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FRAMES User Defined Source Release Module Documentation

JW Buck
MA Pelton
MA Eslinger

December 2000

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J. W. Buck
M. A. Pelton
M. A. Eslinger

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1.0 Introduction

The Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) User-Defined Source Release Module is generally the starting module for most analyses when the user knows the release rates of the contaminants. This module provides the user a way to input the user-defined contaminant mass fluxes for each contaminant and the user-defined media flux rates. This report contains the requirements for this module and will be used by software engineers and testers to ensure that the module functions properly. A test plan will be developed from this document. Test cases will be developed from the test plan to ensure that the product meets the needs of the client(s) and to establish a baseline version of the module.

2.0 Purpose of FRAMES User-Defined Source Release Module

The purpose of the FRAMES User-Defined Source Release Module is to allow the user to input user-defined contaminant and media release rates to generate the appropriate FRAMES data files to be used by fate and transport and exposure modules. Both radionuclides and chemicals can be input into this module. These contaminant mass fluxes are used to describe the loss of contaminant from the source zone via loss routes to various environmental media (i.e., air, soil, and water), while the media release rates define the flow rates of the medium associated with the contaminant mass fluxes. The contaminant and media release rates are time varying, and the user must define the time steps required. The user can define four different contaminant mass flux rate types: infiltration, overland runoff, atmospheric, and/or soil contamination in the FRAMES User-Defined Source Release Module.

3.0 Summary of Requirements for the FRAMES User-Defined Source Release Module

This section provides an overall summary of the requirements for the FRAMES User-Defined Source Release Module. Detailed input, output, and scientific requirements are described in the sections that follow.

The FRAMES User-Defined Source Release Module will:

- Allow user to input time-varying, contaminant mass flux and media release rates for water, air, soil, and overland release mechanisms.

- Allow at least 25 contaminants to be evaluated for a scenario.

- Operate under Windows 95 and have a user-friendly interface with a standard windows look and feel.

- Produce Air Flux File (AFF), Water Flux File (WFF), and Soil Concentration File (SCF) following the FRAMES data file specifications.

3.1 Input Requirements for the FRAMES Use-Defined Source Release Module

The user will enter the input data required for the FRAMES User-Defined Source Release Module via the Module User Interface (MUI). The MUI will allow the user to define the source problem and associated data. The three main inputs to the FRAMES User-Defined Source Release Module MUI are 1) the medium type of source being modeled, 2) time-varying, contaminant mass fluxes, and 3) time-varying, media release rates. The media release rate types depend on which modules are connected to this source module. If a vadose or aquifer module is connected, water fluxes will be required; if an overland or surface water module is connected, sediment fluxes will be required; if an atmospheric module is connected, air emission rates are required; and if an exposure module is connected, soil concentrations are required. The appropriate tabs should appear in the MUI based on the Modules connected.

The following general requirements are associated with the MUI:

1) The MUI will operate in Windows 95 and will have a standard Windows look and feel.

2) The MUI will have online help in an HTML format that provides users with an easy-to-understand description of all input parameters required by the MUI as well as 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 can be referenced if the user desires.

The MUI will show the range of values allowed for each input data item, when the cursor is positioned on that item, as a message at the bottom of the screen will appear. When an out-of-range value is entered in a field, the MUI will indicate this by a red background in the input field and an error message in addition to the allowed range message. Data input values within range are shown with a green field background.

The MUI for the FRAMES User-Defined Source Release Module must allow the user to input all the required data to execute the module. This includes allowing the user to enter data for:

- User-defined, time-varying, instantaneous contaminant mass fluxes and media release rates for water media (aquifer, surface water, or vadose zone medium)

- User-defined, time-varying, instantaneous contaminant mass fluxes and media release rates for overland medium

- User-defined, time-varying, annual average contaminant mass fluxes and media release rates for air medium

- User-defined, time-varying, instantaneous contaminant concentrations for soil in the waste zone.

There are four main data categories associated with the FRAMES User-Defined Source Release Module and each of these categories, when selected, have requirements for entering data. The following data are obtained from the MUI and are needed by the module: 1) water flux, 2) overland flux, 3) atmospheric flux, and 4) soil concentration.

The data requirements for the **Water Flux** category are:

- Medium type (i.e., aquifer, vadose, or surface water)
- Width of flux plane
- Length of flux plane (vadose or surface water only)
- Height of flux plane (aquifer only)
- Distance below water table
- Natural recharge rate
- User-defined, time-varying, instantaneous contaminant mass fluxes for each contaminant
- User-defined, time-varying, instantaneous medium release rates.

The data requirements for the **Overland Flux** category are:

- Medium type (vadose or surface water)
- Width of flux plane
- Height of flux plane
- Distance below water table
- Natural recharge rate
- User-defined, time-varying, instantaneous contaminant mass fluxes for each contaminant
- User-defined, time-varying, instantaneous medium release rates.

The data requirements for the **Atmospheric Flux** category are:

3

- Flux types (gas 1, particle 1, particle 2, or particle 3)
- Flux type flux density (gas and particles) and particle radius (particles only)
- Type of Release (point or area)
- Exit area of source
- Exit height of source (point only)
- Height of adjacent structures (point only)
- Exit velocity of source (point only)
- Exit temperature of source (point only)
- Ambient air temperature (point only)
- User-defined, time-varying, annual average contaminant mass fluxes for each contaminant
- User-defined, time-varying, annual average medium release rates (gas or particle).

The data requirements for the **Soil Concentration** category are:

- Type of contaminated medium (vadose)
- Width of contaminated soil
- Length of contaminated soil
- Depth of contaminated soil
- User-defined, time-varying, instantaneous contaminant soil concentration for each contaminant.

3.2 Output Requirements for the FRAMES User-Defined Source Release Module

The FRAMES User-Defined Source Release Module is required to output time-varying, contaminant mass fluxes for air, water, and overland, as well as soil concentrations associated with the source medium. These outputs must meet the specifications of the FRAMES (Whelan et al. 1997). The mass flux of contaminant to the air medium must be provided in the *.AFF file, the mass flux of contaminant to the water and overland media in the *.WFF file, and the soil concentrations remaining at the source for each time step must be provided in the *.SCF file.

The FRAMES User-Defined Source Release Module outputs the following data to the AFF, WFF, and SCF:

- Time-varying, annual average contaminant particle and gaseous emission rates (AFF)
- Time-varying, instantaneous contaminant infiltration and overland runoff flux rates (WFF)
- Time-varying, instantaneous contaminant soil concentrations at the source (SCF)
- Time-varying, instantaneous infiltration, soil erosion, and wind erosion rates (WFF and AFF)

3.3 Scientific Requirements for the FRAMES User-Defined Source Release Module

The FRAMES User-Defined Source Release Module 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.

4.0 Recommendations

- Allow the user to enter known ground water or surface water concentrations (WCF format).

- Allow the user to enter know air concentrations and deposition rates (ATO format).

- Allow the user to enter known concentrations at the receptor for chemical and radionuclide (EPF format).

- Allow the user to enter known intake rates for chemicals and radionuclides (RIF format).

- Allow the user to enter known impact values for contaminants by receptor (HIF format).

- Although the MUI will convert the dimensions of user input data values into the units needed by the model, the MUI will always display the exact value and units in which the user originally entered each input data item.

5.0 Test Plan

5.1 Summary of Requirements

Requirement Number	General MUI Requirements
1	Allow at least 25 contaminants to be evaluated.
2	The MUI will operate in Windows and will have a standard Windows look and feel.
3	The MUI will have online help in an HTML format that provides users with an easy-to-understand description of all input parameters required by the MUI.
4	For all input parameters having dimensions associated with them, the MUI will provide users with a choice of units.
5	The MUI will include a reference feature in which the source of the specified value for each input item can be referenced if the user desires.
6	Although the MUI will convert the dimensions of user input data values into the units needed by the model, the MUI will always display the exact value and units in which the user originally entered each data item.
7	The MUI will show the range of values allowed for each input data item, when the cursor is positioned on that item, as a scrolling message at the bottom of the screen. When an out-of-range value is entered in a field, the MUI will indicate this by a red background in the input field and a scrolling error message in addition to the allowed range message. Data input values within range are shown with a green field background.
8	The MUI will request only necessary and appropriate input data.
9	The MUI will store data in the appropriate FRAMES spec format.
	Scientific Requirements
10	The FRAMES User-Defined Source Release Module 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.

Matrix of Requirements to Test Case

		Test Cases				
		Air 1	Water 2	Overland 3	Soil 4	All 5
Requirements	1				X	
	2	X	X	X	X	
	3					X
	4					X
	5					X
	6					X
	7					X
	8	X	X	X	X	
	9	X	X	X	X	
	10	X	X	X	X	

5.2 Test Case 1- Air

5.2.1 Description and Rationale

This case is designed to test the user-defined source module to check if it correctly requests and transfers all necessary data to complete the AFF. The MUI should be checked to see that it allows for the following things: flux types (gas or particle), flux type flux density (gas and particles) and particle radius (particles only), type of release (point or area), exit area of source, exit height of source (point only), height of adjacent structures (point only), exit velocity of source (point only), known, time varying contaminant mass fluxes for each contaminant, times associated with time-varying contaminant mass fluxes, known, time-varying medium release rates (gas or particle), and times associated with time-varying medium release rates. Also, error checking of the user input flux data will be evaluated.

5.2.2 Input

Atmospheric Flux Tab	Value	Unit
Type of Release	Point	
Exit Area of Source	1.0	m^2

Exit Height of Source	40	yd
Height of Adjacent Structure	0.0	m
Exit Velocity of Source	500	cm/s
Exit Temperature of Source	8.94	C
Ambient Air Temperature	9.54	C

Atmospheric Flux	Time	Gas 1	Particle 1	Particle 2	Particle 3
	yr	G/yr	G/yr	G/yr	G/yr
Antimony	0	0.0	1000.0	10.0	100.0
	50	100.0	1050.0	70.0	200.0
Tetrachloroethylene	0	100.0	10.0	50.0	40.0
	100	150.0	20.0	90.0	120.0
	yr	Ci/yr	Ci/yr	Ci/yr	Ci/yr
Strontium-90	0	0.0	1000.0	10000.0	50.0
	70	50.0	1050.0	10050.0	100.0

5.2.3 Expected Results

The expected results for this test case will be that it creates an AFF file 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 necessary information for generating an AFF file. It is expected that the transfer of data from the MUI to the AFF file 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 (AFF). It is expected that the MUI will not continue until all data have been entered completely and within the correct specifications shown in the scrollbar and the online help. If data entered are incorrect or incomplete, an error message should appear.

5.2.4 Conducting Test

Follow the steps in Appendix A on how to set up a case. Choose Antimony, Strontium-90 and Tetrachloroethylene as the contaminants. The atmospheric icon is connected to the Source icon, but no data are entered. Enter only the first flux time and related data for Antimony; do not enter the second flux time and data. After the error message appears, go back and fill in the second flux time and data to finish this case.

5.2.5 Result

The MUI was easy to use and looked like standard Windows software. The AFF file was created in accordance with the FRAMES specifications and is attached to this document. All the data in the AFF file were correct, including unit conversions. All the data were placed in the right spot in the AFF file. Although the MUI requires two time entries to compute the atmospheric flux, when only one flux time is entered, there is no guidance or error given to show that this is incorrect. At least two flux times need to be entered for each element, but this message is not reflected anywhere. .

The MUI was correct in requesting the following: flux types (gas or particle), flux type flux density (gas and particles) and particle radius (particles only), type of release (point or area), exit area of source, exit height of source (point only), height of adjacent structures (point only), exit velocity of source (point only), known, time varying contaminant mass fluxes for each contaminant, times associated with time-varying contaminant mass fluxes, known, time-varying medium release rates (gas or particle), and times associated with time-varying medium release rates.

5.3 Test Case #2 Water

5.3.1 Description and Rationale

The MUI must allow for these data requirements: medium type (vadose zone, aquifer, or surface impoundment), width of flux plane (vadose zone or surface impoundment), length of flux plane (vadose zone, aquifer, or surface impoundment), depth of flux plane (aquifer), distance below water table (vadose zone or surface impoundment), natural recharge rate, known, time-varying contaminant mass fluxes for each contaminant, times associated with time-varying contaminant mass fluxes, known, time-varying medium release rates, and times associated with time-varying medium release rates.

5.3.2 Input

The user will enter the input data required for the FRAMES User-Defined Source Release Module via the Module User Interface (MUI). The MUI will allow the user to define the source problem and associated data. The three main inputs of the FRAMES User-Defined Source Release Module MUI are 1) define the type of source being modeled, 2) time-varying contaminant mass fluxes, and 3) time-varying media release rates. The media release-rate types depend on which modules are connected to this Source Module. When an Aquifer Module is connected, water fluxes are required. The appropriate tabs should appear in the MUI based on the Modules connected.

Contaminants: Ammonia, Benzene, Beryllium, Bismuth

Water Flux Tab	Value	Units
Type of Contaminated Media		Vadose
Width of Flux Plane	243.8	Cm
Length of Flux Plane	12190.0	Cm
Distance below Water Surface	0.1	Cm
Natural Recharge Rate	0.064	Cm/day

Water Flux tab	Time	Flux Rate
Parent	Yr	Cm^3/day
Water	0	1900
	200	5000

Ammonia	Yr	G/yr
	0	0
	1	10
	2	20
	3	30
	4	40
	5	50
	6	60
	7	70
	8	80
	9	90
	10	100

	11	110
	12	120
	13	130
	14	150
	15	200
	16	245
	17	65
	18	90
	19	300
	20	310
	15	300
Benzene	1	150
	15	300
Beryllium	10	500
	250	400
Bismuth	0	30
	400	90

5.3.3 Expected Results

The expected results for this test case will be that it creates a WFF file 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 necessary information for generating a WFF file. It is expected that the transfer of data from the MUI to the WFF file 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 (WFF). It is expected that the MUI will not continue until all data have been entered completely and within the correct specifications shown on the screen and in the online help. If data entered is incorrect or incomplete, an error message should appear.

5.3.4 Conducting Test

Open the Multimedia Framework (fui.exe). Click on the contaminant icon. The icon will appear on the work screen. Click and hold on a Source Term icon; pull it down into the work screen. Pull down a vadose (brown and green) icon, saturated zone (mostly blue), and exposure (cow) icon. Follow the instruction in the Appendix to finish conducting the test.

Note: To demonstrate the water-transport feature, an exposure icon must be connected to the transport icon. This exposure icon does not need to be populated with data for the water transport to be demonstrated.

5.3.5 Result

The MUI was easy to use and looked like standard Windows software. The WFF file was created in accordance with the FRAMES specifications and is attached to this document. All the data in the WFF file were correct, including unit conversions. All the data were placed in the right spot in the WFF file.

For Ammonia, 21 fluxes were interred. The attached error (see Figure 1) was displayed, and the light stayed red. When the duplicate time was removed, and everything ran correctly.
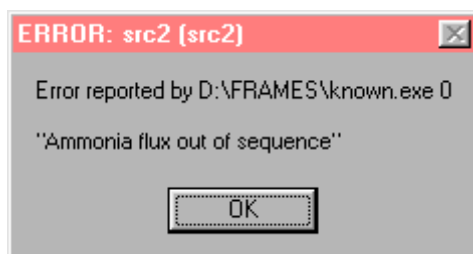
Figure 1. Error Message

5.4 Test Case #3 Overland

5.4.1 Description and Rationale

The data requirements for the Overland fluxes category are medium type (vadose zone or surface impoundment), width of flux plane, depth of flux plane, distance below water table, natural recharge rate, known, time varying contaminant mass fluxes for each contaminant, times associated with time varying contaminant mass fluxes, known, time-varying medium release rates, times associated with varying medium release rates. Because there are currently no active overland models in the FRAMES system, this test was not conducted at this time.

5.5 Test Case #4 Soil (Case 2B)

5.5.1 Description and Rationale

The data requirements for the Source Soil Concentration category are medium type (vadose zone); length, width and depth of source; known, time varying contaminant soil concentration for each contaminant, and times associated with time varying contaminant concentration.

5.5.2 Input

The user will enter the input data required for the FRAMES User-Defined Source Release Module via the Module User Interface (MUI).

Contaminants: Antimony, Arsenic, Benzene, and Beryllium

Type of Contaminated Medium	**Vadose**	
Width of flux plane	Kklk	M
Length of flux plane	20	M
Distance below water table	10	M
Natural recharge rate	2	M/yr

	Flux Time	**Flux Point**	
Water			
Antimony	0	1000	G/yr
	10	150	G/yr
	8	100	G/yr
	20	100	G/yr
Arsenic	0	10	G/yr
	2	30	G/yr
	5	60	G/yr
	5	70	G/yr
	6	30	G/yr
Benzene	0	10	G/yr

	10	50	G/yr
	11	60	G/yr
	9	40	G/yr
	13	80	G/yr
Beryllium	0	20	G/yr
	0	30	G/yr
	5	60	G/yr
	8	92	G/yr
	10	5	G/yr

5.5.3 Expected Results

The MUI will allow the user to define the source problem and associated data. The three main inputs of the FRAMES User-Defined Source Release Module MUI are 1) define the type of source being modeled, 2) time-varying contaminant mass fluxes, and 3) time-varying media release rates. The media release-rate types depend on which modules are connected to this Source Module. When a Vadose Zone Module is connected, water fluxes are required. The appropriate tabs should appear in the MUI based on the Modules connected.

5.5.4 Conducting Test

After receiving the proper error messages and seeing that the module does not run, go back and changed the data in order to proceed.

First switch the lines in Antimony for time 8 and 10 and then changed Arsenic time 5 (point 60) to 4. Delete the time 9 (point 40) in Benzene. Change the time 0 (point 30) in Beryllium.

5.5.5 Results

The proper error messages for the fluxes was displayed. The range is found at the bottom of the screen.

5.6 Test Case 5-All

5.6.1 Description and Rationale

The online help will be tested to ensure that all links work correctly, all input parameters are addressed and parameter descriptions are clear, and it can be understood by a typical user. Online help is not yet developed for this module; therefore, this test was not conducted at this time.

6.0 Quality Assurance Program

Updates to the FRAMES technology software system will be developed under a quality assurance program documented in Gelston et al. (1998). Quality is defined as the capability of the software to meet client needs. Meeting client needs starts with a shared understanding of how the software must perform and continues throughout the software life cycle of design, development, testing, and implementation through attention to details.

Figure 2 outlines the software-development process that will be used for the FRAMES technology software system highlighting the quality check points. The FRAMES technology software system activities flow down the left side of Figure 3 because it is software developed for the first time as opposed to a modification to existing software. The process shown is designed for compatibility with similar processes used by other government agencies. For example, this quality process compares favorably with that in EPA Directive 2182, *System Design and Development Guidance* (EPA 1997). It also compares favorably with the Office of Civilian Radioactive Waste Management's *Quality Assurance Requirements and Description, Supplement I, Software* (OCRWM 1995). Activities roughly equivalent across these processes are shown in Table 1.

Development of the FRAMES technology software system includes the implementation of a quality assurance checklist (see Figure 3). All team members understand the component requirements and design necessary to ensure quality. Completion of this checklist verifies that all documentation will be complete for transfer of the software to client use.
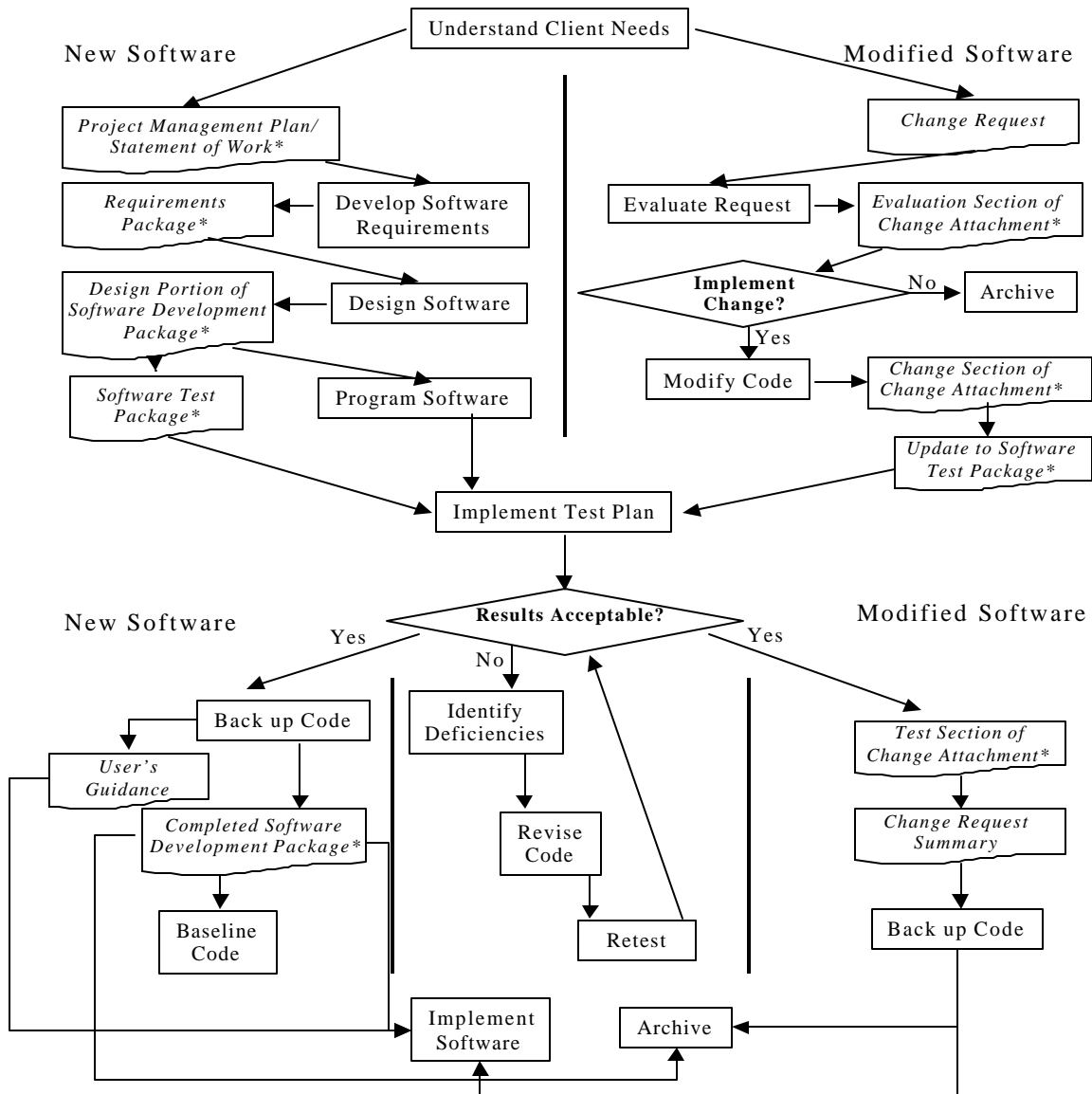
Understand Client Needs

New Software

Modified Software

Project Management Plan/ Statement of Work*

Change Request

Requirements Package* ← Develop Software Requirements

Evaluate Request → *Evaluation Section of Change Attachment**

Design Portion of Software Development Package* ← Design Software

Implement Change? — No → Archive

Yes

Software Test Package* — Program Software

Modify Code → *Change Section of Change Attachment**

Update to Software Test Package*

Implement Test Plan

New Software

Results Acceptable?

Modified Software

Yes

No

Yes

Back up Code

Identify Deficiencies

Test Section of Change Attachment*

User's Guidance

Change Request Summary

Completed Software Development Package*

Revise Code

Back up Code

Baseline Code

Retest

Implement Software

Archive ←

Figure 2. Ensuring Quality in the Environmental Software Development Process (* indicates quality review stage; box with wavy bottom line and italics font indicates a document rather than an activity)

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Table 1. Relationship of PNNL Environmental Software Development Process to Quality Assurance Requirements (OCRWM 1995, EPA 1997)

OCRWM Quality Assurance Requirement[a]	EPA Essential Element of Information[b]	Environmental Software Process Equivalent (Section)
	4—System Implementation Plan	Project Management Plan or Statement of Work
I.2.5A Functional Requirements Information Documentation; I.2.5C Requirements and Design Documentation	5—System Detailed Requirements Document	Requirements Package
I.2.1 Software Life Cycles, Baselines (see their Appendix C), and Controls	6—Software Management Plan	Project Management Plan or Statement of Work and Gelston et al. (1998)
I.2.2 Software Verification[c] and Software Validation; I.2.4 Software Validation[d]	7—Software Test and Acceptance Plan	Software Test Package
I.2.3 Software Verification; I.2.5C Requirements and Design Information Documentation	8—Software Design Document	Design Portion of Software Development Package
I.2.6A Configuration Identification		Completed Software
I.2.6B Configuration Control; I.2.6C Configuration Status; I.2.7 Defect Reporting and Resolution[e]	9—Software Maintenance Document	Modification Documentation
	10—Software Operations Document	User's Guidance and Training
I.2.5B User Information Documentation	11—Software User's Reference Guide	User's Guidance and Training
	12—System Integration Test Reports	Software Test Package

(a) Note that OCRWM requirement I.2.8, Control of the Use of Software, is the responsibility of the OCRWM-related client.

(b) Elements 1 through 3 are generally completed by clients in the U.S. Environmental Protection Agency before contract initiation with the project team.

(c) Verification includes informal code testing by software engineers to ensure that code functions as required.

(d) Validation includes testing by those other than the software engineers who developed the code to provide an independent confirmation that software functions as required.

(e) Note that some changes requested by clients may not be made in the software unless funding has been allocated for such modifications.

```
A.  General Requirements Analysis
          --Documented in
          _____Statement of Work
          --Contains information on (all of the following)
          _____problem description
          _____deliverables
          _____project team
          _____capabilities to be used
          _____restrictions
          _____difficulties envisioned
          _____compatibilities with existing software/hardware
          _____scope of the project
B.  Specific Requirements Analysis
          --Documented in
          _____requirements section of documentation.
          --Contains information on (all of the following)
          _____purpose of the software
          _____structure of the software
          _____hardware and software requirements
          _____input and output requirements
          _____scientific basis
          _____assumptions
          _____limitations
C.  Design Documentation
          --Documented in
          _____design portion of documentation.
          _____team task plans/Project Management Plan
          --Contains information on (all of the following)
          _____code type and description
          _____development team members
          _____specifications
          _____logic diagrams
          _____"help" descriptions
          _____methods to ensure consistency in components
          _____mathematical formulations
          _____need for pre/post-processors
D.  Development Documentation
          --Documented in
          _____Specifications Document
          _____Quality Assurance Archive
          --Contains information on (all of the following)
          _____baseline hard copy of the source code
          _____diskette copy
          _____name of computer language(s) used
E.  Testing Documentation
          --Documented in
          _____test plan that meets quality assurance requirements
          --Contains information on (all of the following)
          _____description of software
```

Figure 3. Quality Assurance Implementation Checklist for the FRAMES Technology Software System

F. User's Guidance
      --Documented in
      _____hardcopy printout of user's guidance for system
      --Contains information on (all of the following)
      _____description of software
      _____description of use of user interface
      _____mathematical formulations
      _____example problems
      _____explanation of modules included

G. General Quality Assurance Documentation
      --Documented in
      _____Quality Assurance Program Document
      _____Quality Assurance Software-Specific Checklist
      --Contains information on (all of the following)
      _____purpose of quality assurance program
      _____client-specified activities
      _____activities required to ensure quality in software

H. Quality Assurance Archive
      --Documented in
      _____hard-copy files
      _____back up disk files in multiple storage locations
      --Contains information on (all of the following)
      _____all quality assurance documentation
      _____client correspondence regarding software
      _____modifications made to baselined software
      _____disk copy back ups
      _____reproducibility of code (check code for comments)

Completed by _____   Date _____

Figure 3. Quality Assurance Implementation Checklist for FRAMES Technology Software System (contd)

7.0 References

Gelston, G. M., R. E. Lundgren, J. P. McDonald, and B. L. Hoopes. 1998. *An Approach to Ensuring Quality in Environmental Software*, PNNL-11880, Pacific Northwest National Laboratory, Richland, Washington.

Office of Civilian Radioactive Waste Management (OCRWM). 1995. *Quality Assurance Requirements and Description, Supplement I, Software*, U.S. Department of Energy, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1997. *System Design and Development Guidance*, EPA Directive Number 2182, Washington, D.C.

Whelan, G., K. J. Castleton, J. W. Buck, G. M. Gelston, B. L. Hoopes, M. A. Pelton, D. L. Strenge, 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

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 slect Open. Enter a site name at the prompt and select Ok.

Click on the contaminant icon. The icon will appear on the work screen. Click and hold on a Source Term icon; pull it down into the work screen. Choose the desired icons to complete your case and repeat, dragging them down onto the work screen. When all icons are in place, connect the icons together. To do this, hold down the shift key, click on an icon, and drag the mouse to the next icon. Release shift and mouse button. A line will connect the two icons with an arrow pointing from the first icon clicked on to the second icon. To remove this line, repeat the steps used to connect it. Continue linking all icons together, moving from left to right across the screen so that the arrows are pointing in the right direction and starting with the Source Term icon, not the contaminant icon. To remove an icon from the screen, drag it to the trash can located on the tool bar. An icon can have more than one arrow coming from it to different icons (i.e., the source icon can have two of the graph icons attached to it with one set as a chart and the other as a viewer).

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 work space and choose User Input on the box 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. Click OK to return to the work screen. The light will change from red into green.

Right click on the Source Term icon on the work area and choose General Info. Choose Label: Source and Module: FRAMES Known Contaminant Flux or Concentration. Click OK. The signal light will turn from black into red.

Right click on the Source Term icon and choose User Input, and the FRAMES Known Source Module screen will open. In the source icon under Atmospheric Release Flux Types, do not change any information; just use the automatic information and click done.

If the progeny is not showing up on the screen when the parent is chosen, click on Options: Choose Progeny. A check mark will appear by this option. To turn off this option, click on Choose Progeny again. Fill in the red boxes on the Atmospheric Flux tab. On all the tabs, fill in the red boxes. These boxes will turn to green when the correct information is entered. For guidance on what to enter in the red boxes, click on one of the boxes and look at the scrolling bar at the bottom of the screen. This bar will give you the boundaries for the box. If more guidance is needed, choose the desired box by clicking on it and press F1. This will open up the online help that will take you directly to the correct section.

Click save and exit; the light will turn from red into yellow.

For each test case, follow the above steps. After these first steps have been followed, continue to build the case using user-input information and the same steps used to fill in the information on the Source Term icon. When the test case has been built, and you are ready for the results, follow these instructions.

Right click on Source and choose Run Model. The model will run, and the light will change from Yellow into Green. Right click on the next icon and choose Run Model. The model will run, and the light will change from Yellow into Green. Instead of running each model individually, click on the GO button in the toolbar at the top of the screen. This button works if all the lights are yellow. If one is black or red and you wish to leave it this way, then you will have to run each model separately.

To view results, right click on the Source Term icon, and select the desired viewer from the View/Print Module Output. To display a different viewer, exit the open viewer and reselect a different viewer from the menu.