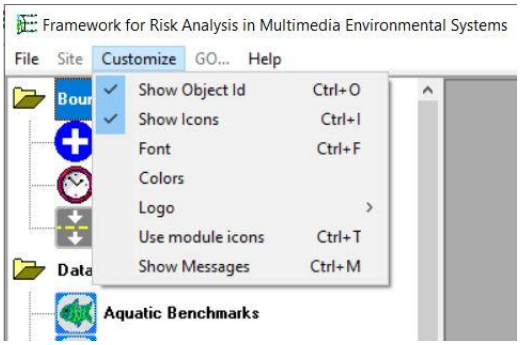
Start FRAMES system. Double click on the FRAMES icon on the desktop.




The GENII Program opens as shown below.

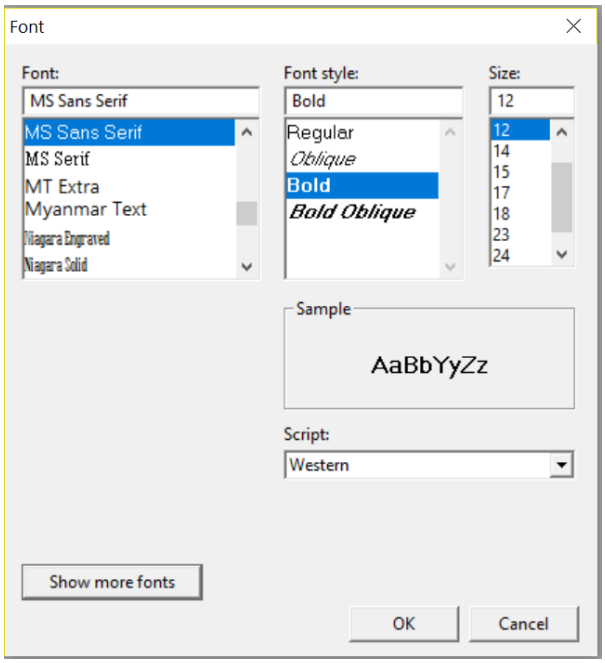


In the ribbon select Customize. The first two items ‘Show Object Id’ and ‘Show Icons’ are usually checked. The Object Id is a code shown in parenthesis to the right of the icon name (three letters followed by a number that is incremented sequentially for each added icon).

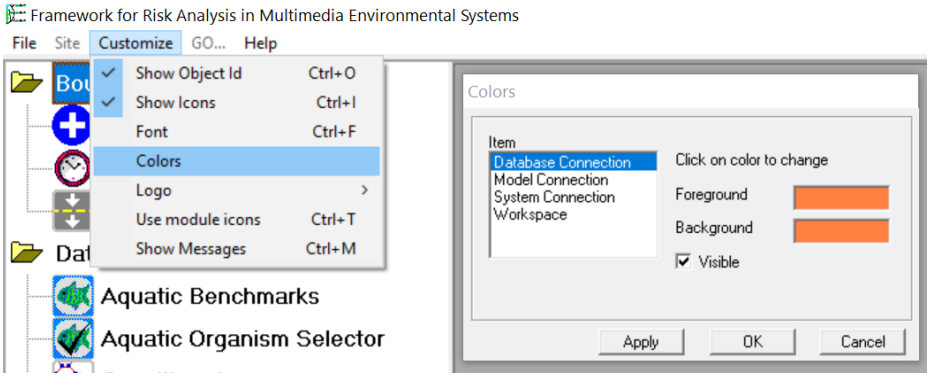



If ‘Show Icons’ is not checked, the icons to the left of each heading are removed.

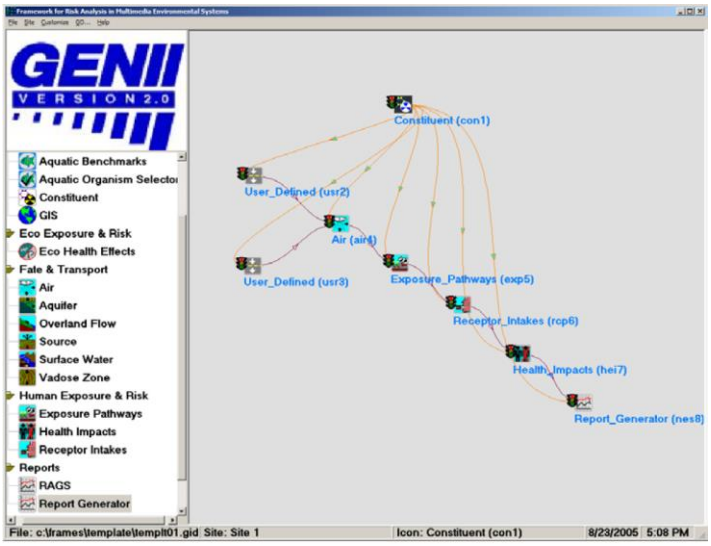
The Font selected is MS Sans Serif Bold 12 point.




Colors provides four options: ‘Database Connection’, ‘Model Connection’, ‘System Connection’, ‘Workspace’.

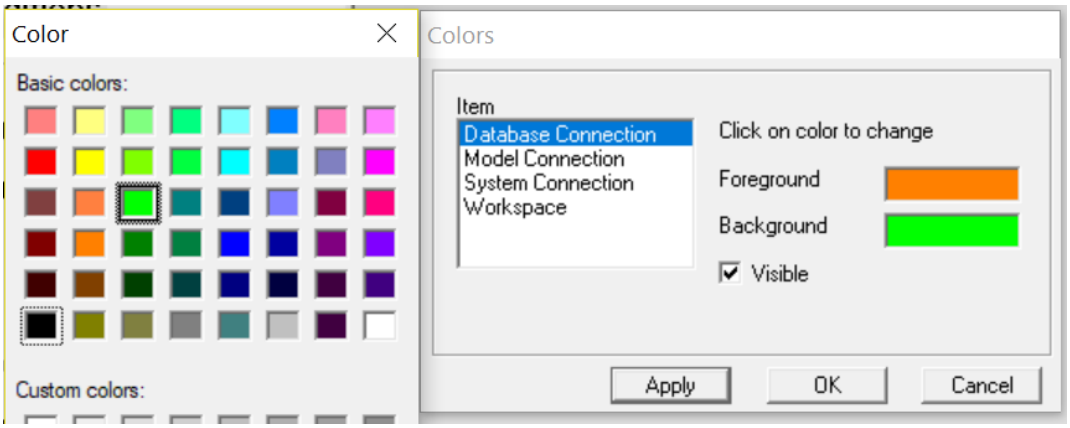



To match the color selections shown in the accompanying documentation “Getting Started with GENII Version 2” Figure on page 4 and shown below, select colors listed below.

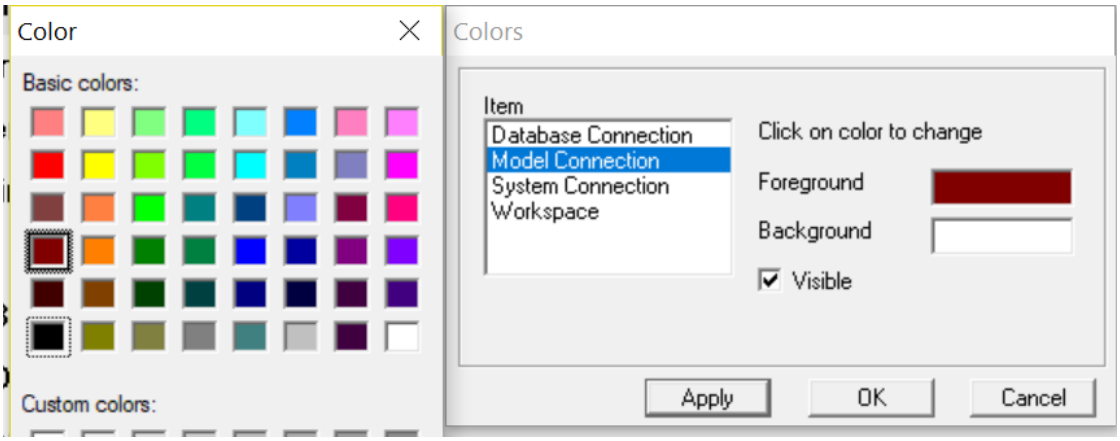



After selecting the color, select ‘Apply’ to transfer the color to the display. Then click ‘OK’ to close the item.

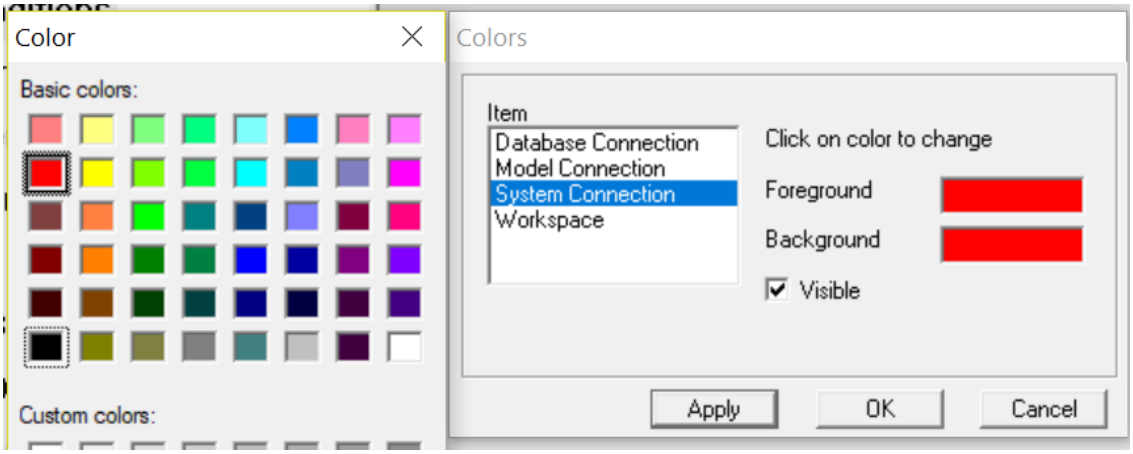
**Database Connection:** Select ‘Apply’ to select the color and ‘OK’ to transfer the color to the screen. The Foreground color is orange in the third row, second column. The Background color is green in the third row, third column. Checking ✓ Visible shows the connection lines and arrows.



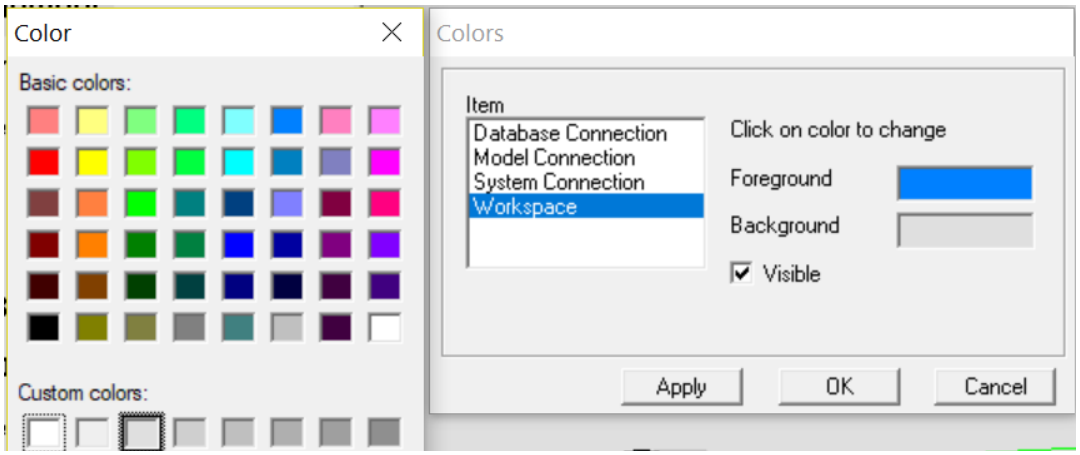

**Model Connection:** The Foreground color is brown in the fourth row first column. The Background color is white in the sixth row eighth column. Checking ✓ Visible shows the brown model connection lines and arrows.



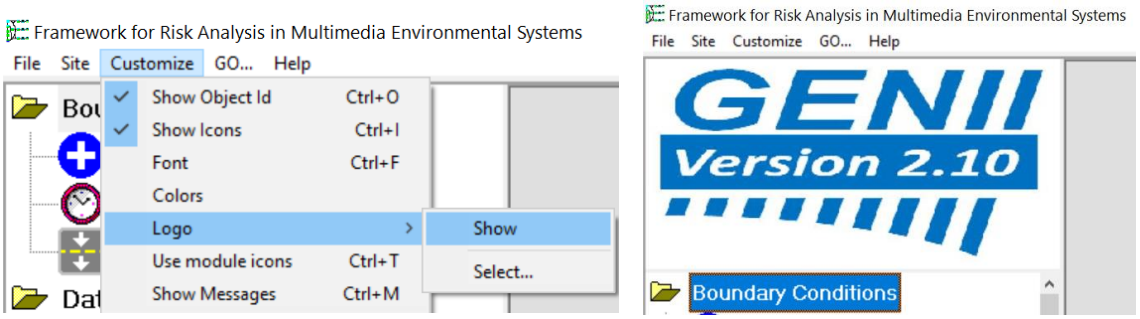

**System Connection:** The Foreground and Background colors are both red in the second column first row.



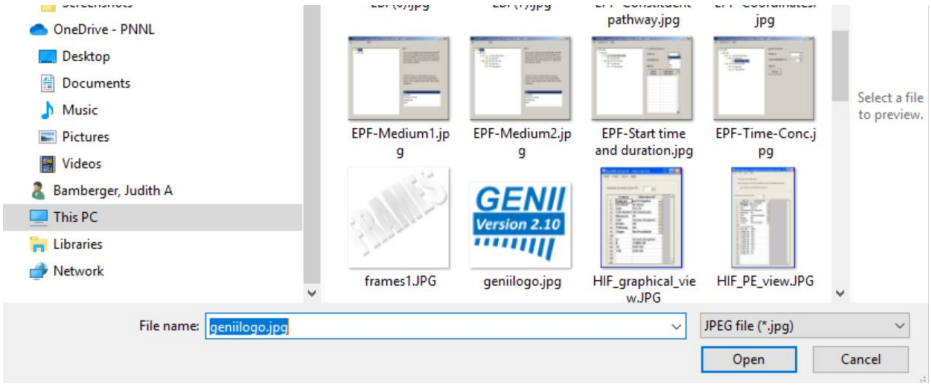

**Workspace:** The Foreground color is blue in the first row, sixth column and is the text color. The Background is Custom Colors light gray in the third column. Checking ✓ Visible shows the text labels on the display. To remove the labels, uncheck the visible box.



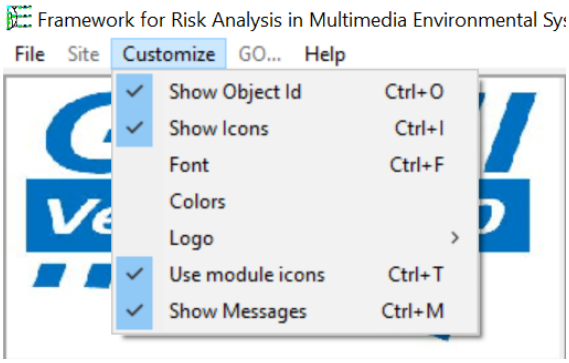

**Logo:** Select 'Show' to show the GENII Version 2.10 logo at the top of the display.




Choose 'Select' to add a custom logo at the top of the display. Select opens a window. Select 'geniilogo.jpg' for the GENII 2.10 logo.



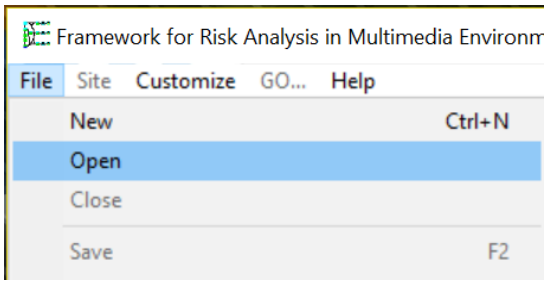

Other topics include 'Use module icons' and 'Show Messages'. If 'Show Messages' is selected, then a message window opens at the bottom of the screen.



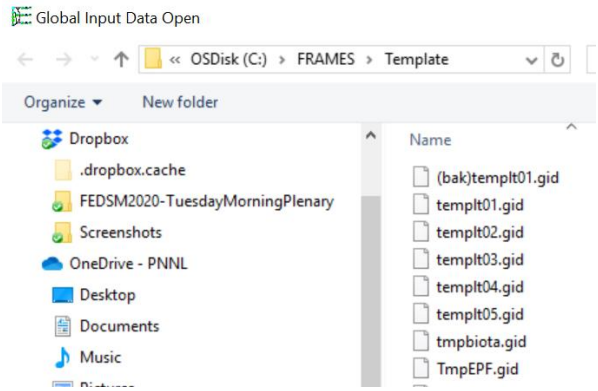

## 2.2 Setting Up a Calculation using Templates

Start FRAMES system. Double click on the FRAMES icon on the desk top.

Left click on File\Open command sequence at the upper left corner of the FRAMES screen.

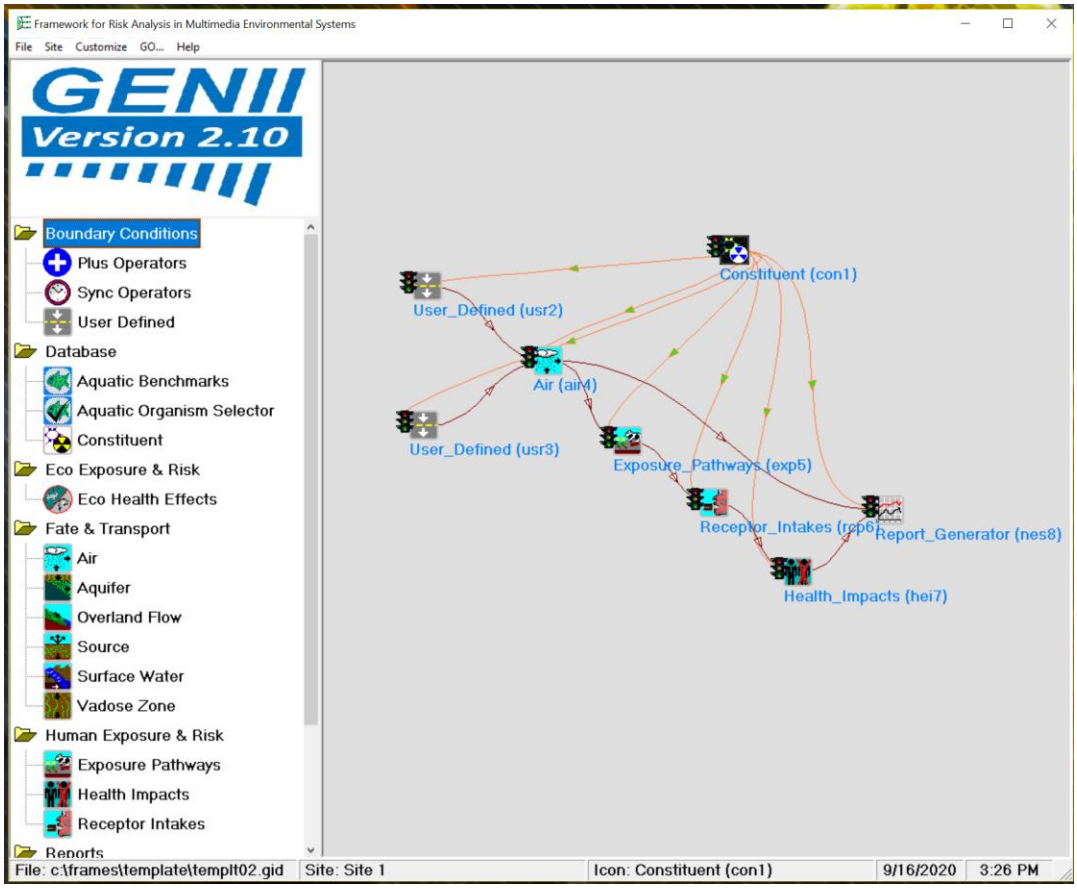



The selection list of templates opens that are located in the FRAMES>Templates folder.



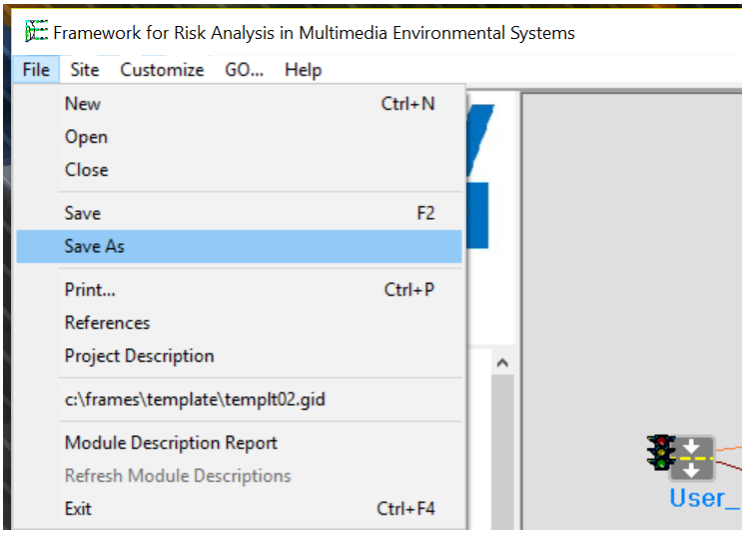

Select a template (templt02.gid in this example) by highlighting it and selecting ‘Open’. The selected template will appear in the FRAMES screen. All module connections and model

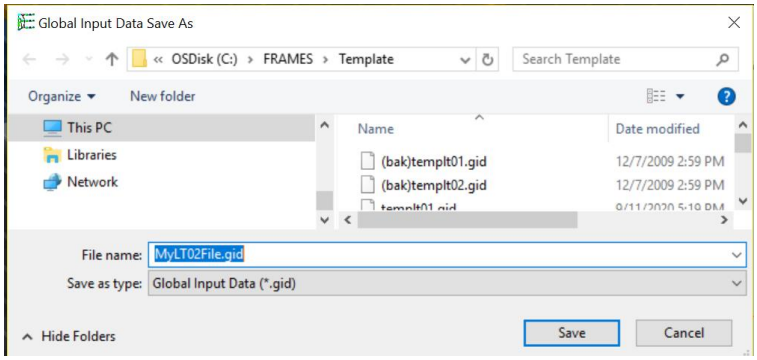
selections are now made. This is indicated on the screen as a series of icons, connected with colored lines as shown below.




This is the GENII 2.10 templt02.gid.

Save the file using the FRAMES File Save As command using a file name and directory of your choice.




Global Input Data Save As
« OSDisk (C:) › FRAMES › Template
Search Template
Organize
New folder
This PC
Libraries
Network
Name
Date modified
(bak)templt01.gid
12/7/2009 2:59 PM
(bak)templt02.gid
12/7/2009 2:59 PM
File name:
MyLT02File.gid
Save as type:
Global Input Data (*.gid)
Hide Folders
Save
Cancel

# 3.0 Step by Step Example 5

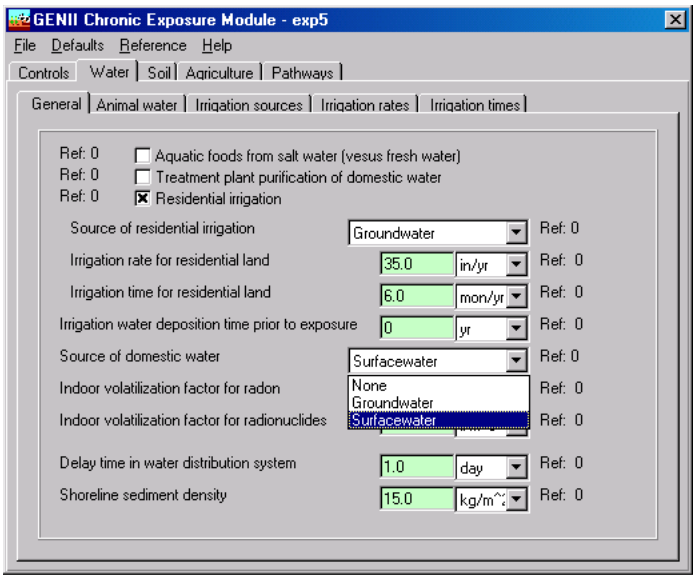
Step by step instructions follow for setting up Example 5 (genii_05.gid).

Examples are located in the GENII directory (c:\FRAMES\Examples).

Example 5 is concisely summarized below.

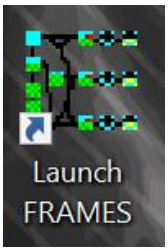
| Example | Description | Complexity |
|---|---|---|
| **GENII_05.GID** | Three sources (air, surface water, and groundwater) with user-defined nuclide concentrations cause exposures through animal products, crops, and aquatic food ingestion, as well as inhalation and external exposure. Irrigation is included. | Complex |

The following summary is provided in GENII Version 2 Users' Guide (Napier 2012).

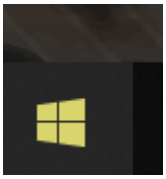
> **"GENII_05:** This example scenario is derived from the template TmpKnown, for which air, surface water, and groundwater concentrations of radioactive contaminants are known. For this example, the radionuclide $^{131}$I is selected, and the decay progeny $^{131m}$Xe is automatically added. The three known environmental media, air (via the ATO Air Module), surface water (via the WCF Surface Water-dissolved module), and groundwater (via the WCF Groundwater-dissolved module) are selected. For the air, the iodine is described as being in particulate form using the Flux Types button and known air concentrations, and total annual deposition rates are entered. For the two water concentration modules, a short time history of water contamination is entered. The GENII Chronic Exposure module is used to estimate concentrations of $^{131}$I in food crops from depositions from air and water. Sources of water for home consumption, irrigation, and farm animal use must be selected from the Water/General and Water/Irrigation Sources tabs, as shown:
>
> 
> 
>
> One age group (defined to be 0-70 years in this example) is selected in the GENII Receptor Intakes module, and consumption rates are input. The GENII Health Impacts module is selected, with the ICRP-26/30 option. Radiation dose is selected. The dose may be viewed by using the right-click and View/Print model output selection. Because three source media have been used, the output summaries are provided for all."

To open Example 5 using the stored example either

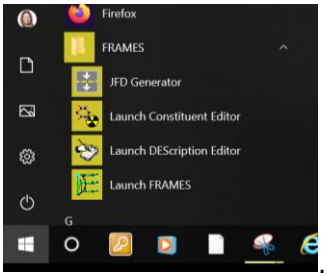
1) Double click on the Icon ‘Launch Frames’ or



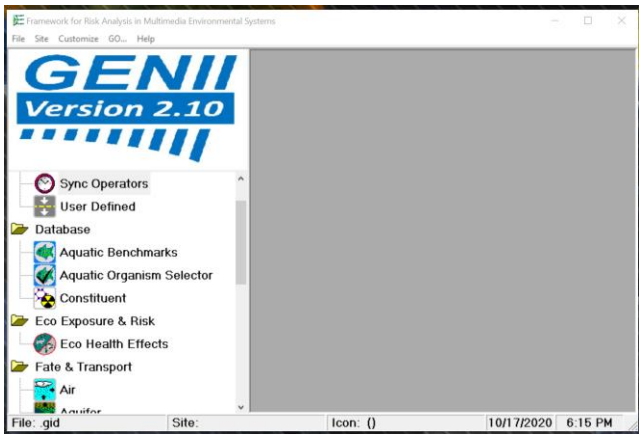

2) Left click on the windows icon in the lower left of the screen



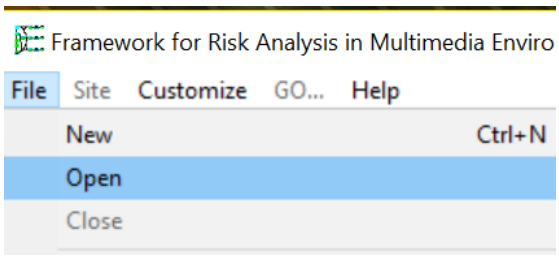
and select the Launch FRAMES icon as shown in the drop-down menu under FRAMES.



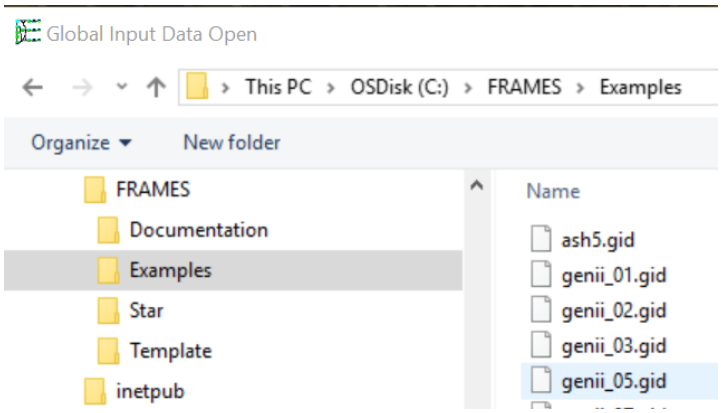

3) Or run \FRAMEX\FUI.exe (FUI stands for Frames User interface). The FRAMES Program opens.



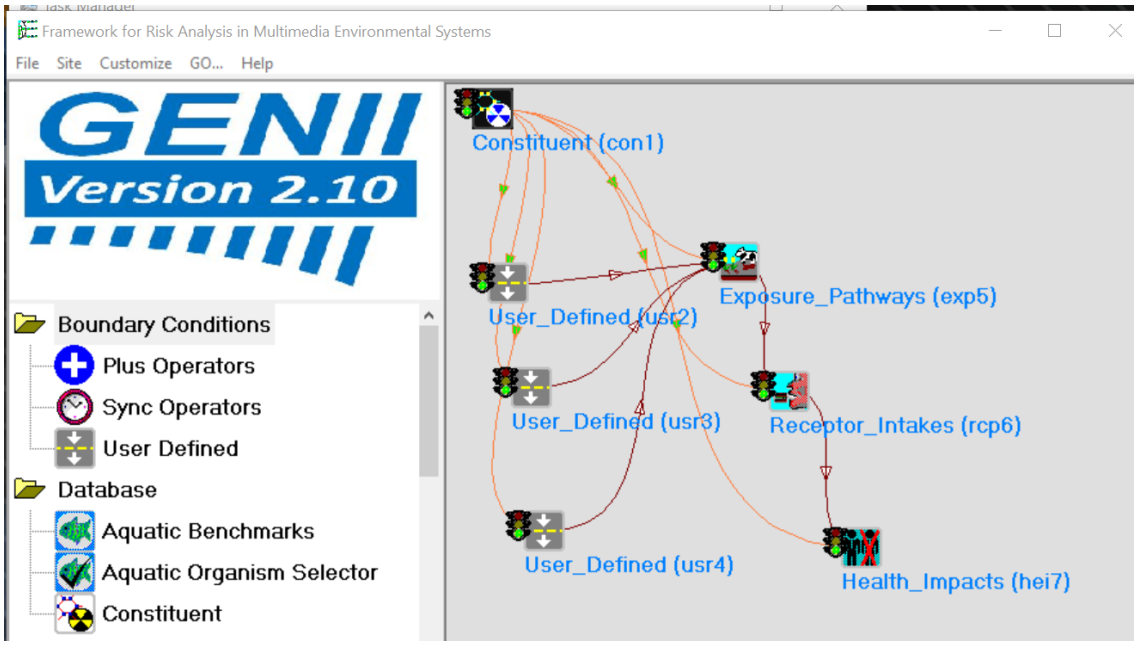

To open the completed Example 5, select File > Open,




then select FRAMES\Examples\genii_05.gid to open the completed example 5.




The completed Example 5 is shown below.




The example consists of seven icons arranged in a single “conceptual model”.

- Database
    - Constituent (con1)

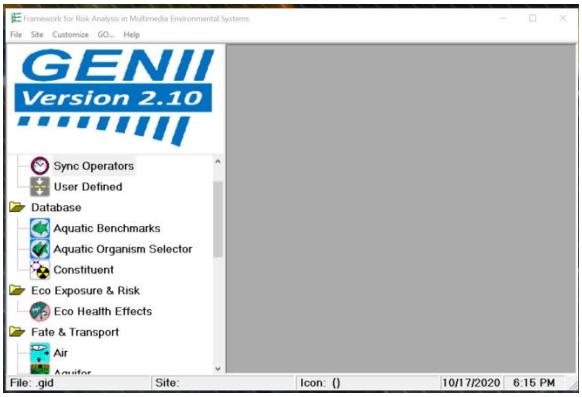
- Boundary Conditions
    - User_Defined (usr2)
    - User_Defined (usr3)
    - User_Defined (usr4)
- Human Exposure & Risk
    - Exposure_Pathways (exp5)
    - Receptor_Intakes (rcp6)
- Human Exposure & Risk (hei7)

Each of the icons has a name in parenthesis followed by a number; for example (con1). The example is built starting with the icon numbered 1, and each icon is added in succession ending with icon 7. The example will be constructed in the following steps:

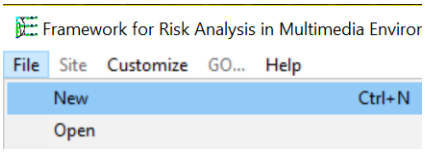
1) Open the program, open a new case, and name the site.
2) Add the icons to the display in a logical order and displayed so that the icons can be connected while being able to see the connections and read the icon names.
3) Add the connections between the icons. Each line has an arrow showing the direction of the connection.
4) Select the models for each step (Add General Information to the model).
5) Add User Input to the models.
6) Run the model.

## 3.1 Getting Started with Example 5

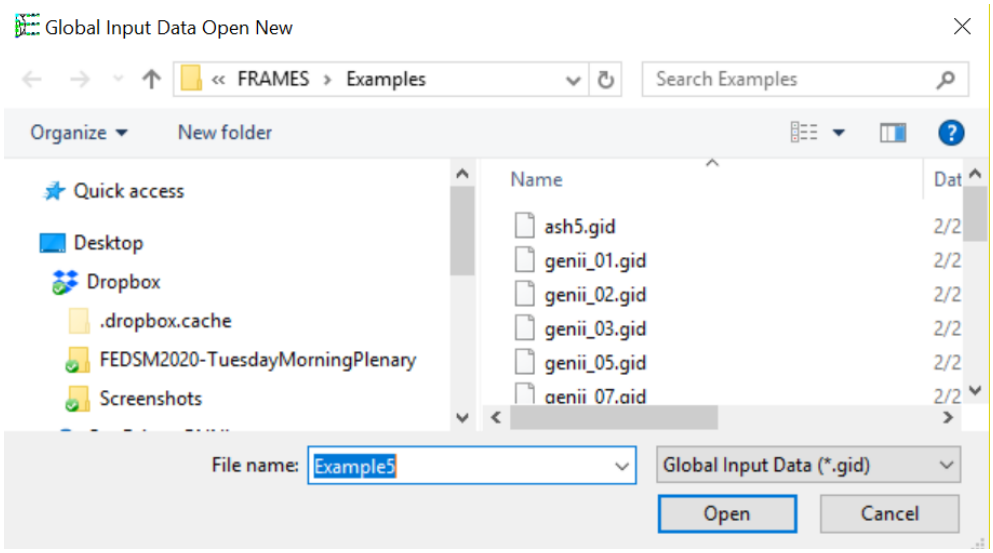
From the open FRAMES program screen open a new file.



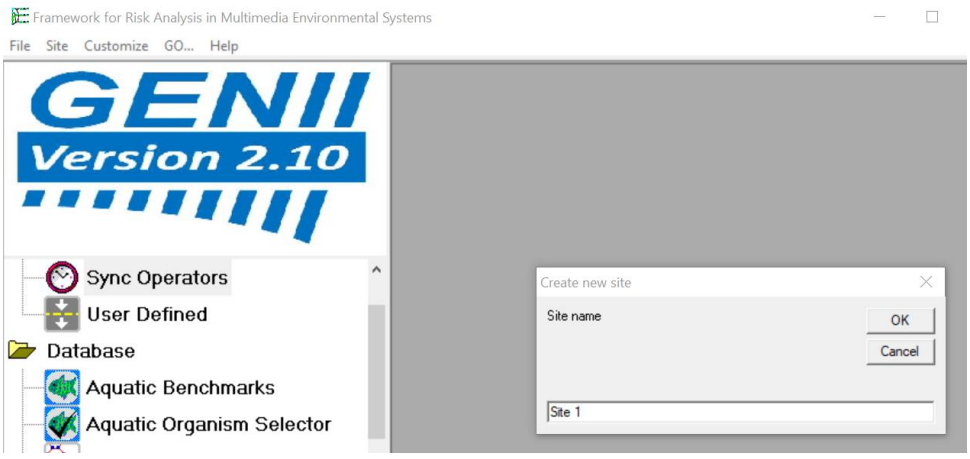

Select File > New.




The following window opens, and a File name is requested. Name this file Example5. Note the file name must contain eight characters or less. Note, this file is now stored in the Frames > Examples sub folder. You may save the file in a folder of your choice.




The program requests a site name. Multiple conceptual models may be saved in the same *.gid file by using Sites; only one conceptual model will be used in this example. The suggested Site name is ‘Site 1’. You may name the site ‘Site1’ as done here or select a name of your choice. After you have named the site select ‘OK’.



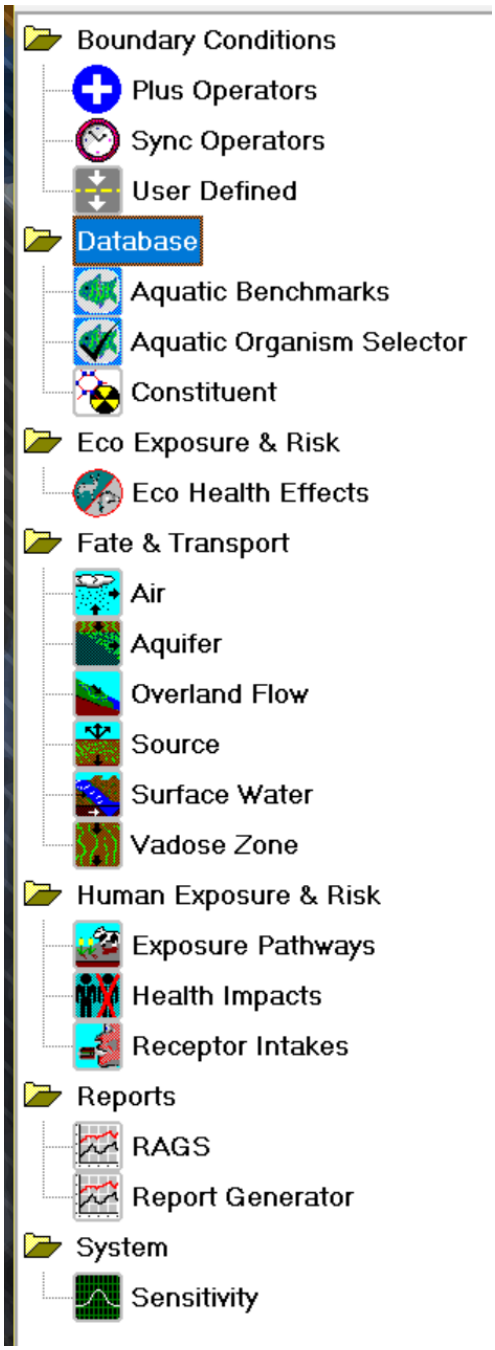

Note that at the bottom of the screen (in the second box from the left) the site is named (Site: Site 1).

Also note at the bottom of the screen the file location 'File:' is listed in the left box. The Site name is listed in the second box. The Icon is listed in the third box. The date is listed in the fourth box. The time is listed in the fifth box.

## 3.2 Add Icons to Example 5

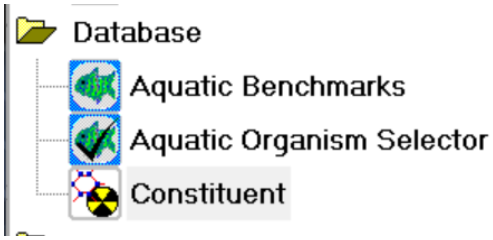
This procedure will add the seven icons (model types) sequentially to the model.

Start building the model using the tool icons shown on the left of the display. These items are grouped as 'Boundary Conditions', 'Database', 'Eco Exposure & Risk', 'Fate & Transport', 'Human Exposure & Risk', 'Reports', and 'System'.



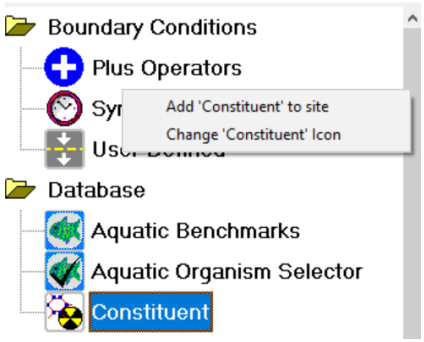

### 3.2.1 Icon 1 Constituent (con1) - Database

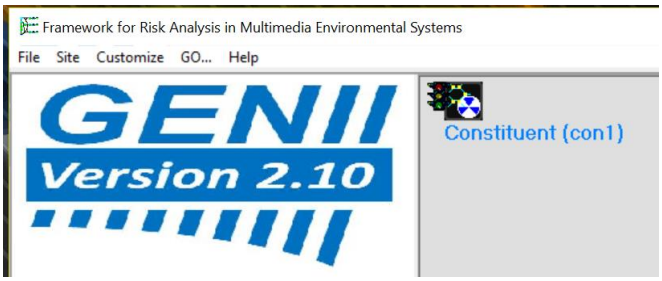
**Icon 1:** From the list of modules on the left of the window, add a Constituent Database to the center top of the display. Three data bases are provided: 'Aquatic Benchmarks', 'Aquatic Organism Selector' and 'Constituent'. Select 'Constituent' for this example.




Right click on ‘Constituent’. There are two choices: Add ‘Constituent’ to site or Change ‘Constituent’ icon. *Note, double clicking on the icon will also add it to the site*.

Select Add ‘Constituent’ to site. The icon shows up in the upper left corner of the screen. It is labeled Constituent (con1); the one signifies it is the first icon added to the model.



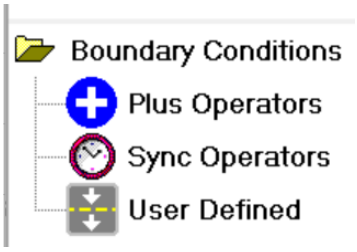




The icon name shows up in the 3rd box at the bottom of the display.

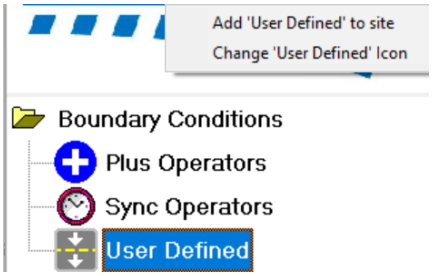
Move the icon slightly to the right of the screen near the top by clicking on the icon and dragging it with the mouse. By moving the icon, a space is available for the next icon to populate.

### 3.2.2 Icons 2, 3, and 4 User Defined (usr2), (usr3), and (usr4) – Boundary Conditions

**Icons 2, 3, and 4:** Add three Boundary Conditions to the upper left of the display, one below the other. Three Boundary Conditions are provided: ‘Plus Operators’, ‘Sync Operators’ and ‘User Defined’. Select three ‘User Defined’ icons for this model.



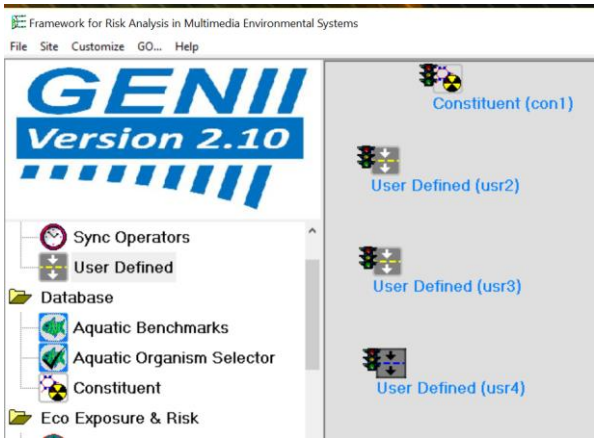

To add them to the upper left of the display: Right click on ‘User Defined’. There are two choices: Add ‘User Defined’ to site or Change ‘User Defined’ icon. Select Add ‘User Defined’ to site.




The icon shows up in the upper left corner of the screen. It is labeled ‘User Defined (usr2)’; the two signifies it is the second icon added to the display.

Move the icon to the left of the screen slightly below (con1) by clicking on the icon and dragging it with the mouse.

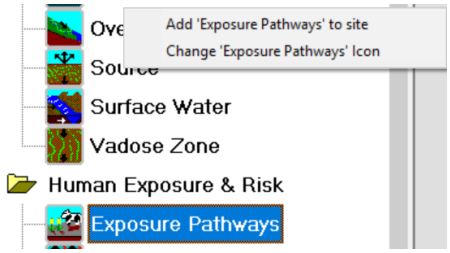
Following the steps above add a second and a third ‘User Defined’ Icons. Place them beneath the first ‘User Defined’ Icon. They are labeled ‘User Defined (usr3)’ and ‘User Defined (usr4)’ on the display.



### 3.2.3 Icon 5 Exposure Pathways (exp5) – Human Exposure & Risk

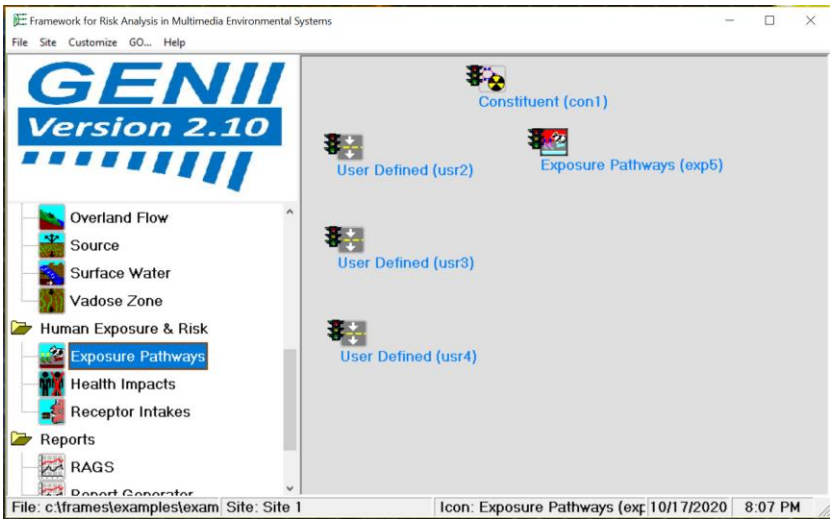
**Icon 5:** Add 'Human Exposure & Risk' to the model. Three items are provided: 'Exposure Pathways', 'Health Impacts', and 'Receptor Intakes'. To add Exposure Pathways to the model:

Right click on 'Exposure Pathways'. There are two choices: Add 'Exposure Pathways' to site and Change 'Exposure Pathways' Icon. Select Add 'Exposure Pathways' to site. The 'Exposure Pathways' icon shows up in the upper left corner of the screen. It is shown in red. Note the prior icon has changed arrow colors from black to white.




It is labeled 'Exposure Pathways (exp5)'; the five signifies it is the fifth icon added to the display. Position the 'Exposure Pathways' icon below and diagonally to the right of 'Constituent (con1)'.

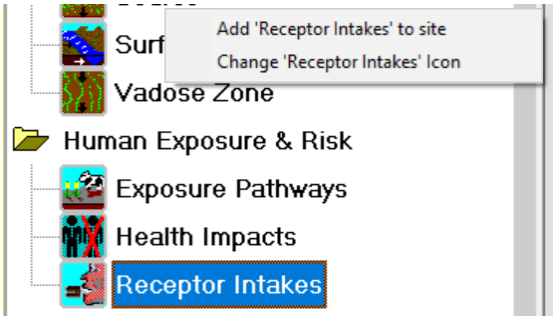
Note the color of the icon. The colors of the last to be input icon are reversed from that shown in the icon list. When another icon is added, the color of the prior icon reverts to that shown in the icon list.




### 3.2.4 Icon 6 Receptor Intakes (rcp6) – Human Exposure & Risk

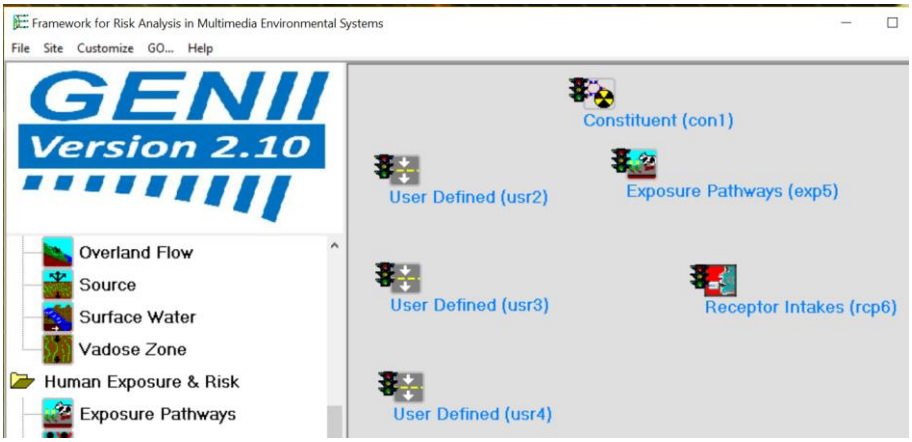
**Icon 6:** Add another Human Exposure & Risk Icon for Receptor Intakes.

Right click on ‘Receptor Intakes’. There are two choices: Add ‘Receptor Intakes’ to site and Change ‘Receptor Intakes’ Icon. Select Add ‘Receptor Intakes’ to site.




The ‘Receptor Intakes’ icon is added in the upper left corner of the screen and is red.

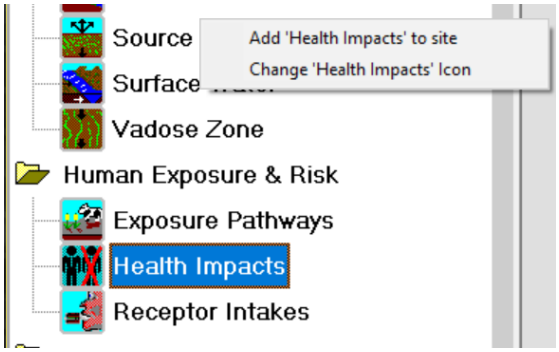
Move the icon diagonally to the right and below the ‘Exposure Pathways’ icon by clicking on the icon and dragging it with the mouse.



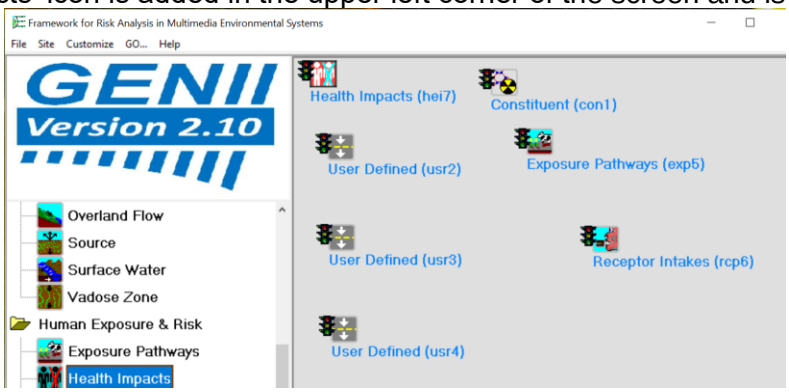

### 3.2.5 Icon 7 Health Impacts (hei7) – Human Exposure & Risk

**Icon 7:** Add another 'Human Exposure & Risk' Icon for Health Impacts.

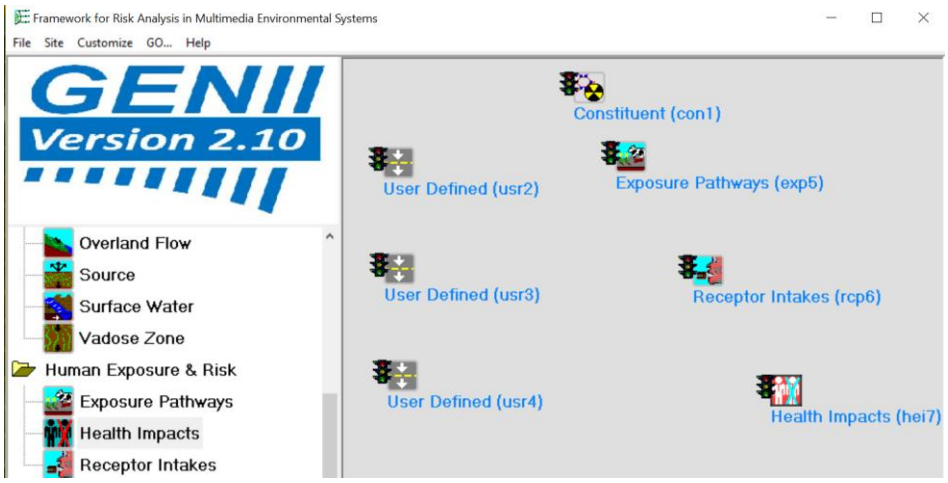
Right click on 'Health Impacts'. There are two choices: Add 'Health Impacts' to site and Change 'Health Impacts' Icon. Select Add 'Health Impacts' to site.



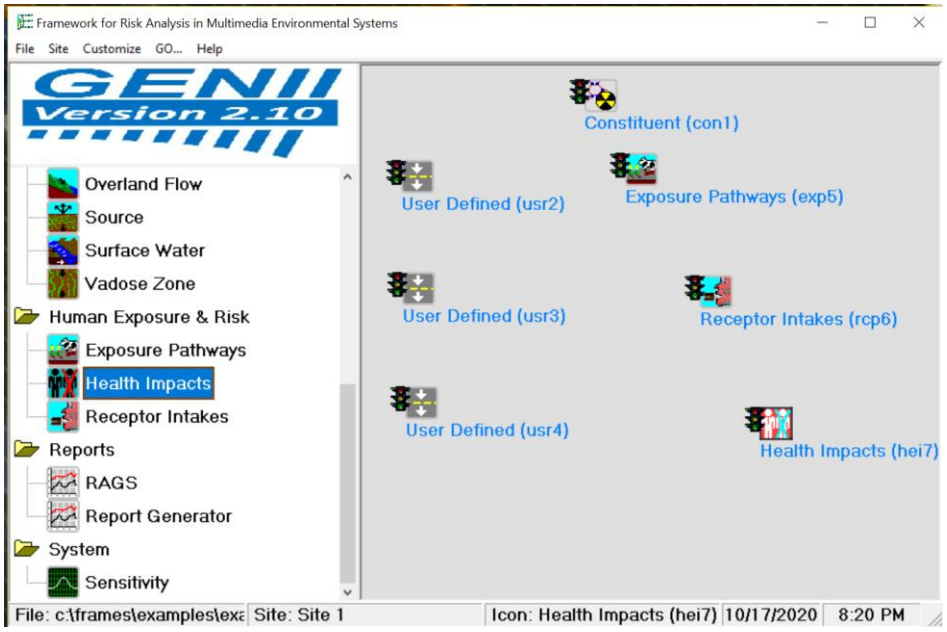

The 'Health Impacts' icon is added in the upper left corner of the screen and is red.



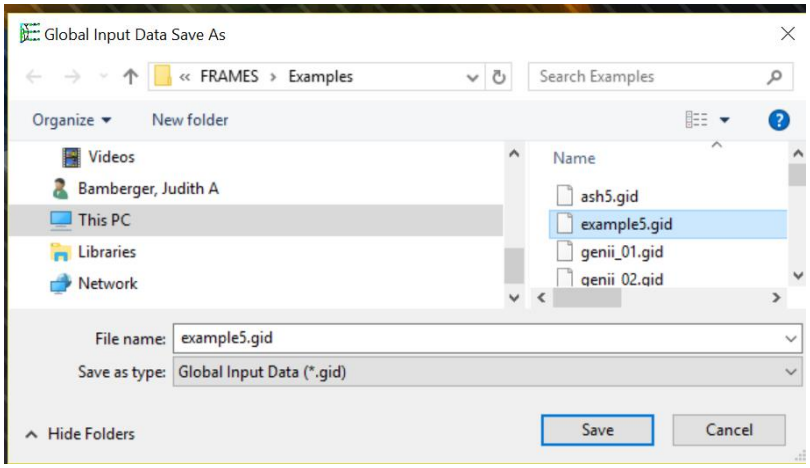

Move the icon down and diagonally to the right of the 'Receptor Intakes' icon by clicking on the icon and dragging it with the mouse.




This step completes the addition of icons to the screen. The model consists of 7 icons arranged as shown below.

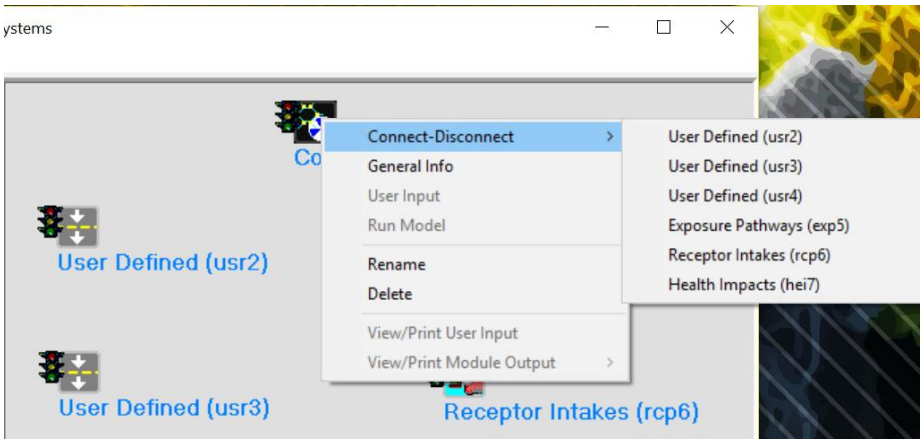



Save the file as: Example5.gid in the Frames > Examples directory or in another directory of your choice.

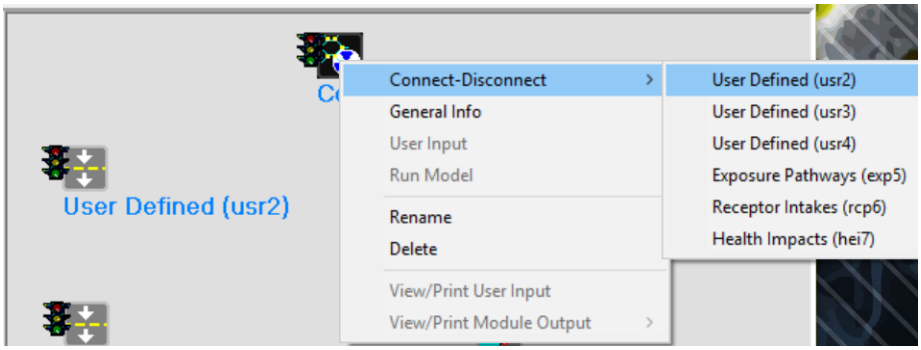


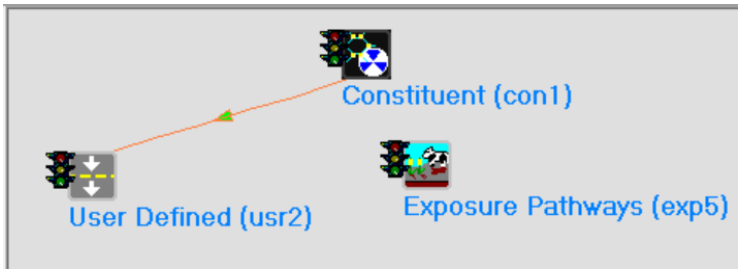

## 3.3 Add Connections to Example 5

Icon 1: To add connections between the icons start with ‘Constituent (con1)’ icon. Right click on the icon and select Connect-Disconnect. A window opens showing all of the icons to be connected. Note that the icon names are numbered sequentially in the order they were added to the model.



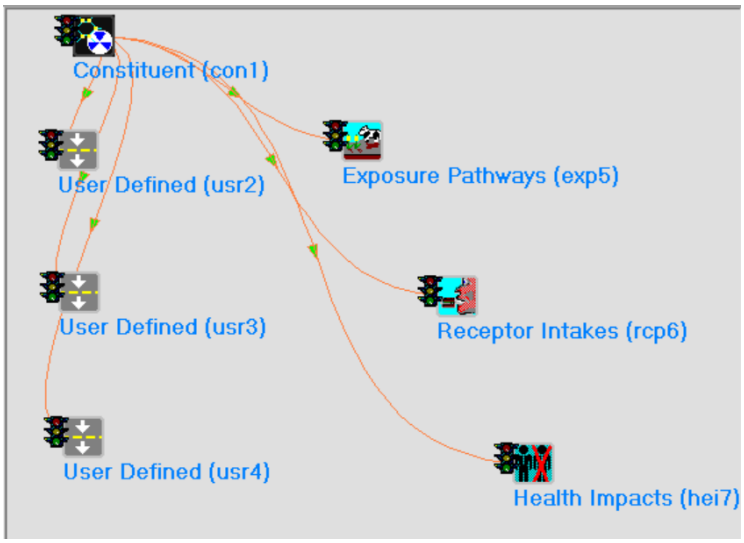

Select ‘User Defined (usr2)’ as the first connection.






Notice that the line connecting the two icons is shown in orange and the green arrow in the middle of the line shows the direction of the connection from (con1) to (usr2).

The constituent data base must be connected to each icon. Sequentially right click on 'Constituent (con1)' and connect to each icon. The result shows 'Constituent (con1)' connections to each icon. Notice that 'Constituent (con1)' has been moved slightly to the left to show the connections more clearly with less overlap.



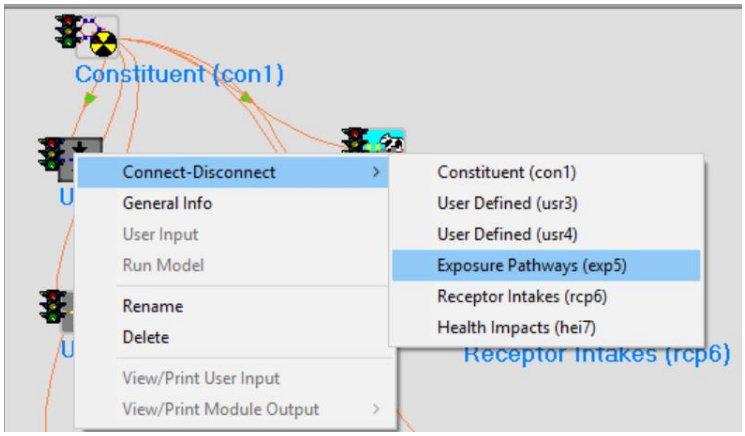

The next step is to connect the user defined icons to the 'Exposure Pathways (exp5)'.

Icon2: Right click on 'User Defined (usr2)' and connect to 'Exposure Pathways (exp5)'.

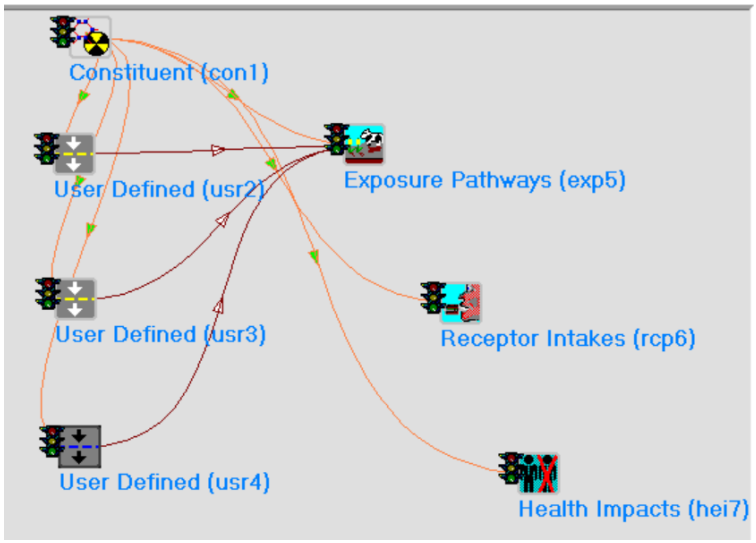
Icon3: Right click on 'User Defined (usr3)' and connect to 'Exposure Pathways (exp5)'.

Icon 4: Right click on 'User Defined (usr4)' and connect to 'Exposure Pathways (exp5)'.

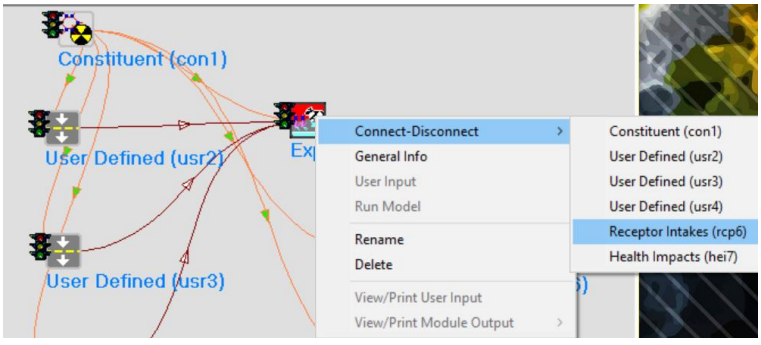
Note that it is also possible to connect icons by placing the cursor on the starting icon, holding down the shift key and left mouse button simultaneously, and dragging from the starting icon to the icon to be connected to it. The connecting lines may be disconnected following the same procedure(s).



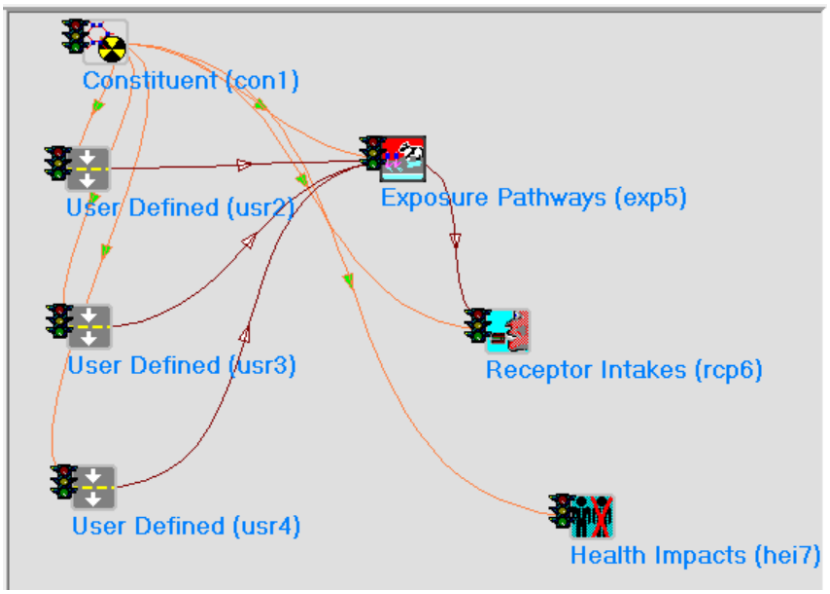

The connections are shown as a brown arrow from each ‘User Defined’ to ‘Exposure Pathways (exp5)’.



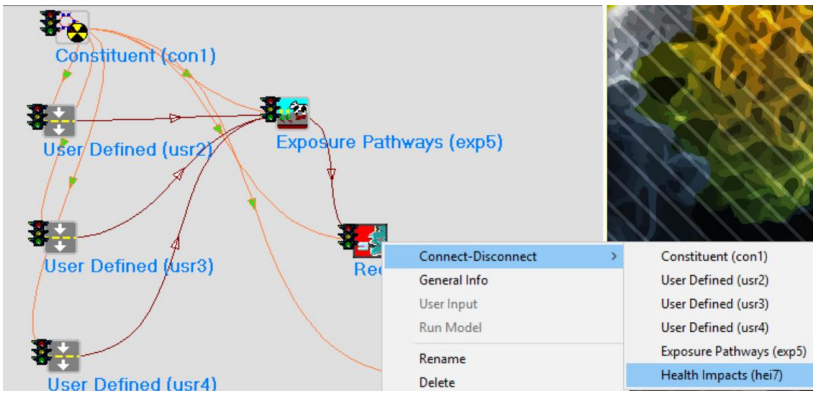

Icon 5: The next step is to connect ‘Exposure Pathways (exp5)’ to ‘Receptor Intakes (rcp6)’ by right clicking on ‘Exposure Pathways (exp5)’ and selecting ‘Receptor Intakes (rcp6)’.



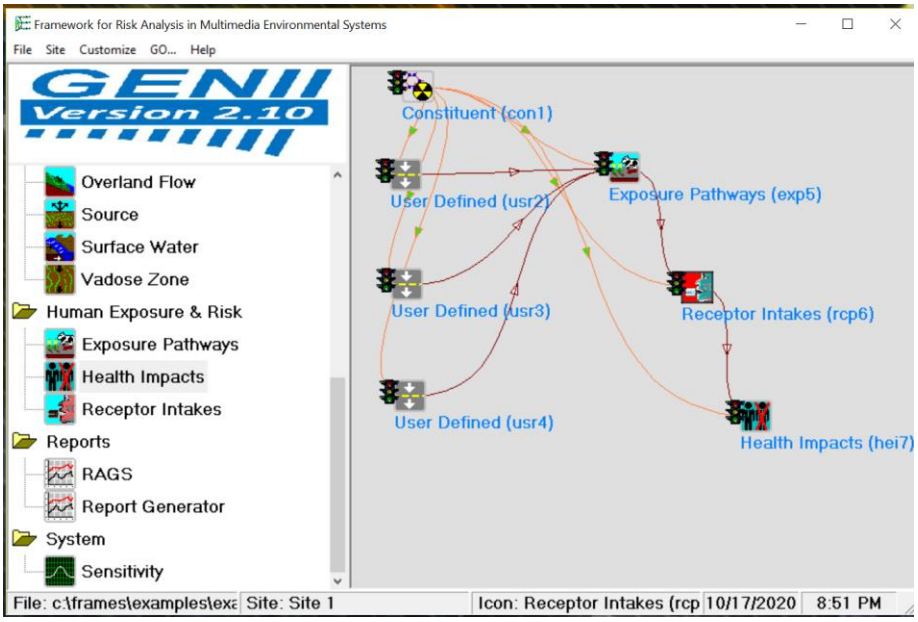

The connection is shown as a brown arrow from ‘Exposure Pathways (exp5)’ to ‘Receptor Intakes (rcp6)’.



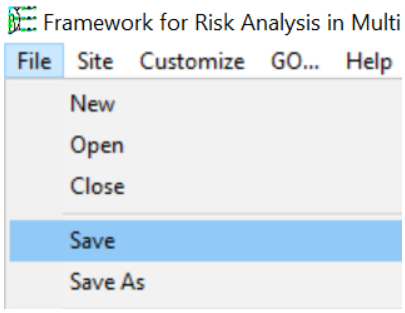

Icon 6: The next step is to connect ‘Receptor Intakes (rcp6)’ to ‘Health Impacts (hei7)’ by right clicking on ‘Receptor Intakes (rcp6)’ and selecting ‘Health Impacts (hei7)’.




The connection is shown as a brown arrow from ‘Receptor Intakes (rcp6)’ to ‘Health Impacts (hei7)’. The resulting wholly connected model is shown below.




Save the model by selecting File along the top ribbon and then selecting Save.

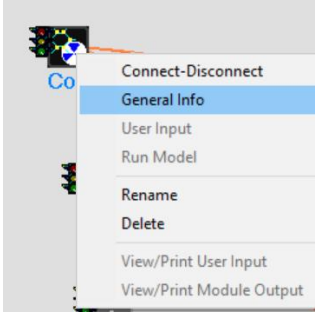



## 3.4 Add General Information (select models) to Example 5

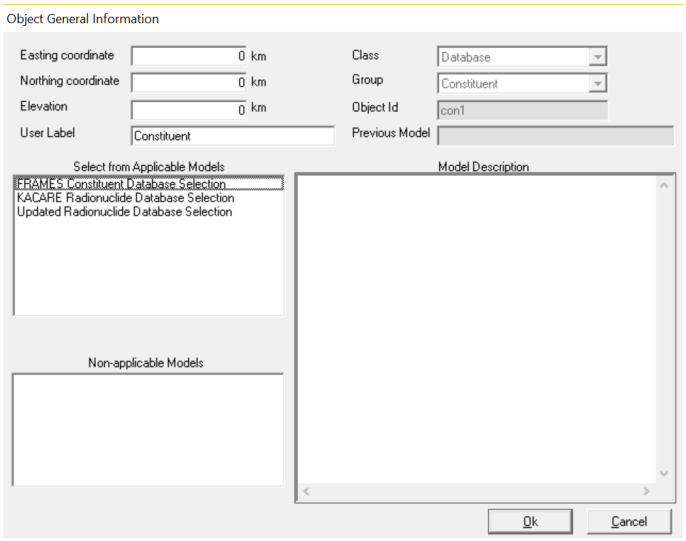
This procedure will select models for each of the seven icons sequentially. The information will be added via General Info.

## 3.5 General Information for Icon 1 Constituent (con1) - Database

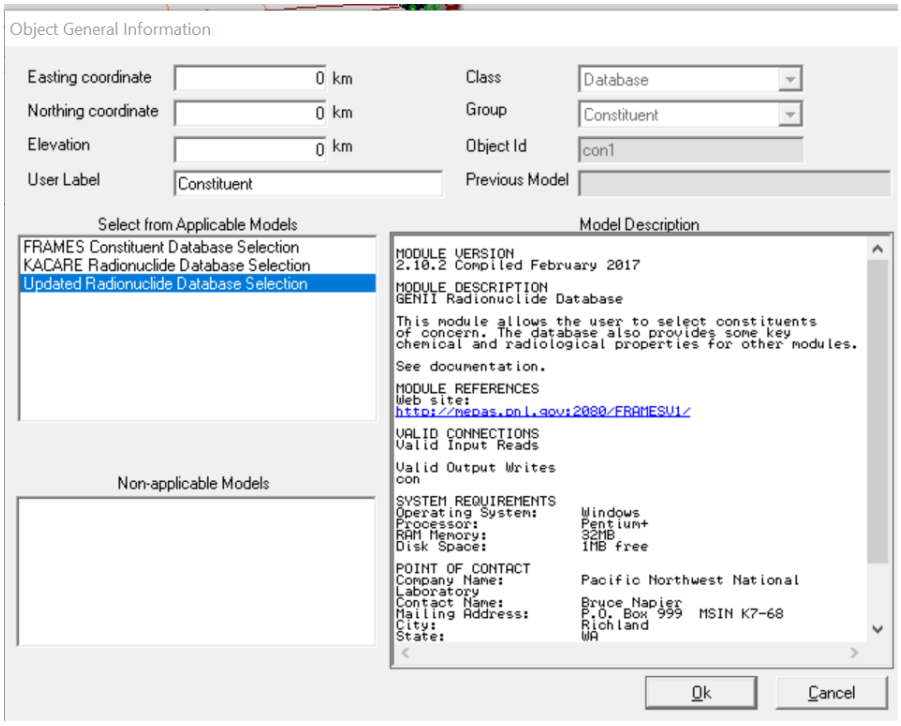
Icon 1: Right click on 'Constituent (con1)' and the following window opens. Select 'General Info'.



The following ‘Object General Information’ window opens.



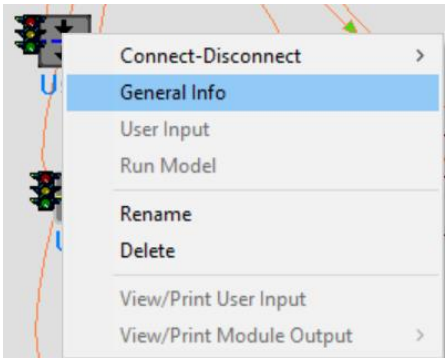

Under ‘Select from Applicable Models’ three options are provided: ‘FRAMES Constituent Database Selection’, ‘KACARE Radionuclide Database Selection’, and ‘Updated Radionuclide Database Selection’. Select the third model: ‘Updated Radionuclide Database Selection’. The ‘Model Description’ is shown in the window to the right. Select ‘Ok’.



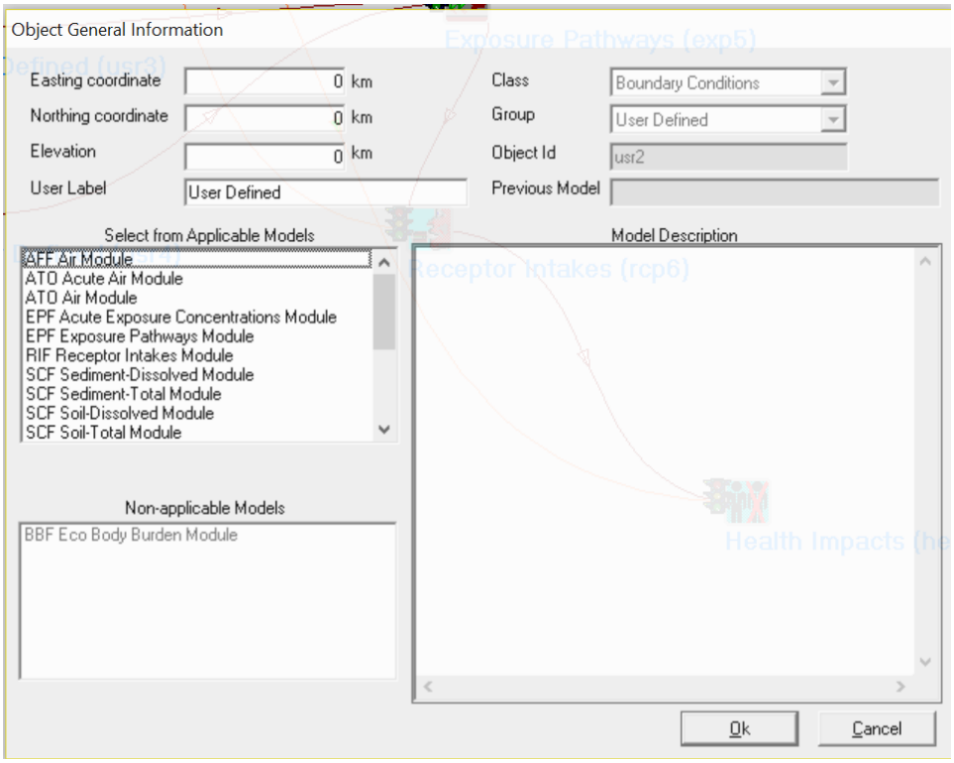

After selecting ‘Ok’, the model window closes and the ‘icon Constituent (con1)’ now shows a red light in the “traffic signal”.

### 3.5.1 General Information for Icon 2 User Defined (usr2) – Boundary Conditions

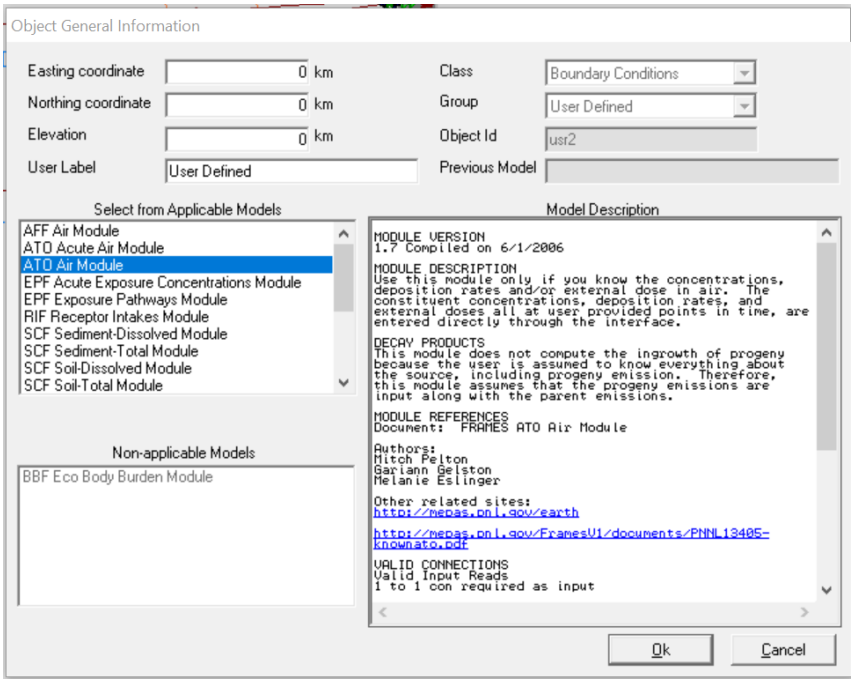
Icon 2: Right click on 'User Defined (usr2)' and the following window opens. Select 'General Info'.



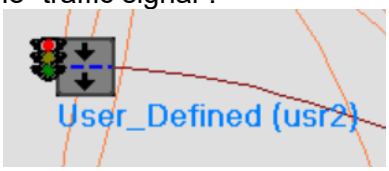

The following window 'Object General Information' opens. A list of models is provided in the 'Select from Applicable Models' window. Not all models are shown below.




For this example, select the third applicable model listed 'ATO Air Module'. Upon selection, the 'Model Description' populates the window to the right. Select 'Ok' to use this model.

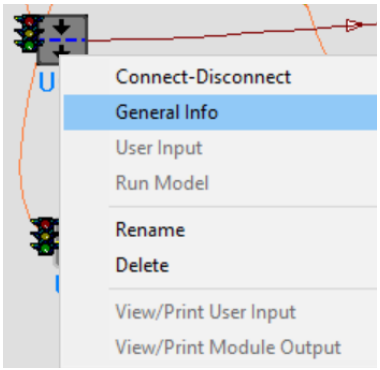



After selecting ‘Ok’, the ‘Object General Information’ window closes, and the icon ‘User Defined (usr2)’ now shows a red light in the “traffic signal”.

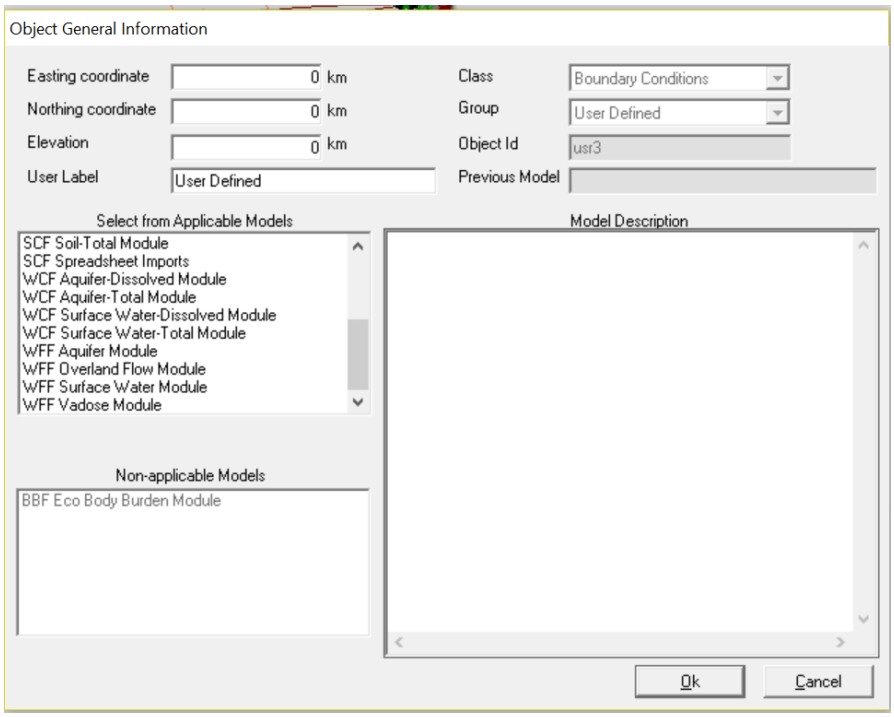



### 3.5.2 General Information for Icon 3 User Defined (usr3) – Boundary Conditions

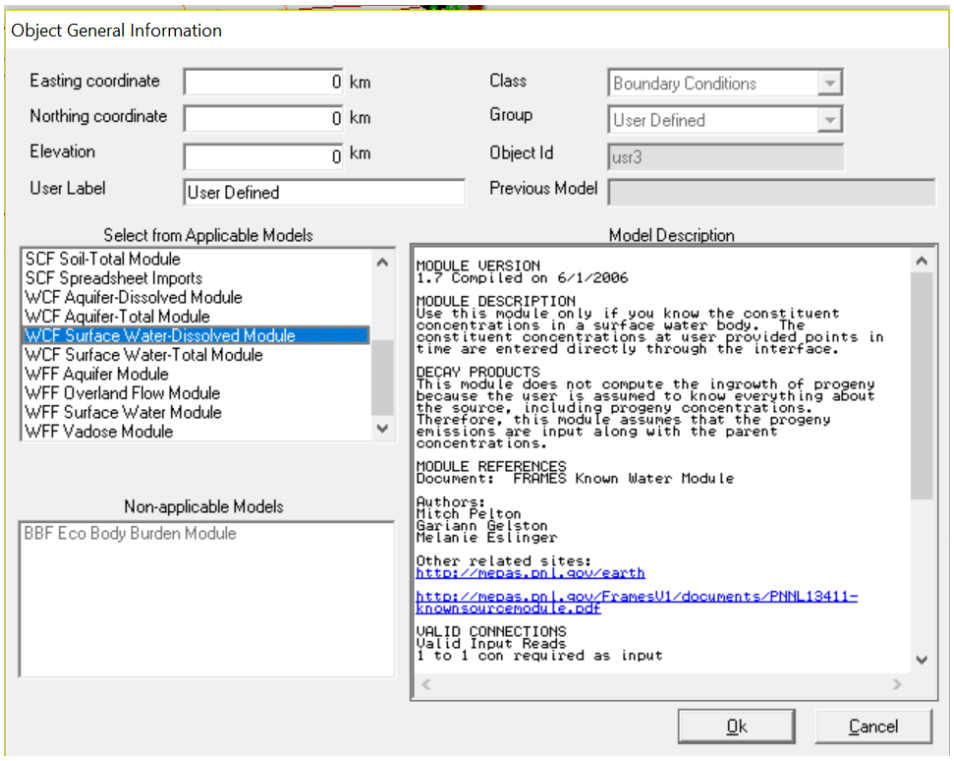
Icon 3: Right click on ‘User Defined (usr3)’ and the following window opens. Select ‘General Info’.



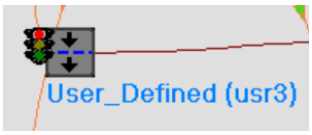

The following window ‘Object General Information’ opens. A list of models is provided in the ‘Select from Applicable Models’ window. Scroll down the list to see additional models.




For this example, select the sixth model from the bottom, 'WCF Surface Water-Dissolved Module'. Upon selection, the Model Description populates the window to the right. Select 'Ok' to use this model.

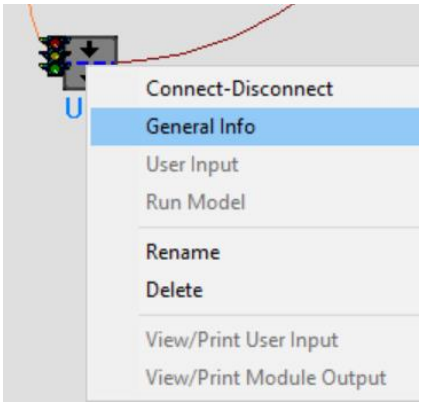



After selecting 'Ok', the 'Object General Information' window closes, and the icon 'User Defined (usr3)' now shows a red light in the "traffic signal".

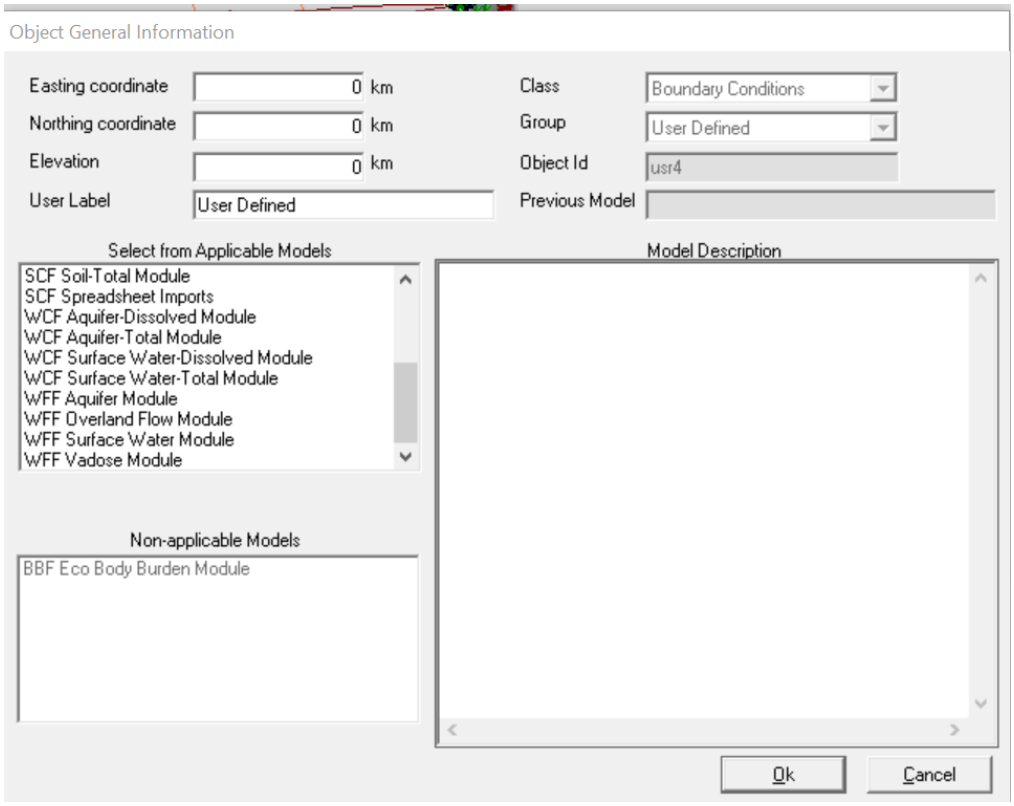



### 3.5.3 General Information for Icon 4 User Defined (usr4) – Boundary Conditions

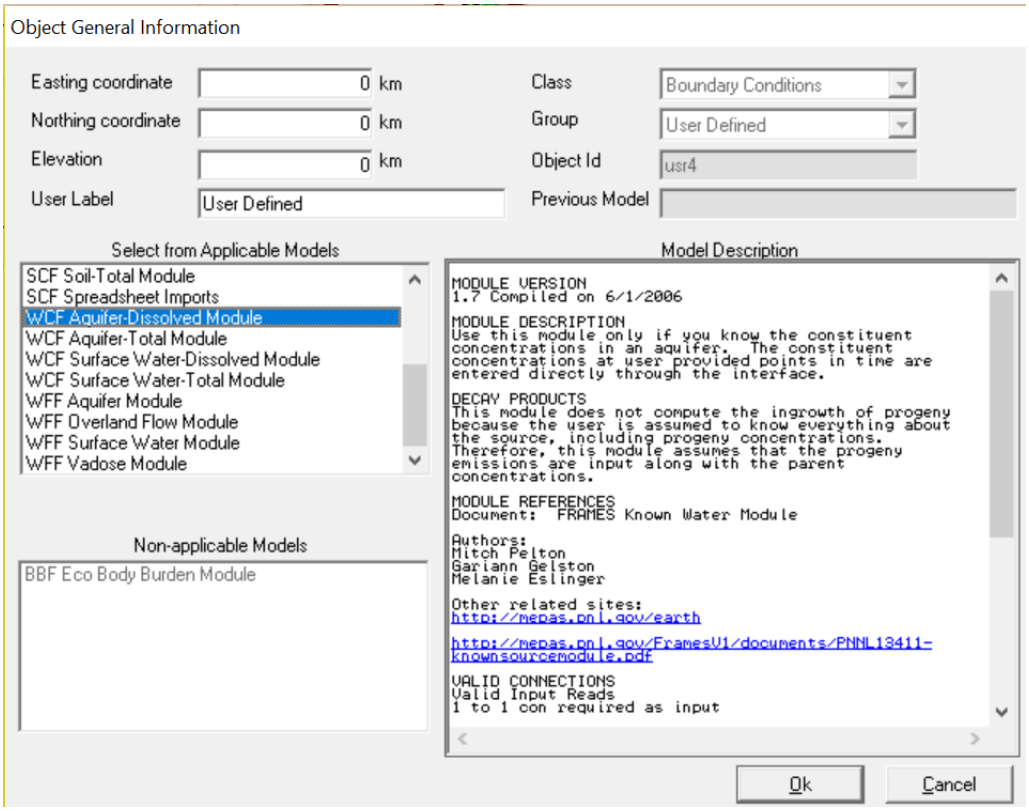
Icon 4: Right click on 'User Defined (usr4)' and the following window opens. Select 'General Info'.



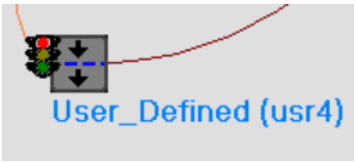

The following window 'Object General Information' opens. A list of models is provided in the 'Select from Applicable Models' window. Scroll down the list to see additional models.



For this example, select the eighth model from the bottom, ‘WCF Aquifer-Dissolved Module’. Upon selection the ‘Model Description’ populates in the window to the right. Select ‘Ok’ to use this model.

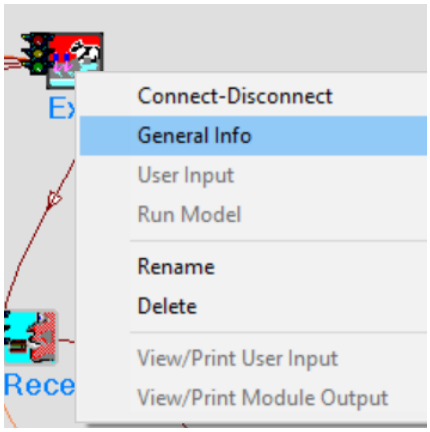



After selecting ‘Ok’, the ‘Object General Information’ window closes, and the icon ‘User Defined (us4)’ now shows a red light in the “traffic signal”.

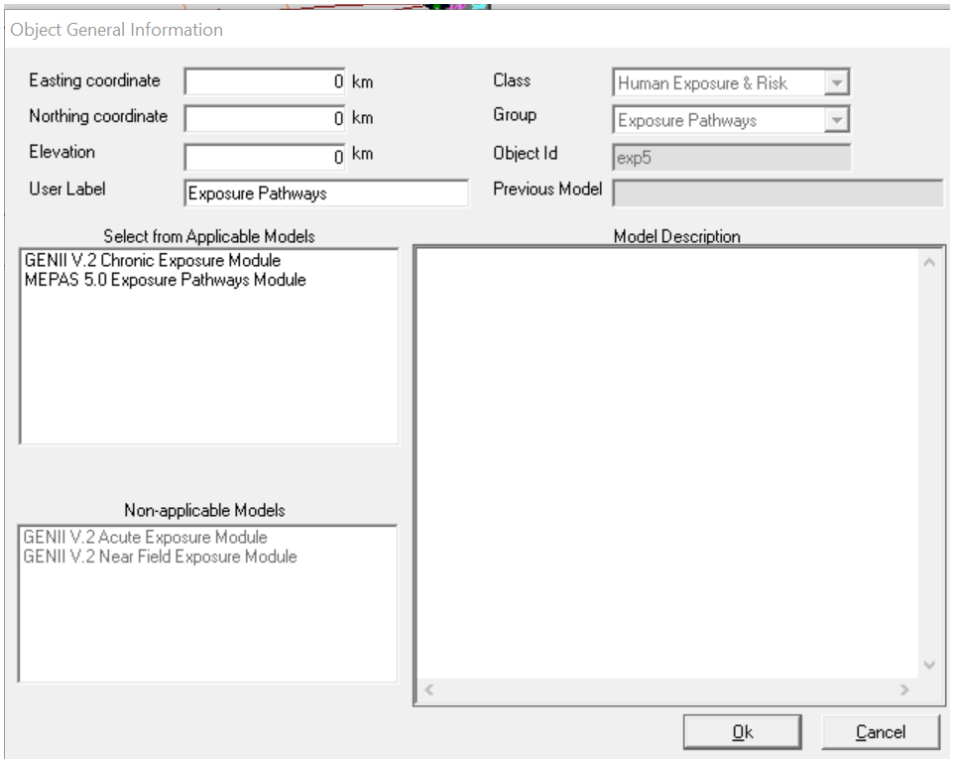



### 3.5.4 General Information for Icon 5 Exposure Pathways (exp5) – Human Exposure & Risk

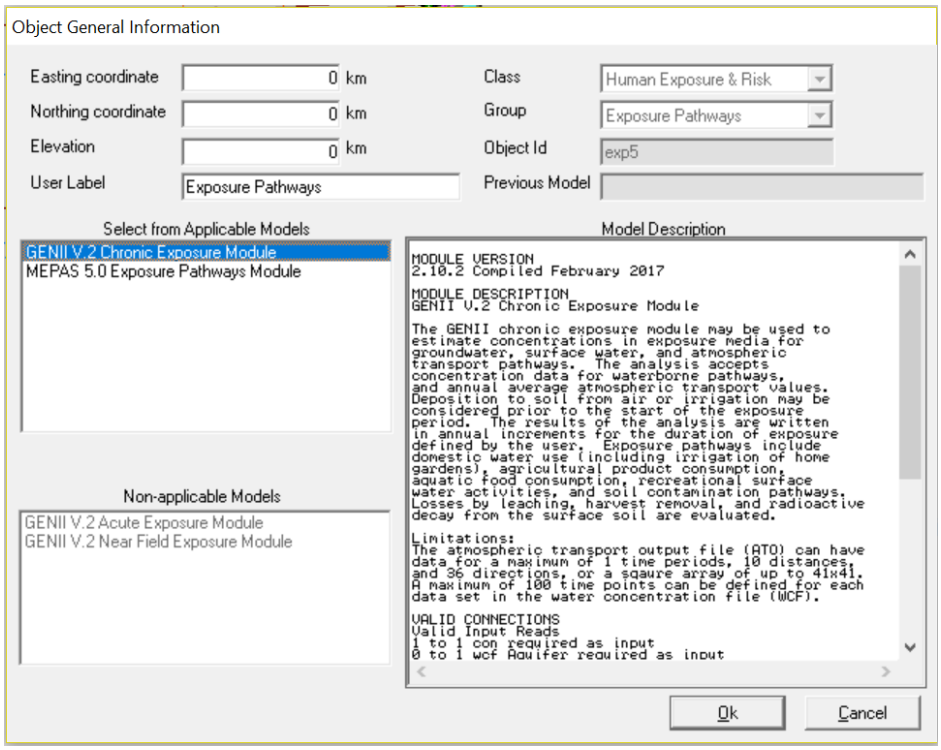
Icon 5: Right click on ‘Exposure Pathways (exp5)’ and the following window opens. Select ‘General Info’.




The following window ‘Object General Information’ opens. A list of models is provided in the ‘Select from Applicable Models’ window.



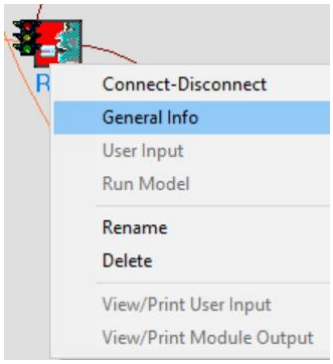

For this example, select the first model, ‘GENII V.2 Chronic Exposure Module’. Upon selection the ‘Model Description’ populates the window to the right. Select ‘Ok’ to use this model.



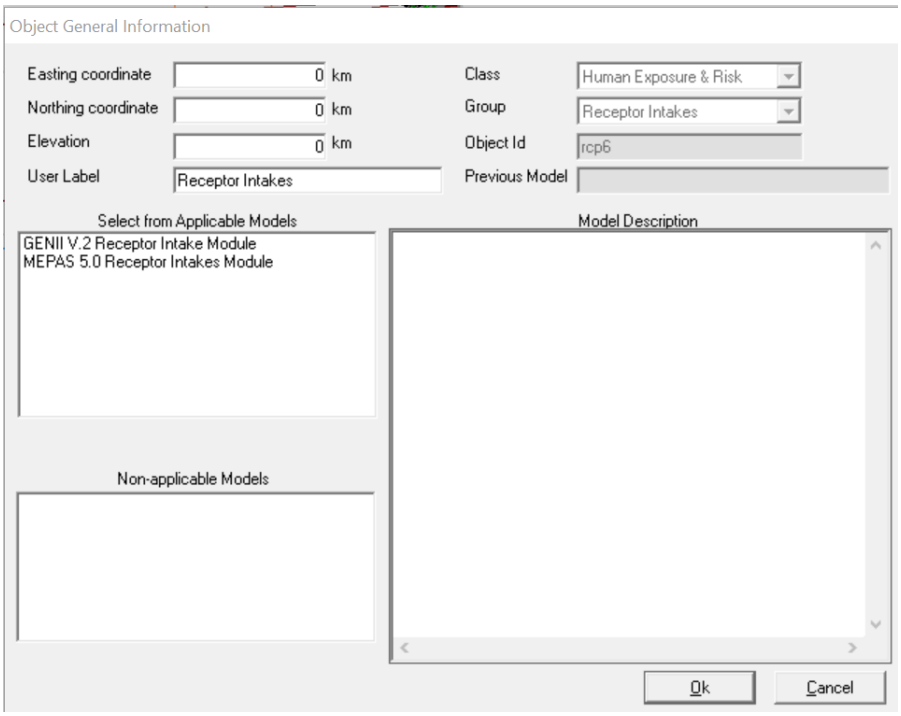

After selecting ‘Ok’, the ‘Object General Information’ window closes and the icon ‘Exposure Pathways (exp5)’ now shows a red light in the “traffic signal”.

### 3.5.5 General Information for Icon 6 Receptor Intakes (rcp6) – Human Exposure & Risk

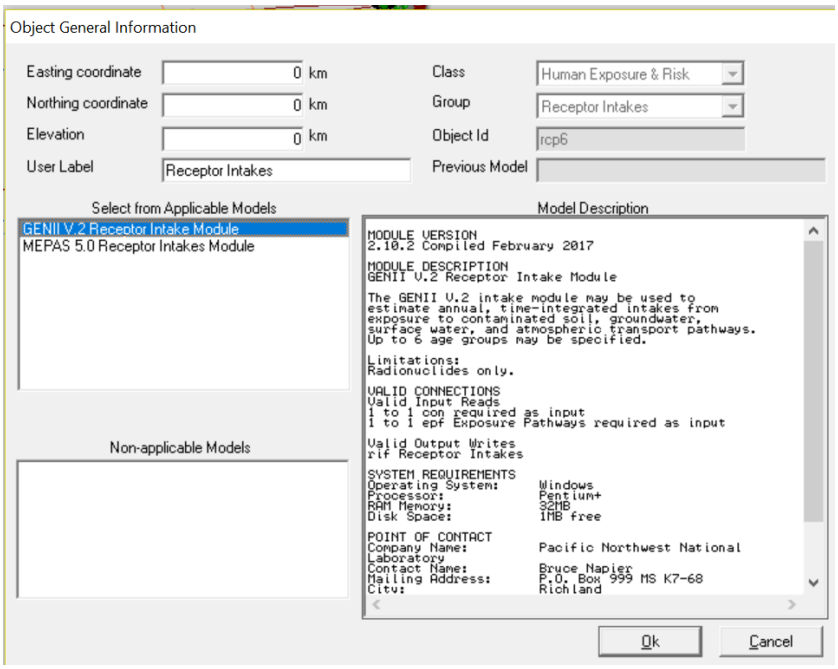
Icon 6: Right click on ‘Receptor Intakes (rcp6)’ and the following window opens. Select ‘General Info’.



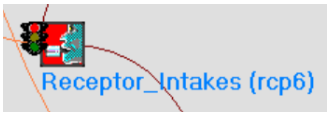

The following window ‘Object General Information’ opens. A list of models is provided in the ‘Select from Applicable Models’ window.




For this example, select the first model, ‘GENII V.2 Receptor Intake Module’. Upon selection, the ‘Model Description’ populates the window to the right. Select ‘Ok’ to use this model.

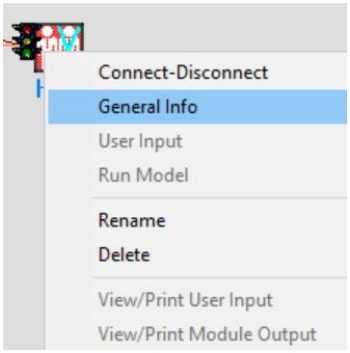



After selecting ‘Ok’, the ‘Object General Information’ window closes and the icon ‘Receptor Intakes (rcp6)’ now shows a red light in the “traffic signal”.

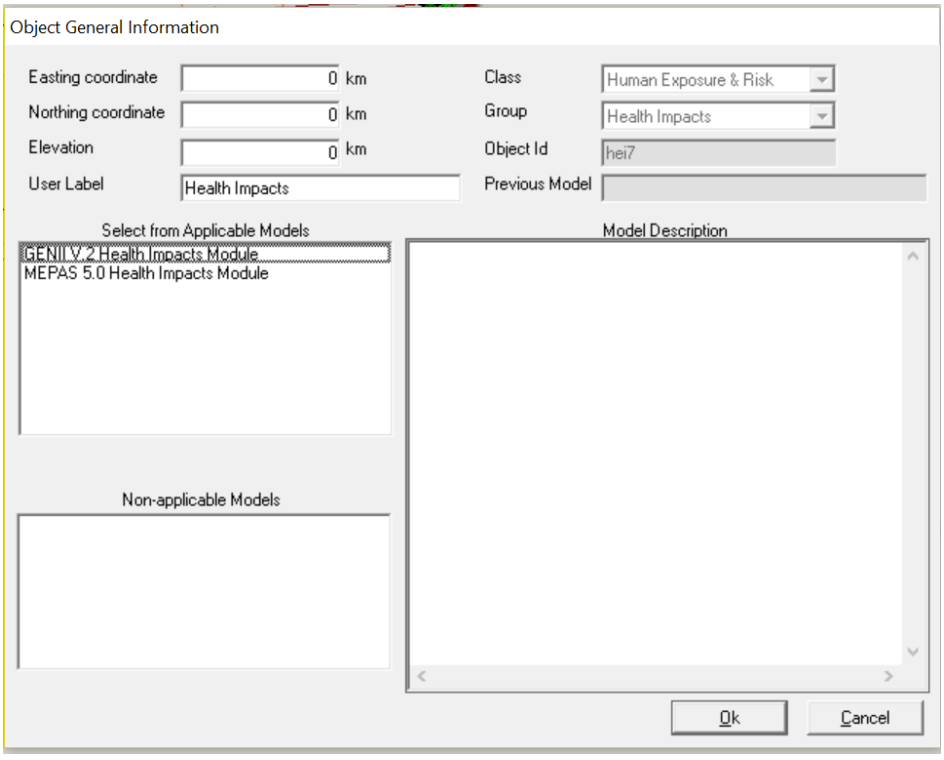



### 3.5.6 General Information for Icon 7 Health Impacts (hei7) – Human Exposure & Risk

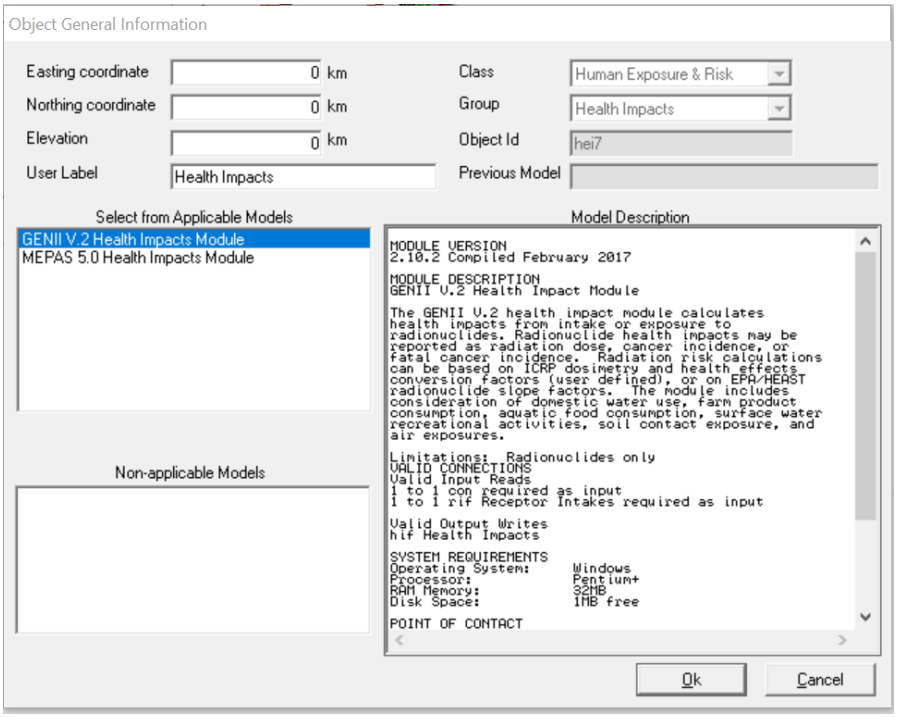
Icon 7: Right click on 'Health Impacts (hei7)' and the following window opens. Select 'General Info'.




The following window 'Object General Information' opens. A list of models is provided in the 'Select from Applicable Models' window.




For this example, select the first model, 'GENII V.2 Health Impacts Module'. Upon selection, the 'Model Description' populates the window to the right. Select 'Ok' to use this model.



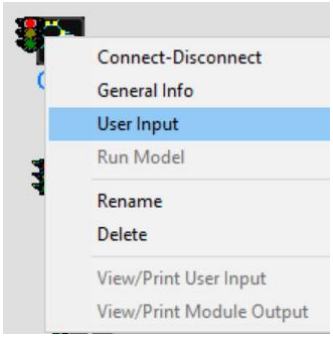

After selecting ‘Ok’, the ‘Object General Information’ window closes, and the icon ‘Health Impacts (hei7)’ now shows a red light in the “traffic signal”.

## 3.6 Add User Input to Example 5

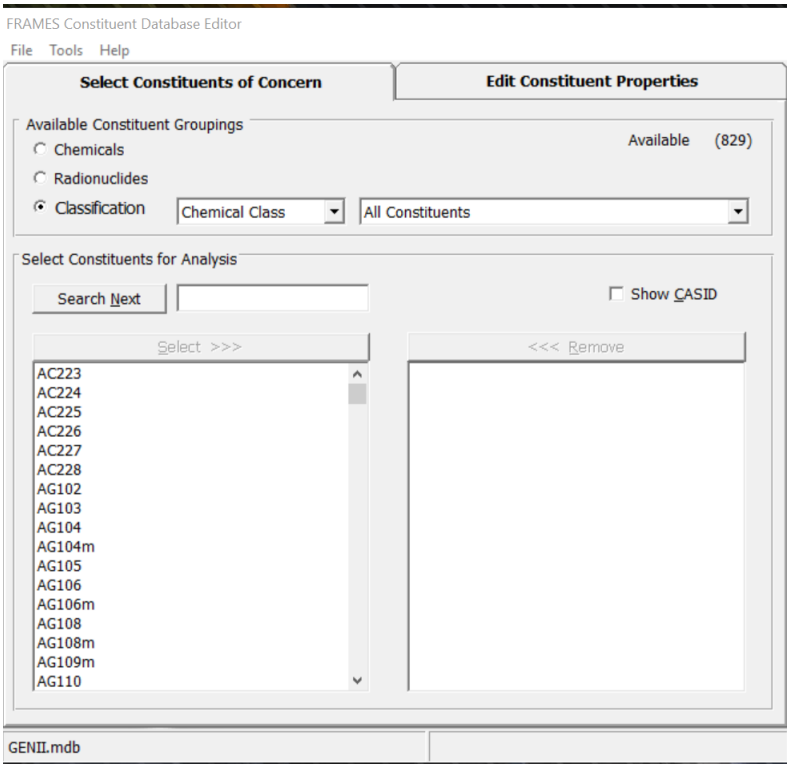
This section will describe entering data for each of the models.

### 3.6.1 User Input for Icon 1 Constituent (con1) - Database

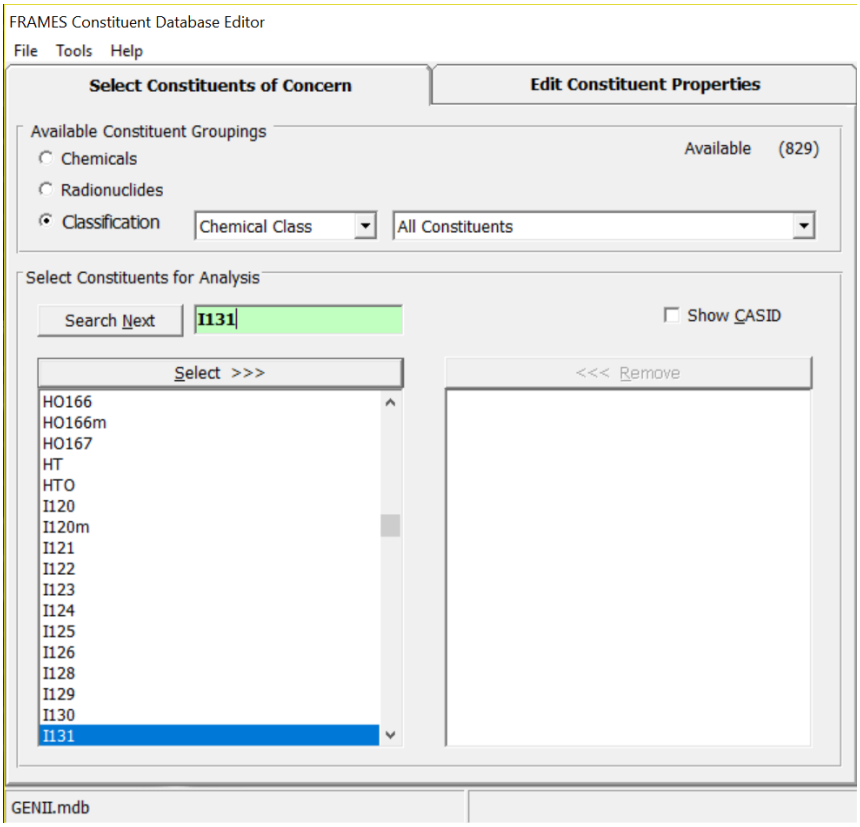
Icon 1: Right click on ‘Constituent (con1)’ and the following window opens. Select ‘User Input’.



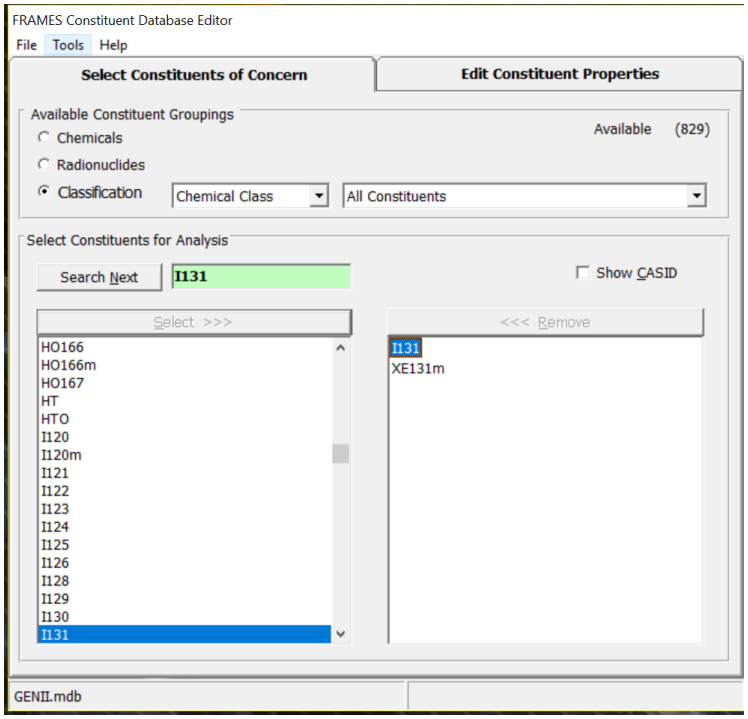

The following window opens and is displaying ‘Select Constituents of Concern’:



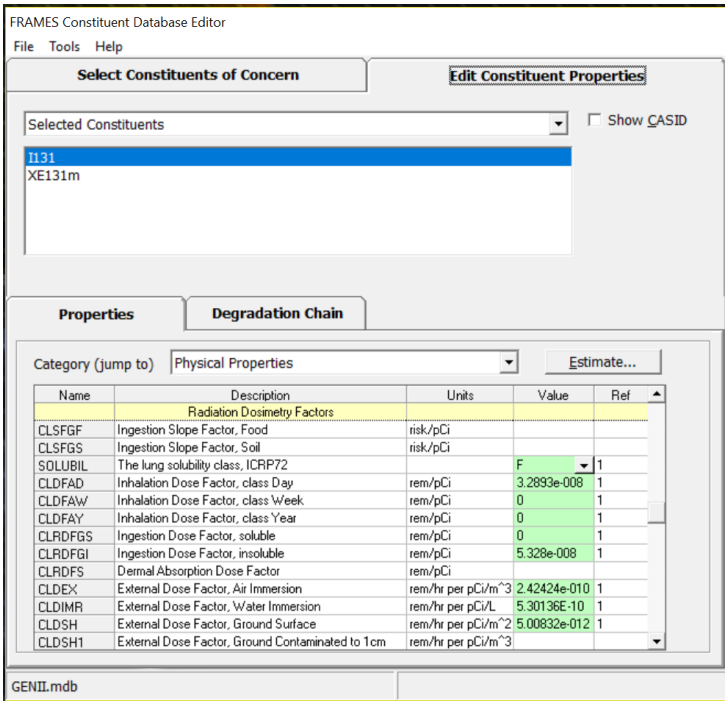

Under 'Select Constituents for Analysis' add $^{131}$I as I131 to the box to the right of Search Next. The background of I131 turns green and I131 is highlighted in blue in the list below.



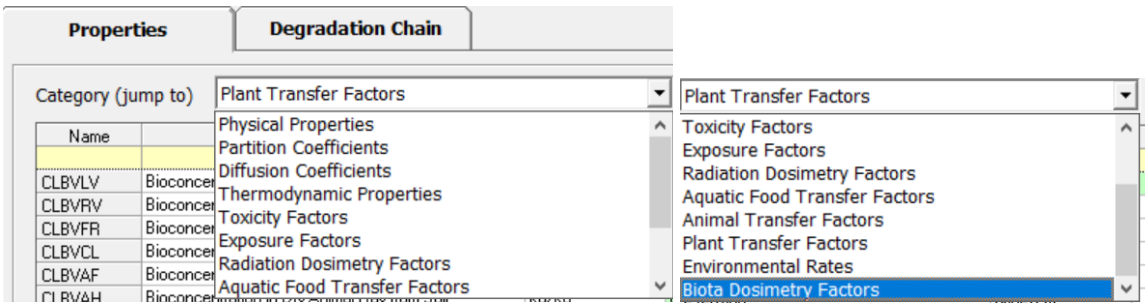
Click on ‘Select >>>’ in the box below ‘Search Next’ and I131 and XE131m are added to the window on the right; note that any decay progeny of a selected radionuclide are automatically added and should not be removed.



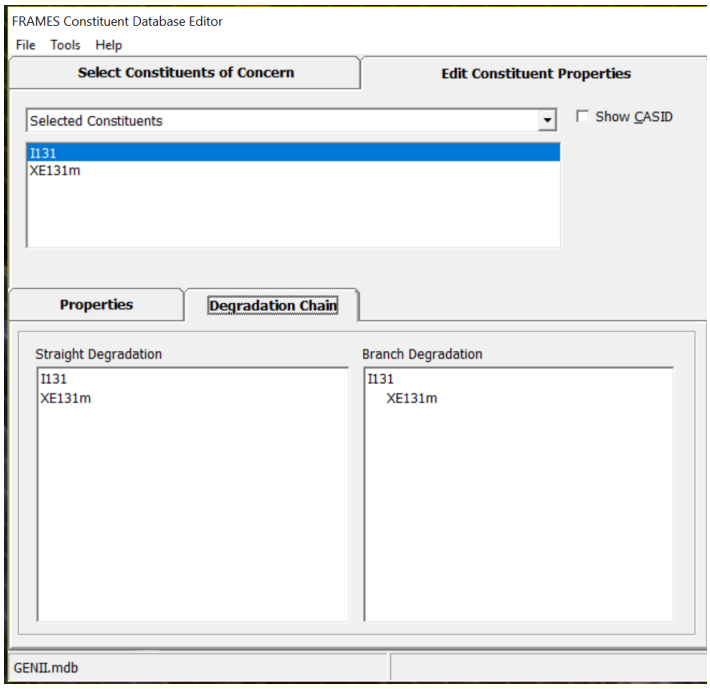

Select tab ‘Edit Constituent Properties’. The two ‘Selected Constituents’ I131 and XE131m are shown in the window. Under tab ‘Properties’ the heading ‘Category (jump to)’ shows ‘Physical Properties’. Values shown with a green background are prepopulated based on the selection of I131 and XE131m. An example is shown below.



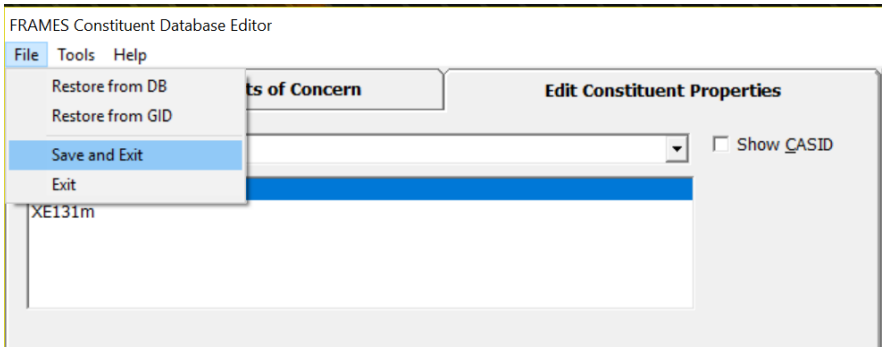

'Category (jump to)' includes many categories of data as shown below that are prepopulated.




Selecting 'Degradation Chain' under tab 'Edit Constituent Properties' shows the two selected constituents. They are listed under 'Straight Degradation' and 'Branch Degradation'.



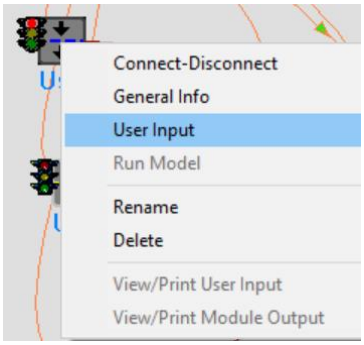

To select the data, go to File and select Save and Exit.



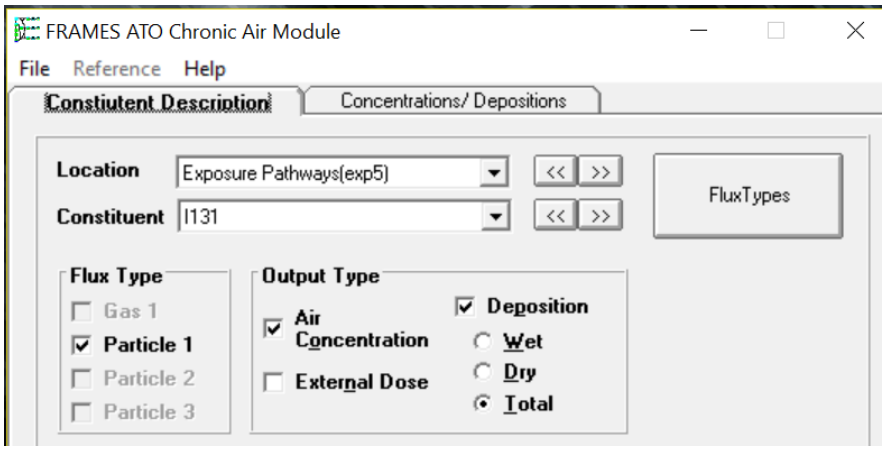

After selecting Save and Exit the window closes. Observe that the 'Constituent (con1)' traffic signal has switched from red to green.

### 3.6.2 User Input for Icon 2 User Defined (usr2) – Boundary Conditions

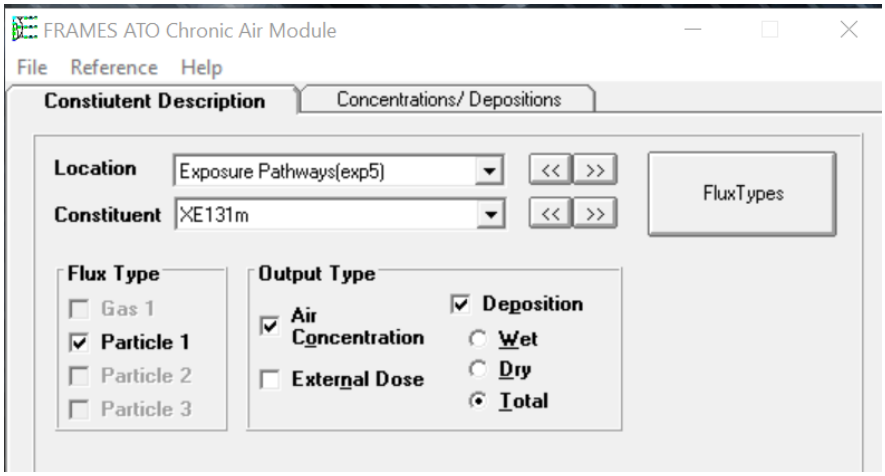
Icon 2: Right click on 'User Defined (usr2)' and the following window opens. Select 'User Input'.



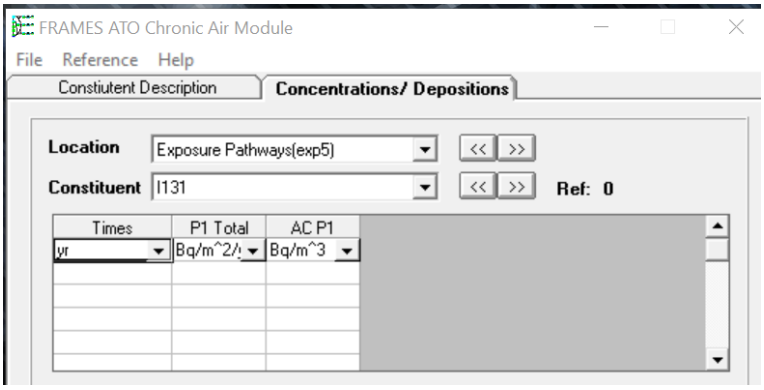

The FRAMES ATO Chronic Air Module window opens showing tab Constituent Description.




Items selected are Location ‘Exposure Pathways (exp5)’, Constituent ‘I131’. Flux Type ‘Particle 1’ is checked. Output Type ‘Air Concentration’ is checked. ‘Deposition’ is checked and ‘Total’ is selected. Only one location is available to select. Using the dropdown arrow select XE131m under Constituent. The same data is shown for this constituent.




Select tab ‘Concentrations/ Depositions’, and the following window opens.

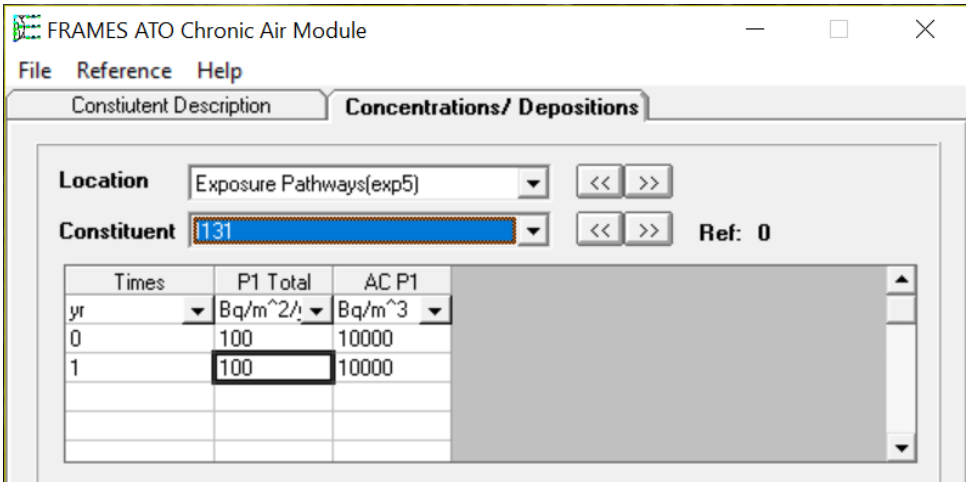



It is necessary to add ‘Times’ for start and end times, ‘P1 Total’ (total atmospheric deposition rate), and ‘AC P1’ (air concentration) data for Constituent I131 and for Constituent XE131m.

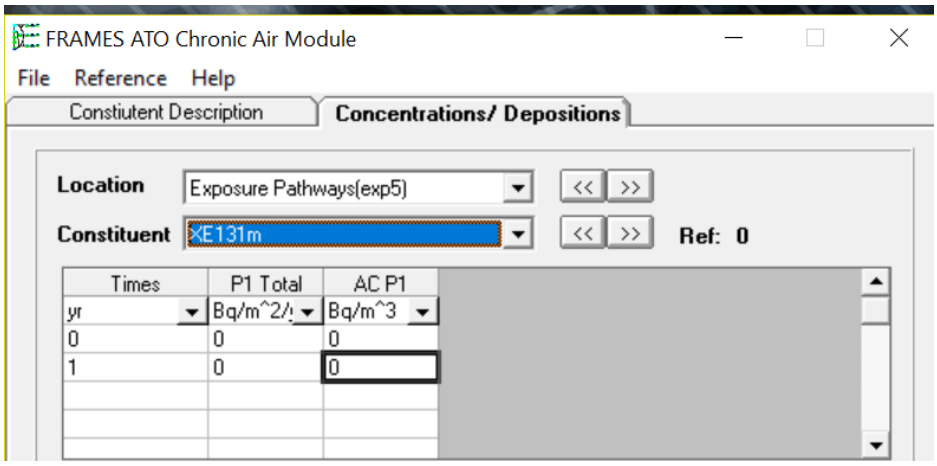
Enter the following data

| Constituent | Times | P1 Total | AC P1 |
|---|---|---|---|
| -- | yr | Bq/m^2/yr | Bq/m^3 |
| I131 | 0 | 100 | 10000 |
| I131 | 1 | 100 | 10000 |
| XE131m | 0 | 0 | 0 |
| XE131m | 1 | 0 | 0 |

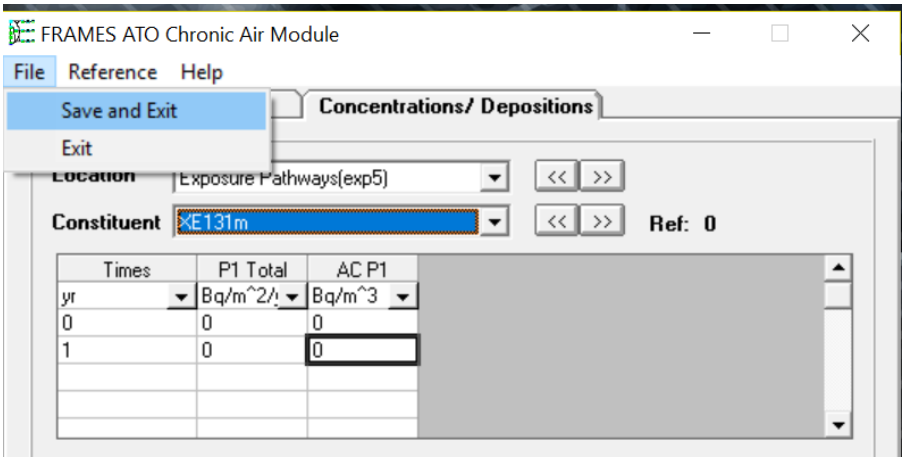
For I131



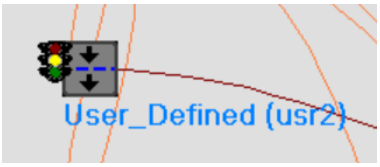

Using the drop down select ‘Constituent XE131m’ and enter the data.




Select File Save and Exit

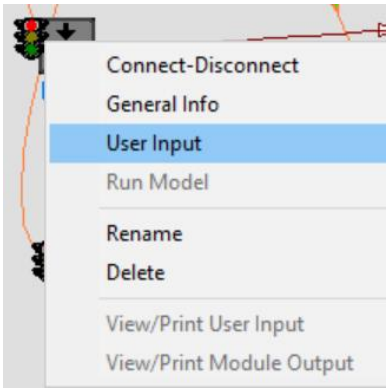



After selecting Save and Exit, the FRAMES ATO Chronic Air Module window closes. Observe the icon 'User Defined (usr2)' traffic signal switched from red to yellow.

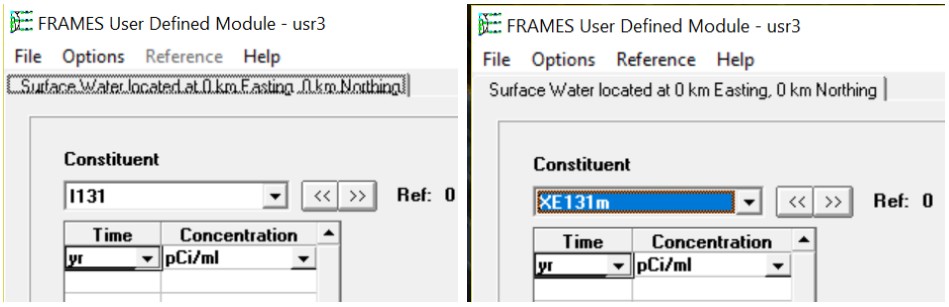



### 3.6.3 User Input for Icon 3 User Defined (usr3) – Boundary Conditions

Icon 3: Right click on 'User Defined (usr3)' and the following window opens. Select 'User Input'.

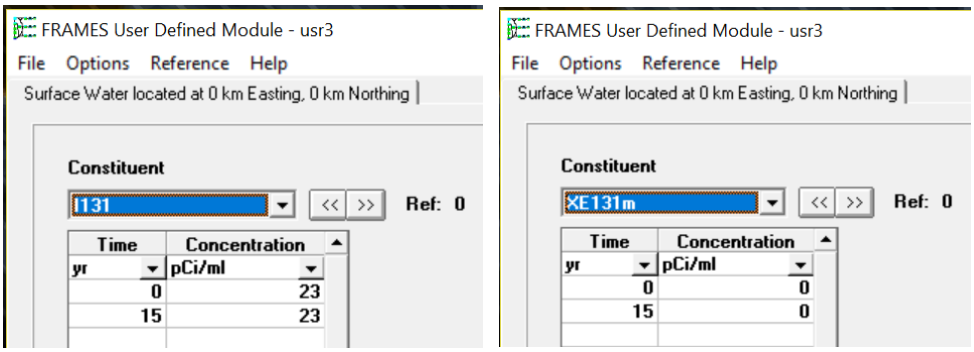



The 'FRAMES User Defined Module – usr3' opens showing Constituent; I131 is shown. Using the drop-down arrow to switch to show XE131m. Both are shown below.

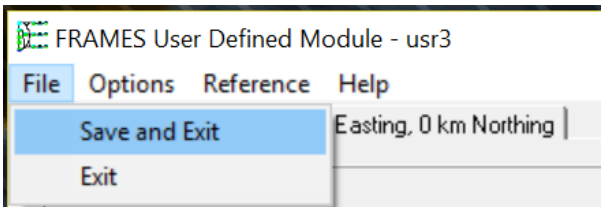



Enter the following data

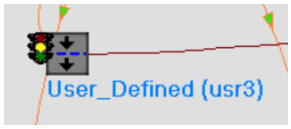
| I131 | I131 | XE131m | XE131m |
|---|---|---|---|
| Time | Concentration | Time | Concentration |
| yr | pCi/ml | yr | pCi/ml |
| 0 | 23 | 0 | 0 |
| 15 | 23 | 15 | 0 |




To save the data select File Save and Exit.

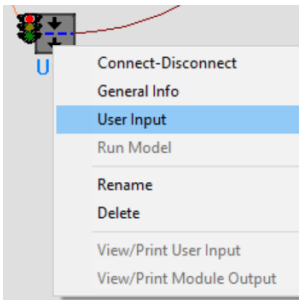



After selecting Save and Exit, the 'FRAMES User Defined Module – usr3' closes. The icon 'User Defined (usr3)' traffic signal switched from red to yellow.

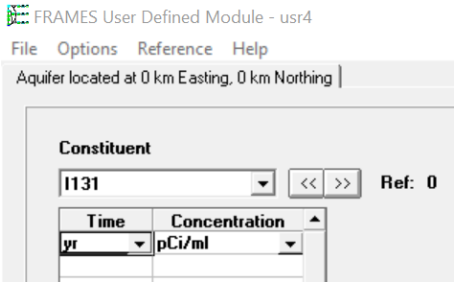


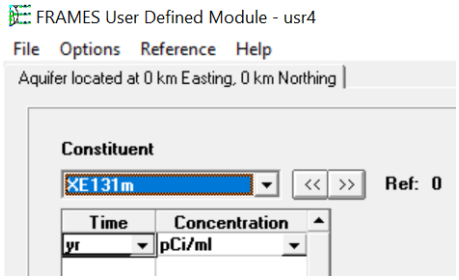

### 3.6.4 User Input for Icon 4 User Defined (usr4) – Boundary Conditions

Icon 4: Right click on 'User Defined (usr4)' and the following window opens. Select 'User Input'.



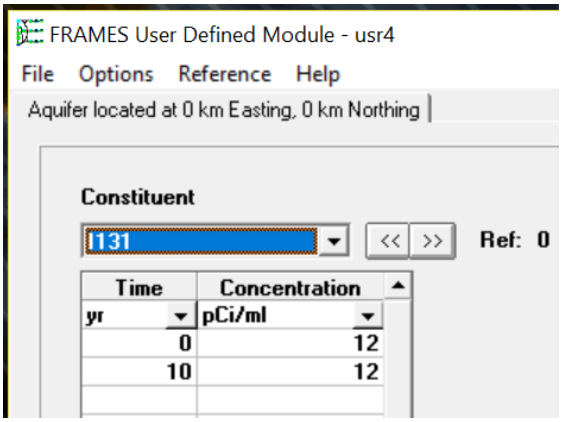

The 'FRAMES User Defined Module – usr4' opens showing Constituent; I131 is shown. Using the drop-down arrow to switch to show XE131m. Both are shown below.

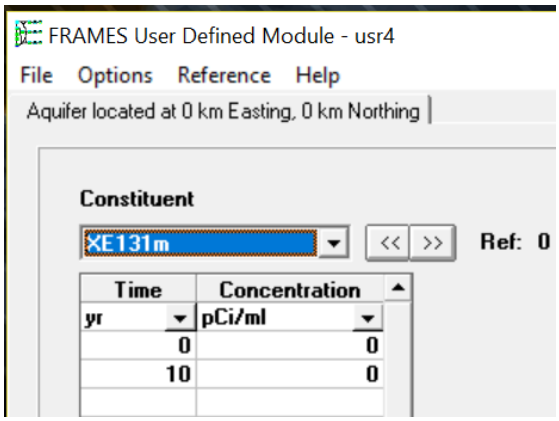


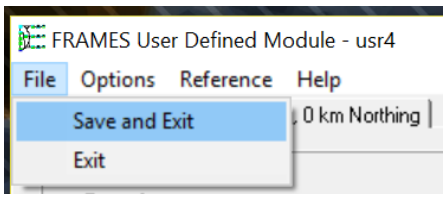

Enter the following data

| I131 | I131 | XE131m | XE131m |
|---|---|---|---|
| Time | Concentration | Time | Concentration |
| yr | pCi/ml | yr | pCi/ml |
| 0 | 12 | 0 | 0 |
| 10 | 12 | 10 | 0 |

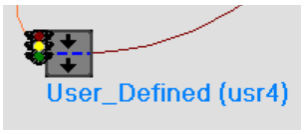



To save the data select File Save and Exit.

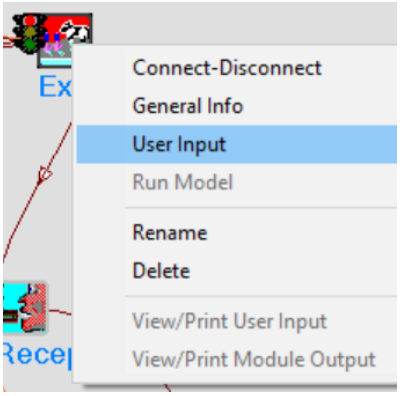



After selecting Save and Exit, the 'FRAMES User Defined Module – usr4' closes. Observe the icon 'User Defined (usr4)' traffic signal switched from red to yellow.

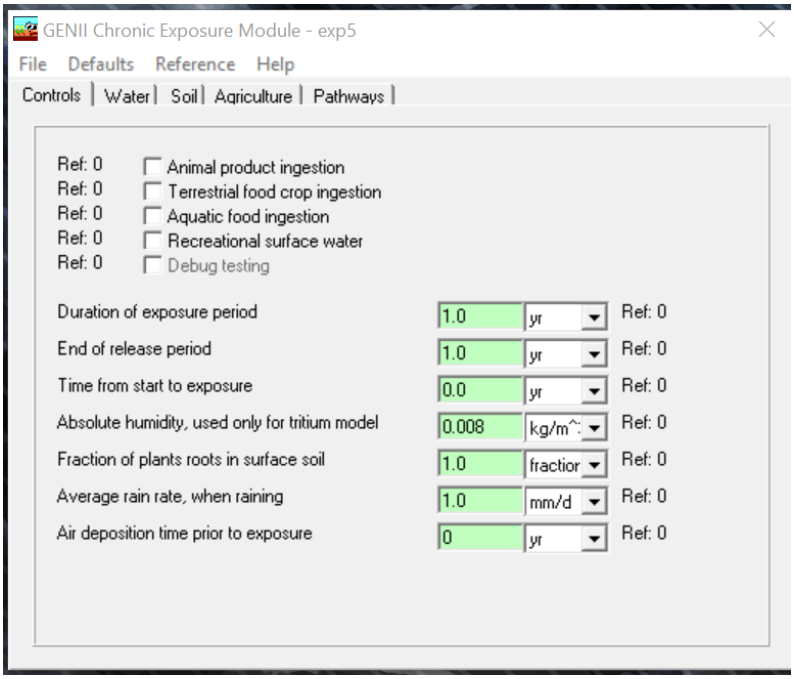



### 3.6.5 User Input for Icon 5 Exposure Pathways (exp5) – Human Exposure & Risk

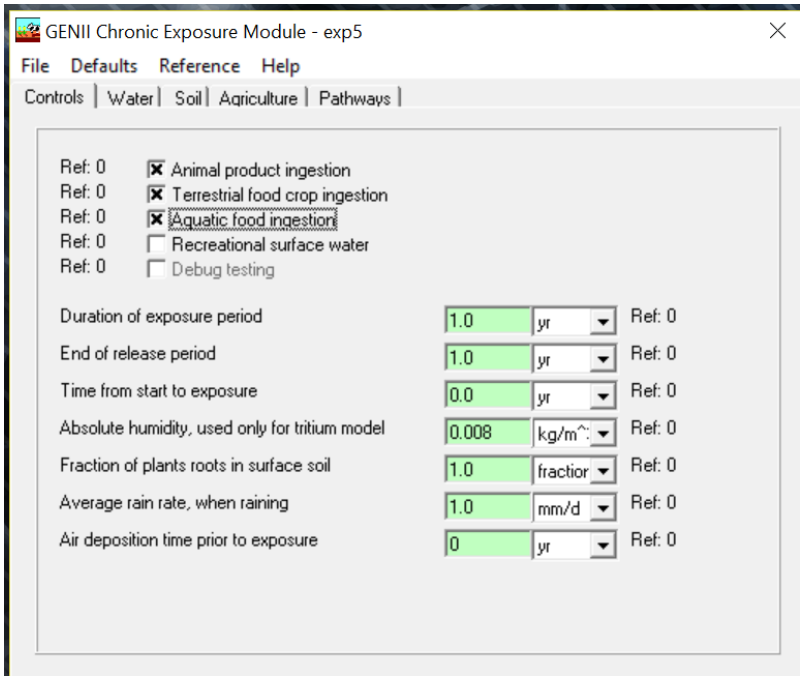
Icon 5: Right click on 'Exposure Pathways (exp5)' and the following window opens. Select User Input.



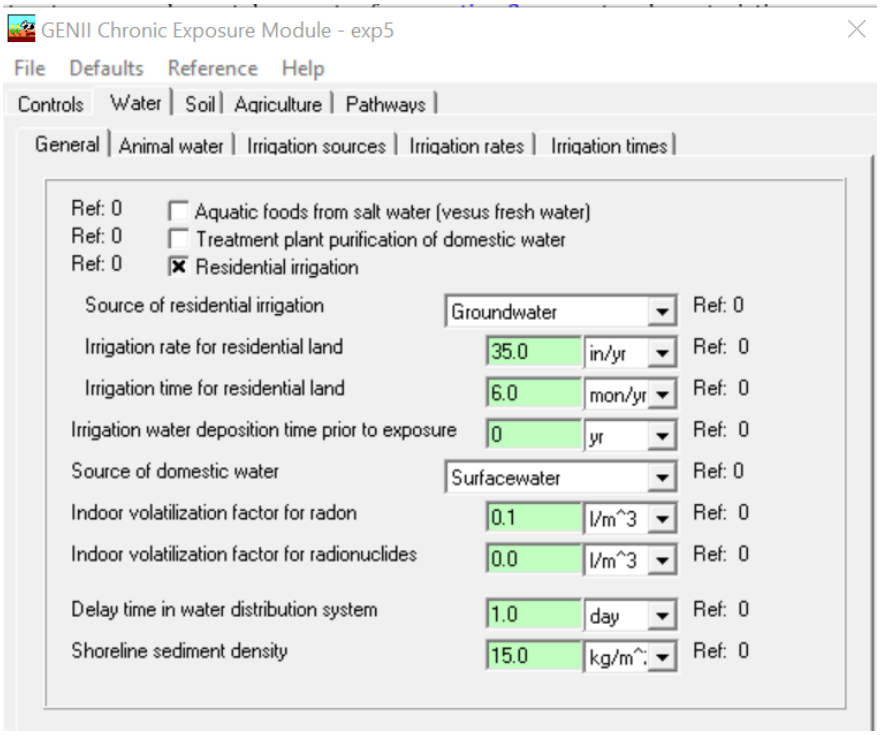

The GENII 'Chronic Exposure Module – exp5' opens.




For this model in the ‘Controls’ tab select the first three: ‘Animal product ingestion’, ‘Terrestrial food crop ingestion’, and ‘Aquatic food ingestion’.

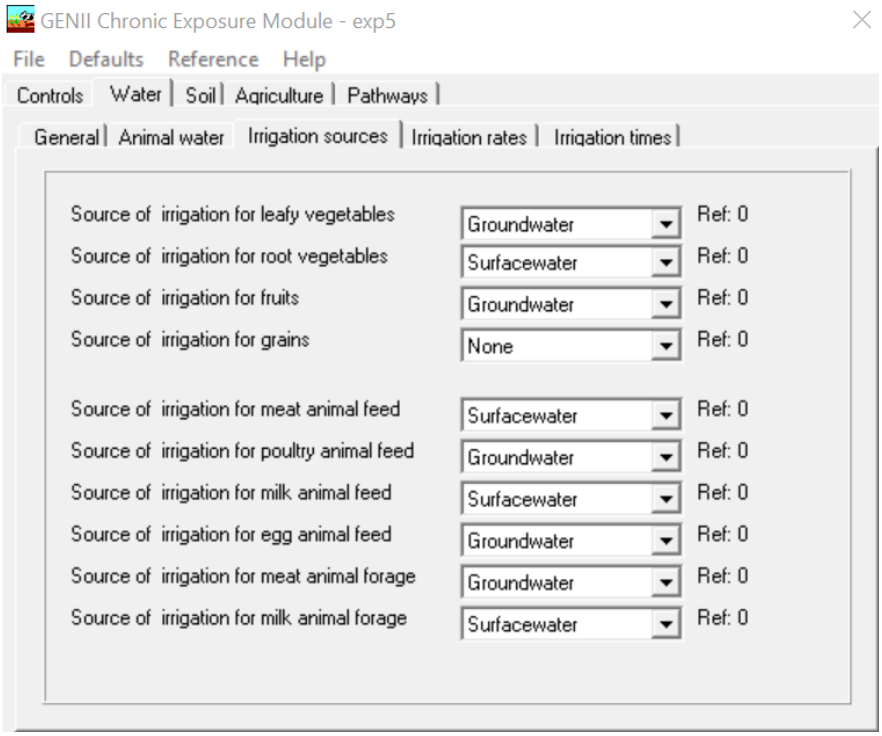



In the ‘Water’ tab, under the ‘General’ subtab select ‘Residential irrigation’. For the ‘Source of residential irrigation’ select ‘Groundwater’. For the ‘Source of domestic water’ select ‘Surfacewater’.



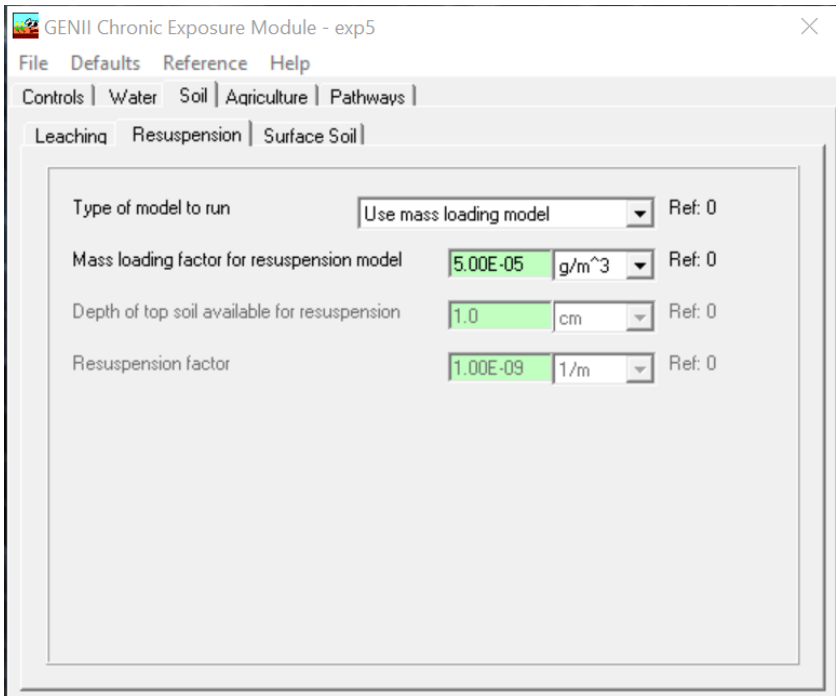

In the ‘Water tab’:  ‘Animal water’ no change.

In the ‘Water tab’:  ‘Irrigation sources’, ‘ground water’ is selected for ‘leafy vegetables’, ‘fruits’, ‘poultry animal feed’, ‘egg animal feed’, and ‘meat animal forage’; ‘surface water’ is selected for ‘root vegetables’, ‘meat animal feed’, ‘milk animal feed’, and ‘milk animal forage’; ‘none’ is selected for ‘grains’ as shown below.

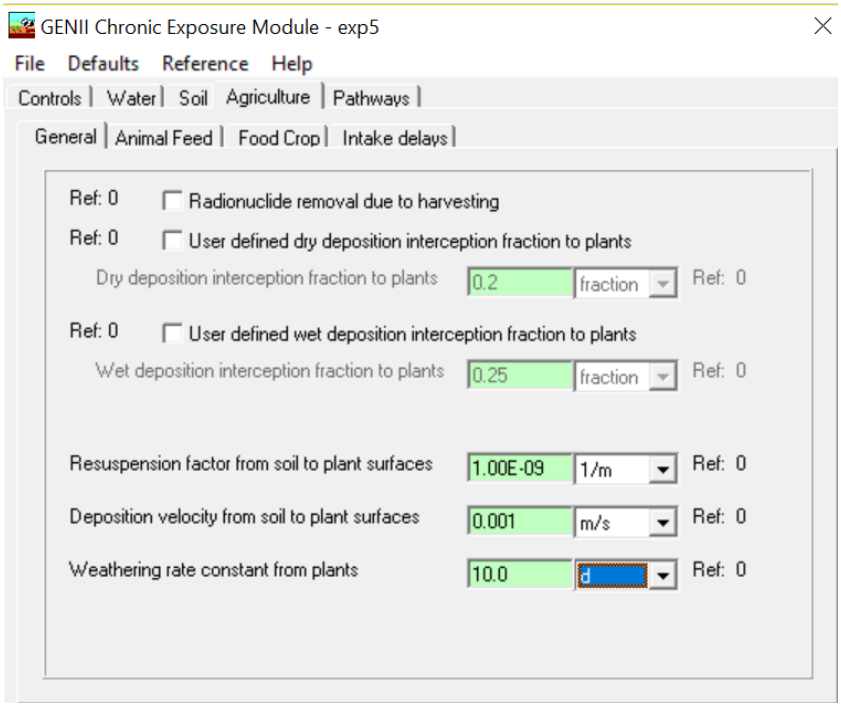


In the ‘Water’ tab:  ‘irrigation rates’ no change; ‘irrigation times’ no change.

In the ‘Soil’ tab:  ‘Leaching’ no change; ‘surface soil’ no change.  In the ‘Soil’ tab, Resuspension select “Use mass loading model”.

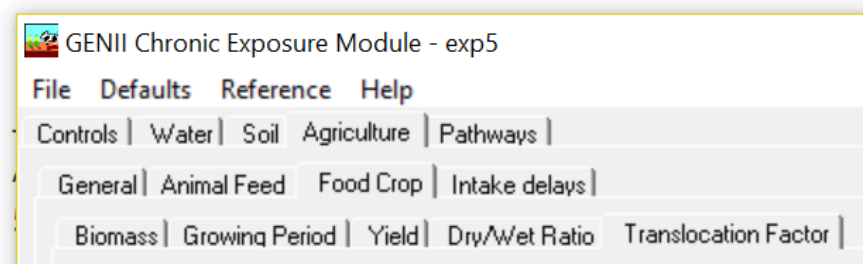



In the ‘Agriculture’ tab, ‘General’ subtab, remove check for ‘Radionuclide removal due to harvesting’ with the resulting window as shown below.

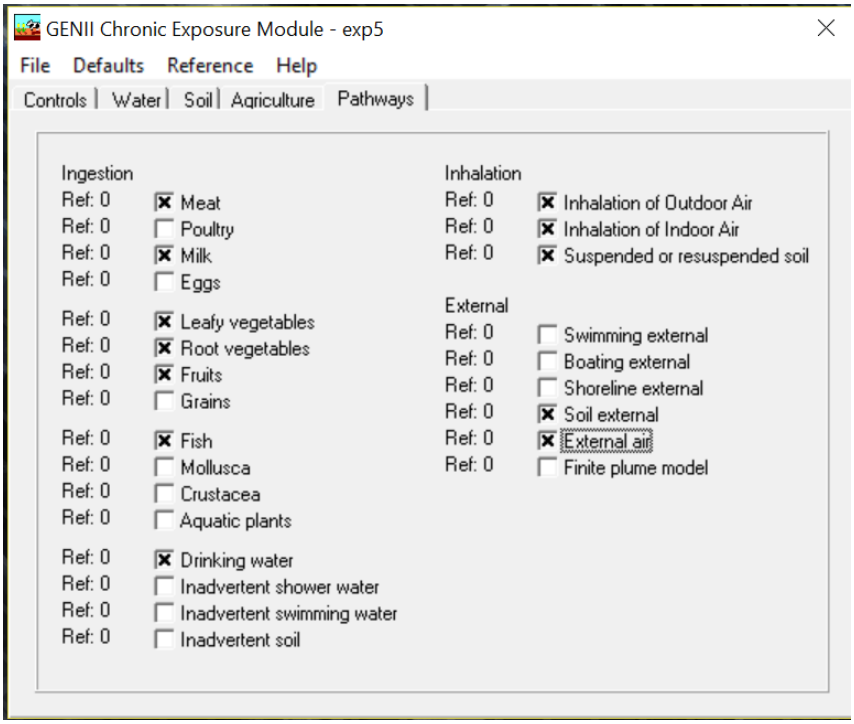


In the ‘Agriculture’ tab: ‘Animal feed’ has the following sub tabs: ‘Biomass’, ‘Consumption’, ‘Storage Time’, ‘Diet Fraction’, ‘Growing Period’, ‘Yield’, ‘Dry/Wet Ratio’, ‘Translocation Factor’, and ‘Soil Intake’. No change to all sub tabs.

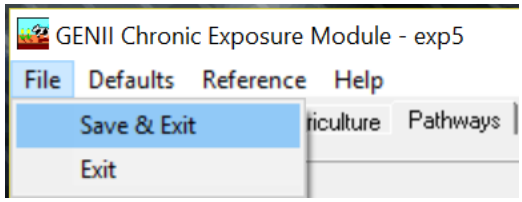
In the ‘Agriculture’ tab: ‘Food Crop’ has the following sub tabs: ‘Biomass’, ‘Growing Period’, ‘Yield’, ‘Dry/Wet Ratio’, and ‘Translocation Factor’. No change to all sub tabs.




In the ‘Pathways’ tab: ‘Ingestion’ select ‘Meat’, ‘Milk’, ‘Leafy vegetables’, ‘Root vegetables’, ‘Fruits’, ‘Fish’, and ‘Drinking water’; ‘Inhalation’ select: ‘Inhalation of Outdoor Air’, ‘Inhalation of Indoor Air’, and ‘Suspended or resuspended soil’; ‘External’ select: ‘Soil external’, and ‘External air’ as shown below.



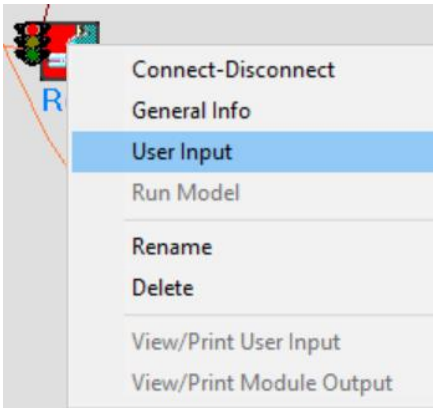

To save the data select File Save and Exit.



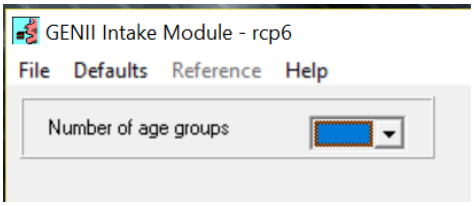
After selecting Save and Exit, the GENII 'Chronic Exposure Module – exp5' closes. Observe the icon 'Exposure Pathways (exp5)' traffic signal switched from red to yellow.

### 3.6.6 User Input for Icon 6 Receptor Intakes (rcp6) – Human Exposure & Risk

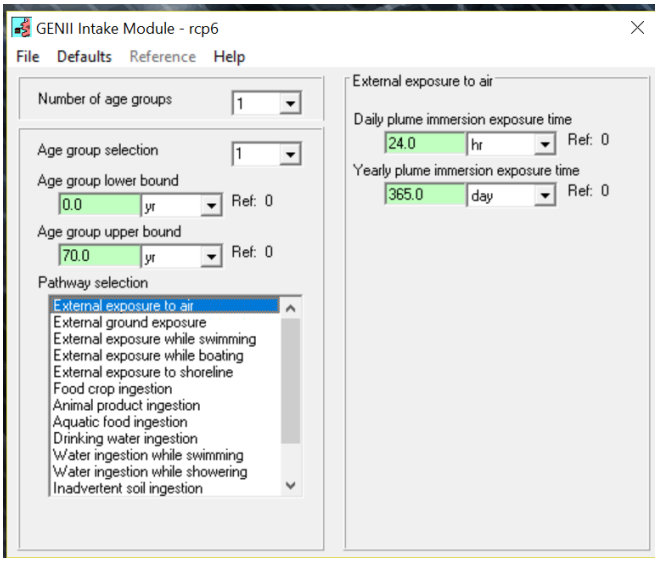
Right click on 'Receptor Intakes (rcp6)' and the following window opens. Select 'User Input'.



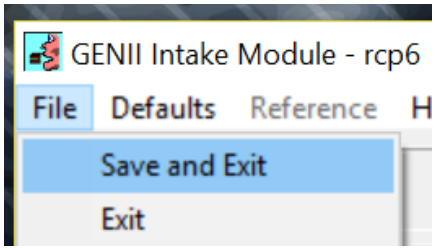

The GENII Intake Module – rcp6 opens.



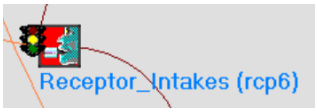

For this model enter '1' in 'Number of age groups'. The window populates as shown.



To save the data select File Save and Exit.

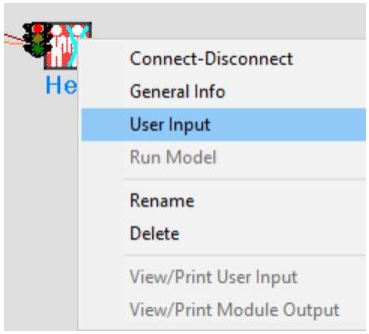



After selecting Save and Exit, the 'GENII Intake Module – Receptor Intakes (rcp6)' closes. Observe the 'Receptor Intakes (rcp6)' traffic signal switched from red to yellow.

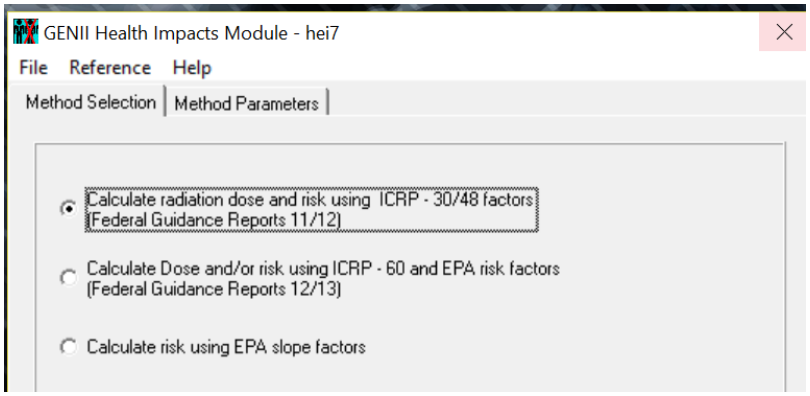



### 3.6.7 User Input for Icon 7 Health Impacts (hei7) – Human Exposure & Risk

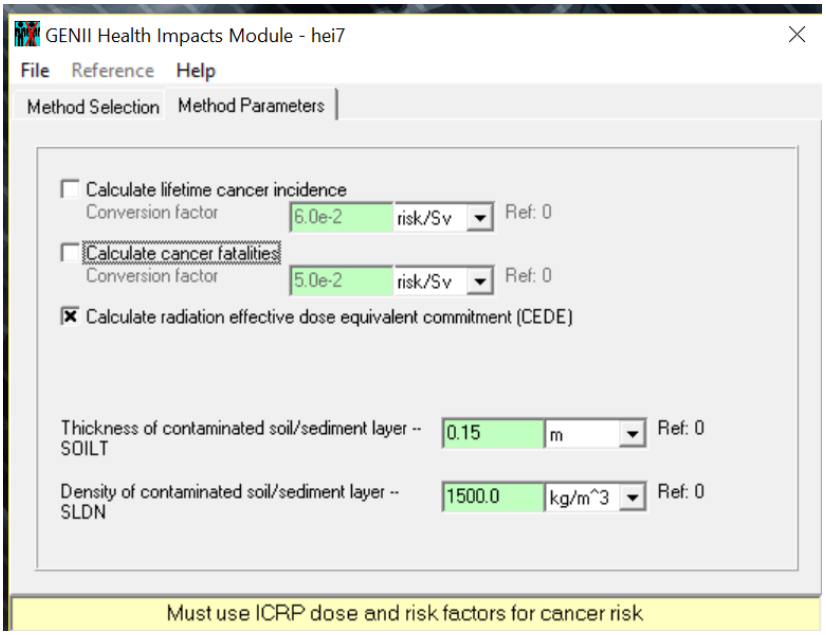
Icon 7: Right click on 'Health Impacts (hei7)' and the following window opens. Select 'User Input'.



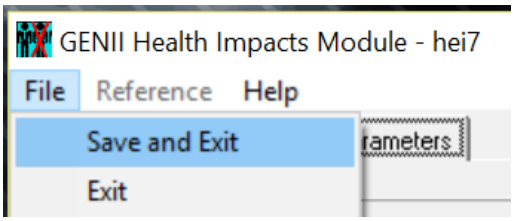

The 'GENII Health Impacts Module – hei7' opens.




For this model there are no changes to the 'Method Selection' tab. For the 'Method Parameters' tab select 'Calculate radiation effective dose equivalent commitment (CEDE)'. Note the yellow clarification below the module.



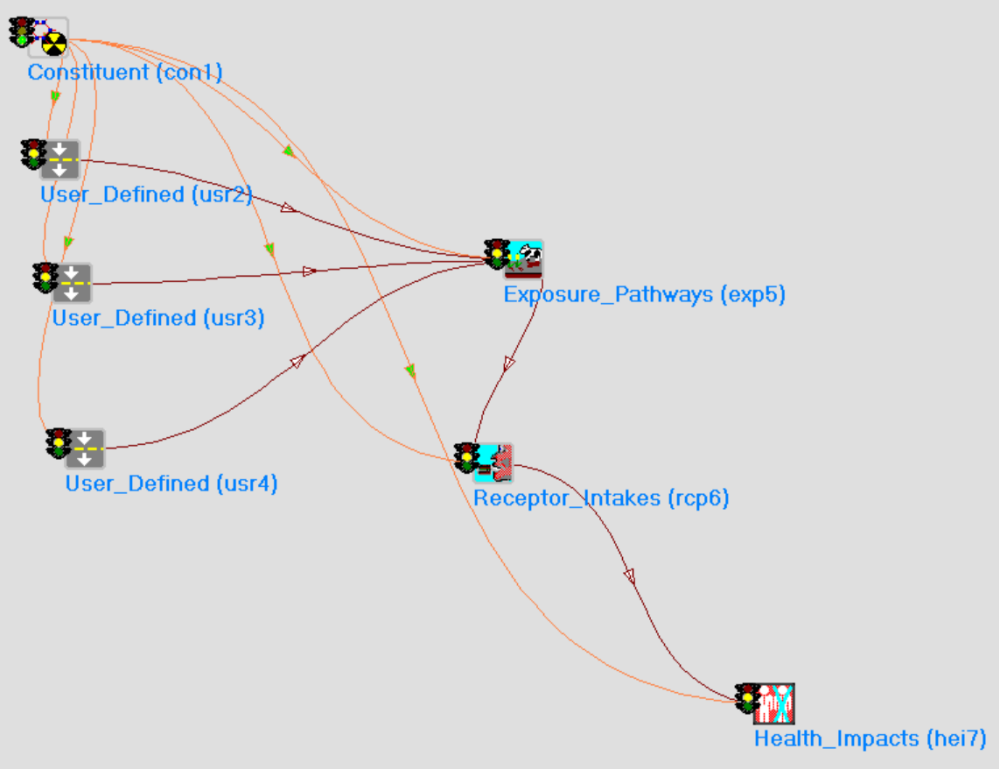

To save the data select File Save and Exit.




After selecting Save and Exit, the 'GENII Health Impacts Module – hei7' closes. Observe the icon 'Health Impacts (hei7)' traffic signal switched from red to yellow.

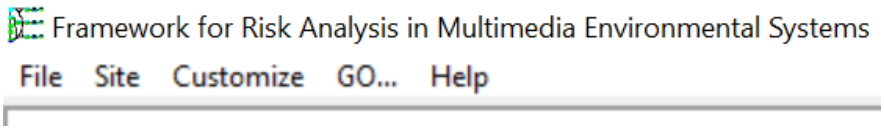
### 3.6.8 User Input Summary

Note that the model icon traffic signals are yellow after this step (the Constituent Database signal will be green).




## 3.7 Running Example 5

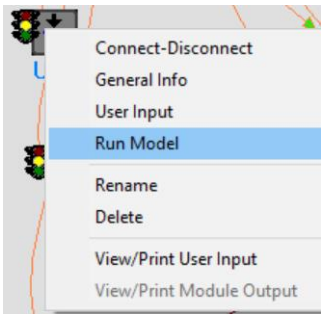
There are two ways to run examples: running the entire model or running each individual icon in sequence. The entire model sequence may be run automatically by selecting 'GO' at the top ribbon.



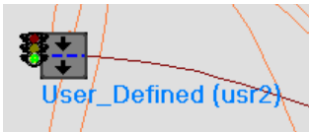

The sequence approach is shown below.

### 3.7.1 Running Icon 2 User Defined (usr2) – Boundary Conditions and Examining the Results

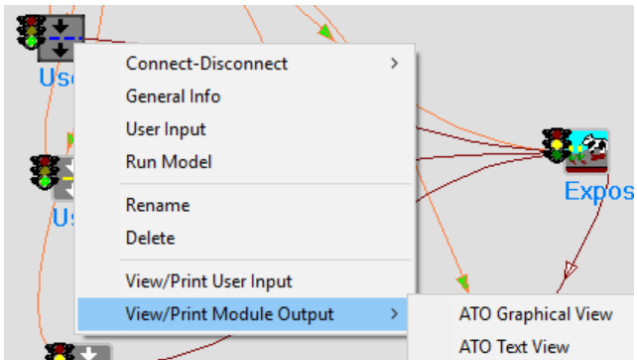
Icon 2: Right click on 'User Defined (usr2)' and the following window opens. Select 'Run Model'.



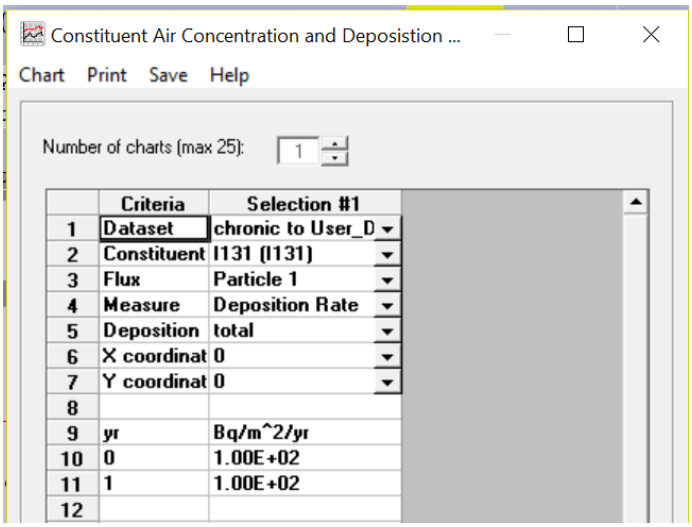

The model runs and the window closes. Observe the icon 'User Defined (usr2)' traffic signal switched from yellow to green.



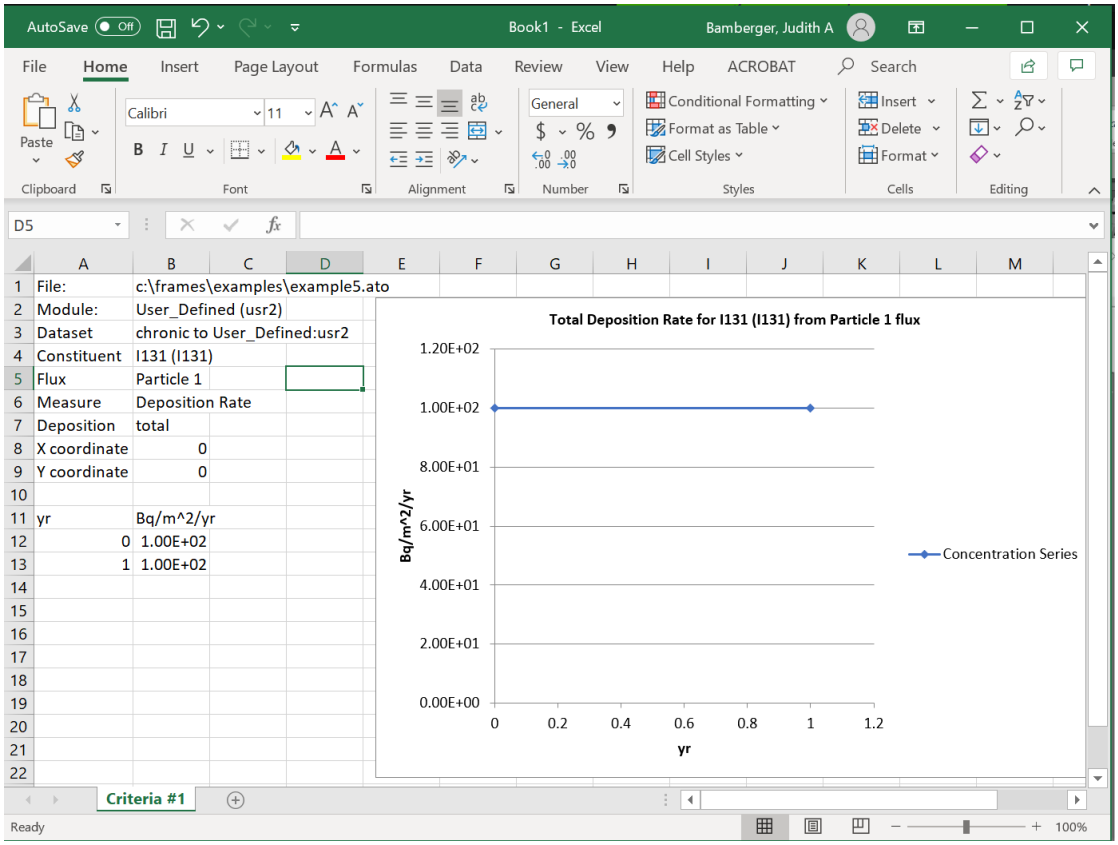

To view the model results right click on 'User Defined (usr2)' and the following window opens. Select 'View/Print Module Output'. There are two options: 'ATP Graphical View' and 'ATO Text View'.




Select 'ATP Graphical View' and the following window 'Constituent Air Concentration and Deposition – Time Series' opens.

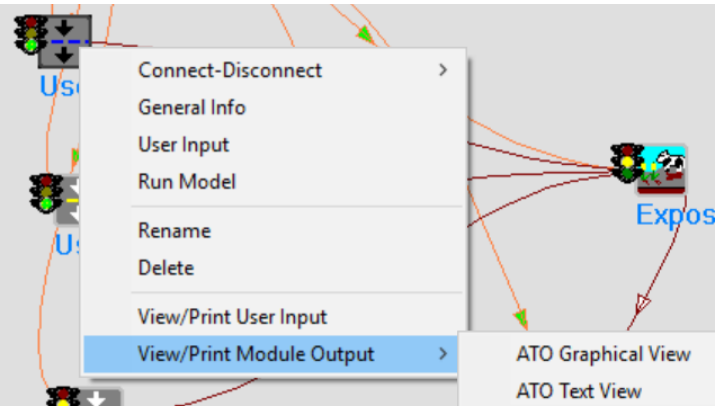



Select ‘Chart’ in the upper ribbon. The following excel spreadsheet and chart open.

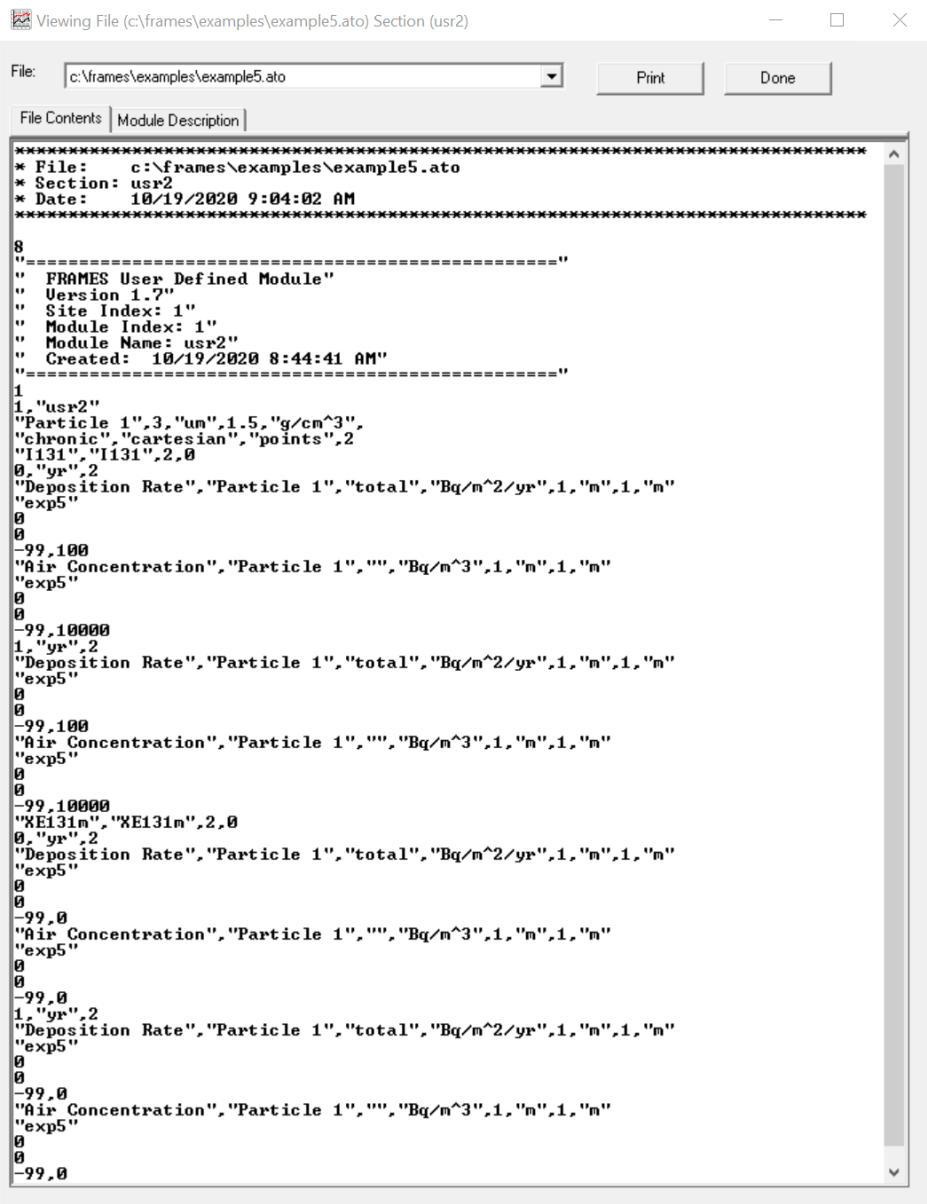



Select ‘Print’ to print the file. Select Save to save the file. Select X in the upper right corner to close the window.

Right click on ‘User Defined (usr2)’ and the following window opens. Select ‘View/Print Module Output’. There are two options ‘ATO Graphical View’ and ‘ATO Text View’.



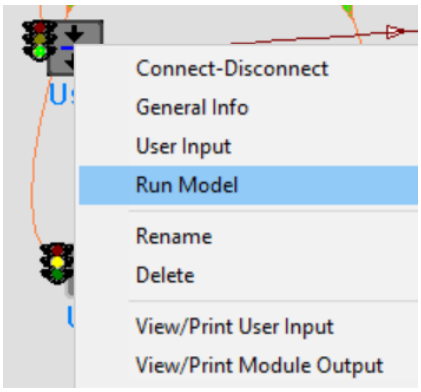

Select ‘ATO Text View’ and the following window Viewing File (c:\frames\Examples\Exmple5.ato) Section (usr2) opens.




Select ‘Print’ to print the file.  Select Done or X in the upper right corner to close the window.

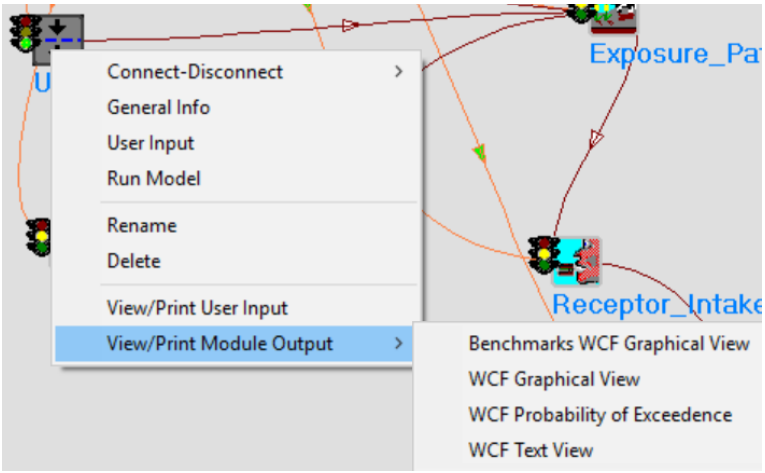
### 3.7.2 Running Icon 3 User Defined (usr3) – Boundary Conditions and Examining the Results

Icon 3:  Right click on ‘User Defined (usr3)’ and the following window opens.  Select ‘Run Model’.

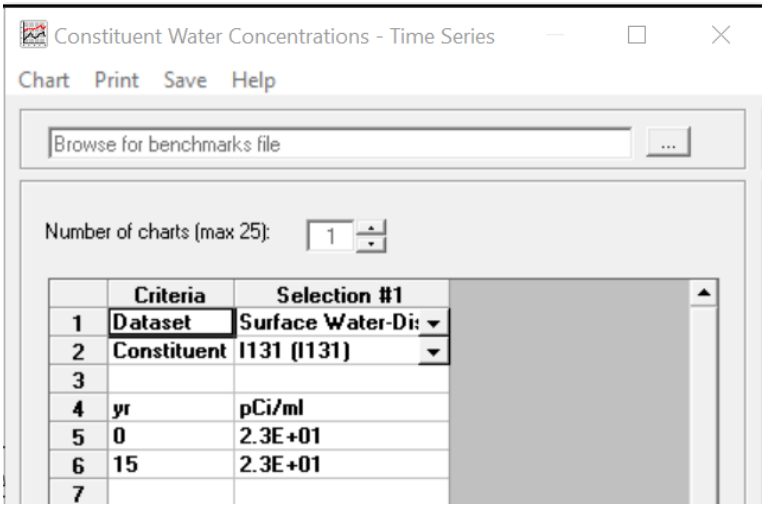



The model runs and the window closes. Observe the 'icon User Defined (usr3)' traffic signal switched from yellow to green.

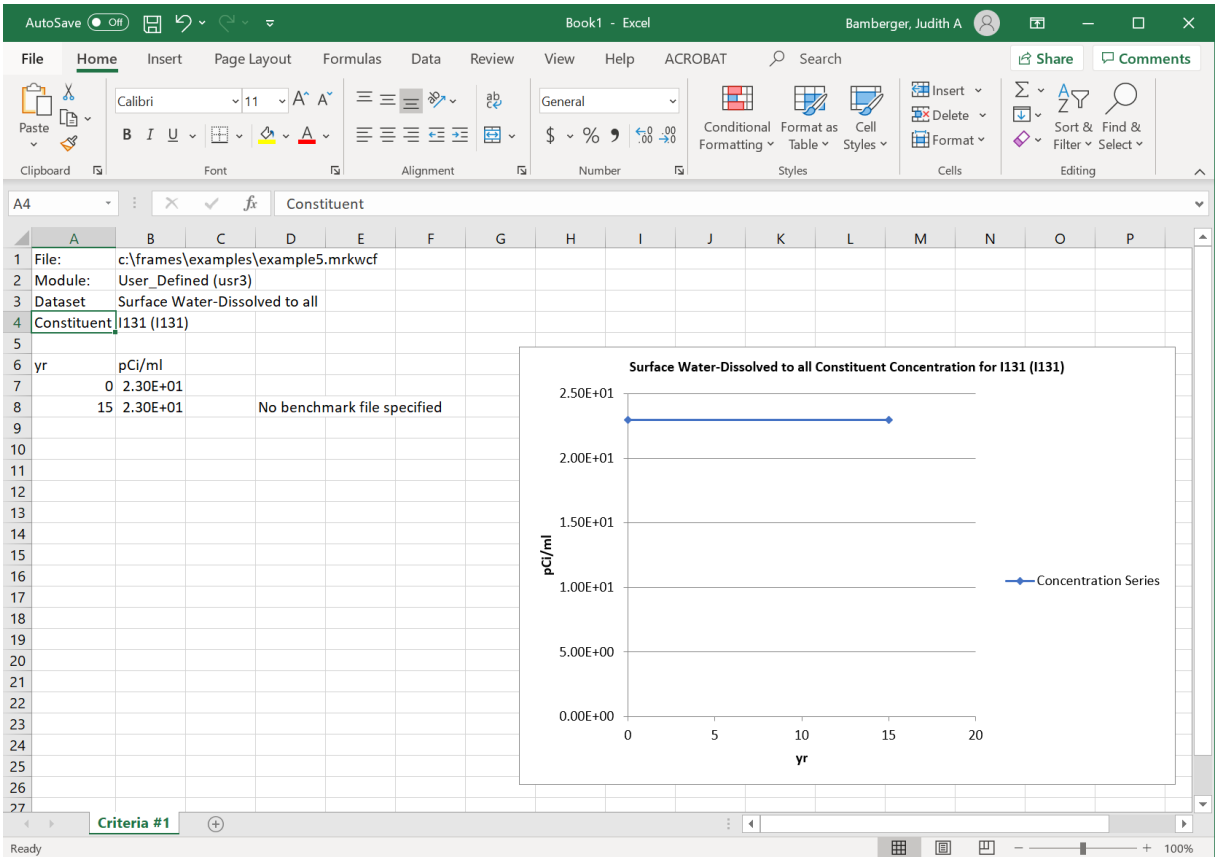
To view the model results right click on 'User Defined (usr3)' and the following window opens. Select 'View/Print Module Output'. There are four options 'Benchmarks WCF Graphical view', 'WCF Graphical View', 'WCF Probability of Exceedance', 'WCF Text View'. The outputs from each of these options are shown sequentially below.




Select 'Benchmarks WCF Graphical View' and the following window 'Constituent Water Concentrations – Time Series' opens. *Note for this example selecting WCF Graphical View opens the same window and links to the same excel file as shown below.*

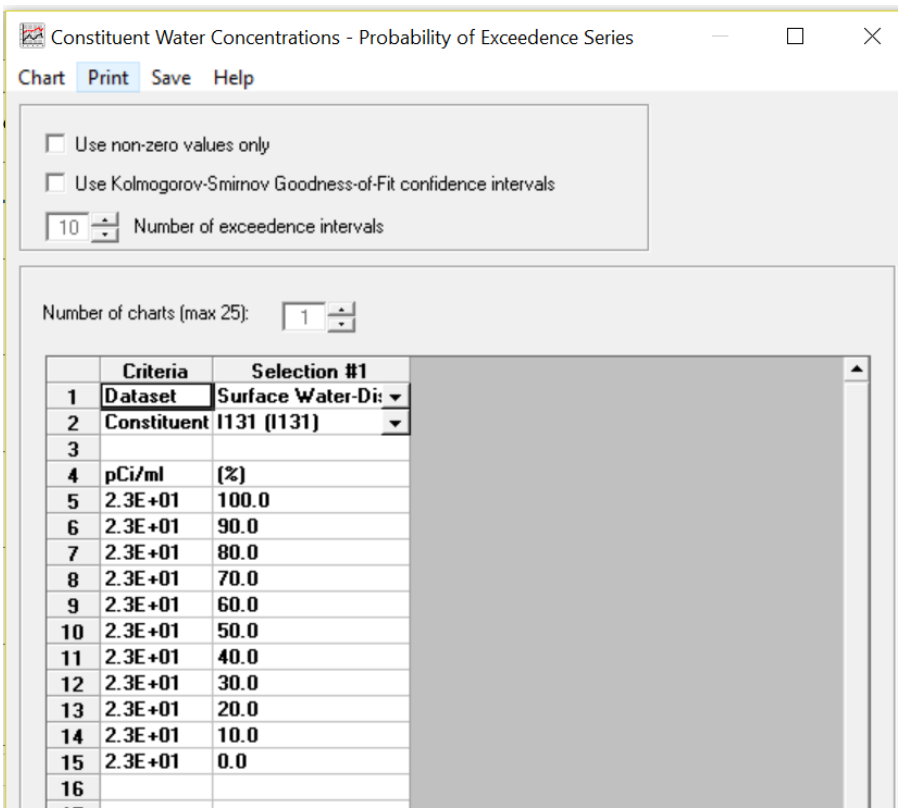



Select ‘Chart’ in the upper ribbon. The following excel spreadsheet and chart open.



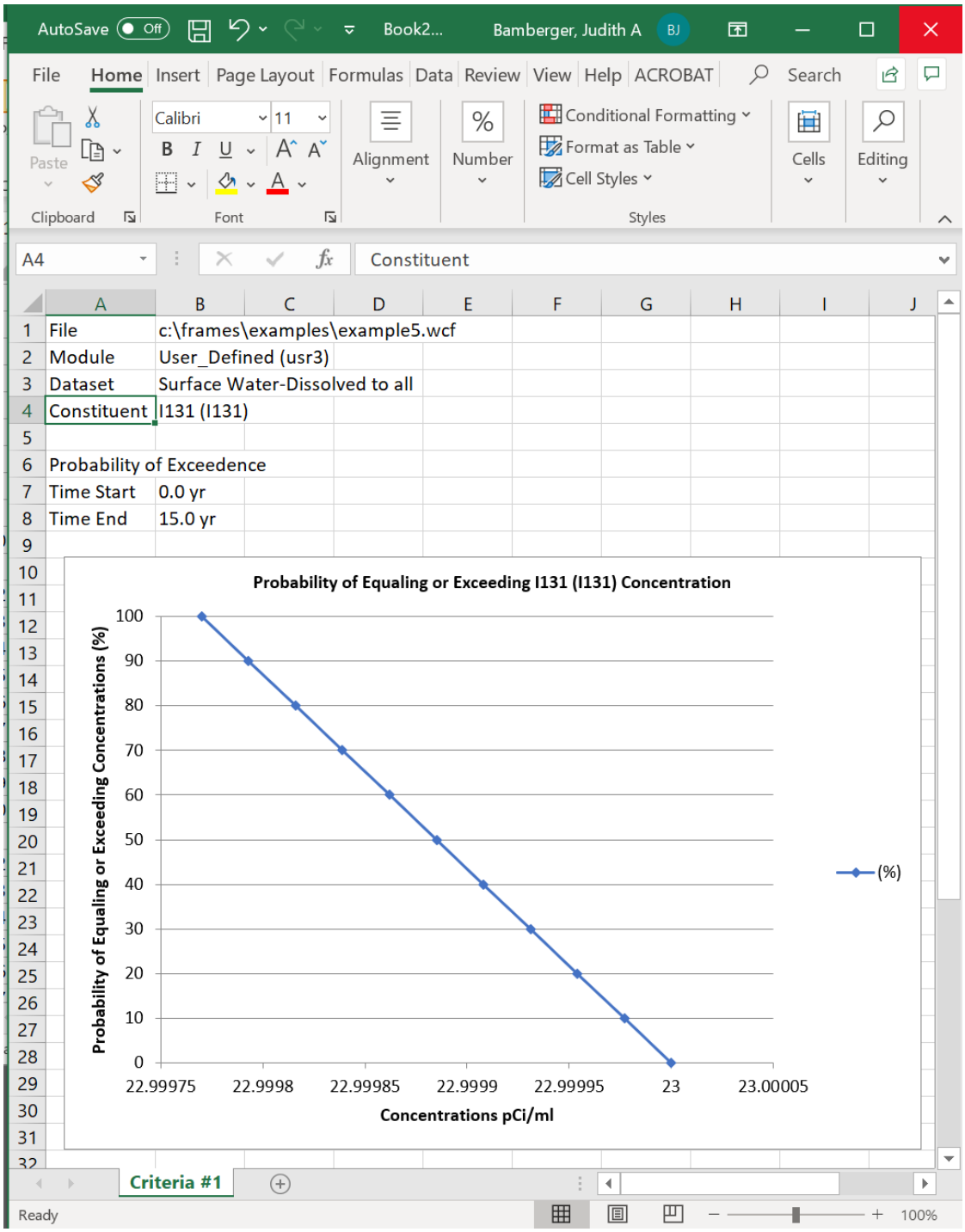

Select ‘Print’ to print the file. Selecting Save to save the file. Select X in the upper right corner to close the window.

Select ‘WCF Probability of Exceedance’ and the following window ‘Constituent Water Concentrations – Probability of Exceedance Series’ opens.



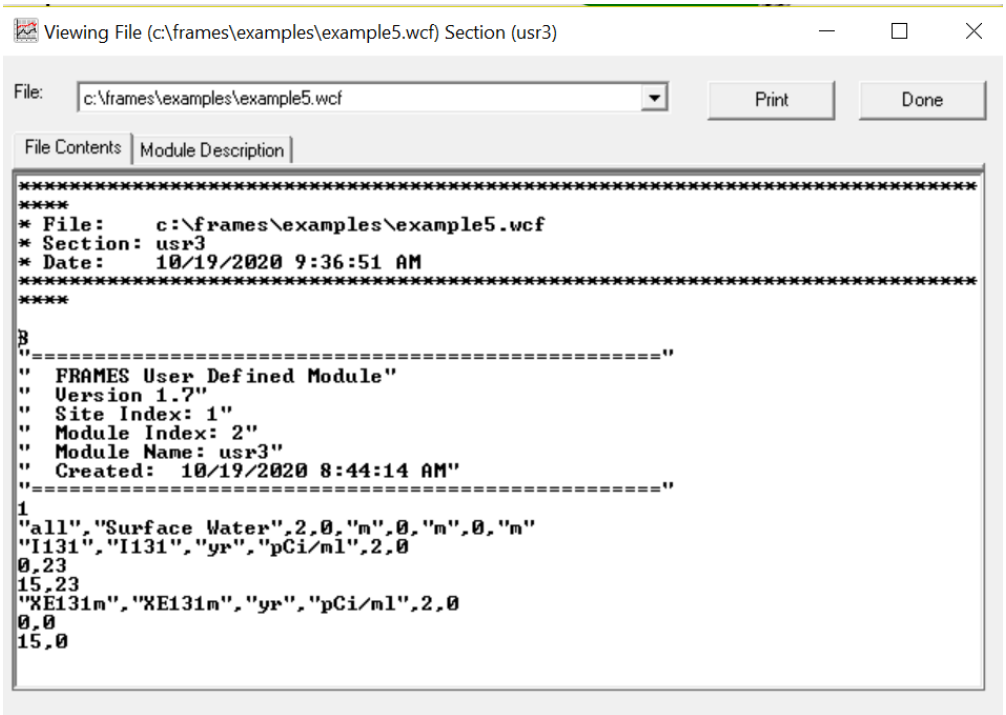

| | Criteria | Selection #1 |
|---|---|---|
| 1 | Dataset | Surface Water-Di: |
| 2 | Constituent | I131 (I131) |
| 3 | | |
| 4 | pCi/ml | (%) |
| 5 | 2.3E+01 | 100.0 |
| 6 | 2.3E+01 | 90.0 |
| 7 | 2.3E+01 | 80.0 |
| 8 | 2.3E+01 | 70.0 |
| 9 | 2.3E+01 | 60.0 |
| 10 | 2.3E+01 | 50.0 |
| 11 | 2.3E+01 | 40.0 |
| 12 | 2.3E+01 | 30.0 |
| 13 | 2.3E+01 | 20.0 |
| 14 | 2.3E+01 | 10.0 |
| 15 | 2.3E+01 | 0.0 |
| 16 | | |

Select ‘Chart’ in the upper ribbon.  The following excel spreadsheet and chart open.




Select ‘Print’ to print the file. Selecting Save to save the file. Select X in the upper right corner to close the window.

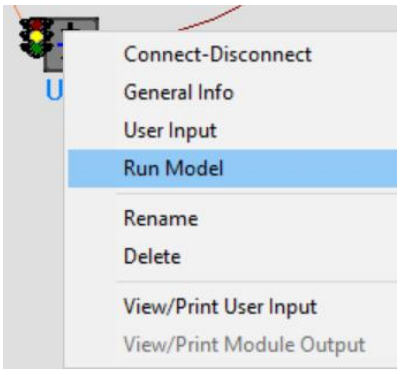
Select ‘WCF Text View’ and the following window opens.



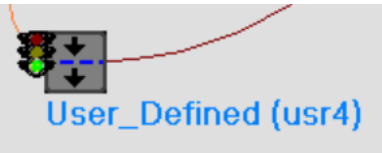

Select 'Print' to print the file. Select Done or X in the upper right corner to close the window.

### 3.7.3 Running Icon 4 User Defined (usr4) – Boundary Conditions and Examining the Results

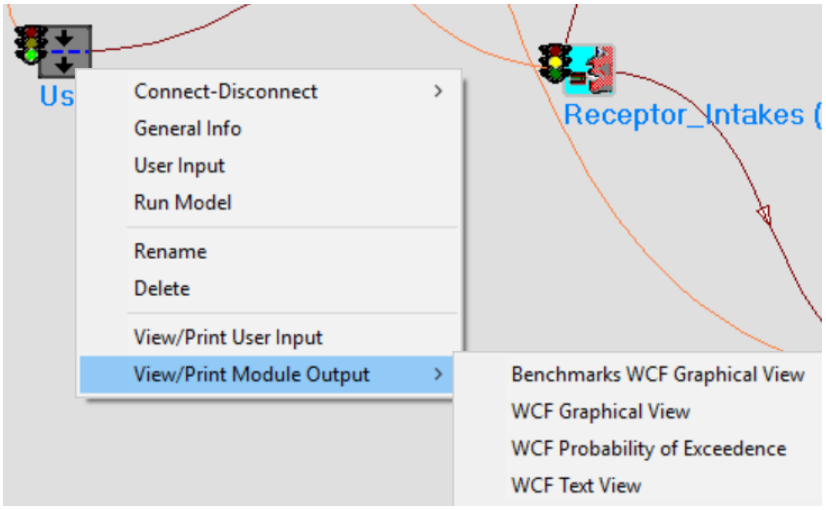
Icon 4: Right click on 'User Defined (usr4)' and the following window opens. Select 'Run Model'.



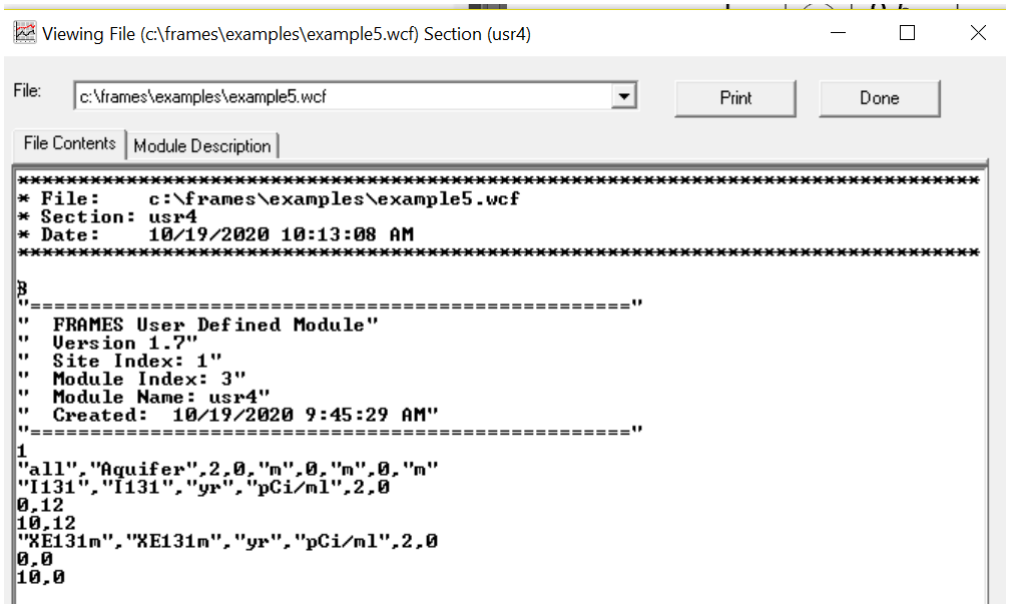

The model runs and the window closes. Observe the icon 'User Defined (usr4)' traffic signal switched from yellow to green.



To view the model results right click on ‘User Defined (usr4)’ and the following window opens. Select ‘View/Print Module Output’. There are four options ‘Benchmarks WCF Graphical view’, ‘WCF Graphical View’, ‘WCF Probability of Exceedance’, ‘WCF Text View’. The ‘WCF Text view’ output is shown sequentially below. For examples of other outputs see output from Icon 3 in the prior section.



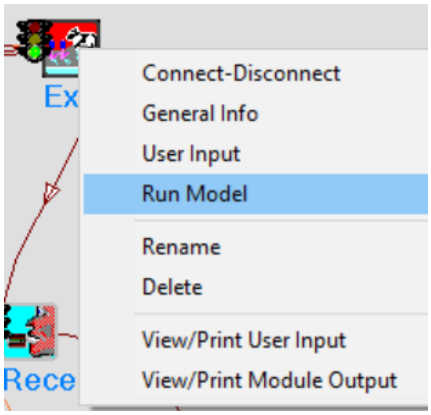

Select ‘WCF Text View’ and the following window opens.




Select ‘Print’ to print the file. Select Done or X in the upper right corner to close the window.

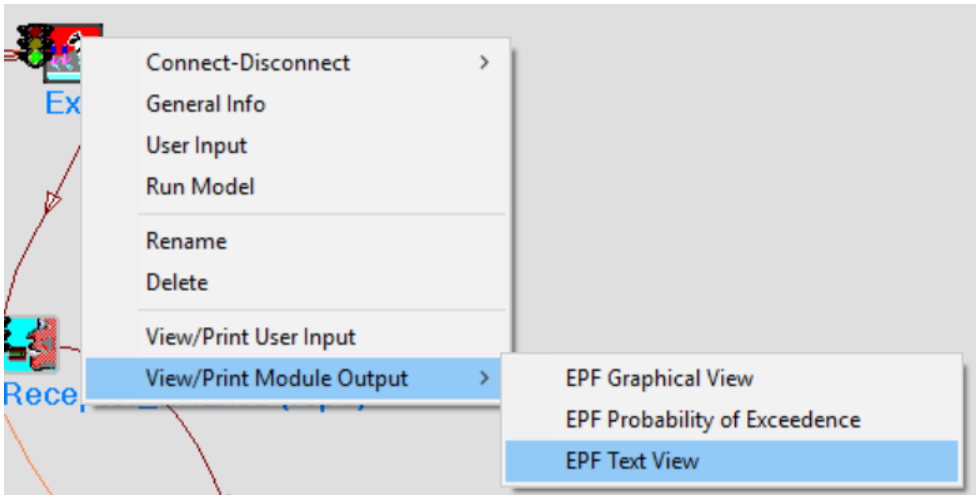
### 3.7.4 Running Icon 5 Exposure Pathways (exp5) – Human Exposure & Risk Text View Results

Icon 5: Right click on ‘Exposure Pathways (exp5)’ and the following window opens. Select ‘Run Model’.

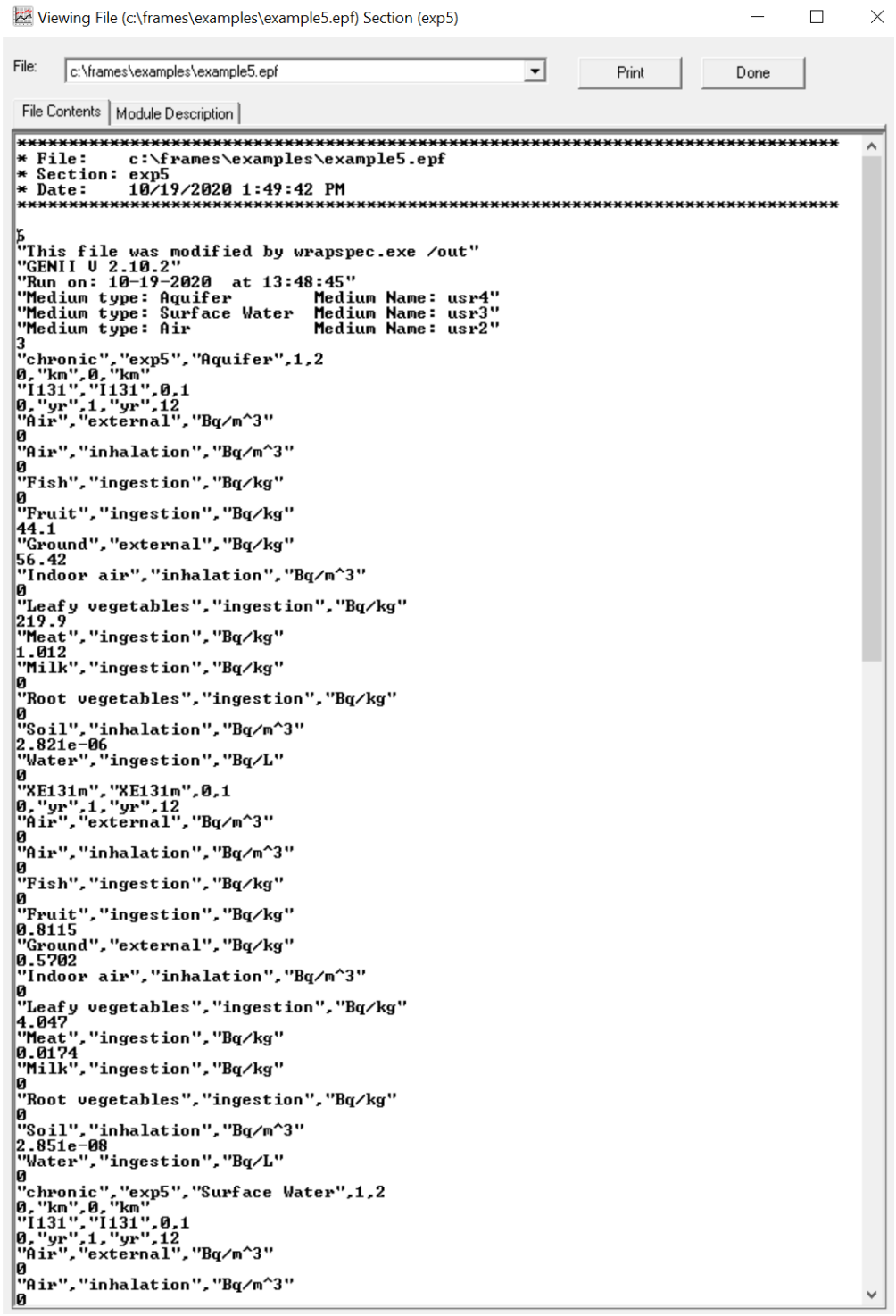



The model runs and the window closes. Observe the icon 'Exposure Pathways (exp5)' traffic signal is green.

To view the model results right click on 'Exposure Pathways (exp5)' and the following window opens. Select 'View/Print Module Output'. There are three options 'EPF Graphical View', 'EPF Probability of Exceedance', 'EPF Text View'. The 'EPF Text view' output is shown sequentially below. For examples of other outputs see output from Running Icon 3 above.



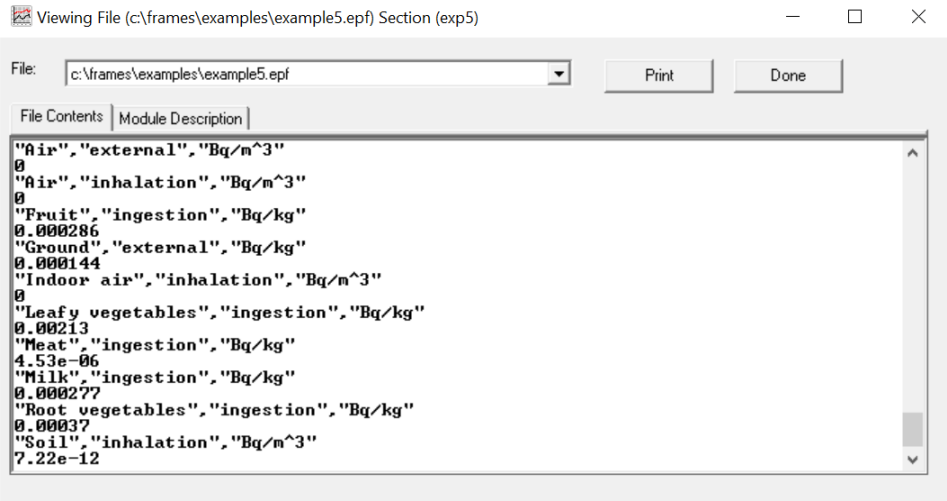

Select 'EPF Text View' and the following window opens. The file is long and is shown in three segments.




```
**********************************************************************************
* File:    c:\frames\examples\example5.epf
* Section: exp5
* Date:    10/19/2020 1:49:42 PM
**********************************************************************************

5
"This file was modified by wrapspec.exe /out"
"GENII V 2.10.2"
"Run on: 10-19-2020  at 13:48:45"
"Medium type: Aquifer         Medium Name: usr4"
"Medium type: Surface Water   Medium Name: usr3"
"Medium type: Air             Medium Name: usr2"
3
"chronic","exp5","Aquifer",1,2
0,"km",0,"km"
"I131","I131",0,1
0,"yr",1,"yr",12
"Air","external","Bq/m^3"
0
"Air","inhalation","Bq/m^3"
0
"Fish","ingestion","Bq/kg"
0
"Fruit","ingestion","Bq/kg"
44.1
"Ground","external","Bq/kg"
56.42
"Indoor air","inhalation","Bq/m^3"
0
"Leafy vegetables","ingestion","Bq/kg"
219.9
"Meat","ingestion","Bq/kg"
1.012
"Milk","ingestion","Bq/kg"
0
"Root vegetables","ingestion","Bq/kg"
0
"Soil","inhalation","Bq/m^3"
2.821e-06
"Water","ingestion","Bq/L"
0
"XE131m","XE131m",0,1
0,"yr",1,"yr",12
"Air","external","Bq/m^3"
0
"Air","inhalation","Bq/m^3"
0
"Fish","ingestion","Bq/kg"
0
"Fruit","ingestion","Bq/kg"
0.8115
"Ground","external","Bq/kg"
0.5702
"Indoor air","inhalation","Bq/m^3"
0
"Leafy vegetables","ingestion","Bq/kg"
4.047
"Meat","ingestion","Bq/kg"
0.0174
"Milk","ingestion","Bq/kg"
0
"Root vegetables","ingestion","Bq/kg"
0
"Soil","inhalation","Bq/m^3"
2.851e-08
"Water","ingestion","Bq/L"
0
"chronic","exp5","Surface Water",1,2
0,"km",0,"km"
"I131","I131",0,1
0,"yr",1,"yr",12
"Air","external","Bq/m^3"
0
"Air","inhalation","Bq/m^3"
0
```

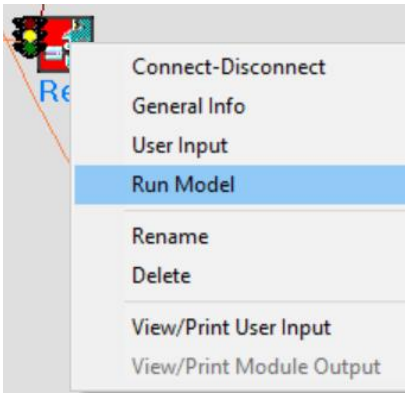
Viewing File (c:\frames\examples\example5.epf) Section (exp5)
File:
c:\frames\examples\example5.epf
Print
Done
File Contents
Module Description
"Air","inhalation","Bq/m^3"
0
"Fish","ingestion","Bq/kg"
31230
"Fruit","ingestion","Bq/kg"
0
"Ground","external","Bq/kg"
0
"Indoor air","inhalation","Bq/m^3"
0
"Leafy vegetables","ingestion","Bq/kg"
0
"Meat","ingestion","Bq/kg"
303.2
"Milk","ingestion","Bq/kg"
1275
"Root vegetables","ingestion","Bq/kg"
85.46
"Soil","inhalation","Bq/m^3"
0
"Water","ingestion","Bq/L"
780.7
"XE131m","XE131m",0,1
0,"yr",1,"yr",12
"Air","external","Bq/m^3"
0
"Air","inhalation","Bq/m^3"
0
"Fish","ingestion","Bq/kg"
20.31
"Fruit","ingestion","Bq/kg"
0
"Ground","external","Bq/kg"
0
"Indoor air","inhalation","Bq/m^3"
0
"Leafy vegetables","ingestion","Bq/kg"
0
"Meat","ingestion","Bq/kg"
5.212
"Milk","ingestion","Bq/kg"
1.682
"Root vegetables","ingestion","Bq/kg"
1.571
"Soil","inhalation","Bq/m^3"
0
"Water","ingestion","Bq/L"
0.5076
"chronic","exp5","Air",1,2
0,"km",0,"km"
"I131","I131",0,1
0,"yr",1,"yr",10
"Air","external","Bq/m^3"
10000
"Air","inhalation","Bq/m^3"
10000
"Fruit","ingestion","Bq/kg"
0.0156
"Ground","external","Bq/kg"
0.0143
"Indoor air","inhalation","Bq/m^3"
10000
"Leafy vegetables","ingestion","Bq/kg"
0.116
"Meat","ingestion","Bq/kg"
0.000264
"Milk","ingestion","Bq/kg"
0.21
"Root vegetables","ingestion","Bq/kg"
0.0201
"Soil","inhalation","Bq/m^3"
7.15e-10
"XE131m","XE131m",0,1
0,"yr",1,"yr",10
"Air","external","Bq/m^3"
0



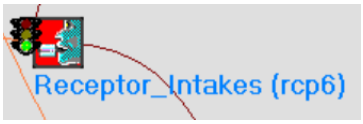

Select ‘Print’ to print the file. Select Done or X in the upper right corner to close the window.

### 3.7.5 Running Icon 6 Receptor Intakes (rcp6) – Human Exposure & Risk Text View Results

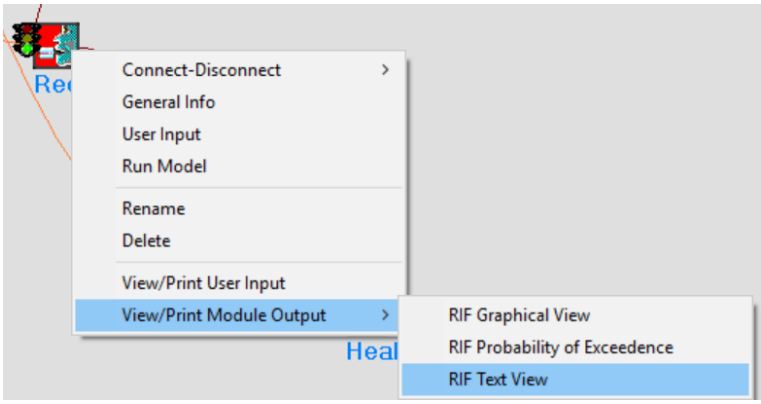
Icon 6: Right click on ‘Receptor Intakes (rcp6)’ and the following window opens. Select ‘Run Model’.




The model runs and the window closes. Observe the icon ‘Receptor Intakes (rcp6)’ traffic signal is green.




To view the model results right click on ‘Receptor Intakes (rcp6)’ and the following window opens. Select ‘View/Print Module Output’. There are three options: ‘RIF Graphical View’, ‘RIF Probability of Exceedance’, ‘RIF Text View’. The RIF Text view output is shown sequentially below. For examples of other outputs see output from Icon 3 above.

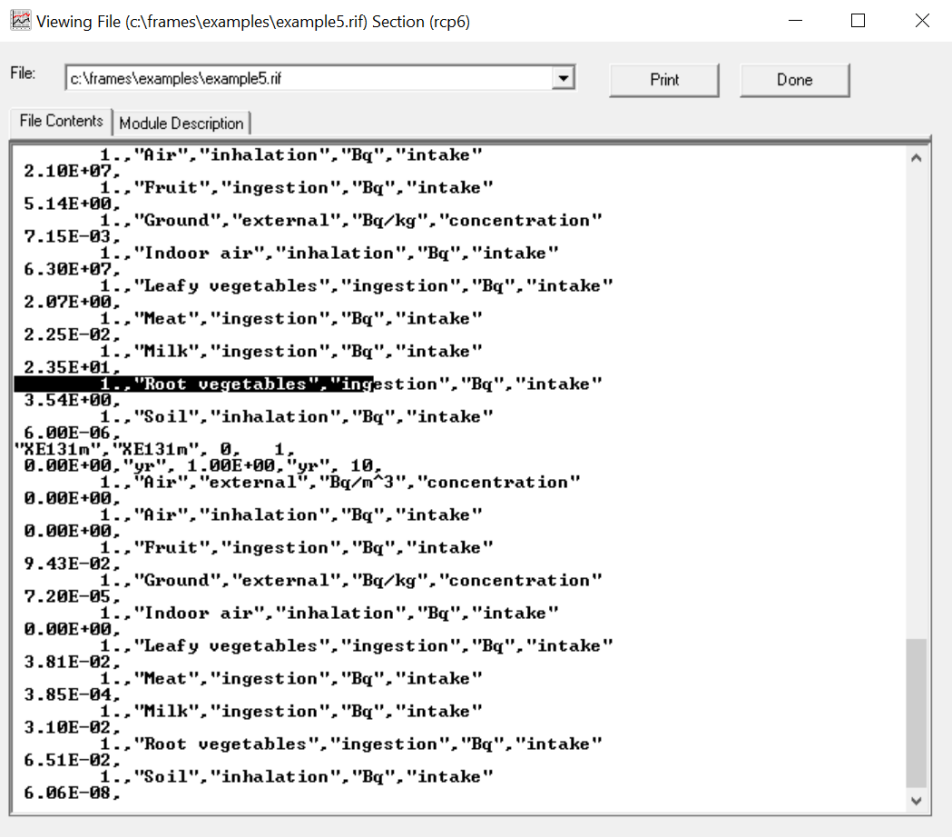



Select ‘RIF Text View’ and the following window opens.  The file is long and is shown in three segments.

```
* File:    c:\frames\examples\example5.rif
* Section: rcp6
* Date:    10/19/2020 1:57:26 PM
********************************************************************************

   4,
 This receptor has data for  1 exposure sources.
 Exposure source  1, is exp5
 GENII VER 2.10.2
Run on: 10-19-2020  at 13:57:05
  3,
"chronic","exp5","Aquifer",  1, 1, 2,
      0.0,"km",       0.0,"km",
   0.,   70.,
"I131","I131", 0,   1,
 0.00E+00,"yr", 1.00E+00,"yr", 12,
         1.,"Air","external","Bq/m^3","concentration"
 0.00E+00,
         1.,"Air","inhalation","Bq","intake"
 0.00E+00,
         1.,"Fish","ingestion","Bq","intake"
 0.00E+00,
         1.,"Fruit","ingestion","Bq","intake"
 1.45E+04,
         1.,"Ground","external","Bq/kg","concentration"
 2.82E+01,
         1.,"Indoor air","inhalation","Bq","intake"
 0.00E+00,
         1.,"Leafy vegetables","ingestion","Bq","intake"
 3.93E+03,
         1.,"Meat","ingestion","Bq","intake"
 8.61E+01,
         1.,"Milk","ingestion","Bq","intake"
 0.00E+00,
         1.,"Root vegetables","ingestion","Bq","intake"
 0.00E+00,
         1.,"Soil","inhalation","Bq","intake"
 2.37E-02,
         1.,"Water","ingestion","Bq","intake"
 0.00E+00,
"XE131m","XE131m", 0,   1,
 0.00E+00,"yr", 1.00E+00,"yr", 12,
         1.,"Air","external","Bq/m^3","concentration"
 0.00E+00,
         1.,"Air","inhalation","Bq","intake"
 0.00E+00,
         1.,"Fish","ingestion","Bq","intake"
 0.00E+00,
         1.,"Fruit","ingestion","Bq","intake"
 2.67E+02,
         1.,"Ground","external","Bq/kg","concentration"
 2.85E-01,
         1.,"Indoor air","inhalation","Bq","intake"
 0.00E+00,
         1.,"Leafy vegetables","ingestion","Bq","intake"
 7.24E+01,
         1.,"Meat","ingestion","Bq","intake"
 1.48E+00,
         1.,"Milk","ingestion","Bq","intake"
 0.00E+00,
         1.,"Root vegetables","ingestion","Bq","intake"
 0.00E+00,
         1.,"Soil","inhalation","Bq","intake"
 2.39E-04,
         1.,"Water","ingestion","Bq","intake"
 0.00E+00,
"chronic","exp5","Surface Water",  1, 1, 2,
      0.0,"km",       0.0,"km",
   0.,   70.,
"I131","I131", 0,   1,
 0.00E+00,"yr", 1.00E+00,"yr", 12,
         1.,"Air","external","Bq/m^3","concentration"
 0.00E+00,
         1.,"Air","inhalation","Bq","intake"
 0.00E+00,
```

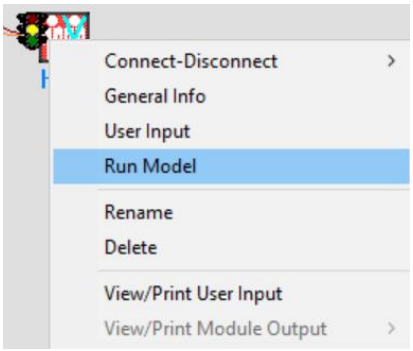
Viewing File (c:\frames\examples\example5.rif) Section (rcp6)
File:
c:\frames\examples\example5.rif
Print
Done
File Contents
Module Description
1.,"Air","inhalation","Bq","intake"
0.00E+00,
1.,"Fish","ingestion","Bq","intake"
1.25E+06,
1.,"Fruit","ingestion","Bq","intake"
0.00E+00,
1.,"Ground","external","Bq/kg","concentration"
0.00E+00,
1.,"Indoor air","inhalation","Bq","intake"
0.00E+00,
1.,"Leafy vegetables","ingestion","Bq","intake"
0.00E+00,
1.,"Meat","ingestion","Bq","intake"
2.58E+04,
1.,"Milk","ingestion","Bq","intake"
1.43E+05,
1.,"Root vegetables","ingestion","Bq","intake"
1.50E+04,
1.,"Soil","inhalation","Bq","intake"
0.00E+00,
1.,"Water","ingestion","Bq","intake"
5.70E+05,
"XE131m","XE131m", 0, 1,
0.00E+00,"yr", 1.00E+00,"yr", 12,
1.,"Air","external","Bq/m^3","concentration"
0.00E+00,
1.,"Air","inhalation","Bq","intake"
0.00E+00,
1.,"Fish","ingestion","Bq","intake"
8.15E+02,
1.,"Fruit","ingestion","Bq","intake"
0.00E+00,
1.,"Ground","external","Bq/kg","concentration"
0.00E+00,
1.,"Indoor air","inhalation","Bq","intake"
0.00E+00,
1.,"Leafy vegetables","ingestion","Bq","intake"
0.00E+00,
1.,"Meat","ingestion","Bq","intake"
4.43E+02,
1.,"Milk","ingestion","Bq","intake"
1.88E+02,
1.,"Root vegetables","ingestion","Bq","intake"
2.76E+02,
1.,"Soil","inhalation","Bq","intake"
0.00E+00,
1.,"Water","ingestion","Bq","intake"
3.71E+02,
"chronic","exp5","Air", 1, 1, 2,
0.0,"km", 0.0,"km",
0., 70.,
"I131","I131", 0, 1,
0.00E+00,"yr", 1.00E+00,"yr", 10,
1.,"Air","external","Bq/m^3","concentration"
9.99E+03,
1.,"Air","inhalation","Bq","intake"
2.10E+07,




Select ‘Print’ to print the file. Select Done or X in the upper right corner to close the window.

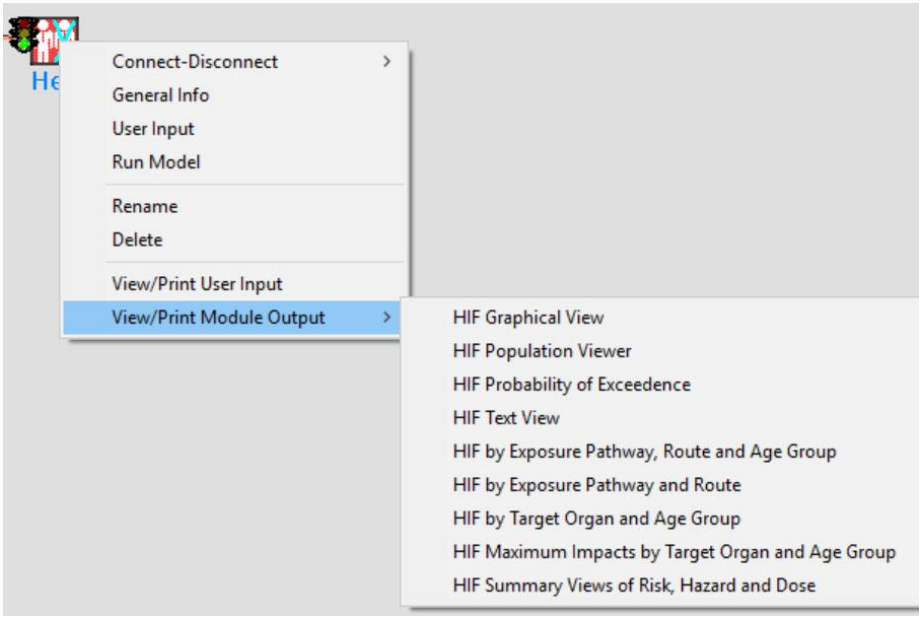
### 3.7.6 Running Icon 7 Health Impacts (hei7) – Human Exposure & Risk Text View Results

Icon7: Right click on ‘Health Impacts (hei7)’ and the following window opens. Select ‘Run Model’.

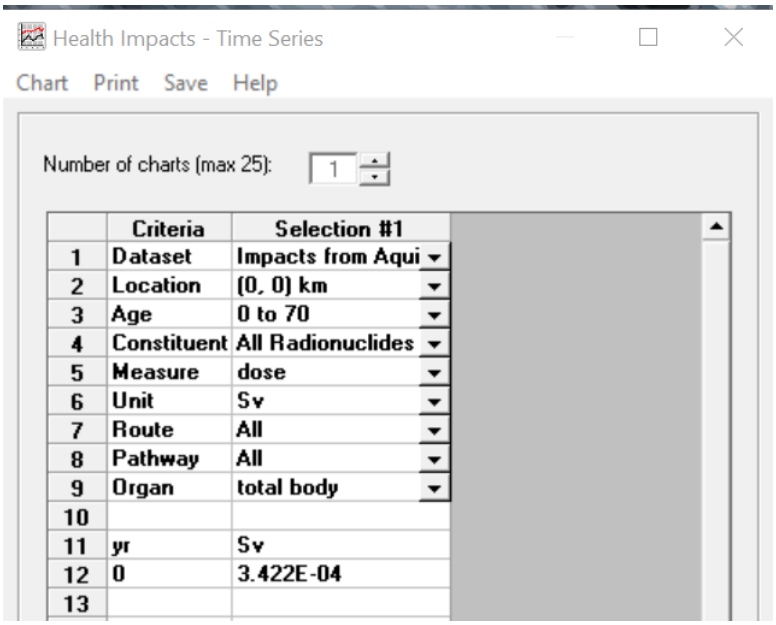



The model runs and the window closes. Observe the icon ‘Health Impacts (hei7)’ traffic signal is green.

To view the model results right click on ‘Health Impacts (hei7)’ and the following window opens. Select ‘View/Print Module Output’. There are nine options: ‘HIF Graphical View’, ‘HIF Population Viewer’, ‘HIF Probability of Exceedance’, ‘HIF Text View’, ‘HIF by Exposure Pathway’, ‘Route’, and Age Group’, ‘HIF by Exposure Pathway and Route’, ‘HIF by Target Organ and Age Group’, ‘HIF Maximum Impacts by Target Organ and Age Group’, ‘HIF Summary Views of Risk’, ‘Hazard and Dose’. Three outputs are shown below: ‘HIF Graphical View’, ‘HIF Text View’, and ‘HIF Summary Views of Risk, Hazard and Dose’.



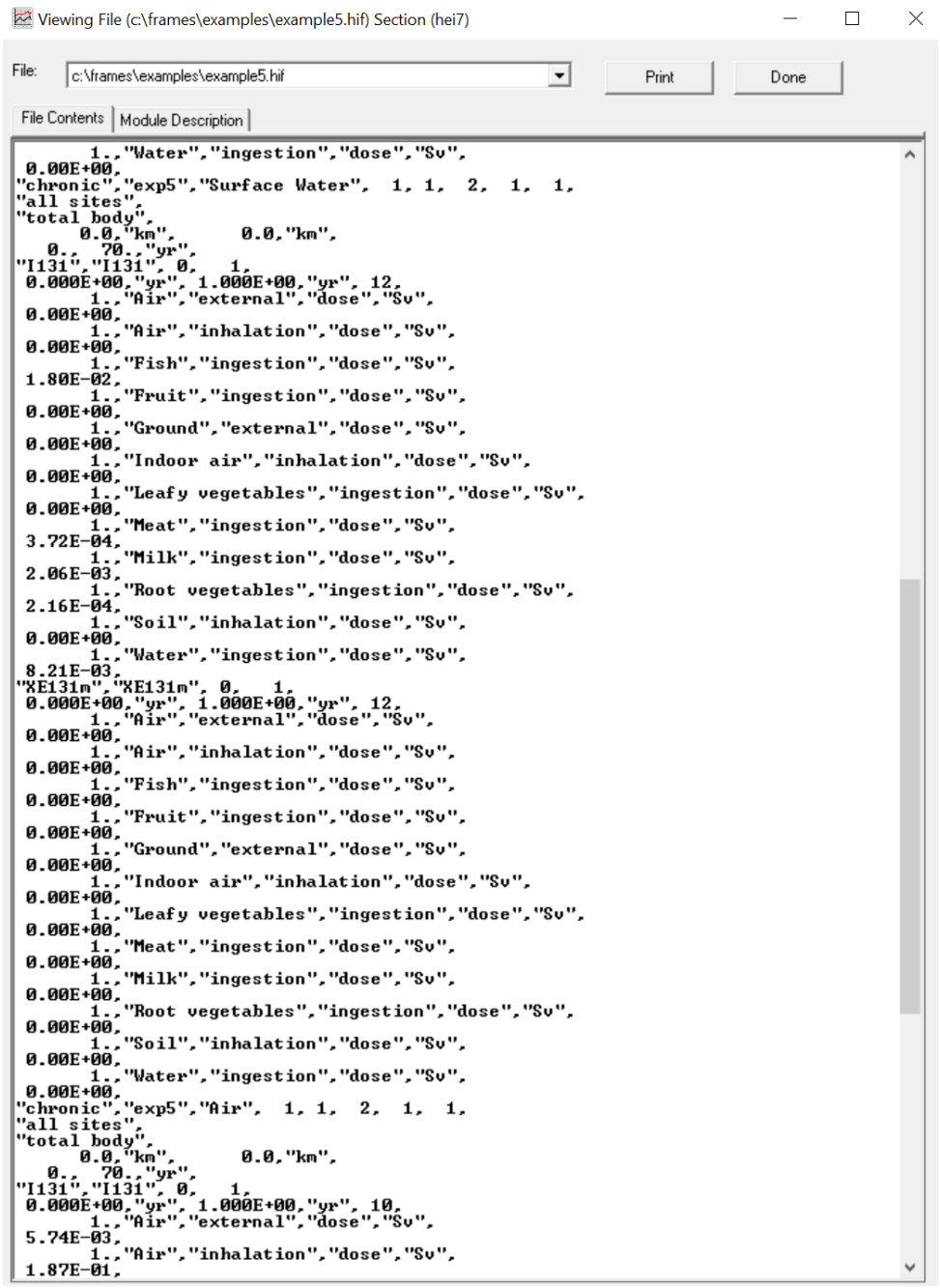

Select ‘HIF Graphical View’ and the following window ‘Health Impacts – Time Series’ opens. In Time Series Change Item 9 ‘Organ’ from ‘All’ to ‘total body’ (or effective dose if available-***never use All***).



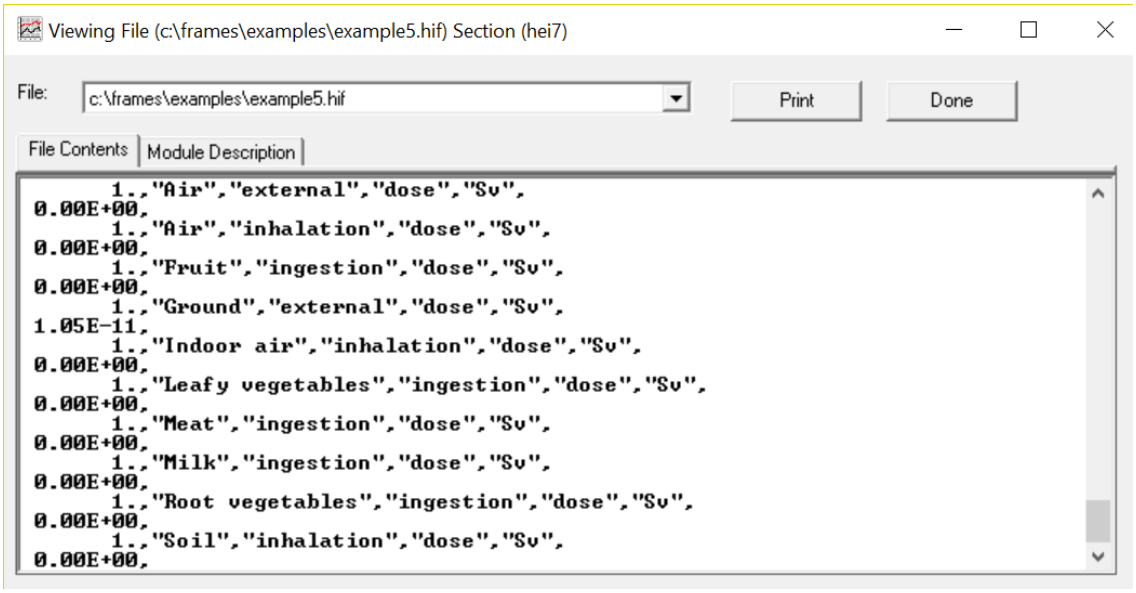

Select ‘Print’ to print the file. Select Done or X in the upper right corner to close the window.

Select ‘Benchmarks HIF Text View’ and the following window ‘Health Impacts – Time Series opens’. The output file is shown in three parts.

Viewing File (c:\frames\examples\example5.hif) Section (hei7)
File:
c:\frames\examples\example5.hif
Print
Done
File Contents
Module Description
********************************************************************************
* File:    c:\frames\examples\example5.hif
* Section: hei7
* Date:    10/19/2020 2:19:54 PM
********************************************************************************
4,
This GLYPH has data for 1 RECEPTOR sources.
GENII VER 2.10.2
Run on: 10-19-2020 at 14:18:20
1,"chronic",
3,
"chronic","exp5","Aquifer", 1, 1, 2, 1, 1,
"all sites",
"total body",
0.0,"km", 0.0,"km",
0., 70.,"yr",
"I131","I131", 0, 1,
0.000E+00,"yr", 1.000E+00,"yr", 12,
1.,"Air","external","dose","Sv",
0.00E+00,
1.,"Air","inhalation","dose","Sv",
0.00E+00,
1.,"Fish","ingestion","dose","Sv",
0.00E+00,
1.,"Fruit","ingestion","dose","Sv",
2.09E-04,
1.,"Ground","external","dose","Sv",
7.53E-05,
1.,"Indoor air","inhalation","dose","Sv",
0.00E+00,
1.,"Leafy vegetables","ingestion","dose","Sv",
5.66E-05,
1.,"Meat","ingestion","dose","Sv",
1.24E-06,
1.,"Milk","ingestion","dose","Sv",
0.00E+00,
1.,"Root vegetables","ingestion","dose","Sv",
0.00E+00,
1.,"Soil","inhalation","dose","Sv",
2.11E-10,
1.,"Water","ingestion","dose","Sv",
0.00E+00,
"XE131m","XE131m", 0, 1,
0.000E+00,"yr", 1.000E+00,"yr", 12,
1.,"Air","external","dose","Sv",
0.00E+00,
1.,"Air","inhalation","dose","Sv",
0.00E+00,
1.,"Fish","ingestion","dose","Sv",
0.00E+00,
1.,"Fruit","ingestion","dose","Sv",
0.00E+00,
1.,"Ground","external","dose","Sv",
4.17E-08,
1.,"Indoor air","inhalation","dose","Sv",
0.00E+00,
1.,"Leafy vegetables","ingestion","dose","Sv",
0.00E+00,
1.,"Meat","ingestion","dose","Sv",
0.00E+00,
1.,"Milk","ingestion","dose","Sv",
0.00E+00,
1.,"Root vegetables","ingestion","dose","Sv",
0.00E+00,
1.,"Soil","inhalation","dose","Sv",
0.00E+00,
1.,"Water","ingestion","dose","Sv",
0.00E+00,



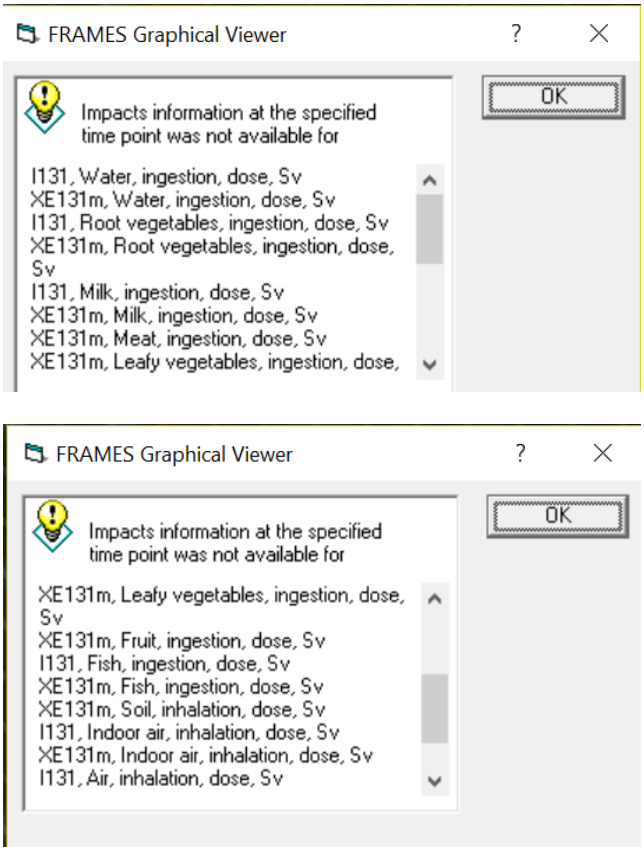

```
       1.,"Water","ingestion","dose","Sv",
 0.00E+00,
"chronic","exp5","Surface Water",  1, 1,  2,  1,  1,
"all sites",
"total body",
      0.0,"km",       0.0,"km",
   0.,  70.,"yr",
"I131","I131",  0,   1,
 0.000E+00,"yr", 1.000E+00,"yr", 12,
       1.,"Air","external","dose","Sv",
 0.00E+00,
       1.,"Air","inhalation","dose","Sv",
 0.00E+00,
       1.,"Fish","ingestion","dose","Sv",
 1.80E-02,
       1.,"Fruit","ingestion","dose","Sv",
 0.00E+00,
       1.,"Ground","external","dose","Sv",
 0.00E+00,
       1.,"Indoor air","inhalation","dose","Sv",
 0.00E+00,
       1.,"Leafy vegetables","ingestion","dose","Sv",
 0.00E+00,
       1.,"Meat","ingestion","dose","Sv",
 3.72E-04,
       1.,"Milk","ingestion","dose","Sv",
 2.06E-03,
       1.,"Root vegetables","ingestion","dose","Sv",
 2.16E-04,
       1.,"Soil","inhalation","dose","Sv",
 0.00E+00,
       1.,"Water","ingestion","dose","Sv",
 8.21E-03,
"XE131m","XE131m",  0,   1,
 0.000E+00,"yr", 1.000E+00,"yr", 12,
       1.,"Air","external","dose","Sv",
 0.00E+00,
       1.,"Air","inhalation","dose","Sv",
 0.00E+00,
       1.,"Fish","ingestion","dose","Sv",
 0.00E+00,
       1.,"Fruit","ingestion","dose","Sv",
 0.00E+00,
       1.,"Ground","external","dose","Sv",
 0.00E+00,
       1.,"Indoor air","inhalation","dose","Sv",
 0.00E+00,
       1.,"Leafy vegetables","ingestion","dose","Sv",
 0.00E+00,
       1.,"Meat","ingestion","dose","Sv",
 0.00E+00,
       1.,"Milk","ingestion","dose","Sv",
 0.00E+00,
       1.,"Root vegetables","ingestion","dose","Sv",
 0.00E+00,
       1.,"Soil","inhalation","dose","Sv",
 0.00E+00,
       1.,"Water","ingestion","dose","Sv",
 0.00E+00,
"chronic","exp5","Air",  1, 1,  2,  1,  1,
"all sites",
"total body",
      0.0,"km",       0.0,"km",
   0.,  70.,"yr",
"I131","I131",  0,   1,
 0.000E+00,"yr", 1.000E+00,"yr", 10,
       1.,"Air","external","dose","Sv",
 5.74E-03,
       1.,"Air","inhalation","dose","Sv",
 1.87E-01,
```



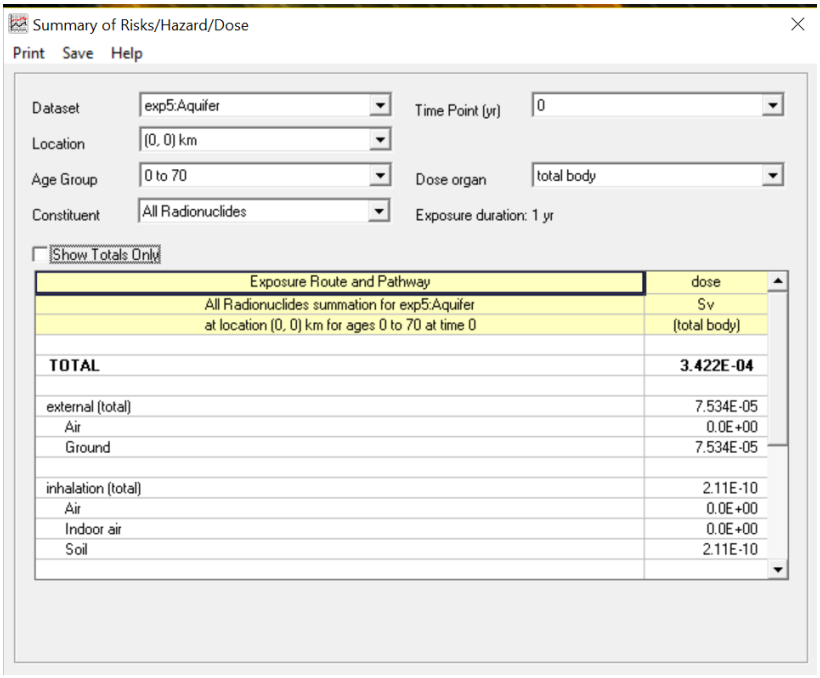

Select ‘Print’ to print the file. Select Done or X in the upper right corner to close the window.

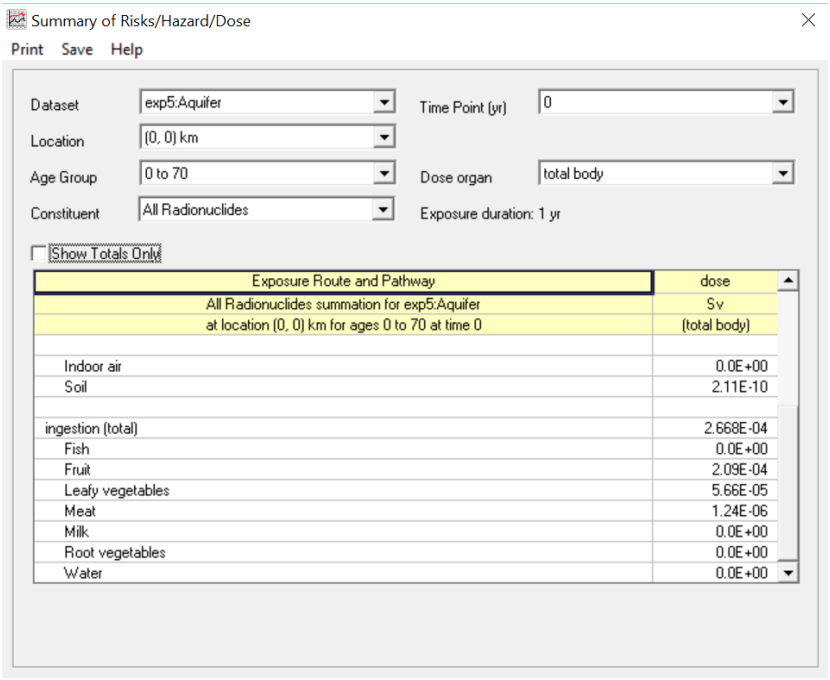
Select ‘Benchmarks HIF Summary Views of Risk, Hazard, and Dose Text View’ and the following window ‘HIF Summary Views of Risk, Hazard and Dose’.

This screen opens first and identifies that some outputs are zero. Select ‘OK’ to proceed.



After selecting ‘OK’ the following window ‘Summary of Risks/Hazard/Dose’ opens. For this case, the doses are reported for each source (groundwater, surface water, and air). The output file for the aquifer source is shown in two parts.




This completes the explanation of how to set up and run genii_05.gid, called Example5.gid in this document.

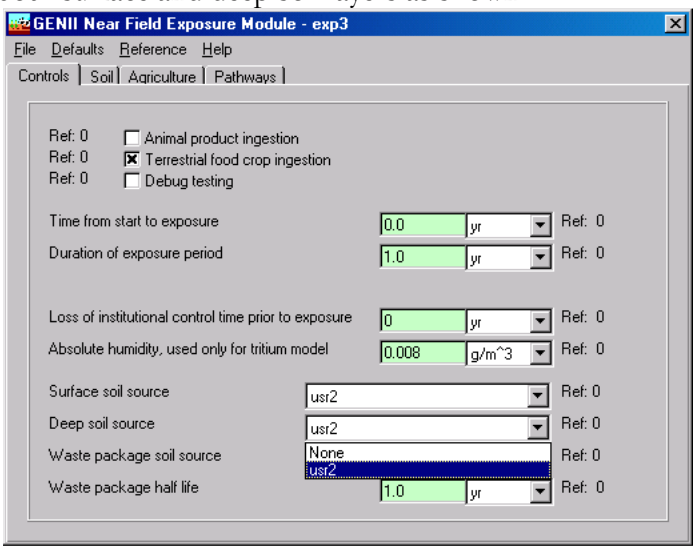
# 4.0 Summarized Example 7

Example 7 is concisely summarized below.

| Example | Description | Complexity |
|---|---|---|
| GENII_07.GID | Near-field scenario resulting from user-defined nuclide concentrations in soil. Crop ingestion impacts modeled. | Simple |

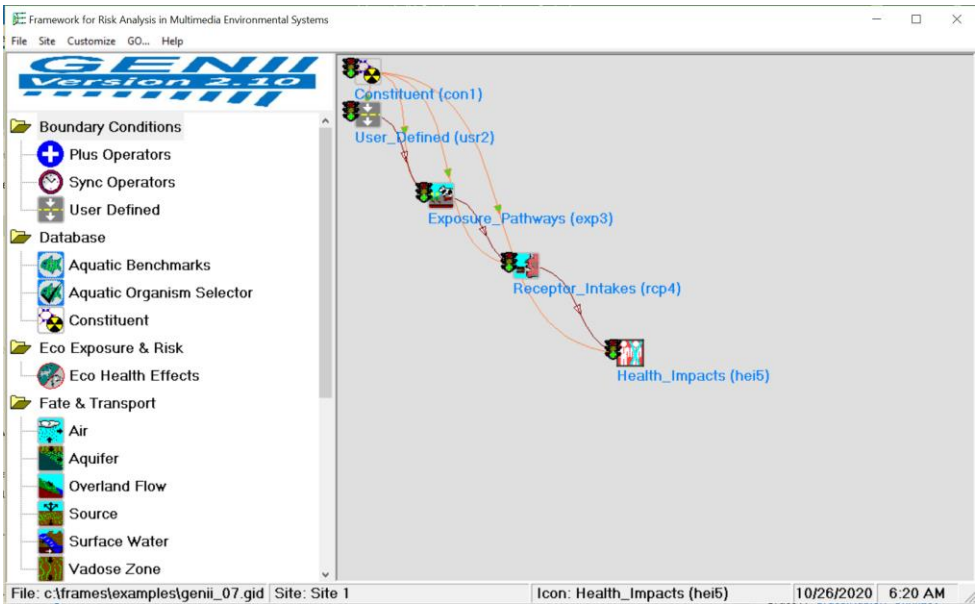
The following summary is provided in GENII Version 2 Users' Guide (Napier 2012).

> **"GENII_07:** This example of the GENII Near Field capability is derived from the template TmpNear. This example postulates a spill resulting in soil contamination with $^{60}Co$ and $^{239}Pu$. The concentrations are input in the SCF Soil – Total module, and their locations for the scenario are set in the GENII Near Field Exposure module. This is done by assigning the source (USR2) to both surface and deep soil layers as shown:




> The relative concentrations are defined on the Soil tab using the Manual Redistribution Factor, set to 1.0 for this example which means that the surface and deep soils have the same concentration. One age group (defined to be 0-10 years in this example) is selected in the GENII Receptor Intakes module and consumption rates are input. The GENII Health Impacts module is selected, with the ICRP-26/30 option. Radiation dose is selected. The dose may be viewed by using the right-click and View/Print model output selection."

The completed Example 7 is shown below.




When icons and connections are added the model should look as shown above. 'Constituent (con1)' connects to 'User Defined (usr2)', 'Exposure Pathways (exp3)', 'Receptor Intakes (rcp4)', and 'Health Impacts (hei5)'. 'User Defined (usr2)' connects to 'Exposure Pathways (exp3)', which connects to 'Receptor Intakes (rcp4)', which connects to 'Health Impacts (hei5)'.

## 4.1 Add General Information (Select Models) for Example 7

Select these models for each icon.

| Icon | Model |
|---|---|
| Constituent (con1) | Updated Radionuclide Database Selection |
| User Defined (usr2) | SCF Soil - Total Module |
| Exposure Pathways (exp3) | GENII V.2 Near Field Exposure Module |
| Receptor Intakes (rcp4) | GENII V.2 Receptor Intake Module |
| Health Impacts (hei5) | GENII V.2 Health Impacts Module |

## 4.2 Add User Input to Example 7

### 4.2.1 User Input for Icon 1 Constituent (con1) - Database

Icon 1: Tab Select Constituents for Analysis: Classification: Chemical Class, All Constituents. Under 'Select Constituents for Analysis' add CO60 and PU239 to the box to the right of 'Search Next'.

Tab Edit Constituent Properties: CO60 and PU239. Subtab Properties: Use default properties shown in green for all items listed to the right of Category (jump to). Subtab Degradation Chain is not populated.

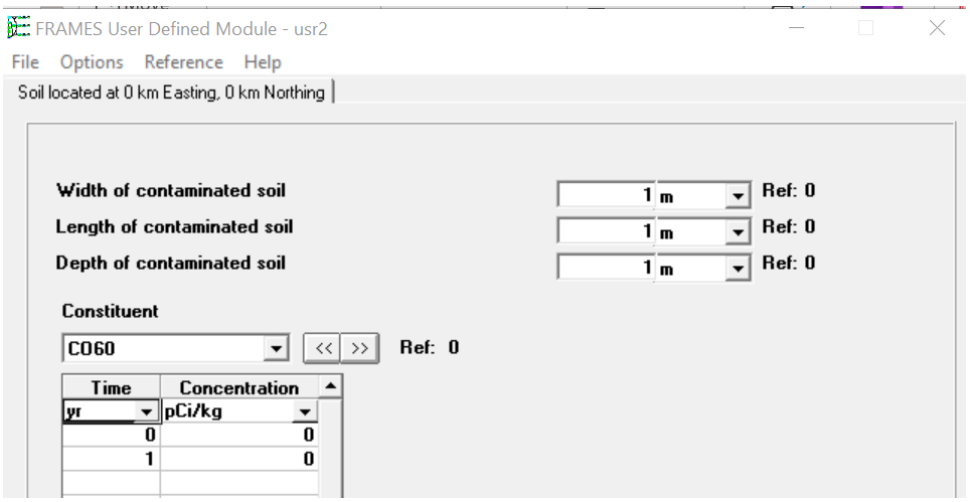
### 4.2.2 User Input for Icon 2 User Defined (usr2) – Boundary Conditions

Icon 2: SCF Soil - Total Module – usr2

Add data of '1 m' for width, length, and depth of contaminated soil and data for each constituent.

Enter the following constituent data:

| CO60 | CO60 | PU239 | PU239 |
|---|---|---|---|
| Time | Concentration | Time | Concentration |
| yr | pCi/kg | yr | pCi/kg |
| 0 | 0 | 0 | 234 |
| 1 | 0 | 1 | 234 |




### 4.2.3 User Input for Icon 3 Exposure Pathways (exp3) – Human Exposure & Risk

Icon 3: GENII Near Field Exposure Module - exp3.

Tab Controls: Select Terrestrial food crop ingestion. Use default properties shown in green.

Tab Soil: Subtab Leaching: Leach rates calculated from user input. Use default properties shown in green. For Parent soil absorption coefficient (Kd) for CO60 and PU239 use default properties shown in green. For Subtab Resuspension: Type of model to run: Select Use mass loading model. Use default properties shown in green. For Subtab Description: Select Biotic transport from deep soil to surface soil; Estimate biotic transport rate prior to start of intake; and Arid climate during period prior to intake. Use default properties shown in green.

Tab Agriculture: Subtab General: do not check either of the two Ref: 0 boxes. Use default properties shown in green. Subtab Food Crop: Use default properties shown in green for Biomass, Growing Period, Yield, Translocation Factor and Dry/Wet Ratio. Subtab Animal Feed: Use default properties shown in green for all sub subtabs: Yield, Translocation Factor, Dry/Wet Ratio, Soil intake, Biomass, Consumption, Storage Time, Diet fraction and Growing Period. Subtab Intake delays: Use default properties shown in green. Subtab Biotic Transport: Use default properties shown in green.

Tab Pathways: For Ingestion: Select Leafy vegetables, Root vegetables, Fruits, Grain. For Inhalation: Select Suspended or resuspended soil. For External: Select Soil external.

### 4.2.4 User Input for Icon 4 Receptor Intakes (rcp4) – Human Exposure & Risk

Icon 4: GENII Intake Module – rcp4. Number of age groups: 1. Age group selection: 1. Use default properties as shown in green. Pathway selection: External exposure to air. Use default properties as shown in green.

### 4.2.5 User Input for Icon 5 Health Impacts (hei5) – Human Exposure & Risk

Icon 5: GENII Health Impacts Module – hei5

Tab Method Selection: Select Calculate Dose and/or risk using ICRP – 60 and EPA risk factors (Federal Guidance Reports 12/13).

Tab Method Parameters: Calculate radiation effective dose equivalent commitment (CEDE). Use default properties as shown in green.

Tab Constituent Parameters:

| Constituent – FS CNAME | Lung transfer inhalation class - SOLUBIL |
|---|---|
| CO60 | Slow |
| PU239 | Medium |

# 5.0 References

Chaki S and B Parks. 2000. CAP88-PC Version 2.0 Updated User's Guide. EPA 402-R-00-004, US EPA Office of Radiation and Indoor Air, Washington, DC.

Eckerman KF, RW Leggett, CB Nelson, JS Puskin, and ACB Richardson. 1999. Cancer Risk Coefficients for Environmental Exposure to Radiation. Federal Guidance Report No. 13. EPA 402-R-99-001, US EPA Office of Radiation and Indoor Air, Washington, DC.

Napier BA. 2012. GENII Version 2 Users' Guide. PNNL-14583, Rev. 4. Pacific Northwest National Laboratory, Richland, Washington.

Napier BA, DL Strenge, JV Ramsdell, Jr, PW Eslinger, C Fosmier. 2012. GENII Version 2 Software Design Document. PNNL-14584, Rev. 4, Pacific Northwest National Laboratory, Richland, Washington.

Snyder SF, CI Arimescu, BA Napier, TR Hay. 2013. Recommended Parameter Values for GENII Modeling of Radionuclides in Routine Air and Water Releases. PNNL-21950, Pacific Northwest National Laboratory, Richland, Washington.

Whelan G, KJ Castleton, JW Buck, GM Gelston, BL Hoopes, MA Pelton, DL Strenge, and RN Kickert. 1997. Concepts of a Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES). PNNL-11748, Pacific Northwest National Laboratory, Richland, Washington.

# Pacific Northwest National Laboratory

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99354
1-888-375-PNNL (7665)

***www.pnnl.gov***