HABIT 1.2
User's Guide (Final)

Version 1.0

January 2015

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Information Technology

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Revision History

Date	Version	Description	Author
January 19, 2015	1.0	Final	Lockheed Martin

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1   Introduction

HABIT V1.2 is a package of computer codes designed to assist in the evaluation of Light-Water Reactor (LWR) control room habitability in the event of accidental spills of toxic chemicals or the accidental release of radionuclides, including noble gas. It consists of a number of program modules and produces files containing tabular output that can be printed, viewed, or imported into spreadsheet programs for further applications.

1.1 Purpose

This *User Guide* provides HABIT users with the information necessary to understand and use the application. This manual provides the HABIT user with information to create new, open existing, import, save or delete designs. Each of the HABIT V1.2 modules is documented, including screenshots of system windows (Figures) and explanatory notes.

1.2 Assumptions

This User Guide is directed toward individuals who have had some instructions and hands-on training with previous versions of HABIT and Microsoft Windows. It is assumed that users will have the following minimum skills and knowledge to use the HABIT 1.2:

- • Familiar with Microsoft Windows 7.
- • User allows changing measurement units from English to SI. Some selections will affect the values used in the Control Room Flow Data and Plant Data tabs as indicated in the manual. In addition, all dose, exposure rate, and radioactivity are displaced in English units, e.g., Rem, rem/hr, and Cuire.

1.3 Applicable Documents

 NUREG/CR-6210, "Computer code for Evaluation of Control Room Habitability (HABIT)," June 1996.

2   System Summary

2.1 Standard Format

The new user interface for HABIT 1.2 uses a Tabbed Document Interface (TDI) which allows all the major functions to be contained within tabs in a single window. Each instance of a module (EXTRAN, CHEM, FPFP_2, TACT5, and CONHAB)[1] is contained within its own tab document. The single window containing the TDI is the Design Package window. This window coordinates the display and execution of the individual modules and well as performing functions which are design-centric (e.g. saving all the files which are part of the design package). The Design window contains a main menu bar on the top and an information bar at the bottom. The

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1   The meaning of the acronyms are: EXTRAN is external transport; CHEM is chemical; FPFP is flow path and filter path; TACT is transport of radioactivity; and CONHAB is control room habitability.

application has been designed for optimal display at a resolution of 1024x768 pixels, but is adaptable to support other resolutions.

The colors for the application are changed in order to increase consistency across the application. All modules in HABIT 1.2 have similar color schemes. The Control Room Flow Diagrams use high contrast colors and share the same color scheme as flow diagrams in other modules.

2.2 HABIT 1.2 Design

2.2.1 Main Menu bar

The main menu bar is on the top of the window and allows the user to perform general file actions against the Design package and access to the Help. These actions against the Design package include:

1. Creating a New Design Package,
2. Opening an Existing Design Package
3. Saving the Design Package
4. Copying the Design Package
5. Deleting the Design Package
6. Importing in an HABIT 1.1 Design Package (.i.e., dsg file)

The main menu bar uses Windows standard dropdown menus. Additionally, this menu bar allows the user to access options and settings for the design and modules. .

2.2.2 Information bar

The information bar is at the bottom of the window and displays information about the currently loaded design. The bottom right corner displays the name of the loaded design while the bottom left corner displays the loaded filename (design file name or input file).

2.2.3 Design Package Tabs

The Main tab and the Output Log tab are tabs which are required by the application to manage the design package and to direct MS-DOS output from the FORTRAN formulations and computations so they are visible from within the application.

2.2.4 Widget Use Guidelines

* **Radio buttons** are used when there is a list of two or more options that are mutually exclusive, and the user must select exactly one choice. There is a default selection.

Figure 2-1: Widget Use (Radio Button)

- **Check boxes** are used when there are lists of options, and the user may select any number of choices, including zero, one, or several.

- **A stand-alone check box** is used for a single option that the user can either select or clear.
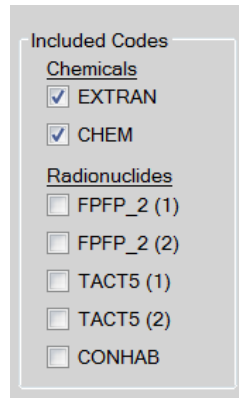

Figure 2-2: Widget Use (Check Box)

2.2.5   Error Messages

There are several ways which HABIT 1.2 displays validation messages to users.

1. Field validation warnings (see Figure 2-3: Validation Warning – input out of range).
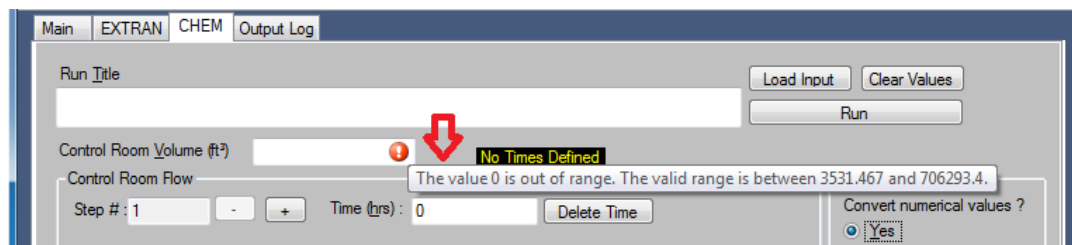

Figure 2-3: Validation Warning – input out of range

These validation warnings alert the user that the value in the field is out of range or the value is required. While it is recommended these validation warnings be fixed before the codes are run, the application does allow attempts to run the FORTRAN code despite the warnings.

2. Field validation errors (see Figure 2-4: Error Message - invalid input)
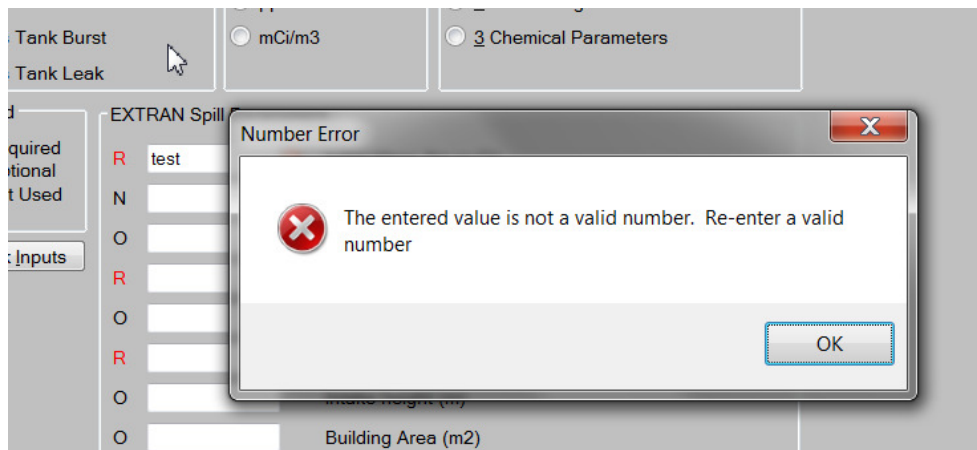
Figure 2-4: Error Message - invalid input

These validation errors occur when trying to enter alphabetic characters in a numeric field. These errors must be fixed before data entry can continue.

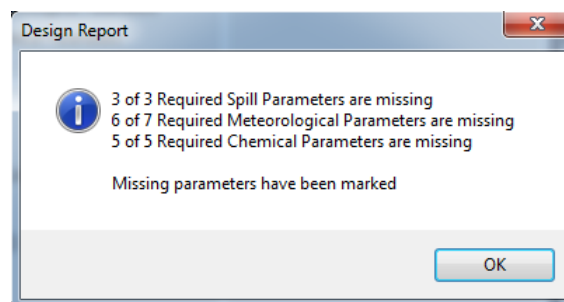3. Module specific validation (see Figure 2-5: Error Messages – input missing)

Figure 2-5: Error Messages – input missing

This type of validation is specific to the EXTRAN module. It checks for all required parameters required by the EXTRAN FORTRAN code. A summary of the validation is provided to the user. The application allows the user to attempt to run the FORTRAN code even if data is missing.

2.3 HABIT Installation

HABIT 1.2 application will be deployed through an installer. The installer will install the execution code, user interface, the available Nuclide Databases, and the Parameter Ranges files.

2.4 HABIT Access

To run HABIT calculations, double-click on the HABIT 1.2 icon, and the application will open.
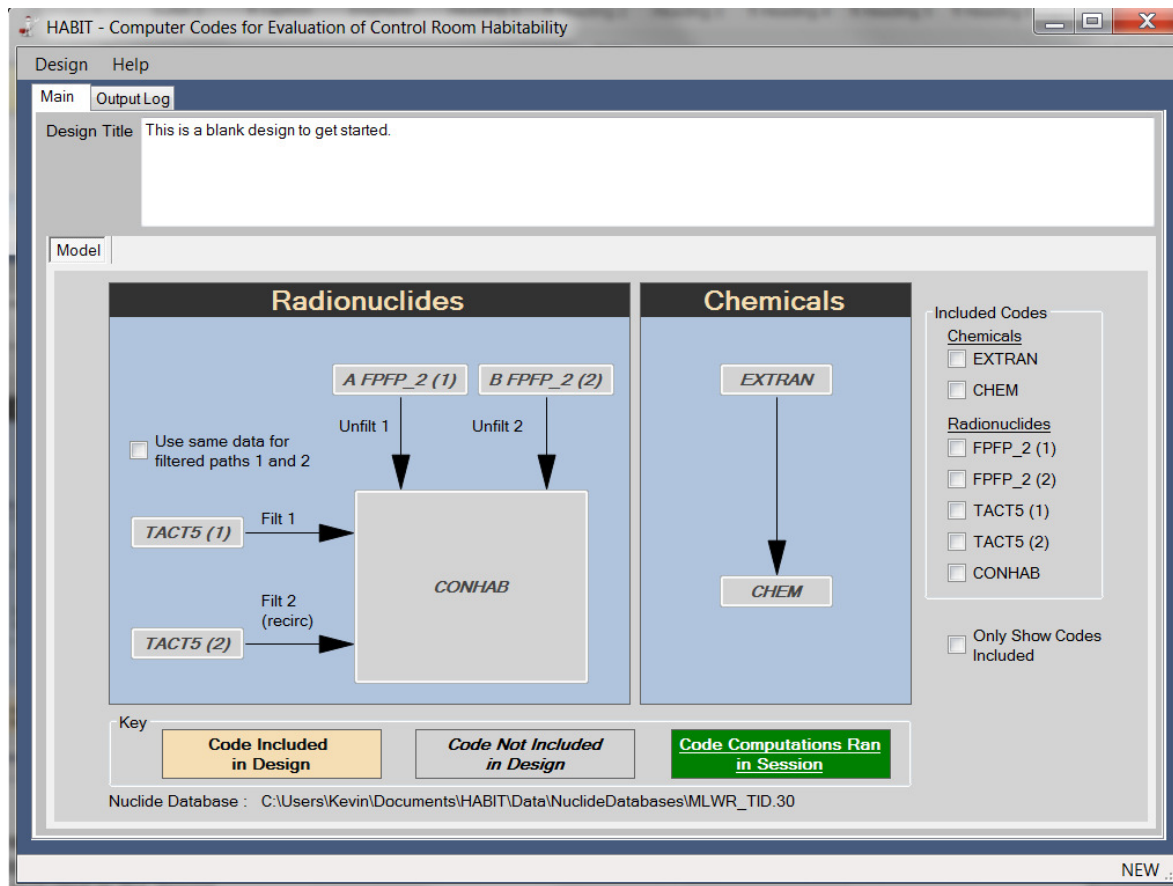
Figure 2-6: HABIT Main window

The application will automatically load the last saved design and its associated modules (if exists). Otherwise, the application will load a blank design and the user will be able to choose which modules should be included in the design.

2.5 Exiting the System

To exit HABIT 1.2, select Design → Exit from the Main Menu Bar or click on the X (upper right corner of application window) to close the window.
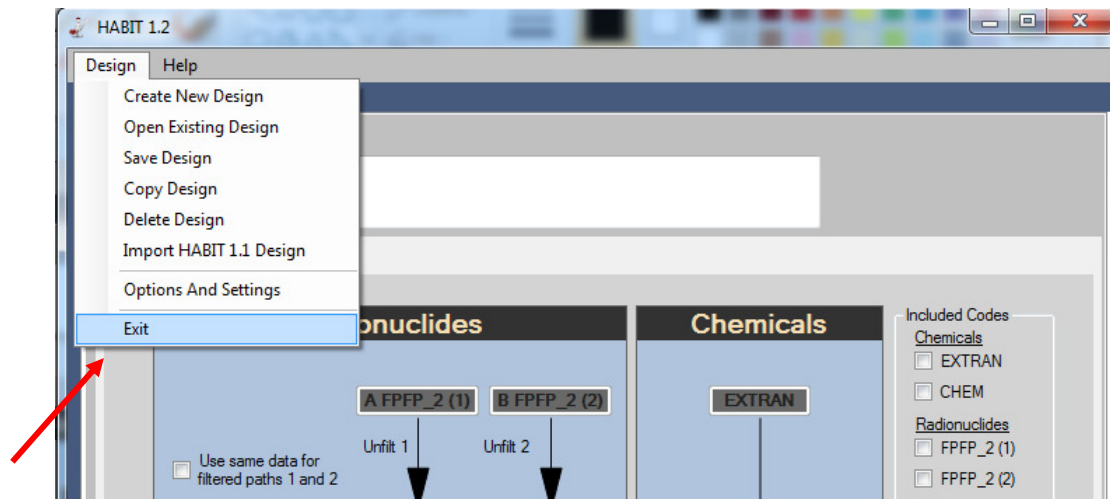
Figure 2-7: Exiting Application (Exit)

The application will provide a prompt to give the user the ability to save the design before exiting.

3   HABIT Functions

Starting from the HABIT Main Menu, the user can perform many functions, including:

1. Create New Design
2. Open Existing Design
3. Save Design
4. Copy Design
5. Delete Design
6. Import HABIT 1.1 Design
7. Options and Settings
8. Exit

3.1 HABIT Main Tab

The Main tab provides a visualization of the design package (See Figure 3-1: HABIT 1.2 Main window) and controls the execution of the other components. This tab includes a flow diagram which shows the dependencies amongst all the HABIT modules. The visual styling of this flow diagram allows the user to see what modules are included in the design package as well as which modules have been run in the current session (since last program restart). The user can use the flow diagram boxes to navigate to their respective tab page. Additionally, users have the option to change what modules should be included in the design and whether to show only the included modules in the flow diagram.
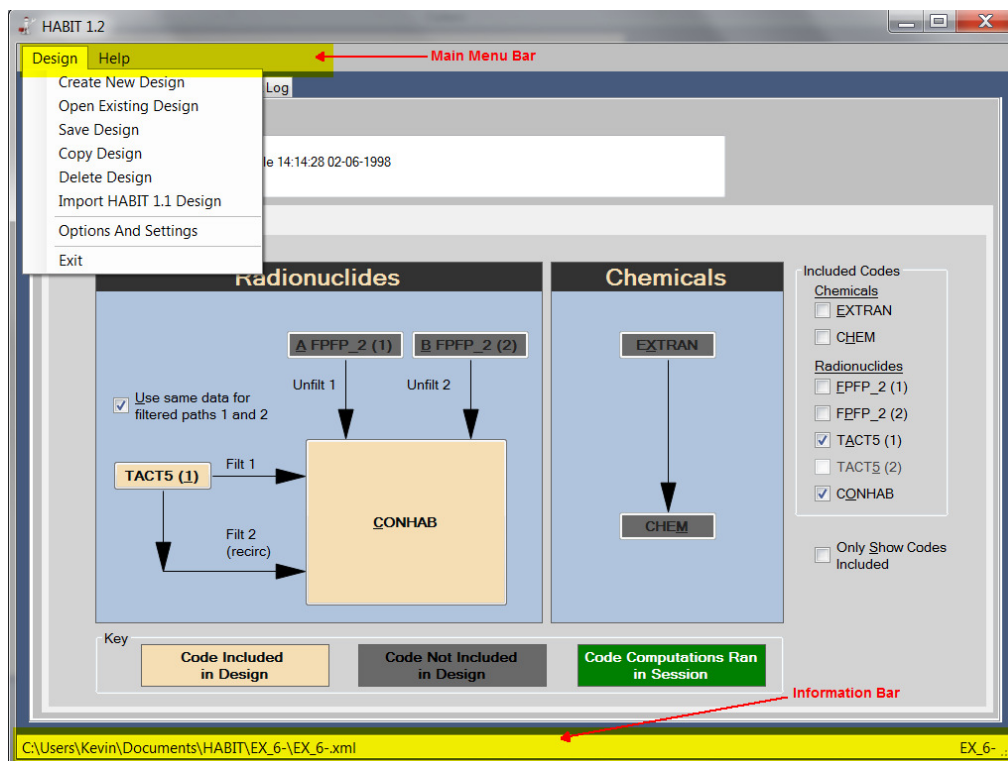
Figure 3-1: HABIT 1.2 Main window

3.2 HABIT Design Function

3.2.1 Create New Design

To create a new design, select Design -> Create New Design from the Main Menu Bar
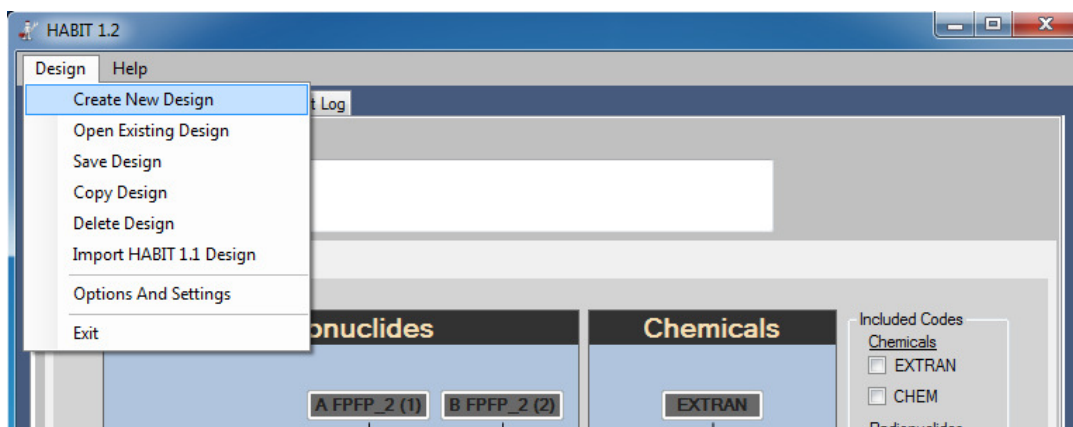

Figure 3-2: HABIT Main Menu (Create New Design)

A prompt will appear to enter a name for the design. The design name can be up to 50 ASCII characters. The entered design name is used for the name of the storage directory for the design package as well as the prefix for the design and module input file names.

Enter title in Design Title, and select the desired modules to include in the design by clicking on the checkbox(es) in the Included Codes group box. As modules are included, note the tab on the top will display the tab page for included modules and will remove the tab page for any modules not included. Additionally, note that included modules are now represented by a different visual style in the model tab page.
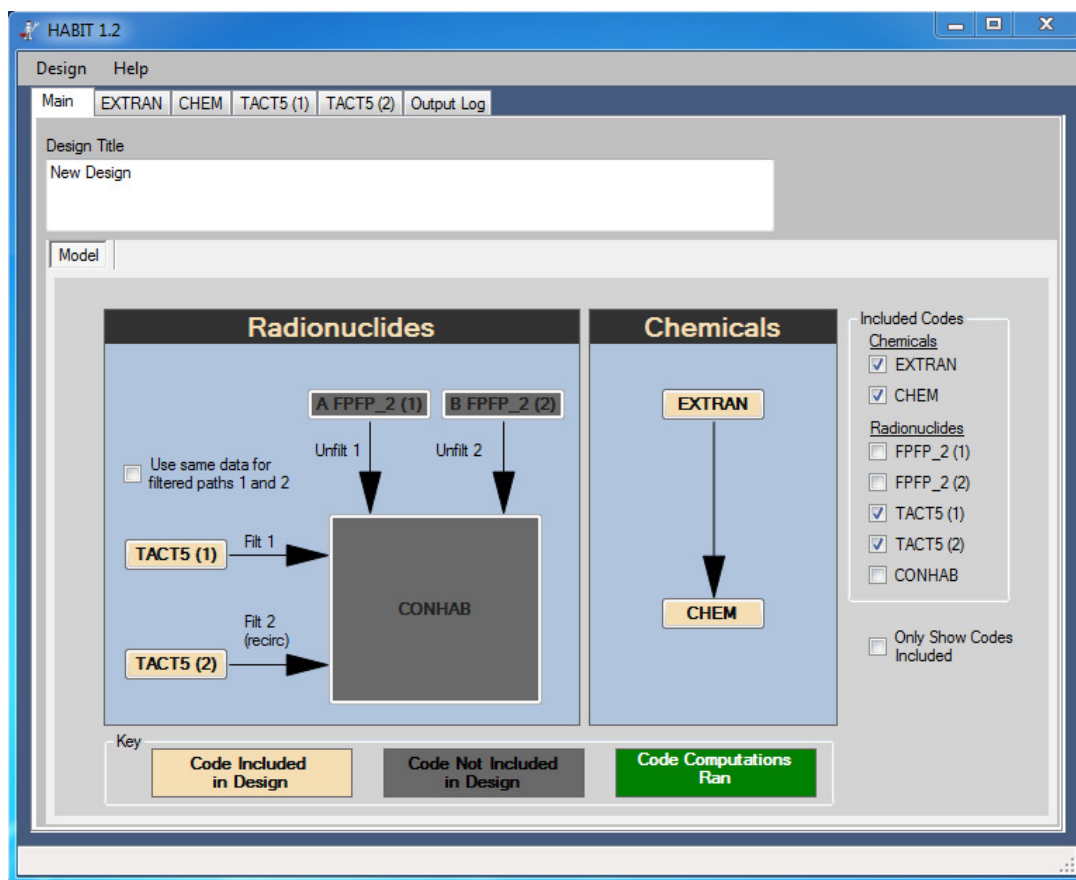

Figure 3-3: HABIT model (after module selection)

Navigate through the tabs and input the appropriate values. Refer to HABIT Modules section for more details on each individual module.

3.2.2 Open Existing Design

To load an existing design, select Design -> Open Existing Design.
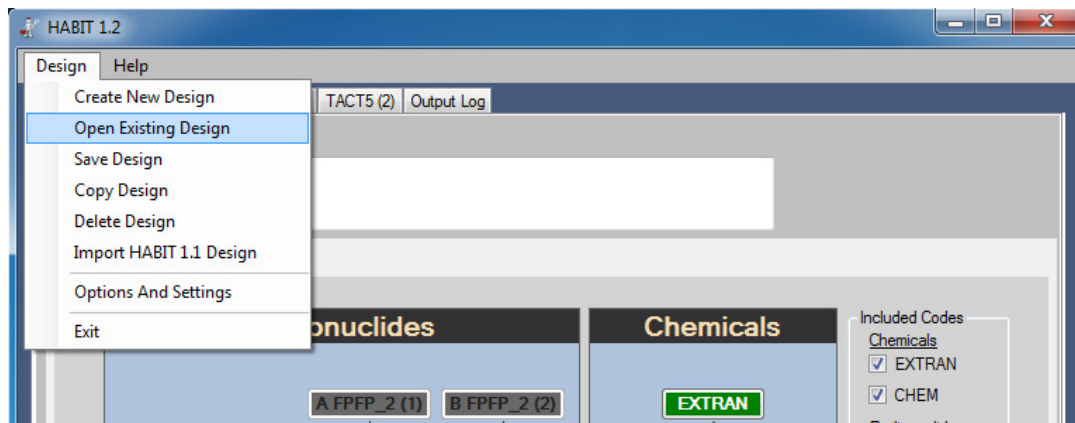
Figure 3-4: HABIT Main Menu (Open Existing Design)

Select the design XML file to load and click Open. By default, design XML files are stored in the user's Documents folder, under the Habit/<Design Name> subdirectory.
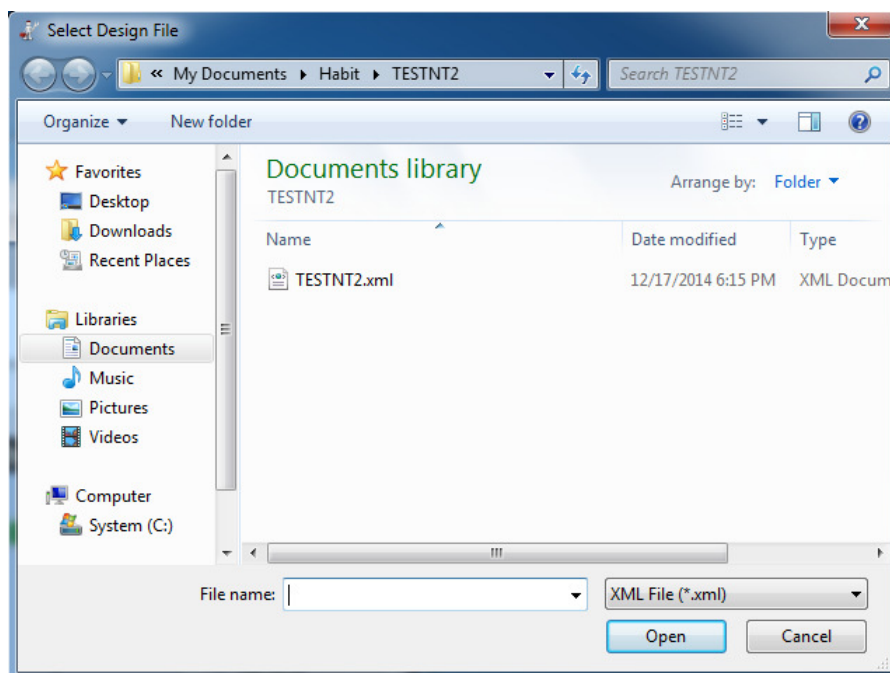

Figure 3-5: Select Design File

The loaded design will display on the Model tab. The modules included in the design will be loaded. The tabs for the included modules will be available for editing with previously saved values already loaded.

3.2.3 Save Design

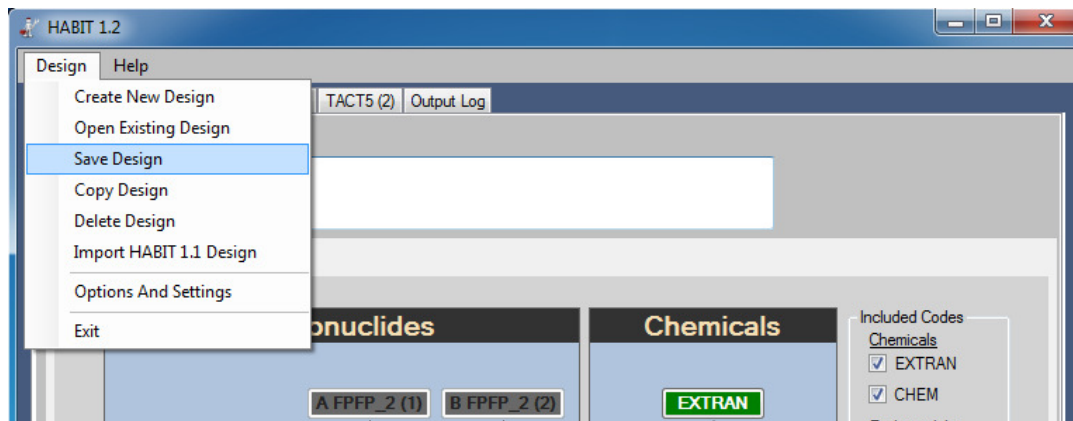To save a design, select Design -> Save Design

Figure 3-6: HABIT Main Menu (Save Design)

Saving the design will save the design XML file as well as the input files for each module included in the design (inp files, nuc files, etc.). If the application does not encounter any problems writing the design package to disk, the system will display a pop-up message indicating success.

If saving the design for the first time, the application will prompt the user to create the directory for which the design package will be saved under. It will also prompt the user to enter a name for the design XML file (if user wants it to be different from the design name).
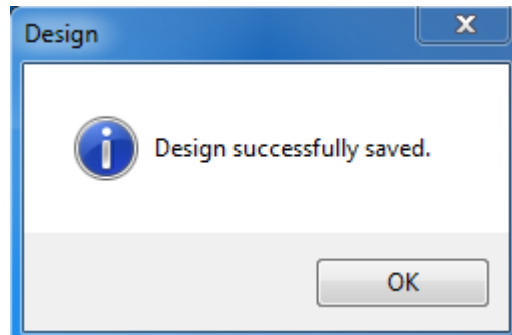

Figure 3-7: Save Design message

3.2.4   Copy Design

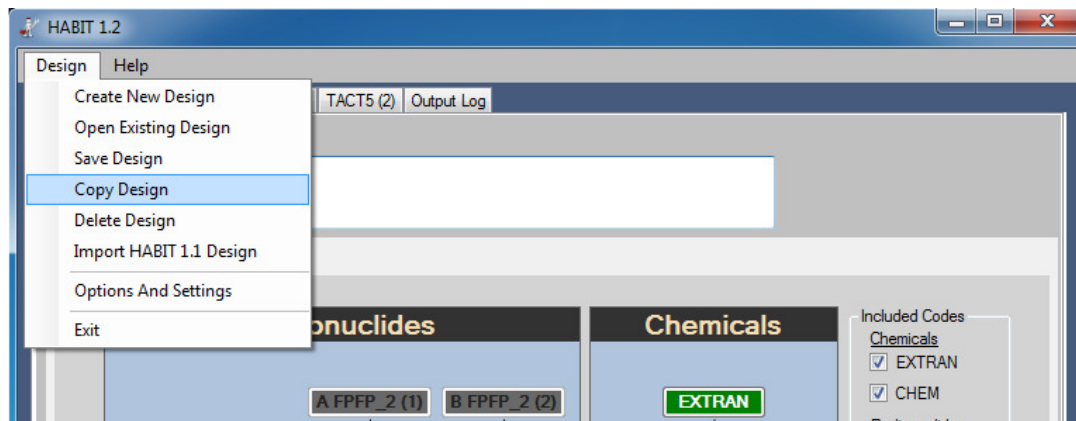To copy a design from another file, select Design -> Copy Design

Figure 3-8: HABIT Main Menu (Copy Design)

Once the Select Design to Copy window opens, select the file to copy
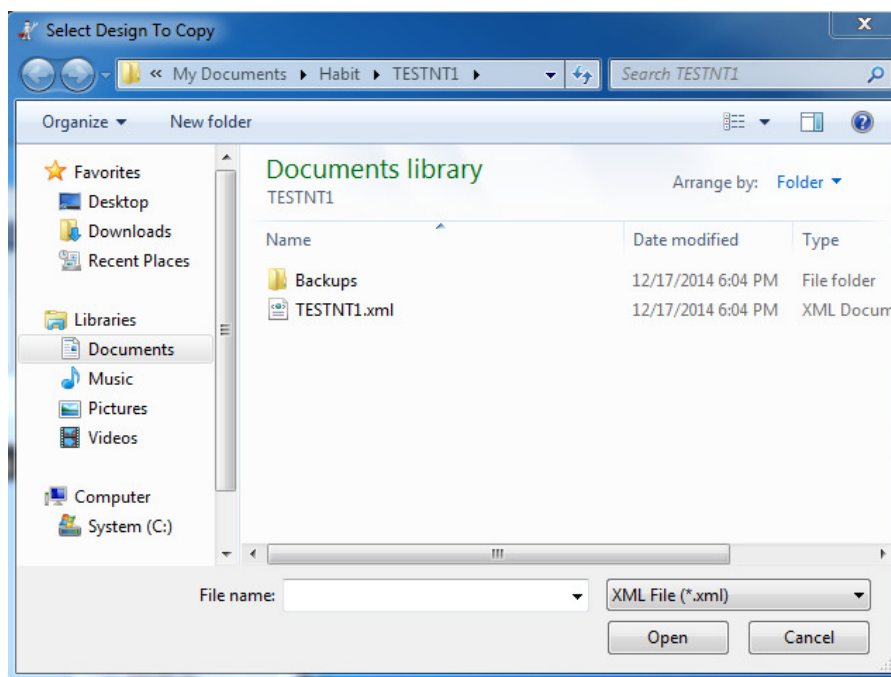

Figure 3-9: Select File To Copy

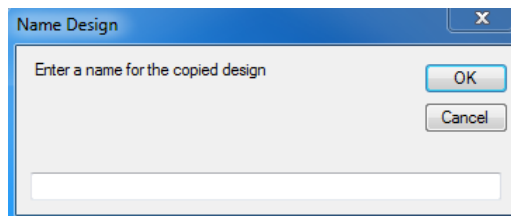Enter a new name for the copied design and click OK

Figure 3-10: Name Design

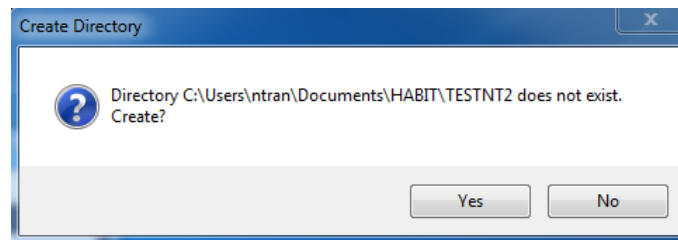A new directory will be created once Yes is clicked
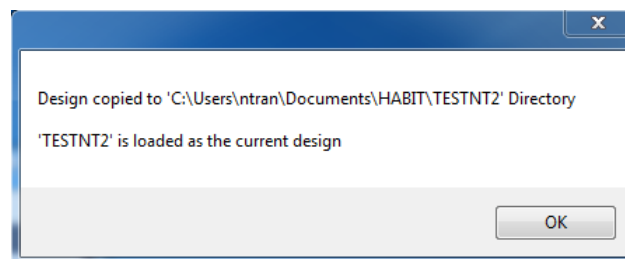

Figure 3-11: Create Directory

Figure 3-12: Design Copied message

When copying a design, the application will copy the input files from the source design package into the copy design package. All files in the copy design will use be prefixed with the design name.   After the design is copied, the copy will be loaded as the currently edited design.

3.2.5 Delete Design

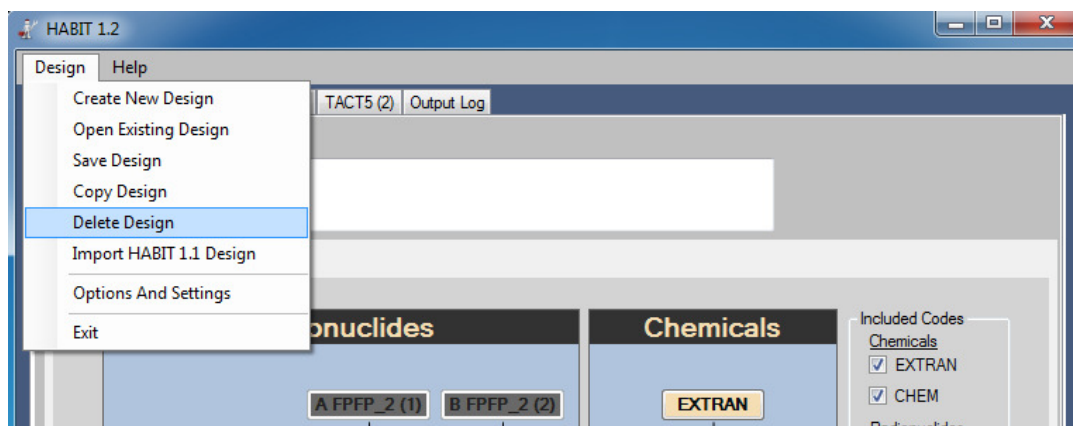To delete a design, select Design -> Delete Design

Figure 3-13: HABIT Main Menu (Delete Design)

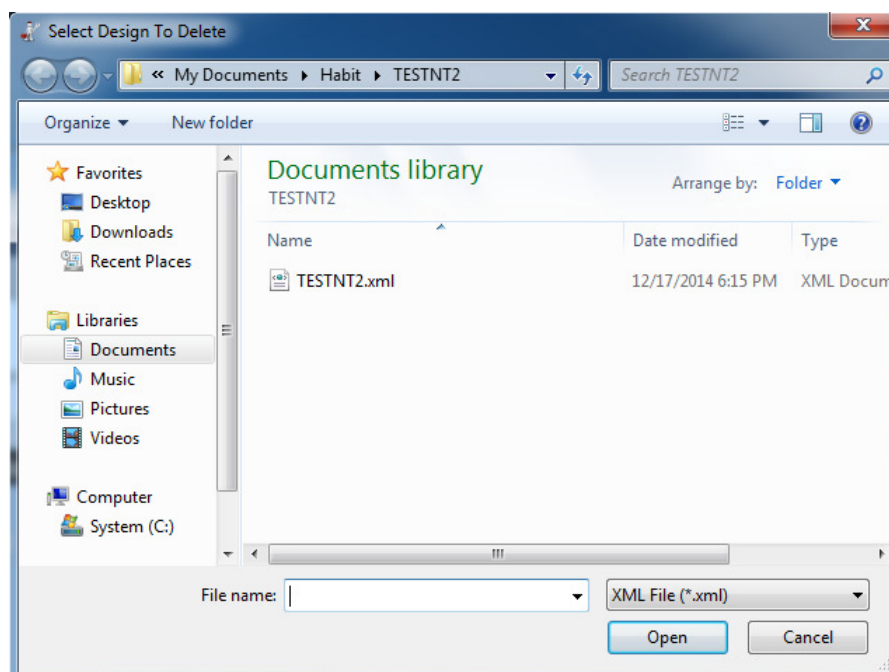Once the Select Design to Delete window opens, select the file to delete and click Open

Figure 3-14: Select Design to Delete

A confirmation of the Design Delete will display. Click on Yes to continue with the delete. The delete function will delete all files associated with a particular design.
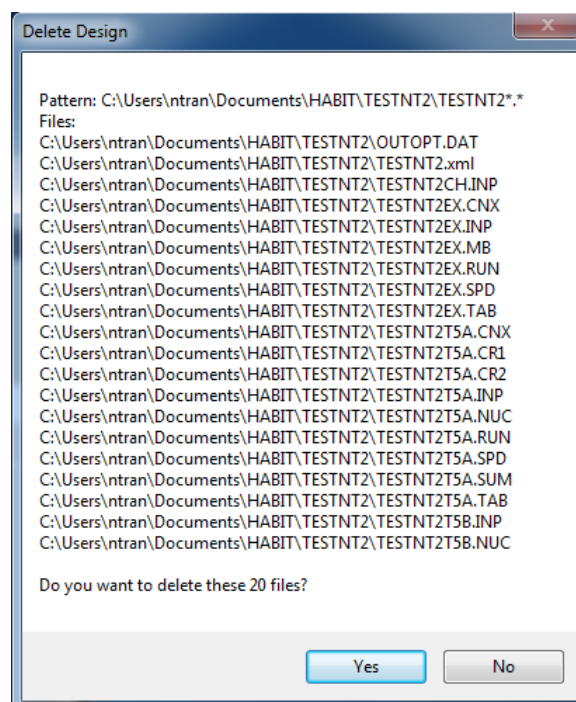
Figure 3-15: Delete Design Confirmation
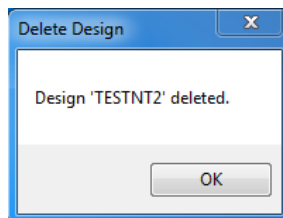
Figure 3-16: Delete Design Complete message

3.2.6   Import HABIT 1.1 Design

When a user selects Design -> Import HABIT 1.1 Design from the Main Menu Bar, the user can select to import previously created design examples from version 1.1.
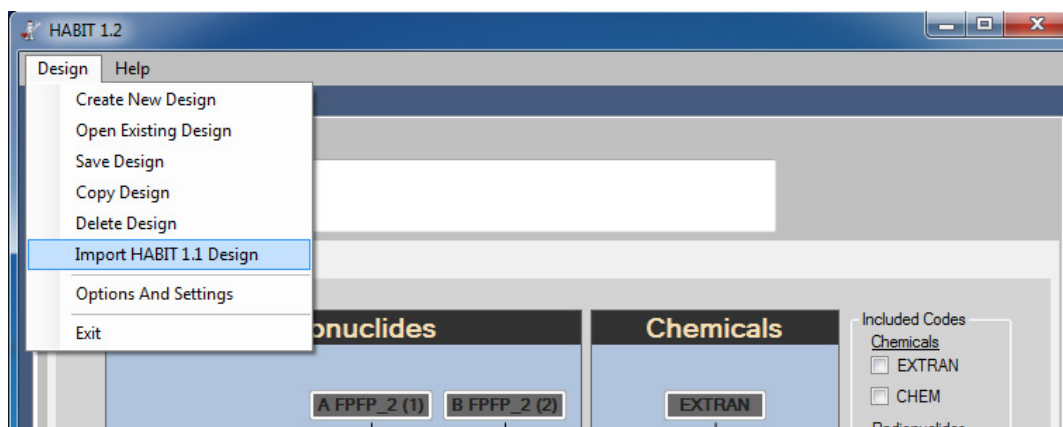
Figure 3-17: HABIT Main Menu (Import HABIT 1.1 Design)

Select HABIT 1.1 Design File will be displayed. Navigate to the appropriate HABIT Design (.dsg) File, select the file, and click Open.
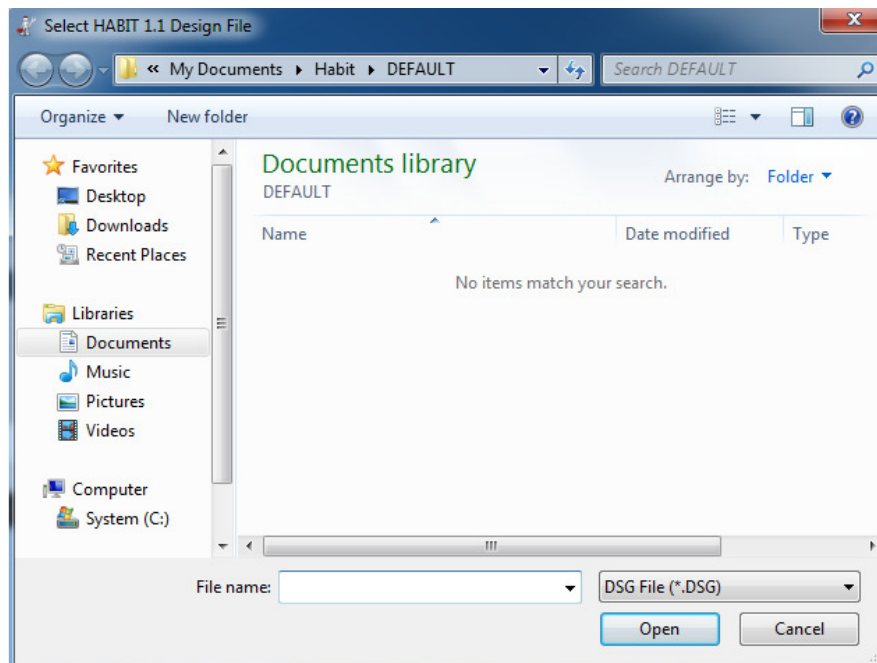
Figure 3-18: Select HABIT 1.1 Design File

If successful, the Design Import informational message will display with the imported directory.
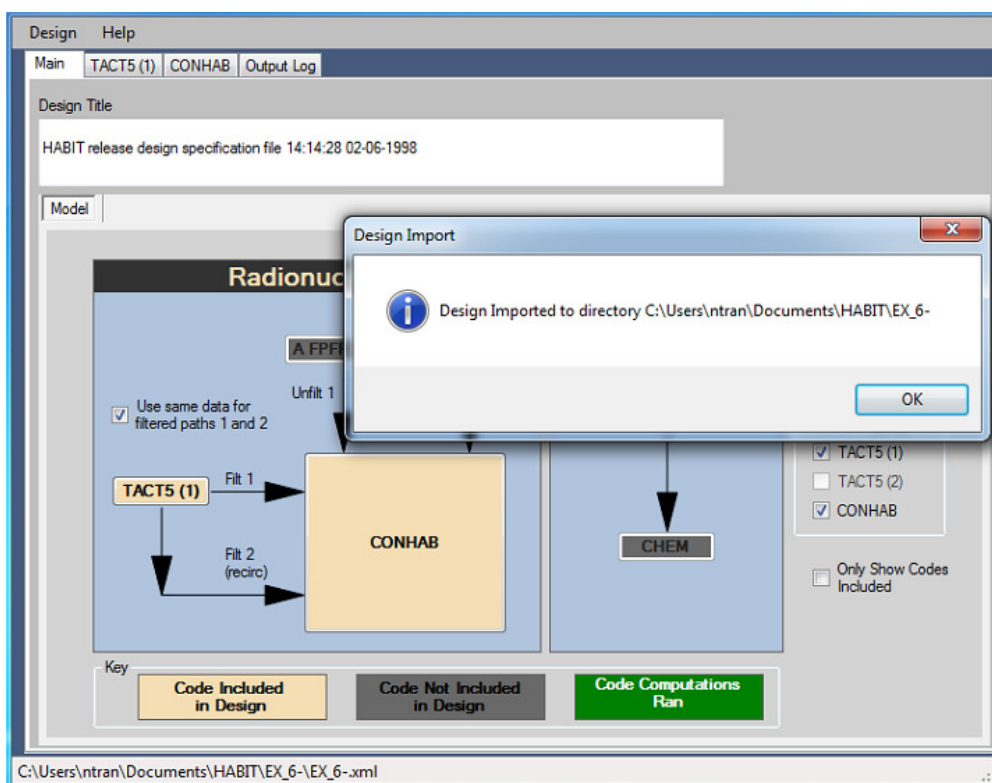
Figure 3-19: Design Imported

Navigate through the available tabs to make any desired update and click on Run button.
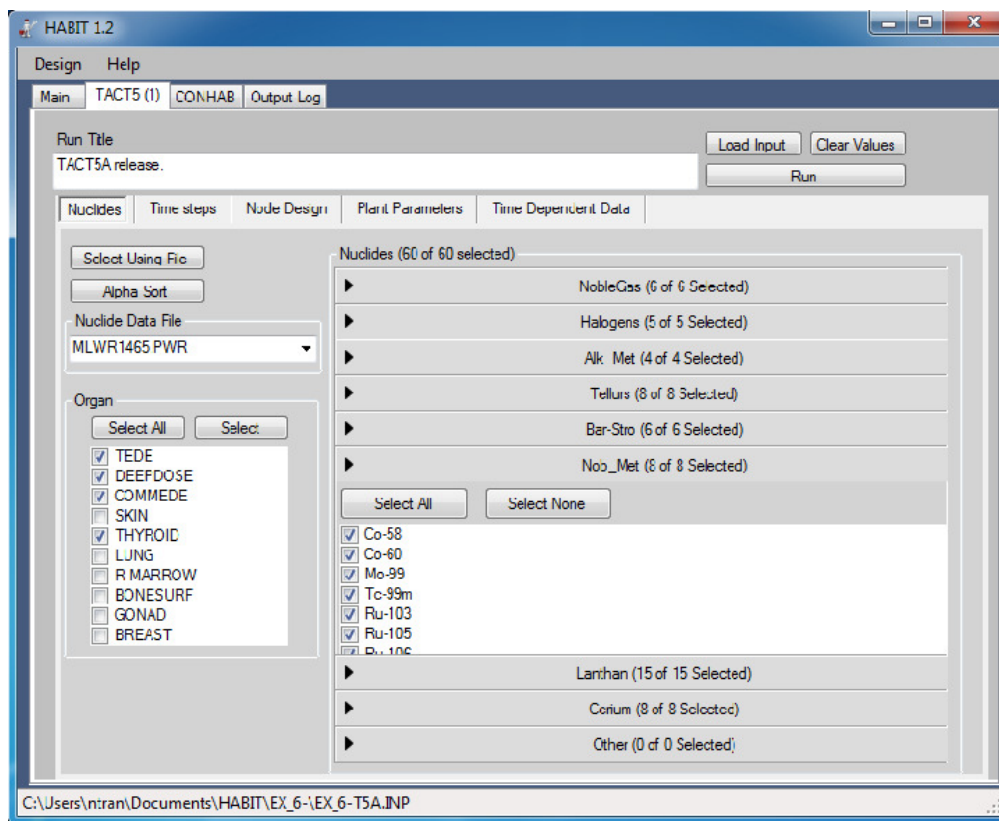
Figure 3-20: TACT5 tab

Once the design computation ran, the Design Model will indicate its completion on the models tab.
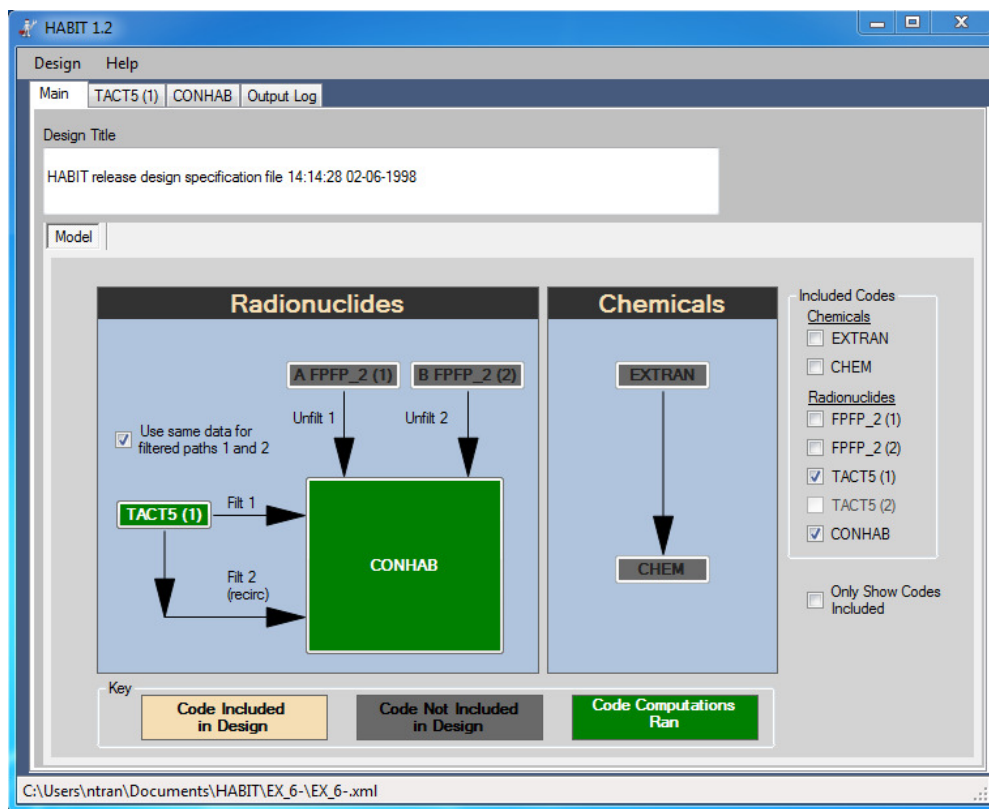
Figure 3-21: Main tab

The Output Log will display the MS-DOS output of the running designed packages. The Output is appended to this log (for the session), but can be cleared by clicking on Clear Log button.
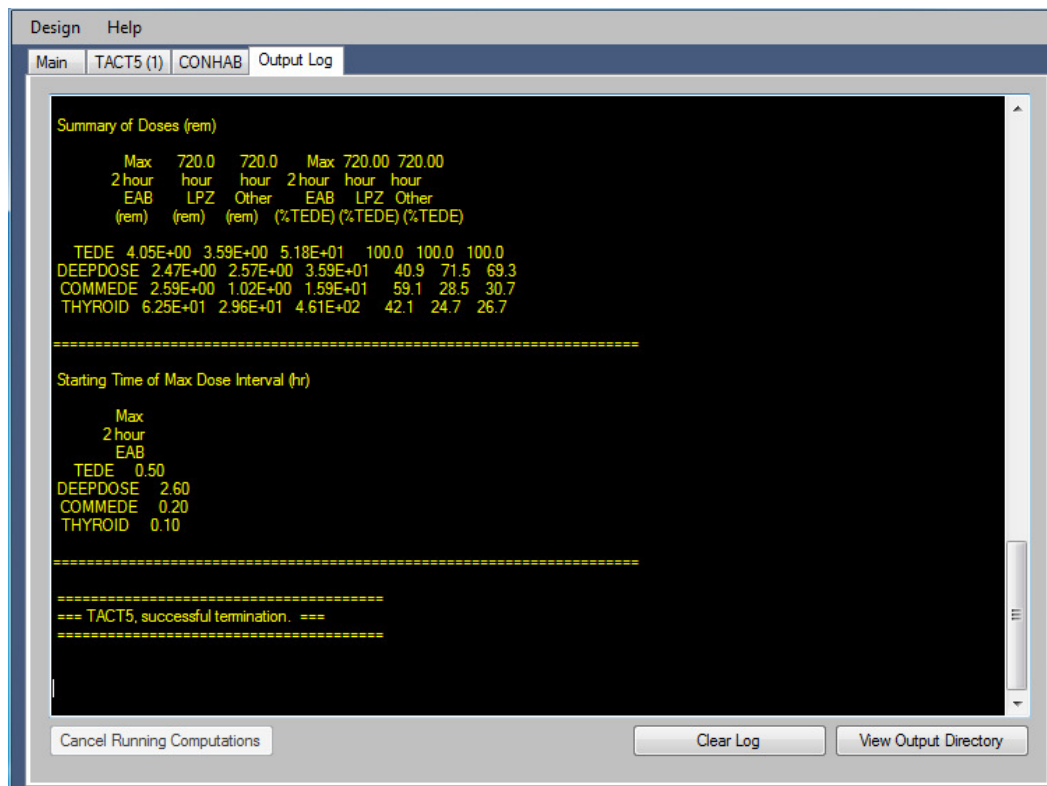
Figure 3-22: Output Log tab

To view the Output Directory and the files created from the FORTRAN code, click on View Output Directory button.
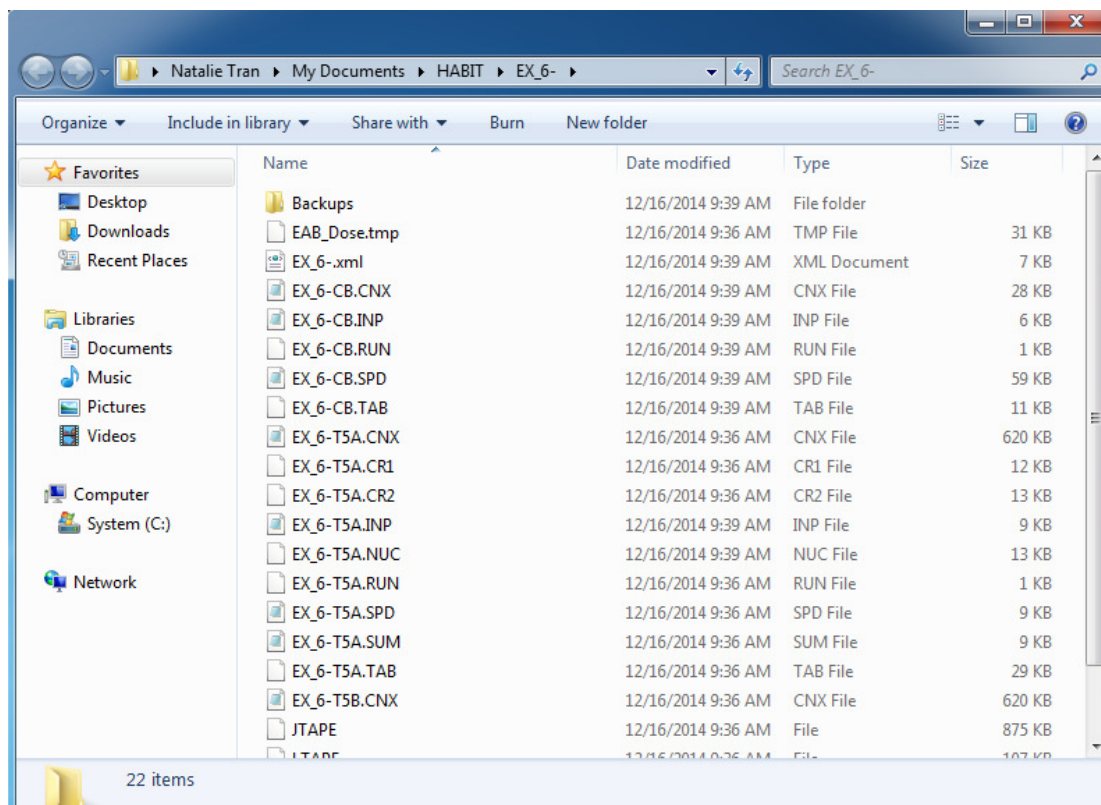
Figure 3-23: Output Directory

4 HABIT Modules

4.1 EXTRAN

EXTRAN determines the release rate of a chemical in the event of release due to leaks or ruptures of liquid or gas tanks. The EXTRAN tab displays the design of the EXTRAN module with required fields indicated by a red 'R' label. The values for the parameters will be pre-populated when importing from previous design; else the user can enter in the appropriate values. When hovering the mouse over the field, the system will display the valid range for that field.

Figure 4-1: EXTRAN tab

- The Load Input button allows the user to load EXTRAN input variables from a valid EXTRAN input file (inp). This function is generally not necessary since the input variables are automatically loaded for any previously saved design.

- The Clear Values button will clear the EXTRAN input variables.

- The Run button will execute the EXTRAN FORTRAN code against the variables inputted in this tab.

- The Check Inputs button will perform required field validation on the input variables and provide a report to the user of required fields.

- Clicking on Release Type will change the fields which are required for proper EXTRAN FORTRAN code computations.

- Clicking on Input Selection radio button to enter the EXTRAN values for Spill Parameters, Meteorological Parameters and Chemical Parameters.

- Once values are entered, user has the option to check if the design is complete by clicking on Check Inputs button.
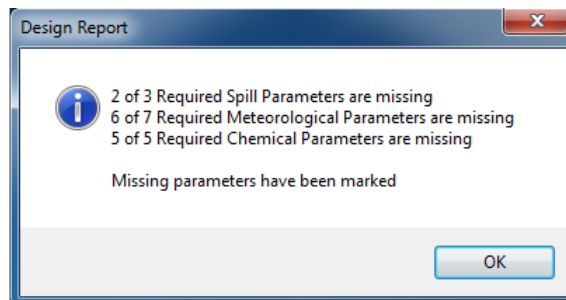
Figure 4-2: Design Report (Required Parameters)

Once all required values are entered, click on Run button to save the design and module input variables and run the EXTRAN FORTRAN code with the entered input variables.
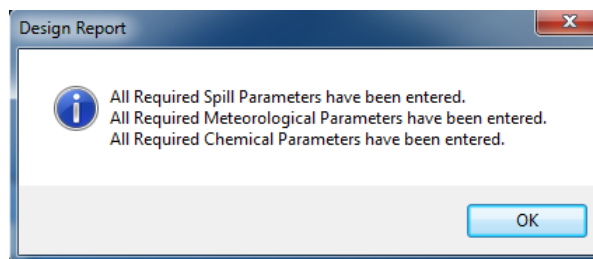
Figure 4-3: Design Report (All required entered)

Click OK and user will be taken to the Output Log.

Figure 4-4: EXTRAN Output Log (page 1)

Figure 4-5: EXTRAN Output Log (page 2)

4.2 CHEM

CHEM is used for estimating chemical exposures, models the dilution of the chemical by flows in the control room, and determines the chemical exposure to control room personnel. The CHEM tab displays the design of the CHEM module. The values for the parameters will be pre-populated when importing from previous design; else the user can enter in the appropriate values.

Figure 4-6: CHEM tab

- The Load Input button allows the user to load a CHEM input variables from a valid CHEM input file (inp). This function is generally not necessary since the input variables are automatically loaded for any previously saved design.

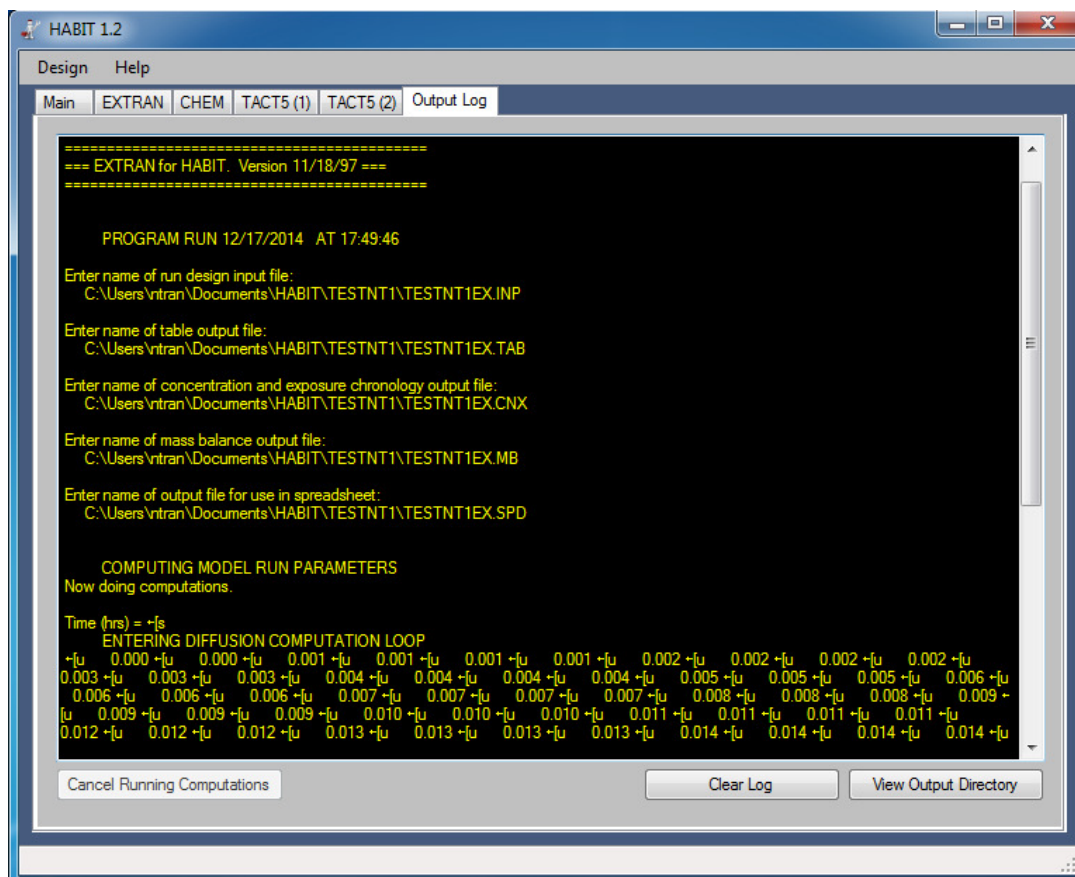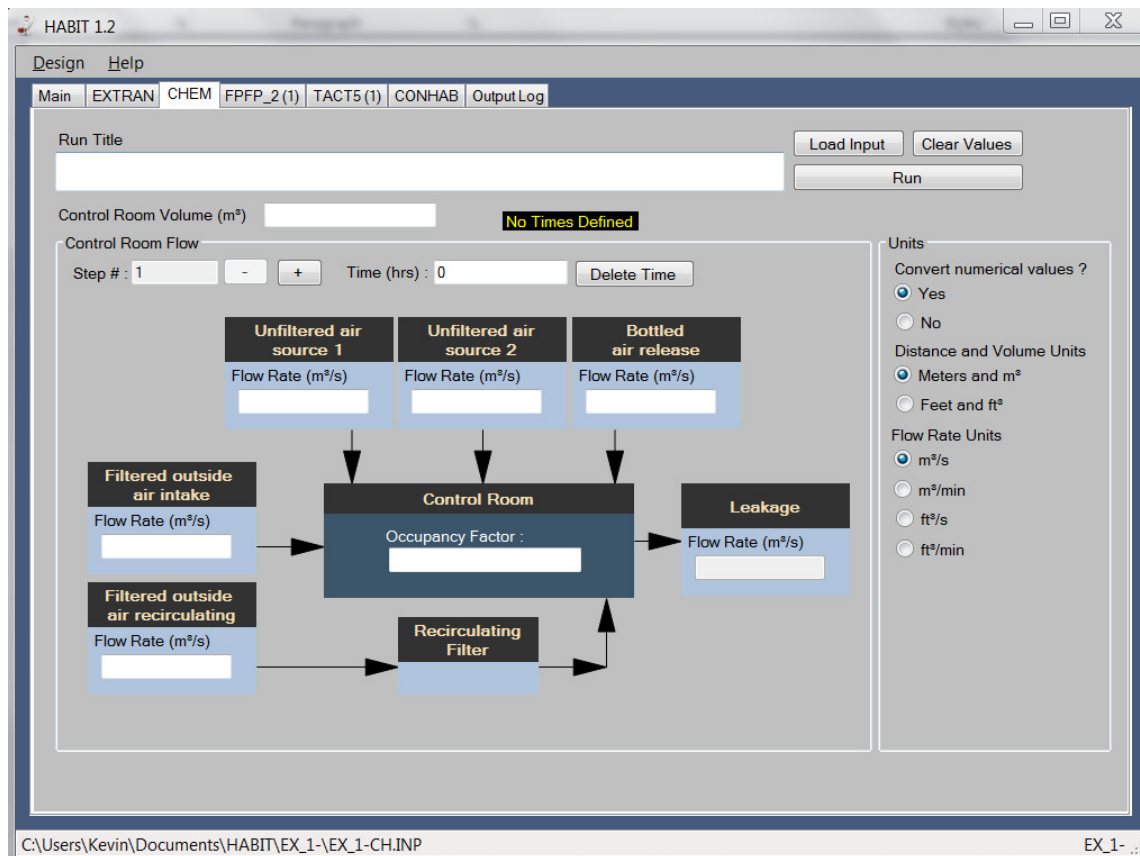- The Clear Values button will clear the CHEM input variables and reset the number of CHEM Steps.

- The Run button will execute the CHEM Fortran code against the variables inputted in this tab.

- The Step + and – buttons allows the user to add and navigate through the variables for each time step of the CHEM simulation. In order to enter add a time step, a time value must be entered in the Time(hrs) textbox, then the + will be clickable.

- The Delete Time button allows the user to delete the currently displayed time step

- The Units radio buttons allows the user to change measurement units from English units to SI units. Selections here will affect the display of the Control Room Flow.

The CHEM module uses the results of EXTRAN so EXTRAN needs to be run as a prerequisite. An error message will display if attempting to run CHEM module without EXTRAN.
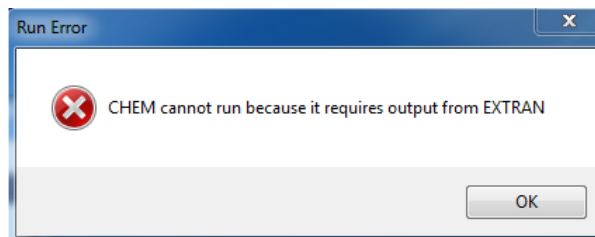
Figure 4-7: CHEM tab error message

4.3 FPFP_2

The FPFP_2 is used to model radioactive flow through the plant and determine doses in the control room associated with the accidental releases of radionuclides. The design allows for two separate instances of FPFP_2; each of these instances receives its own tab. Within each FPFP modules are Spaces and Flow Rates tab. The values for the parameters will be pre-populated when importing from previous design; else the user can enter in the appropriate values.
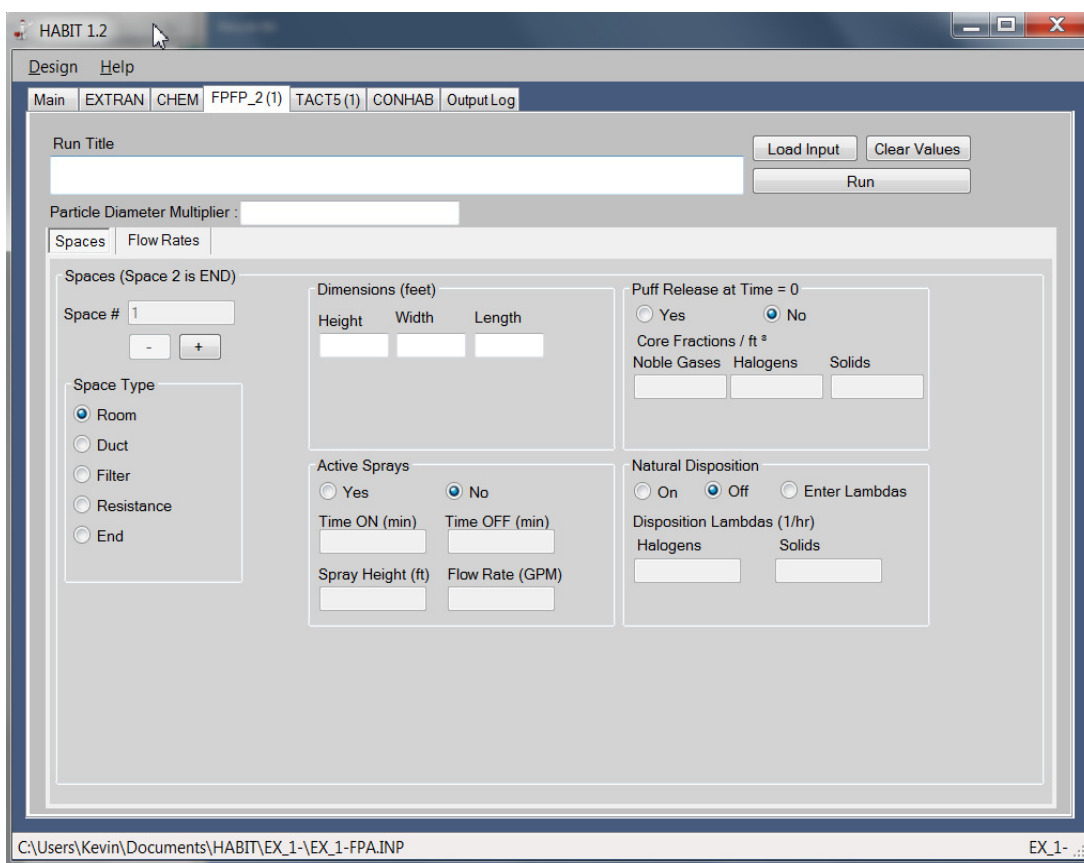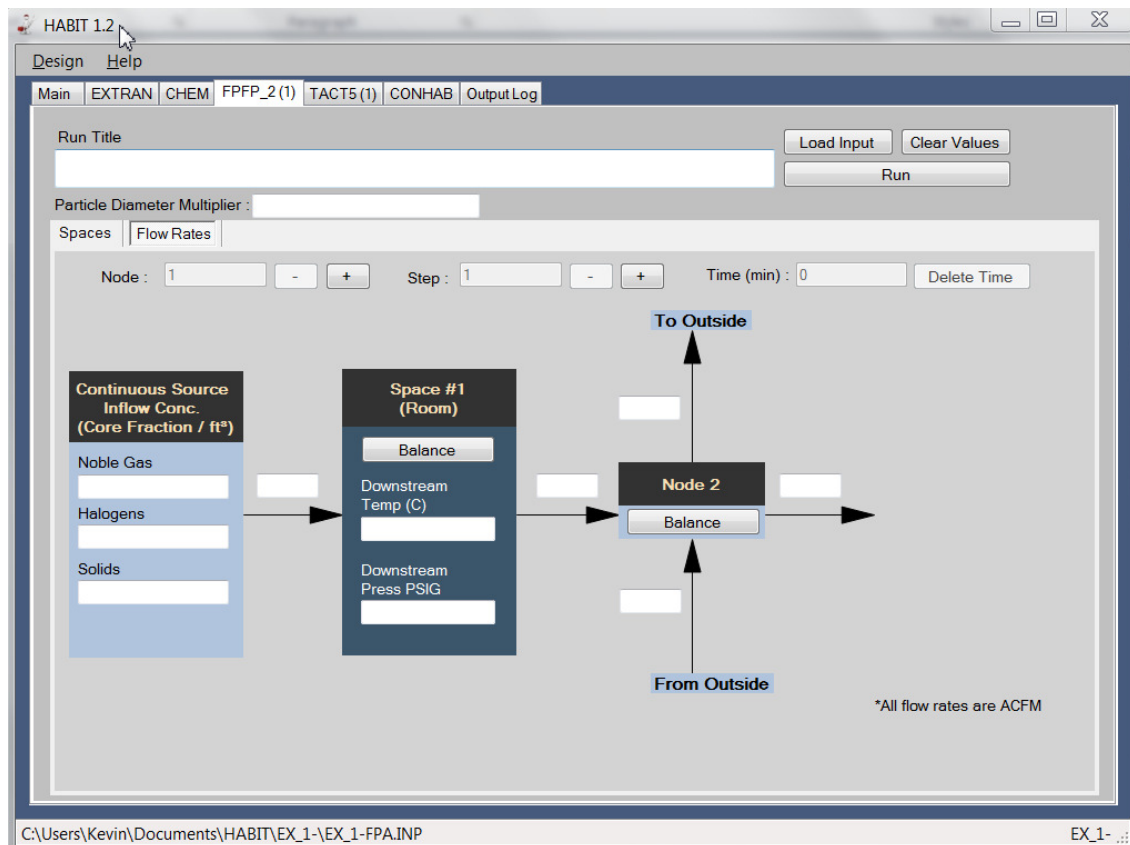

Figure 4-8: FPFP_2 tab (Spaces)

Figure 4-9: FPFP_2 tab (Flow Rates)

- The Load Input button allows the user to load an FPFP2 input variables from a valid FPFP2 input file (inp). This function is generally not necessary since the input variables are automatically loaded for any previously saved design.

- The Clear Values button will clear the FPFP2 input variables and reset the number of Spaces and Flow Rate Steps.

- The Run button will execute the FPFP2 Fortran code against the variables inputted in this tab.

- The Spaces + and – buttons allows the user to add Spaces to the FPFP2 simulation and allows navigation of the entered space data. Each space is selected through the Space Type radiobutton. The last space is always the "End Space"

- The Flow Rates tab is dependent on the Spaces entered. Each space creates a Node on the Flow Rates tab.

- The Node + and – buttons allows the user to navigate the Flow Rate variables for each node (space) of the FPFP2 simulation.

- The Step + and – buttons allows the user to add and navigate the Flow Rate variables for each time step of the current node. In order to enter add a time step, a time value must be entered in the Time(hrs) textbox, then the + will be clickable.

- Delete time allows the user to delete the current time step from the Flow Rate variables.

4.4 TACT(5)

The TACT5 code is used to model situations in which contamination is released to the atmosphere and subsequently enters the control room. The TACT5 tab provides the functionality of the TACT5 module and allows for two separate instances of TACT5; each of these instances receives its own tab. TACT5 contains two tabs, Nuclides and Time steps. Nuclides must be selected to open the Node Design and Plant Parameters tabs.
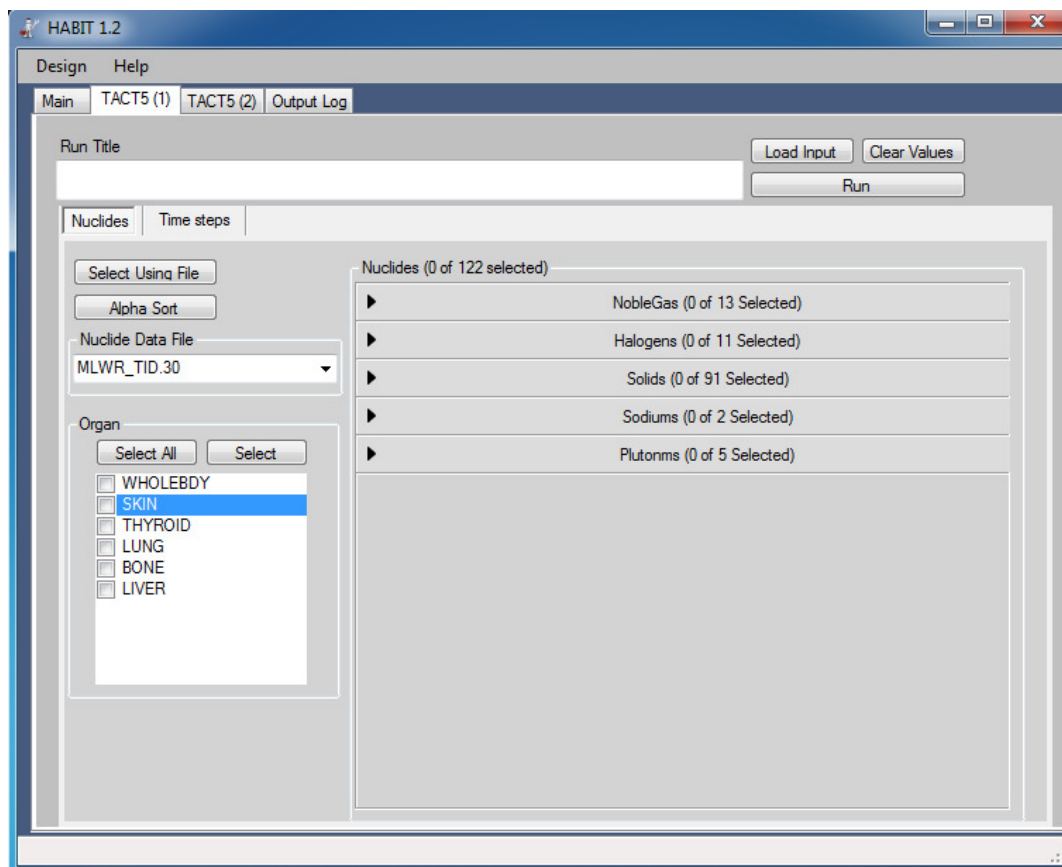

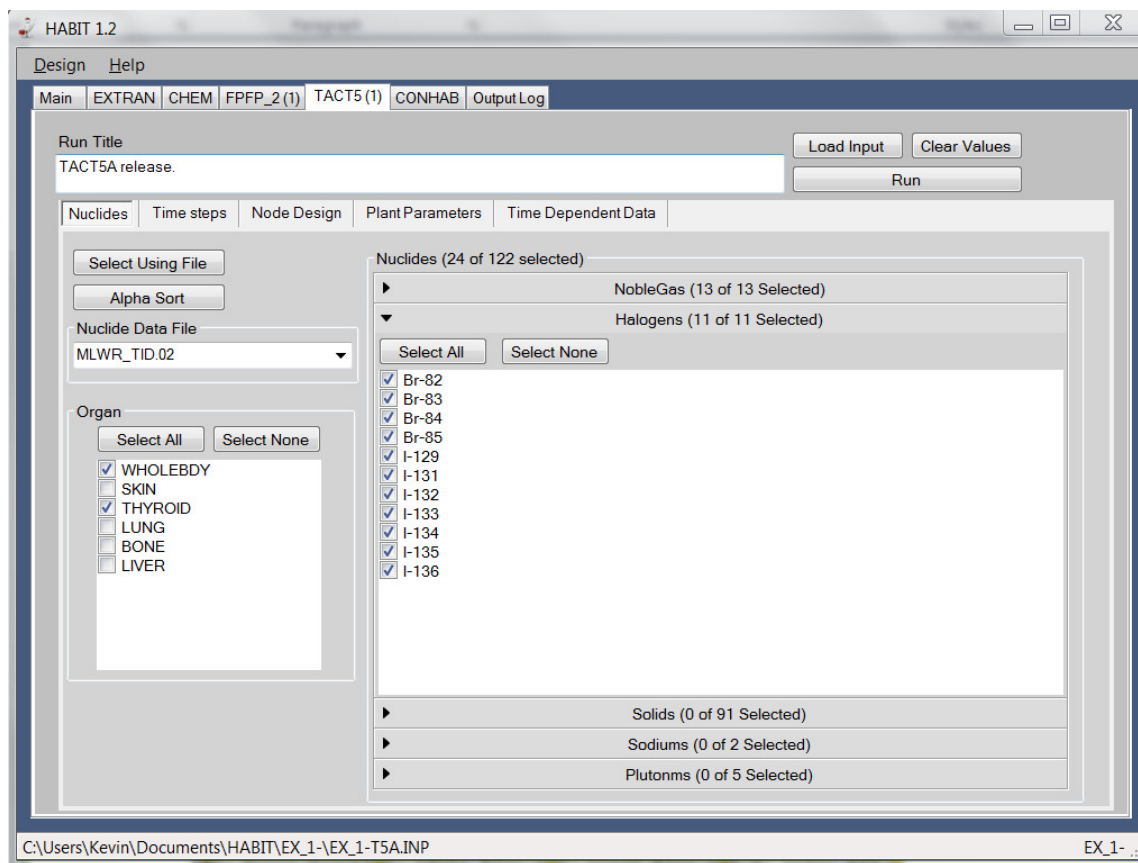
Figure 4-10: TACT5 tab (Nuclides)

Figure 4-11: TACT5 (Time Steps)

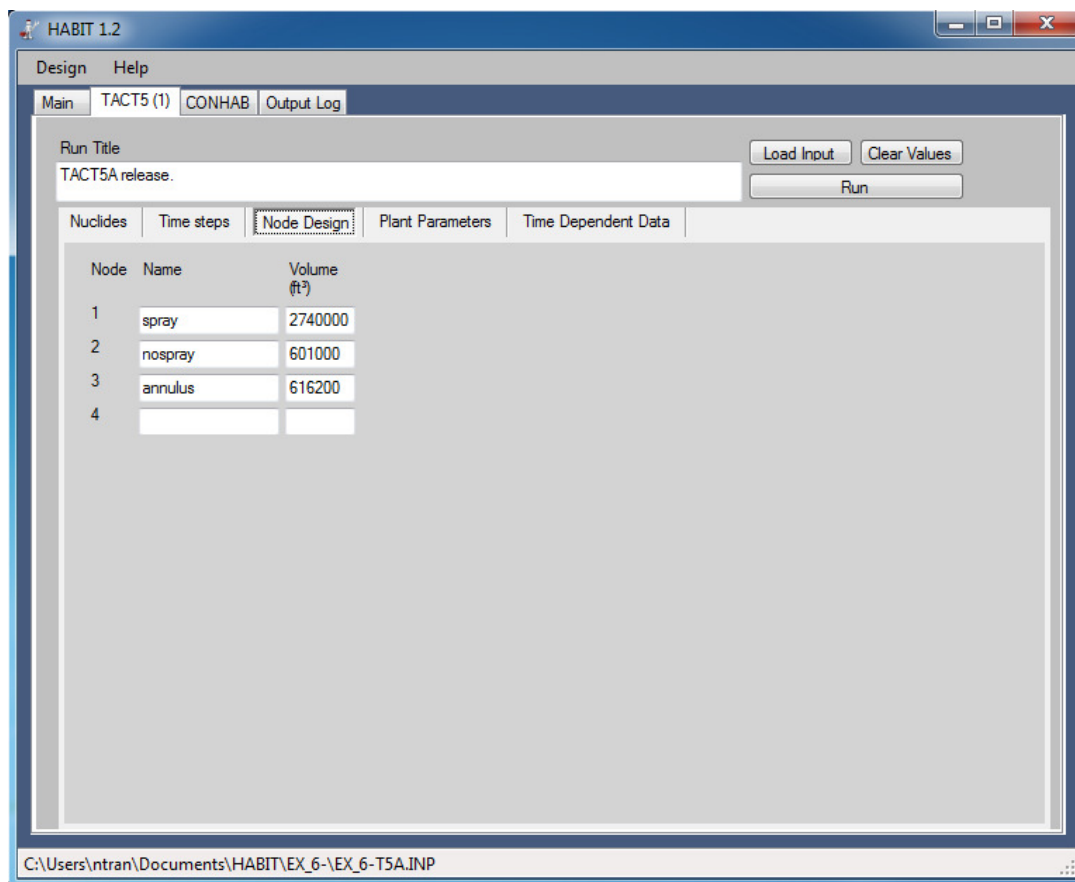Enter data in Node Design tab in order to open Time Dependent Data tab

Figure 4-12: TACT5 (Node Design)

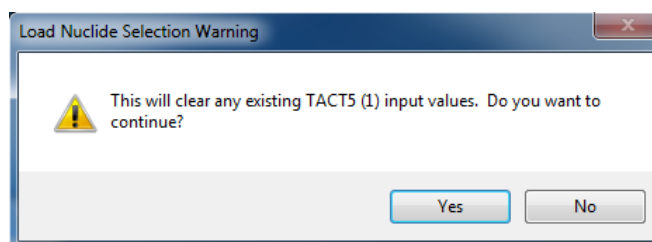To populate fields from a file, click on Select Using File button.

Figure 4-13: Select Using File warning message

Click "Yes" to remove the pop-up message and to bring up TACT5 Nuclide Selection File window.
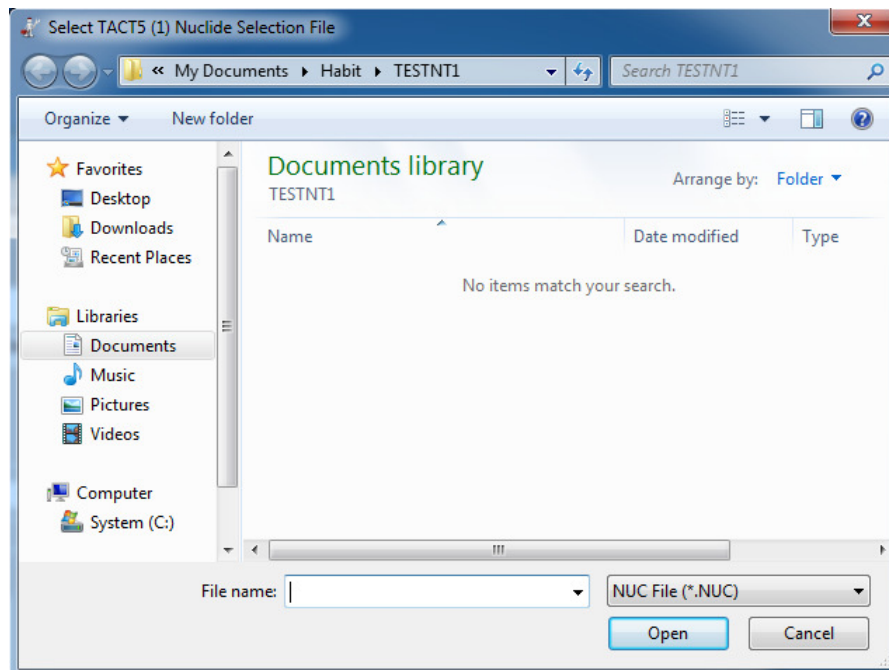
Figure 4-14: Nuclide Selection File

Select a file and click Open. Data from the selected file will be processed and displayed on the window.

- The Load Input button allows the user to load TACT5 input variables from a valid TACT5 input file (inp). This function is generally not necessary since the input variables are automatically loaded for any previously saved design.

- The Clear Values button will clear the TACT5 input variables

- The Run button will execute the TACT5 Fortran code against the variables inputted in this tab.

- The Select Using File button allow the user to load the nuclide selections based from a valid nuclide selection file (.nuc file). The selected nuclide database for the design must be the same as the one from the inputted nuclide selection file.

- The Alpha Sort button sorts the Nuclides items alphabetically

- The Nuclides selection area contains the Nuclide Groups and their related nuclides. To select individual nuclides, click on the Nuclide group. The group will expand and display the nuclides in that group. Each nuclide group contains an Select All and Select None button which allows the user to choose all the nuclides in the group or none of the nuclides in the group.

- At least one organ and one nuclide must be selected before the Node Design and Plant Parameter tabs are available for data entry. At least one node must be entered before the Time Dependent Data tab is available for data entry.

- The Plant Parameters data entry is based on the selected element groups from the Nuclides tab.

- On the Time Dependent Data tab, the Insert Time button allows the user to instantiate a new time value for the simulation. After the time is entered, the time dependent variables can be entered (Initial Activity Distribution, Removal Rate Coefficients, Filtered Transfer Rates, etc.).   The Delete Time button allows the user to delete the variables for the current time step. The Delete All button allows the user to delete all the time variables entered. The checkboxes on each time variable group is used to include or exclude the variable group from the simulation. The First, Previous, Next, Last buttons allows the user to navigate through each set of entered time variable group. The variable group currently displayed is highlighted on the user interface.

4.5 CONHAB

The CONHAB tab provides the functionality of the CONHAB modules and contains four tabs, each for Plant Data, Meteorology or X/Q Data, Control Room Flow Data, and Units. The values for the parameters will be pre-populated when importing from previous design; else the user can enter in the appropriate values. When hovering the mouse over the field, the system will display the valid range for that field. Before running CONHAB, TACT5 and FPFP_2 must be run.

Figure 4-15: CONHAB tab (Plant Data)

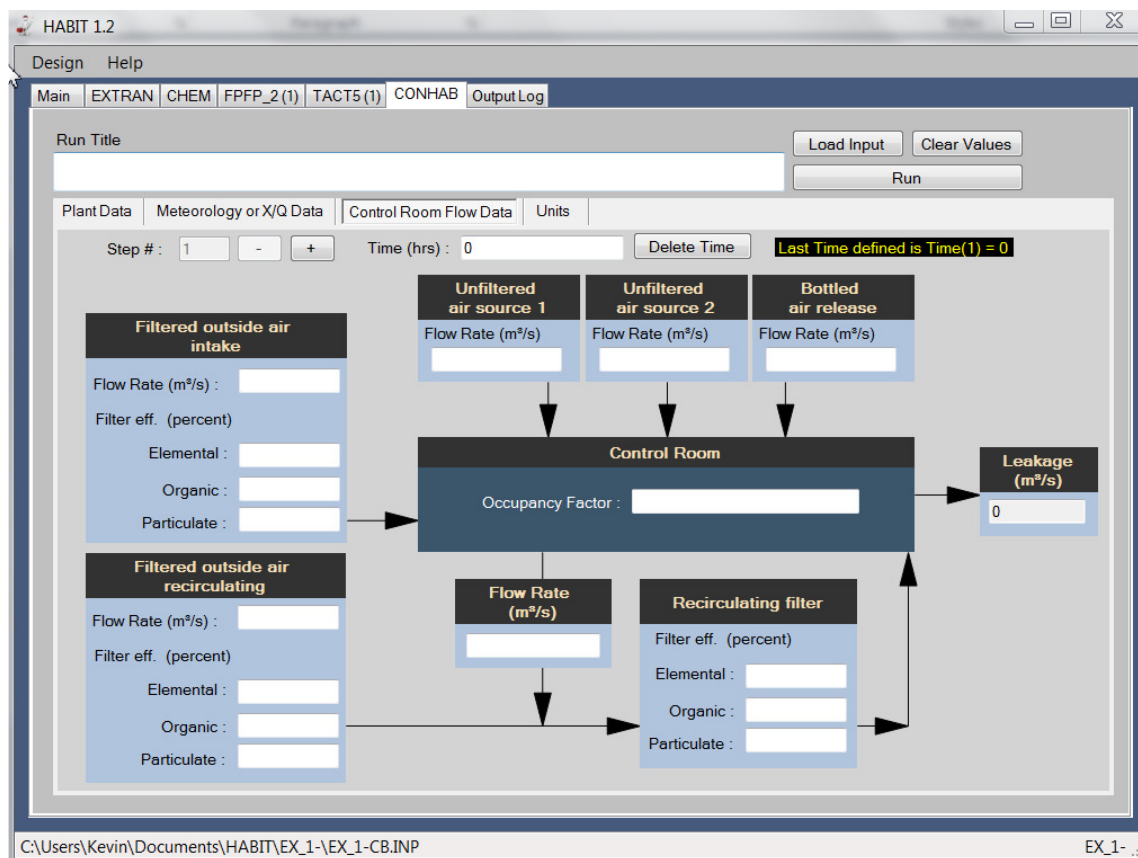*Figure 4-16: CONHAB tab (Meteorology or X/Q Data)*

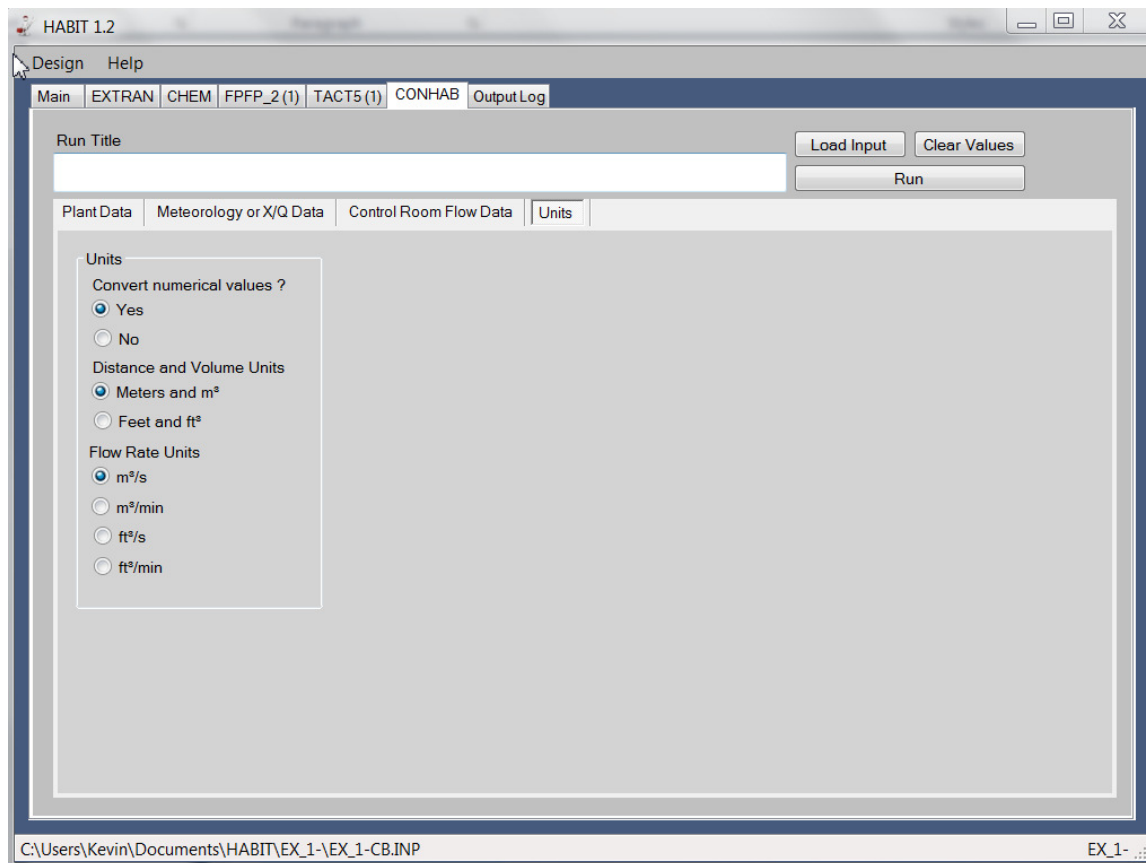*Figure 4-17: CONHAB tab (Control Room Flow Data)*

Figure 4-18: CONHAB tab (Units)

- The Load Input button allows the user to load CONHAB input variables from a valid CONHAB input file (inp). This function is generally not necessary since the input variables are automatically loaded for any previously saved design.

- The Clear Values button will clear the CONHAB input variables

- The Run button will execute the CONHAB FORTRAN code against the variables inputted in this tab.

- The Plant Data tab contains a nuclide database selection dropdown. The selected nuclide database will change the Group Fractions data entry to the element groups contained in the database.

- The Meteorology or X/Q Data tab is used to enter meteorological variables which affect the simulation. The Step "+" and "–" buttons are used to add and navigate the meteorological variables for each time step of the simulation. In order to enter add a time step, a time value must be entered in the Time(hrs) textbox, then the "+" will be clickable. The Delete Time button is used to delete a time step. The user has the option to enter meteorological variables to compute the X/Q value or enter the X/Q value

directly.

- The Control Room Flow Data tab is used to enter control room inflows and concentration values as part of the simulation. The Step + and – buttons are used to add and navigate the control room flow variables for each time step of the simulation. The Delete Time button is used to delete a time step from the simulation.

- The Units tab allows the user to change measurement units from English units to SI units. Selections here will affect the values used in the Control Room Flow Data and Plant Data tabs.