SOFTWARE RELEASE NOTICE

1. SRN Number: GHGC-SRN-266

2. Project Title: Evolution of the near field environment: MULTIFLO Development	Project No. 20-1402-562

3. SRN Title: MULTIFLO GUI V1.2 Beta

4. Originator/Requestor: Scott Painter	Date: 3/26/02

5. Summary of Actions

- ■ Release of new software
- □ Change of access software
- □ Release of modified software:
- □ Software Retirement
  - □ Enhancements made
  - □ Corrections made

6. Validation Status

- □ Validated
- □ Limited Validation
- ■ Not Validated — Explain: Beta Version. Official version will be validated.

7. Persons Authorized Access

Name	Read Only/Read-Write	Addition/Change/Delete
Melissa Wallis	RW	ACD
Scott Painter	RW	ACD

8. Element Manager Approval: E. C. [signature] Date: 3/26/2002

9. Remarks:
This is a Beta test version.

CNWRA Form TOP-6 (09/01)

SOFTWARE SUMMARY FORM

01. Summary Date: 3/25/02	02. Summary prepared by (Name and phone) Scott Painter 210 522-3348	03. Summary Action: NEW 3/26/2002
04. Software Date: 3/25/02	05. Short Title: MULTIFLO GUI	
06. Software Title: MULTIFLO GUI V1.2 Beta		07. Internal Software ID: N/A 3/26/2002

08. Software Type: ☐ Automated Data System ■ Computer Program ☐ Subroutine/Module	09. Processing Mode: ■ Interactive ☐ Batch ☐ Combination	10. Application Area a. General: ■ Scientific/Engineering ☐ Auxiliary Analyses ☐ Total System PA ☐ Subsystem PA ☐ Other b. Specific:
11. Submitting Organization and Address: CNWRA/SwRI 6220 Culebra Road San Antonio, TX 78228		12. Technical Contact(s) and Phone: Scott Painter 210 522 3348

13. Software Application:
Builds input file for use in MULTIFLO application.

14. Computer Platform Platform independent.	15. Computer Operating System: System independent.	16. Programming Language(s): JAVA	17. Number of Source Program Statements: 3/26/2002 NOT KNOWN
18. Computer Memory Requirements: Variable	19. Tape Drives: N/A	20. Disk Units: N/A	21. Graphics: Yes

22. Other Operational Requirements
Requires Java Runtime Environment (JRE)

23. Software Availability: ☐ Available ■ Limited ☐ In-House ONLY	24. Documentation Availability: ☐ Available ☐ Preliminary ☐ In-House ONLY No separate documentation for graphical user interface.

25.
Software Developer: _____ Date: 3-26-02

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→DEVELOPED OR ACQUIRED TO BE MODIFIED SOFTWARE←

Software Title/Name: MultiFlo GUI BETA Version
Version: 1.2
Demonstration workstation: Brahma - Bldg 189 Room A209
Operating System: Windows
Developer: S. Painter / M. Wallis

Software Requirements Description (SRD) [TOP-018, Section 5.3]

SRD Version: 1.2 June 2001
SRD Approval Date: 7/3/2001 by E. Pearcy

SRD and any changes thereto reviewed in accordance with QAP-002 requirements?

Yes: X No: ☐ N/A: X

Is a Software Change Report(s) (SCR) used for minor modifications (i.e., acquired code), problems or changes to a configured version of software?

Yes: ☐ No: ☐ N/A: X

Comments:

Software Development Plan (SDP) [TOP-018, Section 5.4]

SDP Version: July 2001 - Multiflo Graphical Users Interface
SDP (EM) Approval Date: July 2001

The SDP addresses applicable sections of TOP-018, Appendix B, SDP Template?

Yes: X No: X N/A: ☐

Is the waiver (if used) in accordance with specified guidelines?

Yes: ☐ No: ☐ N/A: X

Comments:

Design and Development [TOP-018, Section 5.5.1 - 5.5.4]

Is code development in accordance with the conventions (i.e., coding conventions)described in the SDP/SCR?

Sun Java Soft Coding Conventions

Yes: X No: ☐ N/A: ☐

Module(s) Reviewed: Multiflo Application. Java

Comments:

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→ DEVELOPED OR ACQUIRED TO BE MODIFIED SOFTWARE ←

Is code internally documented to allow a user to understand the function(s) being performed and to follow the flow of execution of individual routines?

Yes: ☒ No: ☐ N/A: ☐

Module(s) Reviewed: MultiFloApplication.JAVA

Comments:

Is development of the code and informal module/subroutine-level testing documented in scientific notebook and/or SCR?

Yes: ☒ No: ☐ N/A: ☐

SCR's and/or Scientific Notebook(s) Reviewed: No. 282E

Comments: Acceptance Testing is in Scientific Notebook No. 282E.

Software designed so that individual runs are uniquely identified by date, time, name of software and version?

Yes: ☒ No: ☐ N/A: ☐

Date and Time Displayed: 2002-03-22 14:18:37:

Name/Version Displayed: multiflo gui V6STA

Comments:

Medium and Header Documentation [TOP-018, Section 5.5.6]

A program title block of main program contains: Program Title, Customer Name, Customer Office/Division, Customer Contact(s), Customer Phone Number, Associated Documentation, Software Developer and Phone Number, Date, and Disclaimer Notice?

Yes: ☒ No: ☐ N/A: ☐

Comments: Copy of main program Title block in documentation. QE

Source code module headers contain: Program Name, Client Name, Contract reference, Revision Number, Revision History, and Reference to SRD/SCR requirement(s)?

Yes: ☒ No: ☐ N/A: ☐

Module(s) Reviewed: MainFrame.JAVA

Comments:

The physical labeling of software medium (tapes, disks, etc.) contains: Program Name, Module/Name/Title, Module Revision, File type (ASCII, OBJ, EXE), Recording Date, and Operating System(s)?

Yes: ☒ No: ☐ N/A: ☐

Comments: Source code was copied 3/26/2002 and put in QA Records. QE

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QA VERIFICATION REPORT
FOR
→ DEVELOPED OR ACQUIRED TO BE MODIFIED SOFTWARE ←

Code Reviews [TOP-018, Section 5.5.6]

Are code reviews (if implemented) documented in a scientific notebook or in another format that allows others to understand the code review process and results?
No Code Reviews Accomplished on This BETA Release. Yes: ☐ No: ☒ N/A: ☐

Documented in Scientific Notebook No.: _____

Comments:

Acceptance and Installation Testing [TOP-018, Section 5.6]

Does *acceptance testing* demonstrate whether or not requirements in the SRD and/or SCR(s) have been fulfilled?

Yes: ☒ No: ☐ N/A: ☐

Has *acceptance testing* been conducted for each intended computer platform and operating system?
MULTIFIO GUI has been Acceptance Tested on Windows Only Yes: ☐ No: ☐ N/A: ☒

Computer Platforms: Beahma Operating Systems: Windows Only

Location of Acceptance Test Results: Scientific Note Book No. 282E Vol. 10

Comments: 1. This is a BETA version of the GUI interface.
2. The non-BETA version will be Tested in accordance the full TOP-018 requirements.

Has *installation testing* been conducted for each intended computer platform and operating system?

Yes: ☒ No: ☐ N/A: ☐

Computer Platforms: Beahma Operating Systems: Windows Only

Location of Acceptance Test Results: S/N No. 282E Vol. 10

Comments: Accomplished by S. Mantra

User Documentation [TOP-018, Section 5.5.7]

Is there a Users' Manual for the software and is it up-to-date?

Yes: ☐ No: ☒ N/A: ☐

User's Manual Version and Date: _____

Comments: No users manual has been developed as of This Time.

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FOR
→ DEVELOPED OR ACQUIRED TO BE MODIFIED SOFTWARE ←

Are there basic instructions for the *installation* and *use* of the software?

Location of Instructions: in The Readme files of The codes. Yes: ☒ No: ☐ N/A: ☐

Comments:

Configuration Control [TOP-018, Section 5.7, 5.9.3]

Is the Software Summary Form (Form TOP-4-1) completed and signed?

Date of Approval: 3/26/2002 Yes: ☒ No: ☐ N/A: ☐

Is the list of files attached to the Software Summary Form complete and accurate?

Comments: NOTE: SEE This ~~DATE~~ package, NOT The Software Summary Form for list of files. QA Yes: ☒ No: ☐ N/A: ☐

Is the source code available or, is the executable code available in the case of (acquired/commercial codes)?

Location of Source Code: QA Records Room in Bldg. 189 Yes: ☒ No: ☐ N/A: ☐

Comments:

Have all the script/make files and executable files been submitted to the Software Custodian?

Location of script/make files: On A CD in This package filed in The QA Records Room. Yes: ☒ No: ☐ N/A: ☐

Comments:

Software Release [TOP-018, Section 5.9]

Upon acceptance of the software as verified above, has a Software Release Notice (SRN), Form TOP-6 been issued and does the version number of the software match the documentation?

SRN Number: GHGC-SRN-266 Yes: ☒ No: ☐ N/A: ☐

Comments:

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→ *DEVELOPED OR ACQUIRED TO BE MODIFIED SOFTWARE* ←

Software Validation [TOP-018, Section 5.10]

Has a Software Validation Test Plan (SVTP) been prepared for the range of application of the software?

Yes: ☐ No: ☒ N/A: ☐

Version and Date of SVTP: _____

Date Reviewed and Approved via QAP-002: _____

Comments: As of This date The BETA Version does not have a scheduled date for Validation.

Has a Software Validation Test Report (SVTR) been prepared that documents the results of the validation cases, interpretation of the results, and determination if the software has been validated?

Yes: ☐ No: ☒ N/A: ☐

Version and Date of SVTR: _____

Date Reviewed and Approved via QAP-002: _____

Comments: As of This date This BETA Version does not have a scheduled date for Validation.

Additional Comments:

3-27-02
Software Developer/Date

3/27/2002
Software Custodian/Date

MAIN Program

```
package multiflo;

/*              Copyright 2002 Southwest Research Institute
```

Title Block

```
* Program Name:          MULTIFLO GUI
* Title:                 MultifloApplication.java<p>
* Author:                Melissa Wallis
* Release Date:          March 2002
* Release Version:       1.2 beta
* Client Name:           USNRC
* Client Contact:        John Bradbury (301-415-6597)
* Contract Number:       NRC 02-97-009
* CNWRA Contact:         Scott Painter (210-522-3348)
*                        Center for Nuclear Waste Regulatory Analyses
*                        San Antonio, Texas 78238-5166
*                        spainter@swri.edu
*/

/* DISCLAIMER/NOTICE

* This computer code/material was developed as an account of work
* performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA)
* for the Division of Waste Management of the Nuclear Regulatory
* Commission (NRC), an independent agency of the United States
* Government. The developer(s) of the code nor any of their sponsors
* make any warranty, expressed or implied, or assume any legal
* liability or responsibility for the accuracy, completeness, or
* usefulness of any information, apparatus, product or process
* disclosed, or represent that its use would not infringe on
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* IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW WILL THE SPONSORS
* OR THOSE WHO HAVE WRITTEN OR MODIFIED THIS CODE, BE LIABLE FOR
* DAMAGES, INCLUDING ANY LOST PROFITS, LOST MONIES, OR OTHER SPECIAL,
* INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR
* INABILITY TO USE (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA
* BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY THIRD PARTIES OR A
* FAILURE OF THE PROGRAM TO OPERATE WITH OTHER PROGRAMS) THE PROGRAM,
* EVEN IF YOU HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES,
* OR FOR ANY CLAIM BY ANY OTHER PARTY.

*/


import javax.swing.UIManager;
import java.awt.*;
import javax.swing.*;
import java.awt.Window;
import org.swri.metra.SplashScreen;

public class MultifloApplication {
    //Construct the application
    public MultifloApplication() {

    // Generate and Start Splashscreen
    SplashScreen splashScreen = new SplashScreen();
    splashScreen.setSize( new Dimension( 400, 300 ) );
    splashScreen.centerSplashScreen();
    splashScreen.setVisible( true );
    splashScreen.update( splashScreen.getGraphics() );
```

```
    MainFrame frame = new MainFrame();

    //Center the window
    Dimension screenSize = Toolkit.getDefaultToolkit().getScreenSize();
    Dimension frameSize = frame.getSize();
    if (frameSize.height > screenSize.height) {
      frameSize.height = screenSize.height;
    }
    if (frameSize.width > screenSize.width) {
      frameSize.width = screenSize.width;
    }

    frame.setLocation( ( screenSize.width - frameSize.width ) / 2,
     ( screenSize.height - frameSize.height ) /2 );
//    frame.pack();
    frame.setVisible(true);

    splashScreen.dispose();
  }

  //Main method
  public static void main(String[] args) {
    try {
      UIManager.setLookAndFeel(UIManager.getSystemLookAndFeelClassName()
);
    }
    catch(Exception e) {
      e.printStackTrace();
    }
    new MultifloApplication();
  }

}
```

Coding Conventions

Sun JavaSoft

```
package multiflo;

import javax.swing.UIManager;
import java.awt.*;
import javax.swing.*;
import java.awt.Window;
import org.swri.metra.SplashScreen;

public class MultifloApplication {
    //Construct the application
    public MultifloApplication() {

    // Generate and Start Splashscreen
    SplashScreen splashScreen = new SplashScreen();
    splashScreen.setSize( new Dimension( 400, 300 ) );
    splashScreen.centerSplashScreen();
    splashScreen.setVisible( true );
    splashScreen.update( splashScreen.getGraphics() );

    MainFrame frame = new MainFrame();

    //Center the window
    Dimension screenSize = Toolkit.getDefaultToolkit().getScreenSize();
    Dimension frameSize = frame.getSize();
    if (frameSize.height > screenSize.height) {
      frameSize.height = screenSize.height;
    }
    if (frameSize.width > screenSize.width) {
      frameSize.width = screenSize.width;
    }

    frame.setLocation( ( screenSize.width - frameSize.width ) / 2,
     ( screenSize.height - frameSize.height ) /2 );
//    frame.pack();
    frame.setVisible(true);

    splashScreen.dispose();
  }

  //Main method
  public static void main(String[] args) {
    try {
      UIManager.setLookAndFeel(UIManager.getSystemLookAndFeelClassName()
);
    }
    catch(Exception e) {
      e.printStackTrace();
    }
    new MultifloApplication();
  }

}
```

Unique identification.

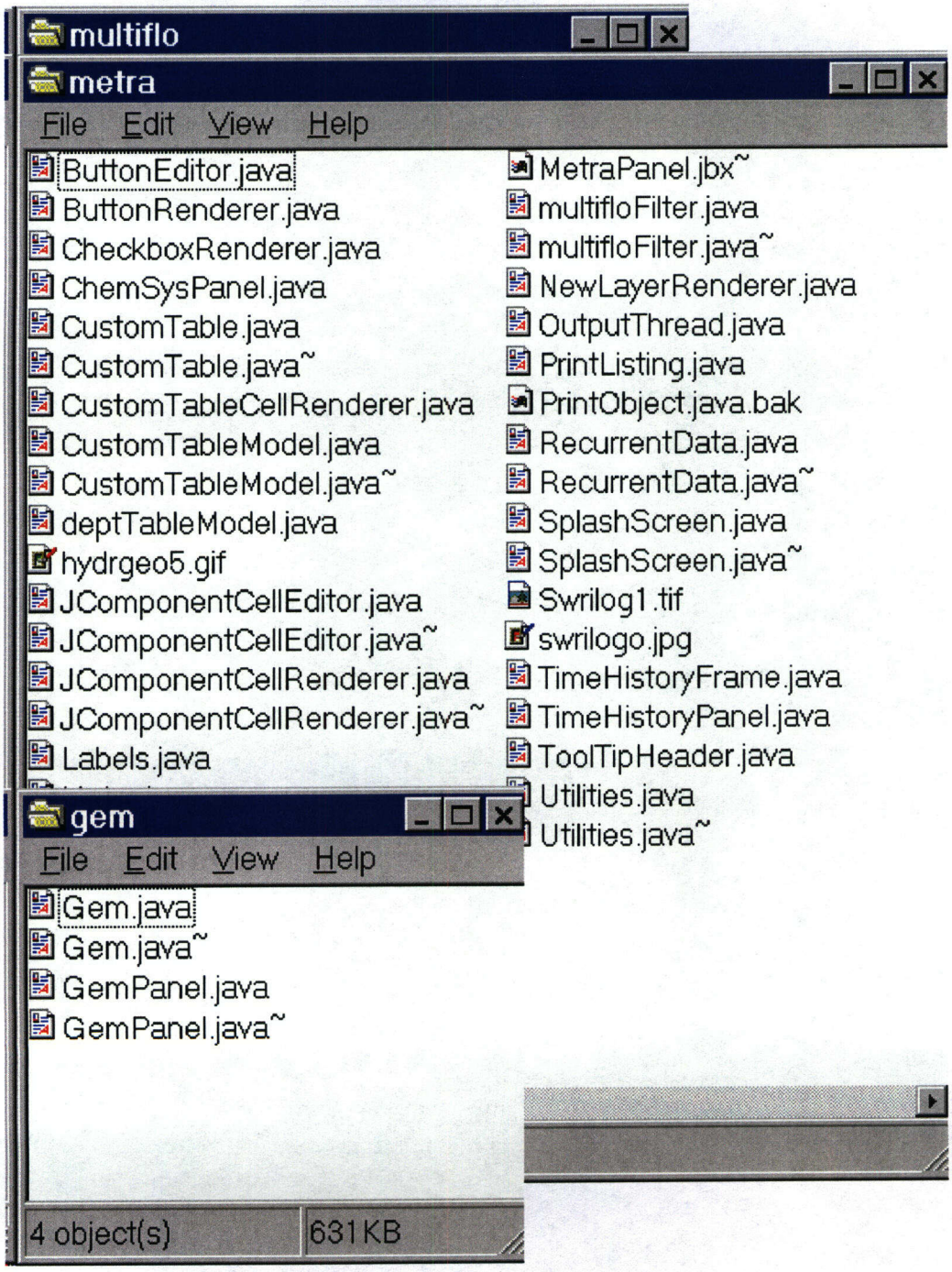
LISTING OF QUARTER5.DAT

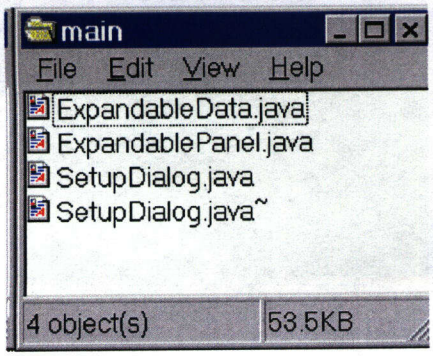
```
2-d quarter 5-spot pattern : Acceptance test multiflo gui VBeta
3.21.02
:  2002-03-22 14:18:37:
:
:  This file is automatically generated.  Any comments
:  added to this file will be discarded.
:
RSTART 0
:
:     geometry  nx  ny  nz  ivplwr ipvcal ioutput gravity pref tref href
GRID  XYZ       20  20  1   0      0      0       9.8068  0    0    0
:
:    igrid   rw   re
DXYZ 0       0    0
:
:(DX(I), I=1, NX)
0.5
:
:(DY(J), J=1, NY)
0.5
:
:(DZ(K), K=1, NZ)
1
:
INIT
:i1   i2   j1   j2   k1   k2    p          t          sg         xa         pm
    tm         sgm        xam
 1    20   1    20   1    1     1.e5       25.        0          0          0
    0          0          0
/
:
:       dws  visw  cws
LIQU    0    0     0

:
PCKR
:     no  type-curv             swirm     rpmm     alpham     swext     sgc     iecm
      1   VAN-gen               0.001     0.85     2.0e-5     -1.e7     0.      0

/
:
PHIK
:     i1   i2   j1   j2   k1   k2   ist  ithrm   vb     por      permx
permy      permz     porm       permm     istm     ithrmm
      1    20   1    20   1    1    1    1       0.     0.05     1.5e-13
1.5e-13    1.5e-13   0          0         0        0

/
:
THERmal
: no    rho       cpr      ckdry     cksat     crp   crt   tau   cdiff      cexp
    enbd
  1     2580      840.     1.74      2.3       0     0     .0    2.13e-5    1.8
     1.
/
:
```


multiflo
metra
File Edit View Help
ButtonEditor.java
ButtonRenderer.java
CheckboxRenderer.java
ChemSysPanel.java
CustomTable.java
CustomTable.java~
CustomTableCellRenderer.java
CustomTableModel.java
CustomTableModel.java~
deptTableModel.java
hydrgeo5.gif
JComponentCellEditor.java
JComponentCellEditor.java~
JComponentCellRenderer.java
JComponentCellRenderer.java~
Labels.java
MetraPanel.jbx~
multifloFilter.java
multifloFilter.java~
NewLayerRenderer.java
OutputThread.java
PrintListing.java
PrintObject.java.bak
RecurrentData.java
RecurrentData.java~
SplashScreen.java
SplashScreen.java~
Swrilog1.tif
swrilogo.jpg
TimeHistoryFrame.java
TimeHistoryPanel.java
ToolTipHeader.java
Utilities.java
Utilities.java~
gem
File Edit View Help
Gem.java
Gem.java~
GemPanel.java
GemPanel.java~
4 object(s)
631 KB


main
File Edit View Help
ExpandableData.java
ExpandablePanel.java
SetupDialog.java
SetupDialog.java~
4 object(s)
53.5KB

MAINFRAME.JAVA
Example

```
/*              Copyright 2002 Southwest Research Institute

* Program Name:          MULTIFLO GUI
* Title:         MainFrame.java<p>
* Description:  This file contains the class definition for the
MainFrame that is
                called upon startup of the Multiflo Application.<p>
* Author:          Melissa Wallis
* Release Date:          March 2002
* Release Version:       1.2 beta
* Client Name:           USNRC
* Client Contact:        John Bradbury (301-415-6597)
* Contract Number:       NRC 02-97-009
* CNWRA Contact:         Scott Painter (210-522-3348)
*                        Center for Nuclear Waste Regulatory Analyses
*                        San Antonio, Texas 78238-5166
*                        spainter@swri.edu
*
* Revision History:      Beta version 3/21/02
* SRD Section:           2
*/

package multiflo;

import java.awt.*;
import java.awt.event.*;
import javax.swing.*;
import org.swri.metra.Metra;
import org.swri.metra.MetraPanel;
import org.swri.gem.GemPanel;
import org.swri.metra.*;
import org.swri.gem.*;
import java.io.*;
import java.awt.print.*;
import org.swri.main.*;

public class MainFrame extends JFrame {

  int runType = -1;
  String gemOptions = new String();
  String fileName = new String("");
  String gem_filePath = new String("");
  String metra_filePath = new String("");
  File file_opened, metra_file_opened, gem_file_opened;
  JEditorPane menuHelpMultifloPane = new JEditorPane();

  JPanel contentPane;
  JMenuBar mainMenuBar = new JMenuBar();
  JMenu menuFile = new JMenu();
  JMenu menuHelp = new JMenu();
  JMenuItem menuHelpAbout = new JMenuItem();
  JToolBar toolBar = new JToolBar();
  JButton BtnFileOpen = new JButton();
  JButton BtnFileSave = new JButton();
  JButton BtnHelp = new JButton();
  ImageIcon image1;
  ImageIcon image2;
  ImageIcon image3;
  JLabel statusBar = new JLabel();

  public Metra metra = new Metra();
```

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SOFTWARE DEVELOPMENT PLAN (SDP) FOR THE MULTIFLO GRAPHICAL USER'S INTERFACE (GUI) FOR MULTIFLO

Version 1.2

Prepared by

Melissa Wallis
Scott Painter

Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

July 2001

APPROVED:

E. C. Pearcy

English C. Pearcy, Manager
Geohydrology and Geochemistry

7/10/2001

Date

2/20

TABLE OF CONTENTS

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1.0 Scope

The MULTIFLO Graphical User Interface (GUI) for MULTIFLO project will provide the MULTIFLO users with the capability to graphically generate and change the input data required to run MULTIFLO.

2.0 Baseline Items

Baseline items include:

- Source code
- Build and support files
- Documentation

3.0 Project Management

3.1 Work Breakdown Structure

For each task, the estimated number of hours is provided.

Work Element	Estimated Labor Hrs				Labor Subtotal
Estimated hours by labor category	PL4	PL3	PL2	PL1	
Resources					
Software					
Hardware					
Client Furnished					
Project Management					
SDP Development		8			8
Status Reports					
Client Reviews					
Technical Tasks					
Proof-of-Concept Development					
Development of SRD		8			8
Design and Code		408			408
Development of User's Manual					
Acceptance Testing		4			4
Development of Software Validation Test Plan		4			4
Validation Testing		4			4
Development of Software Validation Test Report		4			4
Support Activities					
Materials					
Publications					
Travel					
Other					
Estimated Hours Total		440			440

3.2 Project Schedule and Milestones

ID	Task Name	Start Date	End Date
1	Develop SRD	May 1, 2001	May 7, 2001
2	Develop SDP	May 8, 2001	May 15, 2001
3	Design and Code	June 1, 2001	August 30, 2001
4	Acceptance Testing	September 1, 2001	September 8, 2001
5	Develop Software Validation Test Plan	September 8, 2001	September 15, 2001
6	Validation Testing	September 15, 2001	September 22, 2001
7	Develop Software Validation Test Report	September 22, 2001	September 29, 2001

3.3 Staffing Plan

The following table contains the project team members that are planned to execute the project. For each team member the role the team member will play is provided as well as the team members commitment to the project and cost information. The table includes technical, managerial and clerical staff.

Staffing Plan				
Team Member	**Project Role**	**Start Date**	**End Date**	**% Commitment**
Melissa Wallis	Software Developer	6/1/2001	10/1/2001	70%

3.4 Risk Management

Risks fall in to the following categories:

- Product Engineering
  - Requirements
  - Design
  - Implementation
- Development
  - Developmental system
  - Developmental process
  - Management process
  - Work environment
- Program Constraints
  - Resources
  - External Organizations

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The risks will be evaluated according to the following criteria:

- Risk impacts:
  - Negligible: no impact to cost and schedule will occur.
  - Marginal: The risk can be absorbed with available cost and schedule.
  - Critical: Cost and schedule impacts will occur to the program

- Risk Probabilities
  - High: The risk has a 75% chance of occurring.
  - Medium: The risk has a 50% chance of occurring.
  - Low: The risk has a 25% change of occurring.
  - Very Low: The risk has a 5% chance of occurring.

The following table contains the risk management plan for the project using the criteria defined above.

Risk Management			
Risk	**Probability**	**Impact**	**Mitigation**
Requirements	Very Low	Negligible	Conduct peer reviews
Design	Very Low	Negligible	Conduct peer reviews

4.0 Development Procedures

The following sections contain the development procedures that will be used on the project. These include the development environment and resources, the development lifecycle, coding standards and testing methods.

4.1 Environment and Resources

The following sections describe the hardware and software resources that will be utilized during the project.

4.1.1 Hardware Resources

The following table lists the hardware resources that will be utilized during the project.

Hardware Resources			
Description	**Supplier**	**Owner**	**Purpose**
Desktop PC	Melissa Wallis (Division 16)	Melissa Wallis (Division 16)	Software Development

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4.1.2 Software Resources

The following table lists the software resources that will be utilized during the project.

Software Resources			
Description	**Supplier**	**Owner**	**Purpose**
Borland JBuilder 3.5	Melissa Wallis (Division 16)	Melissa Wallis (Division 16)	Software Development

4.2 Software Development Lifecycle

The development lifecycle for the MULTIFLO GUI includes the following five (5) phases:

Phase	Description	Output
Analysis	Determine input formats, formulate requirements interface, and determine output requirements format	Software Requirements Document (SRD)
Development	Develop code and perform module level testing	Software development file and software development folder
Acceptance Testing	Demonstrates whether the requirements specified in the SRD have been fulfilled	Software development files
Preliminary Release	Users provide developer feedback on the "look and feel" and functionality of the software. Developer uses this information to develop the final version of the software	Software change reports
Final Delivery	Developer incorporates changes, performs necessary regression testing and provided final version of software to users.	Final version of software Design Verification Report, SSF, SRN

4.3 Coding

This section describes the coding conventions that will be applied throughout this project.

- Programming Language: Java
- Coding style: Sun Javasoft coding conventions

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4.4 Acceptance Testing

The following documentation technique and tools that will be used for acceptance testing:

- Documentation: SDF, SCR

5.0 Configuration Management

This section contains the configuration management plan for the project.

5.1 Tools

- Microsoft Visual SourceSafe

5.2 Configuration Identification

Software version numbers shall be of the form Version V.r, where V is an incrementing major version number beginning at 1 and r is an incrementing minor revision number beginning at 0.

Given that the current version of MULTIFLO is Version 1.2, the MULTIFLO GUI will start with Version 1.2.

5.3 Configuration Procedures

The software will be maintained using Microsoft Visual SourceSafe. The software will reside on the division 16 computer network and on the developers local hard drive in the following directory: c:/proj/MULTFLO.

5.3.1 Check-in/Check-out Procedures

Software under development will be checked out of the repository into a developer directory for modification. Modified files will be checked back into and newly created files will be added to the repository under the following conditions:

- To provide other developers with the latest set of changes
- Periodically during development when new functionality is added
- Upon completion of major tasks defined in the SDP, or
- Before major milestones

When a file is checked in, the developer will generate comments describing the modification.

5.3.2 Creating Releases and Preparing for Deliveries

New releases of the software will be created at determined times during the project at the discretion of the developer. Creating a new release requires the following steps to be executed:

- Return any checked out files to Microsoft Visual SourceSafe.
- Verify that all new files have been added to Microsoft Visual SourceSafe.
- Create a label for this release, i.e. name this release.
- Get all of the files associated with this release.

5.3.3 Problem Reporting and Change Control

A Software Change Report (SCR) may be used to track problems, design changes and enhancements to the software. SCRs will be submitted to the developer, who will forward them to the appropriate team member. The team member will be responsible for prioritization, assignment, and resolution. SCRs that affect multiple components will be prioritized and assigned by the developer or EM. SCRs will be maintained in the repository.

5.3.4 Backups

The project repository will be used to store the baseline configuration items during development. The following parameters apply to the configuration repository.

- Host Information:
  - Host Name: Division 16 Sun Workstation Eigen
  - Host Directory: Directory structure defined by MainSoft Visual Source Safe
- Backup Media: Floppy diskette, CD
- Backup Frequency: As needed
- Automated Backup Tools: None

6.0 References

Not applicable.

7.0 Appendices

Not applicable

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SOFTWARE REQUIREMENTS DESCRIPTION FOR THE MULTIFLO GRAPHICAL USER'S INTERFACE (GUI) FOR MULTIFLO VERSION 1.2

Prepared by

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June 2001

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7/3/2001

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1.0 Software Function

The MULTIFLO Graphical User Interface (GUI) program will provide MULTIFLO users with the capability to graphically generate and change the input data required to run MULTIFLO and display selected output. MULTIFLO is a general subsurface flow and transport code comprised of two main modules: METRA, which simulates non-isothermal flow of air and water, and GEM, which simulates transport of aqueous and gaseous species coupled with chemical reactions.

2.0 Technical Basis

Currently users modify ASCII text files manually prior to running METRA and GEM. The MULTIFLO GUI will provide the users with a graphical user interface that provides the following capabilities:

GENERAL

- Provide limited help to the user at this time.
- Send *.dat file to printer.
- If no *.dat file selected provide the user with standard defaults.
- The application must be able to be run on a variety of platforms, which include: Unix, Windows NT/95/98/2000.
- Provide error checking for all data entered by the user.
- Save all data entry to a *.dat file with the filename specified by the user.
- Display selected output of METRA and/or GEM simulations, including previous simulations.
- The software will allow the user to start a MULTIFLO simulation from the GUI after the input files are built.

METRA

- The software will allow the user to define data associated with METRA keywords.
- Open an existing *.dat file for modification for METRA
- Create a new *.dat file initialized to default values for use with METRA.
- Allow the user to enter data for fixed data, initialization and recurrent keywords.
- All conditions and exceptions for all METRA keywords defined in the MULTIFLO USER'S Manual, MULTIFLO Version 1.2, Revision 2, Change 1, dated February 2000 are to be implemented. For example, for keyword AUTOstep, the parameter TACCEL is conditional on the parameter IAUTODT and is not used if IAUTODT = 0.
- Allow the user to define, open, and save hydraulic property parameter sets, which are stored in files separate from the *.dat file.

GEM

- The software will allow the user to define data associated with GEM keywords.
- Open an existing *.dat file for modification for GEM.

- Create a new *.dat file initialized to default values for use with GEM.
- All conditions and exceptions for all GEM keywords defined in the MULTIFLO USER'S Manual, MULTIFLO Version 1.2, Revision 2, Change 1, dated February 2000 are to be implemented.

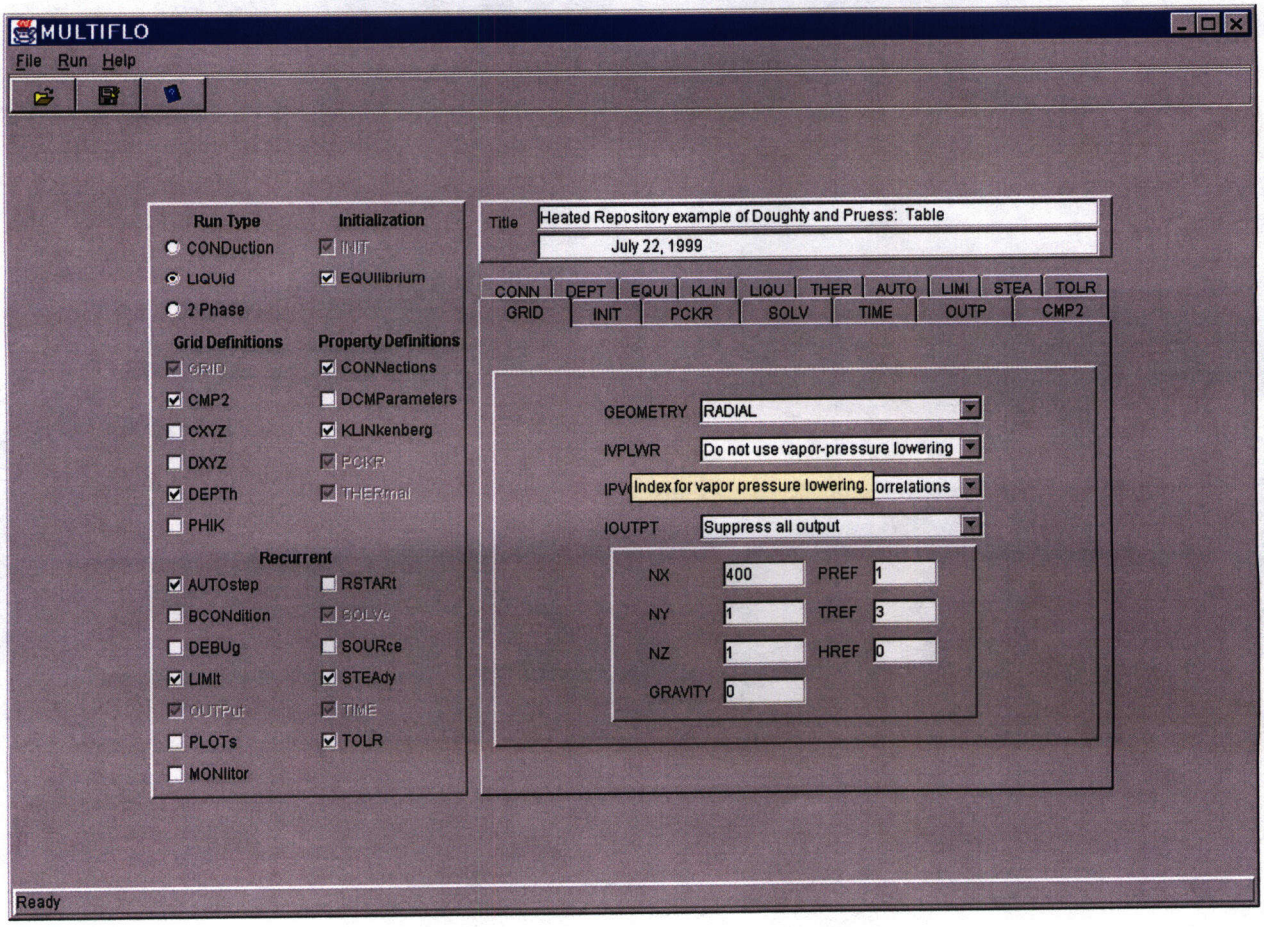
3.0 Technical Approach

This project will be completed in 5 phases as follows:

- Development of the overall GUI for MULTIFLO in which METRA input, GEM input, and the display of the MULTIFLO output will be presented.
- Development of the software related to the construction of the METRA input file.
- Development of the software related to display of the METRA output.
- Development of the software related to the construction of the GEM input file.
- Development of the software related to display of the GEM output.

3.1 Data Flow and User Interface

A sample interface is provided below. The user interface design will be coordinated with the users to ensure the user interfaces meet their needs.



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3.2 Hardware and Software Requirements

- Programming Language: Java
- Target Platform: PC, SUN, HP
- Target Operating System: Unix, NT, Windows 95/98/2000

3.3 Graphics Requirements

There are no special graphics requirements.

3.4 Pre- and Post-Processors

Not applicable.

4.0 References

- MULTIFLO User's Manual, MULTIFLO Version 1.2, Revision 2, Change 1, dated February 2000

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SOFTWARE REQUIREMENTS DESCRIPTION FOR THE COMPUTER CODE MULTIFLO VERSION 1.2

Prepared for

Nuclear Regulatory Commission
Contract NRC-02-97-009

Prepared by

Peter C. Lichtner

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San Antonio, Texas

March 1998

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ABSTRACT

This Software Requirements Description presents proposed revisions to the computer code MULTIFLO to implement a dual continuum model (DCM) capability. The DCM will be used in place of the equivalent continuum model in thermal-hydrological-chemical modeling of the proposed high-level nuclear waste repository at Yucca Mountain, Nevada.

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ACKNOWLEDGMENTS

This report was prepared to document work performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA) for the Nuclear Regulatory Commission (NRC) under Contract No. NRC-02-97-009. The activities reported here were performed on behalf of the NRC Office of Nuclear Material Safety and Safeguards (NMSS), Division of Waste Management (DWM). The report is an independent product of the CNWRA and does not necessarily reflect the views or regulatory position of the NRC.

QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: CNWRA-generated original data contained in this report meets quality assurance requirements described in the CNWRA Quality Assurance Manual. Sources for other data should be consulted for determining the level of quality for those data.

ANALYSES AND CODES: No analyses work is reported in this document. This document describes planned changes to software.

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1 INTRODUCTION

This Software Requirements Description (SRD) document describes proposed revision to the computer code MULTIFLO, a numerical model describing multiphase, multicomponent, reactive transport in a variably saturated porous medium. This software could be used in the high-level waste (HLW) repository license application review process for Yucca Mountain (YM).

The code can be used to address the very-near-field (drift scale), and near-field (repository scale) performance of the repository. The code can be applied to such processes as:

(i) isothermal and nonisothermal liquid and vapor phase movement of water through unsaturated rock at YM.

(ii) predicting the evolution of groundwater compositions near and within the engineered barrier system.

(iii) predicting changes in porosity and permeability of the host rock resulting from mineral alteration and their effect on fluid transport.

(iv) prediction of transport of aqueous and gaseous radionuclides from the waste package.

2 SOFTWARE REQUIREMENT DESCRIPTION: MULTIFLO, VERSION 1.2

This SRD briefly outlines the software function, technical basis, and computational approach, that are relevant to the proposed enhancements of the code MULTIFLO. Version 1.0 of MULTIFLO has been completed and satisfies TOP-018 QA requirements. A SRD was completed for Version 1.0 of MULTIFLO. A draft version of the User's Manual has been completed. The revised code will be issued as Version 1.2.

2.1 SOFTWARE FUNCTION

Planned change to the code MULTIFLO is to include a dual continuum model (DCM) capability. The DCM will be used both to replace and enhance the multiple interacting continua (MINC) approach for modeling highly fractured porous rock at the YM proposed repository site. The MINC method is currently being programmed into both METRA and GEM modules which will be released as Version 2.0 of MULTIFLO. The programming language used in MULTIFLO is FORTRAN. The code will be developed on a Sun-sparc workstation and PCs running NEXTSTEP and PC-UNIX.

2.2 BACKGROUND

The main purpose of this revision to MULTIFLO to incorporate the DCM is to aid in providing a detailed model of the near-field environment from which total performance assessment analyses may be abstracted. Both Lawrence Livermore National Laboratory (LLNL) and Lawrence Berkeley National Laboratory (LBNL) have begun using the DCM almost exclusively in place of the equivalent continuum model (ECM). The ECM is based on the assumption of capillary equilibrium between matrix and

fractures which is much too stringent to explain field observations of pore water chemistry at YM, including recent observations of ^{36}Cl and differences in matrix and fracture solution chemistry. Observations of ^{36}Cl at the proposed repository horizon indicate the existence of fast pathways from the ground surface to the watertable which are presumed related to flow through fractures. To describe such situations it is important to be able to distinguish between fracture and matrix flow systems.

Two available alternative approaches to the ECM, one the DCM and the other the MINC model (Pruess and Narisimhan, 1980), have been applied to YM. The DCM is applicable to the case where the matrix forms a connected flow region unobstructed by fractures. The MINC model on the other hand applies when matrix blocks are disconnected from one another by the presence of through-going fractures. Thus the two models are complementary to one another. In particular, the MINC model is not a generalization of the DCM, but is applicable to large-scale fractures in contrast to the DCM which is applicable to rocks with a high fracture density such as characterize parts of YM. Future models for YM could employ the MINC for large-scale fractures and use the DCM to represent matrix blocks within the MINC formulation.

The added capability of the DCM in MULTIFLO will enable evaluation of DOE's current DCM modeling effort. Because many of the thermal-hydrologic aspects of DOE's Total System Performance Assessment for the Viability Assessment will be based on the DCM rather than the ECM, it is important for the CNWRA to also have an independent capability to conduct effective reviews. This is especially true because of the greater flexibility and additional parameter requirements of the DCM.

2.3 CURRENT STATUS OF MULTIFLO

The current status of MULTIFLO is as follows:

- Unstructured grid has been completed in METRA and GEM but is not fully tested
- Programming MINC into METRA has been initiated, but not completed
- Operator splitting is not implemented with the unstructured grid version of GEM
- The MULTIFLO User's Manual is incomplete with respect to MINC and the unstructured grid

2.4 DUAL CONTINUUM MODEL IMPLEMENTATION IN MULTIFLO

The DCM represents a fractured porous medium as two interacting continua: one continuum represents the fracture network and the other the rock matrix. In the case of solute transport a linear coupling term describes mass transfer between the two continua. For partially saturated systems the coupling is a nonlinear function of the saturation and is linear in the pressure difference between matrix and fracture network. The DCM is presumed valid provided the rock mass contains fractures which are connected to form a continuous flow network, typical of rock with a high density of fractures which are closely spaced. The matrix must also form a connected flow regime. For a system with widely spaced continuous fractures which isolate matrix blocks thereby disrupting their continuity, the dual continuum approach is not valid and an explicit representation of each fracture or a multiple interacting continua model MINC approach may be necessary.

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Flow equations for the DCM consist of separate mass conservation equations for the matrix and fracture. As a result it necessary to solve twice the number of equations compared to a single continuum model. The implementation of the DCM into MULTIFLO is relatively easy because the complete structure for a single continuum is already in place. Furthermore, the coupling terms are linear in pressure or concentration difference between matrix and fracture.

2.5 RELATED CODES

The code DCM3D (Updegraff et al., 1991) applies the DCM model to unsaturated flow. However, the code applies only to isothermal conditions and uses incorrect coupling terms between fracture and matrix which depend only on matrix and not fracture properties. Codes used by LBNL which incorporate the DCM, such as TOUGH and its derivatives (Pruess, 1989), are not currently available. The NUFT code (Nitao, 1996) incorporates the same general approach to the DCM as envisaged for MULTIFLO. This code may be available in the future for comparison and benchmarking with MULTIFLO.

3 IMPLEMENTATION

It is proposed to begin work on the DCM immediately, postponing further work on MINC until the DCM is completed and implemented for the following reasons:

- An immediate need exists for an alternative model to replace the ECM
- The DCM requires far less programming effort compared to the MINC implementation
- MINC may not be applicable to small-scale fractures at YM which constitute the bulk of the rock mass. This type of geometry may be better described by the DCM

An estimate of time and effort involved in the planned developmental work and the order in which the work will be performed is provided in table 3-1. Although, the time for some tasks may exceed the individual estimates, the total time should represent a good estimate. This time includes debugging time which adds additional uncertainty. Work will be carried out by M. Seth under supervision by P. Lichtner.

Table 3-1. Estimation of DCM implementation time

Task	Description	Time (hrs)	
		METRA	GEM
I	DCM Coding	60	60
II	Testing	40	40
III	Revise User's Manual	16	16
Total		116	116

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4 REFERENCES

Nitao, J.J. 1996. *Reference Manual for the NUFT Flow and Transport Code, Version 1.0.* UCRL-ID-113520. Lawrence Livermore National Laboratory: Lawrence Livermore, CA.

Pruess, K., and T.N. Narisimhan. 1985. A practical method for modeling fluid and heat flow in fractured porous media. Society of Petroleum Engineers 25(1): 14–27.

Pruess, K. 1991. TOUGH2: *A General—Purpose Numerical Simulator for Multiphase Fluid and Heat Flow*. LBL-29400. Lawrence Berkeley Laboratory: Berkeley, CA.

Updegraff, C.D., C.E. Lee, D.P. Gallego. 1991. *DCM3D: A Dual-Continuum, Three-Dimensional, Groundwater Flow Code for Unsaturated, Fractured Porous Media*. NUREG/CR-5536. Washington, DC: Nuclear Regulatory Commission.