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| Date | October 2001 |
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| Title of Effort | Test Plan and Baseline Testing Results for the FRAMES User Defined RIF Module User Interface |
| Task Title | WEAP and MEPAS Module Enhancements |
| Task # | 2.1 |
| Item # | 8 |
| Revision # | 0 |
| Client | Engineer Research and Development Center (Waterways Experiment Station) |
| Project SA # | 42339 |
| Related PNNL Documents | |

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1.0 Background and Scope

This paper presents a test plan and the baseline testing results for the RIF Module User Interface (MUI) of the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES). The purpose of the FRAMES RIF is to allow the user to input user-defined intake rates of each pollutant from an exposure medium for specific age groups, exposure pathways, and intake routes to generate the appropriate FRAMES data files to be used by health-impact modules. The RIF contains sets of data for each intake module included in the current case. The constituent intake rates are time varying, and the user must define the time steps required. Both radionuclides and chemicals can be input into this module. FRAMES is a platform that allows various multimedia modules to be linked into complete transport/exposure assessment systems (Whelan et al. 1997).

The RIF Module User Interface is being baseline tested for FRAMES Version 1.3. The test cases developed for this testing, and presented in this paper, will also be used for assessing the effects of future code modifications. Each time a modification is made to the program code, these test cases are rerun, and their results are compared to the previous run (regression testing). Changes in the results are evaluated to determine if they were expected as a result of the modification and are an acceptable change, or if they are an unintended side effect. In the latter case, the program code can be changed and the testing performed again.

The following sections list the requirements of the viewers, explain how these requirements relate to the specific test cases in this plan, and then present the test cases themselves.

2.0 Requirements

Requirements for the RIF Module are described in the paper entitled, *FRAMES User Defined Intake Pathway File Module Documentation* (Pelton et al. 2001). The requirements listed below are the fundamental requirements suitable for testing the Module User Interface.

Table 2.1. Testing Requirements for the RIF Module User Interface

| Requirement Number | General MUI Requirements |
|---------------------------|--|
| 1 | The MUI will operate in Windows 98 and have a user-friendly interface with a standard Windows look and feel. |
| 2 | Each module will contain an About tab to inform the user of the module title, version number, and brief description. |
| 3 | For all input parameters having dimensions associated with them, the MUI will provide users with a choice of units. |
| 4 | The MUI will include a reference feature in which the source of the specified value for each input item or set of items can be referenced if the user desires. |
| 5 | The MUI must allow the user to input all the required data to execute the module, including user-defined, time-varying, contaminant intake rates for |

| Requirement Number | General MUI Requirements |
|---------------------------|--|
| | different intake pathways and routes at different locations from different transport media and age groups. |
| 6 | Allow unlimited constituents, progeny, and intake rates. |
| 7 | Produce RIF following the FRAMES datafile specifications. |
| 8 | Allow the user to input different intake routes. |
| 9 | The appropriate tabs and media-release-rate type should appear in the MUI based on the modules connected. |
| 10 | The FRAMES Intake Pathway Module is required to output user-defined, time-varying, average contaminant intake rates for different intake pathways and routes at different locations from different transport media. These outputs must meet the specifications of FRAMES (Whelan et al. 1997). |
| 11 | The FRAMES RIF does not conduct computations that change the values input by the user except to convert units to internal FRAMES units. This is done by the MUI. No other scientific requirements exist for this Module. |

3.0 Test Cases and Baseline Testing Results

3.1 RIF01

3.1.1 Description and Rationale

The purpose of this section is to test the user-defined RIF module to ensure that it correctly requests and transfers all necessary data to complete the RIF. This test case is intended to check if the MUI allows the following: location of each media point (x,y), DATANET type (acute or chronic), number of age groups, starting and ending ages of age groups, number of time periods, start time, duration of time period, types of exposure pathway (air, ground, leafy vegetable, fruit, etc.), intake rate, and exposure intake route (ingestion, inhalation, dermal, external). Also, error checking of the user-input concentration data will be evaluated.

3.1.2 Input Data

Build a case using Appendix A. Save the file as RIFtest1.gid. Select benzene and strontium-90 from the list of contaminants. Choose Air as the Exposure Pathway. (For every screen that has Population, enter 1 to replace the 0).

For Air/ Chronic

| X (m) | Y (m) |
|--------------|--------------|
| 100 | 150 |
| 1000 | 400 |

| | |
|------|-----|
| 1900 | 900 |
|------|-----|

Age Group

| Starting Age | Ending Age |
|--------------|------------|
| 0.0 yr | 3.0 yr |
| 0 | 70 |

Benzene (Age Group 0 - 3)

| Time | Duration |
|------|----------|
| 0 yr | 20 day |
| 50 | 40 |
| 100 | 60 |

Inhalation (indoor air) mg/m³

| | | |
|---|----|-----|
| 1 | 2 | 3 |
| 5 | 6 | 7 |
| 9 | 10 | 111 |

Strontium-90 (Age Group 0-3)

| Time | Duration |
|------|----------|
| 0 yr | 30 day |
| 60 | 50 |
| 100 | 70 |

Inhalation (air) Bq

| | | |
|-----|-----|------|
| .2 | .3 | .4 |
| .6 | .7 | .8 |
| .10 | .11 | .121 |

Add new Dermal (showering) Bq

| | | |
|-----|-----|-----|
| 15 | 20 | 30 |
| 50 | 60 | 70 |
| 609 | 610 | 611 |

Save and exit to check values. Re-enter the User Input section and enter the following:

Yttrium-90

Inhalation (air) Bq

| | | |
|---|----|----|
| 5 | 10 | 15 |
| 6 | 7 | 8 |
| 8 | 9 | 10 |

Benzene (Age Group 0 to 70)

| Time | Duration |
|-------------|-----------------|
| 10 yr | 60 hr |
| 20 | 20 |
| 30 | 130 |

Dermal (soil) mg/kg/day

| | | |
|----|----|----|
| 15 | 20 | 25 |
| 16 | 17 | 18 |
| 18 | 19 | 20 |

Strontium-90 (Age Group 0 to 70)

| Time | Duration |
|-------------|-----------------|
| 0 yr | 50 (mn) |
| 60 | 10 |
| 100 | 120 |

Ingestion (beef) mg/kg/day

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 3 | 4 | 5 |
| 5 | 6 | 7 |

Ingestion (milk) mg/kg/day

| | | |
|----|----|----|
| 10 | 12 | 21 |
| 13 | 14 | 41 |
| 15 | 16 | 61 |

Yttrium-90 (Age Group 0 to 70)

Ingestion (meat) mg/kg/day

| | | |
|----|----|----|
| 14 | 15 | 16 |
| 97 | 57 | 47 |
| 11 | 12 | 13 |

Open the RIFtest1.rif file with Notepad or similar program and compare results to input.

3.1.3 Expected Results

The expected results for this test case will be that it creates an RIF in accordance with the FRAMES specifications. It is expected that the MUI will be easy to use and have a functionality consistent with standard Windows software. It is expected that the MUI will request only the required information.

It is expected that the transfer of data from the MUI to the RIF will occur properly and that any necessary unit conversions will be done correctly. The transfer of data between files can be confirmed

by visual inspection of these files (RIFtest1.rif). It is expected that the MUI will not continue until all data have been entered completely and within the correct specifications. If data entered are incorrect or incomplete, an error message should appear.

3.1.4 Testing Results

All requirements were met except for the following:

There were no unit choices for concentrations.

While error checking the rif file, I noticed that the conversions for units were correct, but the proper units do not appear (i.e., I entered 1900 m and this is converted to 1.9 km, but the rif shows meters as the units with the converted 1.9.)

The conversion from year to a choice from the list does not appear as the user entered it.

Recommend more user guidance on the Parent screen where exposure pathways are selected. At least one pathway must be selected, and data input must be completed for each contaminant and progeny for the module to continue.

4.0 References

Pelton, M.A., F.C. Rutz, G. M. Gelston, and M.A. Eslinger. 2001. *FRAMES User Defined Intake Pathway File Module Documentation*, PNNL-13409, Pacific Northwest National Laboratory, Richland, Washington.

Whelan G., K. J. Castleton, J. W. Buck, G. M. Gelston, B. L. Hoopes, M. A. Pelton, D. L. Streng, and R. N. Kickert. 1997. *Concepts of a Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES)*, PNNL-11748, Pacific Northwest National Laboratory, Richland, Washington.

Appendix A: General Procedure for Test Case Implementation

Open the Multimedia Framework (fui.exe). Select New from the File menu. Enter a file name and select Open. Enter a site name at the prompt and select Ok.

Double click on a contaminant database icon and a receptor intake icon. The icons will appear on the main screen. Left click the mouse and drag the icons to the desired locations. Connect the contaminant and intake icons together. To do this, hold down the shift key, click on the contaminant icon, and drag the mouse to the intake icon. Release the mouse button and the shift key. A line will connect the two icons with an arrow pointing from the contaminant icon to the intake icon. To remove this line, repeat the steps used to connect it. To remove an icon from the screen, right click on the selected icon and select delete.

Right click on the contaminant icon and choose General Info. When the General Info screen opens, select Label: Contaminants and Module: FRAMES Default Chemical Database Selection. Click on OK at the bottom of the screen; this returns you to the work area, and the signal light attached to the contaminant icon changes from black into red. Right click on the contaminant icon in the main screen and choose User Input on the menu that appears and the Contaminant Selection screen will open. Select from Possible Contaminants: All Contaminants. Scroll to select the contaminants or use the Find option on this screen. Choose File/Save and exit to return to the work screen. The light will change from red into green.

Right click on the intake module you placed on the main screen and choose General Info. Select the applicable model (FRAMES Known Intake Module) and click OK. The signal light will turn from black into red.

Right click on the intake module and choose User Input, and the FRAMES Known User Input screen will open.

Fill in all the required information in the menu by selecting each level in the tree view on left side of the screen, and then click save and exit; the light will turn from red into yellow.

Right click on the intake module and choose Run Model. The model will run, and the light will change from Yellow into Green. To view results, right click on the icon and select the desired viewer from the View/Print Module Output menu.