SOFTWARE RELEASE NOTICE

1. SRN Number: MGFE-SRN- 330 9/20/04

2. Project Title: Repository Design and Thermal-Mechanical Effects Code Development–PCSA	Project No. 20.06002.01.103
3. SRN Title: PCSA Tool Version 3.0.0	
4. Originator/Requestor: George Adams	Date: Sep. 17, 2004

5. Summary of Actions

- ☐ Release of new software
- ☐ Change of access software
- ☑ Release of modified software:
  - ☑ Enhancements made
  - ☑ Corrections made
- ☐ Software Retirement

6. Validation Status

- ☑ Validated
- ☐ Limited Validation
- ☐ Not Validated Explain: _____

7. Persons Authorized Access

Name	Read Only/Read-Write	Addition/Change/Delete
CNWRA Staff	Read / Execute	Addition
NRC Staff	Read / Execute	Addition
Norm Eisenberg	Read / Execute	Addition

8. Element Manager Approval: Date: 9-17-2004

9. Remarks: None

CNWRA Form TOP-6 (09/01)

SOFTWARE SUMMARY FORM

01. Summary Date: September 17, 2004	02. Summary prepared by (Name and phone) George Adams, (210) 522-4957	03. Summary Action: REPLACEMENT
04. Software Date: September 17, 2004	05. Short Title: PCSA Tool Version 3.0.0	
06. Software Title: Preclosure Safety Analysis Tool Version 3.0.0		07. Internal Software ID: none

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: Preclosure Safety Analysis
11. Submitting Organization and Address: CNWRA/SwRI 6220 Culebra Road San Antonio, TX 78228		12. Technical Contact(s) and Phone: George Adams, (210) 522-4957

13. Software Application:

The software is used to perform preclosure safety analysis. It is an interactive program in which the user enters data that is stored in a database. The software retrieves, stores, and displays information from the database.

14. Computer Platform IBM compatible PC	15. Computer Operating System: Windows XP	16. Programming Language(s): Visual Basic 6.0	17. Number of Source Program Statements: Greater than 5,000
18. Computer Memory Requirements: not known	19. Tape Drives: N/A	20. Disk Units: N/A	21. Graphics: No special graphics required

22. Other Operational Requirements
No other special operational requirements

23. Software Availability: ☑ Available ☐ Limited ☐ In-House ONLY	24. Documentation Availability: ☑ Available ☐ Preliminary ☐ In-House ONLY

25. George Adams

Software Developer: George R Adams Date: September 17, 2004

CNWRA Form TOP-4-1 (05/98)

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

Software Title/Name: PCSA Tool
Version: 3.0.0
Demonstration workstation: PC
Operating System: Windows XP
Developer: G. Adams

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

SRD Version: SRD- PCSA Tool 3.0.0
SRD Approval Date: December 9, 2003

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

Yes: ☐ No: ☒ N/A: ☐

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: ☐

Comments: 431-438, 506-514, 531, 537, 539-541

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

SDP Version: PCSA Tool 3.0.0
SDP (EM) Approval Date: 6/3/2004

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

Yes: ☑ No: ☐ N/A: ☐

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

Yes: ☐ No: ☐ N/A: ☒

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?

Yes: ☒ No: ☐ N/A: ☐

Module(s) Reviewed:

Comments:

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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:

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:

Comments: Scientific Notebook 014 and applicable SCR's.

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: N/A

Name/Version Displayed: N/A

Comments: Interactive rather than batch.

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:

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:

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:

Code Reviews [TOP-018, Section 5.5.6]

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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?

Yes: ☐ No: ☒ N/A: ☐

Documented in Scientific Notebook No.: N/A

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 - All SCRs testing performed and reviewed for acceptance.

Yes: ☒ No: ☐ N/A: ☐

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

Yes: ☒ No: ☐ N/A: ☐

Computer Platforms: PC Operating Systems: Windows XP

Location of Acceptance Test Results: SCRs + Scientific Notebook 635E

Comments:

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

Yes: ☒ No: ☐ N/A: ☐

Computer Platforms: PC Operating Systems: Windows XP

Location of Acceptance Test Results: See Above

Comments:

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: PCSA Tool V2.0

Comments: Reference E-mail to G. Adam from R. Brient 8/2/2004 regarding Users Manual V2.0

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

Yes: ☒ No: ☐ N/A: ☐

Location of Instructions: User manual V2.0

Comments:

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

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

Yes: ☒ No: ☐ N/A: ☐

Date of Approval: 9/17/04

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

Yes: ☐ No: ☐ N/A: ☐

Comments: On CD

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

Yes: ☒ No: ☐ N/A: ☐

Location of Source Code: CD

Comments:

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

Yes: ☒ No: ☐ N/A: ☐

Location of script/make files: CD - PCSA V3.0.0 in QA Records

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?

Yes: ☒ No: ☐ N/A: ☐

SRN Number: 330

Comments:

Software Validation [TOP-018, Section 5.10]

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QA VERIFICATION REPORT
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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: 3.0.0 10/6/03, Test Report 3.0.0 9/15/04

Date Reviewed and Approved via QAP-002: 10/6/03

Comments:

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: Revision 0 9/15/04

Date Reviewed and Approved via QAP-002: 9/15/2004

Comments:

Additional Comments:

9/20/04
Software Developer/Date

Software Custodian/Date 9/20/04

SOFTWARE VALIDATION TEST REPORT SUMMARY FOR PCSA TOOL VERSION 3.0.0

Center for Nuclear Waste Regulatory Analyses
Southwest Research Institute
San Antonio, Texas

Prepared by

George Adams
Troy Maxwell

Asadul H. Chowdhury
Manager, Mining, Geotechnical, and Facility Engineering

9-15-04
Date

CONTENTS

1.0 INTRODUCTION

1.1 Purpose

The Preclosure Safety Analysis (PCSA) Tool has been developed for use by U.S. Nuclear Regulatory Commission (NRC) and Center for Nuclear Waste Regulatory Analyses (CNWRA) staff to conduct a systematic independent analysis and review of the U.S. Department of Energy (DOE) preclosure safety analysis for a proposed repository at Yucca Mountain, Nevada. As part of a license application for construction authorization and a subsequent license amendment to receive and possess waste at the proposed repository, the DOE must conduct a preclosure safety analysis for the period until permanent closure. The PCSA Tool will be used to identify areas of vulnerability in the DOE safety analysis, to assess the DOE calculation of radiological consequences to workers and the public, and to evaluate the identification of structures, systems, and components important to safety.

This Software Validation Test Report (SVTR) Summary was prepared to document validation testing of PCSA Tool Version 3.0.0. It is intended to supplement the previously reviewed and approved Software Validation Test Plan (SVTP) by providing documentation for the individual validation tests performed. Individual validation tests are documented on the attached SVTRs.

1.2 Background

The PCSA Tool is structured around a preclosure safety analysis review methodology, which is based on both the requirements and objectives of 10 CFR Part 63 and the guidance provided in Yucca Mountain Review Plan (NRC, 2003). The structures, modules, and data flow within the PCSA Tool are described in Chapter 2 of the PCSA Tool Version 2.0 User Guide.

Validation testing was performed on PCSA Tool Version 3.0.0 using the SVTP as a reference. Section 6 of the SVTP describes the individual validation tests required. During validation testing, SVTRs were completed to document how individual tests were conducted, to identify the results obtained, and to indicate whether the test was passed. In addition, these SVTRs refer to the appropriate sections of the SVTP that were used while conducting the test. Section 6.14 of the SVTP describes testing for functionality added to the PCSA Tool which was not present at the time the SVTP was written. The SVTRs for this additional functionality document the testing by describing the procedure used and describing the results obtained.

2.0 SCOPE OF THE VALIDATION

PCSA Tool Version 3.0.0 is projected to be used for reviewing the preclosure safety analysis in a potential license application for the proposed repository at Yucca Mountain. Hence, PCSA Tool Version 3.0.0 is the subject of this validation test, and this validation testing is a complete validation for PCSA Tool Version 3.0.0.

A large part of the PCSA Tool's functionality involves the manipulation of data to include: (i) the display of data on the screen and in the form of reports, (ii) the storage and retrieval of data to and from a database, and (iii) the supply and retrieval of data to and from standalone code modules. Therefore, much of the validation testing focused on this data manipulation.

In addition to data manipulation, the PCSA Tool is used to invoke standalone code modules. In some cases data is sent to and retrieved from the standalone code modules in addition to invoking them (e.g., RSAC), and in other cases, the standalone code modules are invoked without being supplied with data (e.g., SAPHIRE). Whenever a standalone code module was part of a validation test, it was identified in the Test Environment Setup, Software section of the SVTR.

The following software was not developed as part of the PCSA Tool but will be released with PCSA Tool Version 3.0.0: (i) RSAC Version 6.2, (ii) MELCOR Version 1.8.5, and (iii) SAPHIRE Version 6.80. RSAC Version 6.2 and MELCOR Version 1.8.5 have been validated; however, SAPHIRE Version 6.80 validation has not been completed. SAPHIRE Version 6.80 validation is projected for September 2004.

3.0 REFERENCES

Adams, G., T. Maxwell, B. Dasgupta, and R. Benke. "Software Validation Test Plan for PCSA Tool Version 3.0." San Antonio, Texas: CNWRA. September 2003.

Adams, G., T. Maxwell, R. Benke. "Software Validation Test Report for RSAC Version 6.2." San Antonio, Texas: CNWRA. January 2004.

Benke, R. "Analytical and Numerical Solutions of the Expected Number of Occurrences for Combinations of Event Sequences due to Variability." San Antonio, Texas: CNWRA. December 2003.

Benke, R. "Software Validation Test Plan for MELCOR Version 1.8.5." San Antonio, Texas: CNWRA. October 2001.

Dasgupta, B., R. Benke, B. Sagar, R. Janetzke, and A. Chowdhury. "PCSA Tool Development Progress Report II." San Antonio, Texas: CNWRA. September 2002.

Dasgupta, B., R. Benke, T. Maxwell, and N. Eisenberg. "PCSA Tool Version 2.0 User Guide." San Antonio, Texas: CNWRA. June 2003.

Dasgupta, B., R. Benke, G. Adams. "Software Requirements Description for the PCSA Tool Version 3.0 (Revision 04)." San Antonio, Texas: CNWRA. July 2002.

Dasgupta, B. "Software Validation Test Report for SAPHIRE Version 6.80." San Antonio, Texas: CNWRA. September 2004 (projected date).

4.0 SOFTWARE VALIDATION TEST REPORTS

All validation testing is documented on individual SVTRs which are included with this summary. The following table is provided to link the test case from the SVTP with its associated SVTR and supporting files. SVTRs and supporting files are included on the attached CD.

Test Case	SVTR ID	Associated Files
Section 6.1 Project Tree	1-1	SVTRs\SVTR_1\SVTR_1-1.wpd SVTRs\SVTR_1\1-1.pdf
Section 6.2 External Events	2-1	SVTRs\SVTR_2\SVTR_2-1.wpd SVTRs\SVTR_2\2-1.pdf SVTRs\SVTR_2\2-2.pdf
Section 6.3.1 System—System Description	3-1	SVTRs\SVTR_3\SVTR_3-1.wpd SVTRs\SVTR_3\3_1_1.pdf SVTRs\SVTR_3\3_1_2.pdf SVTRs\SVTR_3\3_1_3.pdf SVTRs\SVTR_3\3_1_4.pdf SVTRs\SVTR_3\3_1_5.pdf SVTRs\SVTR_3\3_1_6.pdf SVTRs\SVTR_3\3_1_7.pdf SVTRs\SVTR_3\3_1_8.pdf SVTRs\SVTR_3\3_1_9.pdf
Section 6.3.2 System—Structures, Systems, and Components (SSCs)	3-2	SVTRs\SVTR_3\SVTR_3-2.wpd SVTRs\SVTR_3\3_2_1.pdf SVTRs\SVTR_3\3_2_2.pdf
Section 6.4.1 Internal Events—FMEA	4-1	SVTRs\SVTR_4\SVTR_4-1.wpd SVTRs\SVTR_4\4_1.pdf
Section 6.4.2 Internal Events—What If	4-2	SVTRs\SVTR_4\SVTR_4-2.wpd SVTRs\SVTR_4\4_2.pdf
Section 6.4.3 Internal Events—Energy Method	4-3	SVTRs\SVTR_4\SVTR_4-3.wpd SVTRs\SVTR_4\4_3.pdf
Section 6.4.4 Internal Events—HRA	4-4	SVTRs\SVTR_4\SVTR_4-4.wpd SVTRs\SVTR_4\4_4.pdf
Section 6.4.5 Internal Events—Severe Events (All)	4-5	SVTRs\SVTR_4\SVTR_4-5.wpd SVTRs\SVTR_4\4_5.pdf
Section 6.5.1 Frequency Analysis—Initiating Event	5-1	SVTRs\SVTR_5\SVTR_5-1.wpd SVTRs\SVTR_5-51.pdf
Section 6.5.2 Frequency Analysis—Event Tree	5-2	SVTRs\SVTR_5\SVTR_5-2.wpd SVTRs\SVTR_5\5-2-1.pdf SVTRs\SVTR_5\5-2-2.pdf
Section 6.5.3 Frequency Analysis—Fault Tree	5-3	SVTRs\SVTR_5\SVTR_5-3.wpd SVTRs\SVTR_5\5-3-1.pdf SVTRs\SVTR_5\5-3-2.pdf
Section 6.5.4 Frequency Analysis—Event Sequence	5-4	SVTRs\SVTR_5\SVTR_5-4.wpd SVTRs\SVTR_5\5-4.pdf

Test Case	SVTR ID	Associated Files
Section 6.6 SAPHIRE	6-1	SVTRs\SVTR_6\SVTR_6-1.wpd
Section 6.7.1 Consequence Analysis—Consequence Worker Dose	7-1-1	SVTRs\SVTR_7\SVTR_7-1-1.wpd SVTRs\SVTR_7\WorkerDose.xls SVTRs\SVTR_7\WorkerDosefromPoolRelease2min.xls
Section 6.7.2.1.1 Consequence Analysis—RSAC Execution Standard Input-Deterministic	7-2-1	SVTRs\SVTR_7\SVTR_7-2-1.wpd SVTRs\SVTR_7\7-2-1A_Rsac6.out SVTRs\SVTR_7\7-2-1B_Rsac6.out SVTRs\SVTR_7\7-2-1C_Rsac6.out SVTRs\SVTR_7\7-2-1D_Rsac6.out SVTRs\SVTR_7\7-2-1-Aout.pdf SVTRs\SVTR_7\7-2-1-Bout.pdf SVTRs\SVTR_7\7-2-1-Cout.pdf SVTRs\SVTR_7\7-2-1-Dout.pdf SVTRs\SVTR_7\7-2-1-Ain.pdf SVTRs\SVTR_7\7-2-1-Bin.pdf SVTRs\SVTR_7\7-2-1-Cin.pdf SVTRs\SVTR_7\7-2-1-Din.pdf
Section 6.7.2.1.2 Consequence Analysis—RSAC Execution Standard Input-Deterministic-User Specified	7-2-2	SVTRs\SVTR_7\SVTR_7-2-2.wpd SVTRs\SVTR_7\7-2-2A_Rsac6.out SVTRs\SVTR_7\7-2-2B_Rsac6.out SVTRs\SVTR_7\7-2-2-Aout.pdf SVTRs\SVTR_7\7-2-2-Bout.pdf SVTRs\SVTR_7\7-2-2-Ain.pdf SVTRs\SVTR_7\7-2-2-Bin.pdf
Section 6.7.2.1.3 Consequence Analysis—RSAC Execution Advanced Input	7-2-3	SVTRs\SVTR_7\SVTR_7-2-3.wpd SVTRs\SVTR_7\7-2-3_RSAC6.OUT
Section 6.7.2.1.4 Consequence Analysis—RSAC Execution Standard Input-Probabilistic-Four Realizations	7-2-4	SVTRs\SVTR_7\SVTR_7-2-4.wpd SVTRs\SVTR_7\7-2-4_lhs.out SVTRs\SVTR_7\7-2-4_Rsac6.out
Section 6.7.2.1.5 Consequence Analysis—RSAC Execution Standard Input-Probabilistic-Ten Realizations	7-2-5	SVTRs\SVTR_7\SVTR_7-2-5.wpd SVTRs\SVTR_7\7-2-5_lhs.out SVTRs\SVTR_7\7-2-5_Rsac6.out SVTRs\SVTR_7\7-2-5.xls SVTRs\SVTR_7\7-2-5A.xls SVTRs/SVTR_7\distribution-7-2.A.xls
Section 6.7.2.2.1 Consequence Analysis—MELCOR Execution-PWR	7-2-6	SVTRs\SVTR_7\SVTR_7-2-6.wpd SVTRs\SVTR_7\7-2-6_8mel.doc
Section 6.7.2.2.2 Consequence Analysis—MELCOR Execution-BWR	7-2-7	SVTRs\SVTR_7\SVTR_7-2-7.wpd SVTRs\SVTR_7\7-2-7_8mel.doc

Test Case	SVTR ID	Associated Files
Section 6.8.1.1 Performance Analysis—Safety Assessment-Current Level Results	8-1	SVTRs\SVTR_8\SVTR_8-1.wpd SVTRs\SVTR_8\8-1_1.pdf SVTRs\SVTR_8\8-1_2.pdf SVTRs\SVTR_8\8-1_3.pdf SVTRs\SVTR_8\8-1_4.pdf SVTRs\SVTR_8\calc_8.xls (tab 8-1)
Section 6.8.1.2 Performance Analysis—Safety Assessment-Compliance Assessment	8-2	SVTRs\SVTR_8\SVTR_8-2.wpd SVTRs\SVTR_8\8-2_1.pdf SVTRs\SVTR_8\8-2_2.pdf SVTRs\SVTR_8\8-2_3.pdf SVTRs\SVTR_8\calc_8.xls (tab 8-2a, 8-2b)
Section 6.8.1.3 Performance Analysis—Safety Assessment-Structures, Systems, and Components Important to Safety (SSCIS)	8-3	SVTRs\SVTR_8\SVTR_8-3.wpd SVTRs\SVTR_8\8-3_1.pdf SVTRs\SVTR_8\8-3_2.pdf SVTRs\SVTR_8\calc_8.xls (tab 8-3)
Section 6.8.2 Performance Analysis—Risk Assessment	8-4	SVTRs\SVTR_8\SVTR_8-4.wpd SVTRs\SVTR_8\8-4_1.pdf SVTRs\SVTR_8\8-4_2.pdf SVTRs\SVTR_8\calc_8.xls (tab 8-4)
Section 6.9 Software Reliability	9-1	SVTRs\SVTR_9\SVTR_9-1.wpd SVTRs\SVTR_9\9-1.pdf
Section 6.10.1 Failure Rate—View Taxonomy	10-1	SVTRs\SVTR_10\SVTR_10-1.wpd
Section 6.10.2 Failure Rate—Search Database	10-2	SVTRs\SVTR_10\SVTR_10-2.wpd
Section 6.10.3 Failure Rate—Failure calculator	10-3	SVTRs\SVTR_10\SVTR_10-3.wpd
Section 6.10.4 Failure Rate—Human Error Probability (HEP) Generator	10-4	SVTRs\SVTR_10\SVTR_10-4.wpd
Section 6.11 Checklists	11-1	SVTRs\SVTR_11\SVTR_11-1.wpd
Section 6.12 Regulations	12-1	SVTRs\SVTR_12\SVTR_12-1.wpd
Section 6.13 Help	13-1	SVTRs\SVTR_13\SVTR_13-1.wpd
Section 6.14 Additional Functionality—Worker Dry Form	14-1	SVTRs\SVTR_14-1\SVTR_14-1.wpd SVTRs\SVTR_14-1\14-1.xls

Test Case	SVTR ID	Associated Files
Section 6.14 Additional Functionality—Worker Downwind Dose	14-2	SVTRs\SVTR_14-2\SVTR_14-2.wpd SVTRs\SVTR_14-2\14-2.xls
Section 6.14 Additional Functionality—Display Images	14-3	SVTRs\SVTR_14-3\SVTR_14-3.wpd
Section 6.14 Additional Functionality—Highlight Doses and Dose Rates Above Limits (Performance Assessment)	14-4	SVTRs\SVTR_14-4\SVTR_14-4.wpd SVTRs\SVTR_14-4\14-4_1.pdf SVTRs\SVTR_14-4\14-4_2.pdf SVTRs\SVTR_14-4\14-4_3.pdf
Section 6.1.4 Additional Functionality Saving the System Log and Database	14-5	SVTRs\SVTR_14-5\SVTR.14-5.wpd

5.0 NOTES

At the time that the SVTP was written, some functionality was not present in the PCSA Tool, and it wasn't at that time possible to determine the scope of the changes that were yet to be made to the software. Therefore, the individual SVTRs identify when procedures were modified from the SVTP or changes in input data were required from that listed in the SVTP.

The SVTP calls for validation testing on a Windows NT 4.0/Windows XP machine. Instead, due to availability, one validation tester performed some of the validation tests on a Windows 2000 machine and a second validation tester performed the remaining tests on a Windows XP machine. The individual SVTRs identify the operating system used for the test. Software validation was not performed on a Windows NT 4.0 machine.

Validation testing started with Version 3.0 BetaN of the PCSA Tool and continued with subsequent versions (BetaP, BetaQ, etc.). As errors were found in the PCSA Tool during validation testing or upgrades were performed (e.g., upgrading SAPHIRE to Version 6.80), changes were implemented, tested, and then documented on SCRs. Afterwards, a new version of the software was made available for validation testing.

Software Validation Test Reports (SVTRs)

Software Validation Test Report (SVTR)

SVTR#: 1-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.1	Test Series Name: Project Tree

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Input information in accordance with Section 6.1.1 of the SVTP for PCSA Tool Version 3.0

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies the project tree is built correctly and the input is stored correctly in the database into the proper functional areas within the tree structure.

Test Procedure: Tested in accordance with section 6.1.2 of the SVTP for PCSA Tool Version 3.0 except the Saphire Project Location is no longer entered.

Test Results

The level information and remarks appear correctly on the PCSA Project Tree Report after exiting and re-entering the PCSA Tool.

Test results are attached.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: July 29, 2004

PCSA Project Tree Report

Project: valid_1_1

Functional ID	1st Level	2nd Level	3rd Level	4th Level	Remarks
A.1.2.3	Node A	Node A1	Node A2	Node A3	Functional Area A
B.1.2.3	Node B	Node B1	Node B2	Node B3	Functional area B

Software Validation Test Report (SVTR)

SVTR#: 2-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.2	Test Series Name: External Events

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is correctly stored in the database.

Test Procedure: Tested in accordance with section 6.2.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The user input appears correctly on the PCSA External Events Report and PCSA External Events Detail Report after exiting and re-entering the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

PCSA External Events Report

Project: SVTP

Generic List of Events	Ext Hazard ID	Potential exists for event to be applicable	Rate of process high enough to affect facility	Consequence of event high enough to affect facility	Event Frequency (per yr)	Applicability of the event to the site
Aircraft crash						
Avalanche	EXHZ_AVALANCHE1	N	N	N	1.00E-07	N
Coastal erosion						
Dam failure						
Debris avalanching						
Denudation						
Dissolution						
Eperogenic displacement						
Erosion						
External Event 1	EXHZ_Ex1	Y	N	Y	1.00E-03	N
Extreme weather fluctuations						
Extreme wind						
Fire (facility)						
Fire (range)						
Flooding (storm, river diversion)						
Fungus, bacteria, and algae						
Glacial erosion						
Glaciation						
High lake level						
High river stage						
High tide						
Hurricane						
Inadvertent future intrusions (man-made)						
Industrial activity induced accident						
Intentional future intrusions (man-made)						
Landslides						
Lightning						
Loss of off-site/on-site power						
Low lake level						
Low river level						
Meteorite impact						
Military activity induced accident						
Orogenic Diastrophism						
Pipeline accident						
Rainstorm						
Sandstorm						
Sedimentation						

PCSA External Events Report

Project: SVTP

Generic List of Events	Ext Hazard ID	Potential exists for event to be applicable	Rate of process high enough to affect facility	Consequence of event high enough to affect facility	Event Frequency (per yr)	Applicability of the event to the site
Seiche						
Seismic activity, earthquake						
Seismic activity, subsurface fault displacement						
Seismic activity, surface fault displacement						
Seismic activity, uplifting (tectonic)						
Static fracturing						
Stream erosion						
Subsidence						
Tornado						
Tsunami						
Undetected geologic features						
Undetected geologic processes						
Undetected past intrusions (man-made)						
Volcanic eruption						
Volcanism, ashfall						
Volcanism, ashflow (extrusive magmatic activity)						
Volcanism, intrusive magmatic activity						
Waves (aquatic)						

PCSA External Events Detail Report

Project: SVTP

Generic Event Name		External Event 1
External Hazard ID		EXHZ_Ex1
Definition		External Event 1.1
Required Condition		External Event 1.2
Potential exists for the event to be applicable to the site	Y	External Event 1.3
Rate of process high enough to affect the facility during preclosure	N	External Event 1.4
Consequence of process significantly high to affect the facility during preclosure period	Y	External Event 1.5
Event Frequency (per yr)		1.00E-03
Justification		External Event 1.6
Applicability of the Event to the site	N	
Additional Discussion		External Event 1.7
DOE References		External Event 1.8
NRC Review Report File Na		External Event 1.txt

Software Validation Test Report (SVTR)

SVTR#: 3-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.3.1	Test Series Name: System - System Description

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Input data is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database and can be retrieved from the database and displayed.

Test Procedure: Since this form was being developed at the time the SVTP was written, a detailed procedure did not exist in the SVTP. However, the procedure used was to enter information on each tab of the form until all tabs were filled out and verify upon exiting and reentering the PCSA Tool that the information entered was retrieved from the database.

Test Results

The user input appears correctly on the individual PCSA System Description Reports after exiting and re-entering the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: The Detailed Operations Sequence form was renamed 'System Description.'

Tester: Troy Maxwell	Date: August 12, 2004

Attachment 1

Input Data: Detailed Operations Sequence

Data Entry Field	Record 1	Record 2
Tab: Function		
Function	SysDes_Function_1.1	N/A
Additional Information	SysDes_Function_1.2	N/A
References	SysDes_Function_1.3	N/A
Tab: Operations Sequence		
Detailed Operation Sequence	SysDes_OperationSequence_1.1	SysDes_OperationSequence_2.1
Duration of Operation	3 Hours	2 Hours
Additional Information	SysDes_OperationSequence_1.2	SysDes_OperationSequence_2.2
DOE Reports and References	SysDes_OperationSequence_1.3	SysDes_OperationSequence_2.3
Lift Height	24 meters	N/A
Distance Traveled	3 miles	N/A
Speed of Travel	4.5 mph	N/A
Tab: Waste Characterization		
Description of Waste	SysDes_WasteCharacterization_1.1	SysDes_WasteCharacterization_2.1
Material Type	Mat_Type_1.2	Mat_Type_2.2
Material Container	Mat_Container_1.3	Mat_Container_2.3
Material Amount	Mat_Amount_1.4	Mat_Amount_2.4
Heat Generation Rate	1	2
External Dose Rate	.001	.002
References	SysDes_WasteCharacterization_1.5	SysDes_WasteCharacterization_2.5
Tab: Human Actions		
A) Maintenance and Standby	SysDes_HumanActions_1.1	SysDes_HumanActions_2.1
B) Operational Actions	SysDes_HumanActions_1.2	SysDes_HumanActions_2.2
C) References	SysDes_HumanActions_1.3	N/A

D) Additional Information	SysDes_HumanActions_1.4	N/A
Tab: Shielding		
Additional Information	SysDes_Shielding_1.1	SysDes_Shielding_2.1
Source Geometry	SysDes_Shielding_1.2	SysDes_Shielding_2.2
Worker Location Relative to Sources	SysDes_Shielding_1.3	SysDes_Shielding_2.3
Shield Locations Relative to Sources	SysDes_Shielding_1.4	SysDes_Shielding_2.4
References	SysDes_Shielding_1.5	SysDes_Shielding_2.5
Shield Material	SysDes_Shielding_1.6	SysDes_Shielding_2.6
Shield Composition	SysDes_Shielding_1.7	SysDes_Shielding_2.7
Shield Density	8 kg/m^3	7 kg/m^3
Shield Thickness	9 cm	2 cm
Tab: Software System		
Software System Used	SysDes_SoftwareSystem_1.1	SysDes_SoftwareSystem_2.1
References	SysDes_SoftwareSystem_1.2	N/A
Additional Information	SysDes_SoftwareSystem_1.3	N/A
Tab: Fire Hazards		
Presence of Combustible Materials	(Yes) SysDes_FireHazards_Yes	(No)
Location and Description of Combustible Material	SysDes_FireHazards_1.1	SysDes_FireHazards_2.1
Additional Information	SysDes_FireHazards_1.2	SysDes_FireHazards_2.2
DOE Reports and References	SysDes_FireHazards_1.3	SysDes_FireHazards_2.3
Function	SysDes_FireHazards_1.4	SysDes_FireHazards_2.4
Tab: General		
There is presence of neutron moderators for criticality	Checked	N/A
Radiation Area Designation	Radiation Area	N/A
Ventilation Flow Rate	3	N/A

Tab: Assumptions		
Assumptions	SysDes_Assumptions_1.1	SysDes_Assumptions_2.1
Additional Information	SysDes_Assumptions_1.2	SysDes_Assumptions_2.2

PCSA System Description (Function Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Function	Additional Information	References
SysDes_Function_1.1	SysDes_Function_1.2	SysDes_Function_1.3

PCSA System Description (Operation Sequence Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Detailed Operations Sequence	Duration of Operation	Lift Height	Distance Traveled	Speed of Travel	Additional Information	DOE Reports and References
0001.00	SysDes_OperationSequence_1.1	3 hours	24 m	3 miles	4.5 mph	SysDes_OperationSequence_1.2	SysDes_OperationSequence_1.3
0002.00	SysDes_OperationSequence_2.1	2 hours				SysDes_OperationSequence_2.2	SysDes_OperationSequence_2.3

PCSA System Description (Waste Characterization Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Material Type Material Container Material Amount	Heat Generation Rate (W) Ext. Dose Rate (mrem/hr)	Description of Waste	References
0001.00	Mat_Type_1.2	1	SysDes_WasteCharacterization_1.1	SysDes_WasteCharacterization_1.5
	Mat_Container_1.3	.001		
	Mat_Amount_1.4			
0002.00	Mat_Type_2.2	2	SysDes_WasteCharacterization_2.1	SysDes_WasteCharacterization_2.5
	Mat_Container_2.3	.002		
	Mat_Amount_2.4			

PCSA System Description (Human Actions Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

	Item No	Data
Maintenance & Standby		
	0001.00	SysDes_HumanActions_1.1
	0002.00	SysDes_HumanActions_1.2
Operational		
	0001.00	SysDes_HumanActions_2.1
	0002.00	SysDes_HumanActions_2.2

References:
SysDes_HumanActions_1.3

Additional Information
SysDes_HumanActions_1.4

PCSA System Description (Shielding Report)

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

Item No	0001.00
Source Geometry	SysDes_Shielding_1.2
Worker Location	SysDes_Shielding_1.3
Shield Locations Relative to Sources	SysDes_Shielding_1.4
Shield Material	SysDes_Shielding_1.6
Shield Composition	SysDes_Shielding_1.7
Shield Density	8 kg/m^3
Shield Thickness	9 cm
Additional Information	SysDes_Shielding_1.1
References	SysDes_Shielding_1.5

PCSA System Description (Shielding Report)

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

Item No	0002.00
Source Geometry	SysDes_Shielding_2.2
Worker Location	SysDes_Shielding_2.3
Shield Locations Relative to Sources	SysDes_Shielding_2.4
Shield Material	SysDes_Shielding_2.6
Shield Composition	SysDes_Shielding_2.7
Shield Density	7 kg/m^3
Shield Thickness	2 cm
Additional Information	SysDes_Shielding_2.1
References	SysDes_Shielding_2.5

PCSA System Description (Software System Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Software System Used
0001.00	SysDes_SoftwareSystem_1.1
0002.00	SysDes_SoftwareSystem_2.1

References:
SysDes_SoftwareSystem_1.2

Additional Information
SysDes_SoftwareSystem_1.3

PCSA System Description (Fire Hazards Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Combustible Material	Location and Description of the Combustible Material	Function	Additional Information	DOE Reports and References
0001.00	SysDes_FireHazards_Yes	SysDes_FireHazards_1.1	SysDes_FireHazards_1.4	SysDes_FireHazards_1.2	SysDes_FireHazards_1.3
0002.00		SysDes_FireHazards_2.1	SysDes_FireHazards_2.4	SysDes_FireHazards_2.2	SysDes_FireHazards_2.3

PCSA System Description (General Report)

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

There is presence of neutron moderators for criticality	True
Ventilation flow rate (m^3/sec)	3
Radiation area designation	Radiation Area

PCSA System Description (Assumptions Report)

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Assumptions	Additional Information
0001.00	SysDes_Assumptions_1.1	SysDes_Assumptions_1.2
0002.00	SysDes_Assumptions_2.1	SysDes_Assumptions_2.2

Software Validation Test Report (SVTR)

SVTR#: 3-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta V)
Test ID: 6.3.2	Test Series Name: System - Structures, Systems, and Components (SSCs)

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaV installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Input data is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is correctly stored in the database and can be retrieved from the database and displayed.

Test Procedure: Since this form was being developed at the time the SVTP was written, a detailed procedure did not exist in the SVTP. However, the procedure used was to enter information on each tab of the form until all tabs were filled out and verify upon exiting and reentering the PCSA Tool that the information entered was retrieved from the database.

Test Results

The user input appears correctly on the PCSA Structures, Systems, and Components Report as well as the Design Bases and Design Criteria Report after exiting and re-entering the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: None

Tester: Troy Maxwell	Date: September 13, 2004

Attachment 1:

Input Data: Structures, Systems, and Components (SSCs)

Data Entry Field	Record 1	Record 2
Tab: General		
SSC ID	SSC_1.1	SSC_2.1
SSC Description	SSC_1.2	SSC_2.2
System	SSC_1.3	SSC_2.3
Mode of Operaton	Manual	Manual
Subsystem	SSC_1.4	SSC_2.4
DOE Determination	(No)	(Yes)
Staff Determination	(No)	(Yes)
Functions	N/A	Criticality Control
Additional Information	SSC_1.5	SSC_2.5
Tab: Design Bases and Design Criteria		
Design Bases	SSC_1.6	N/A
Design Criteria	SSC_1.7	N/A
Design Review Comment	SSC_1.8	N/A
Additional Information	SSC_1.9	N/A
Functions	Backup Power	N/A
Hazards	Hazards_1.10	N/A
Initiating Events	InitiatingEvents_1.11	N/A
Event Tree	EventTree_1.12	N/A

PCSA Structures, Systems, and Components Report

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

Item Number: 0001.00

SSC ID: SSC_1.1

SSC Description: SSC_1.2

Mode of Operation: Manual

System: SSC_1.3

Subsystem: SSC_1.4

Important to Safety

DOE Determination: N **Staff Determination:** N

Additional Information: SSC_1.5

Item No	Design Bases	Design Criteria	Design Review Comment	Additional Information
0001.00	SSC_1.6	SSC_1.7	SSC_1.8	SSC_1.9

PCSA Design Bases and Design Criteria Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

SSC ID: SSC_1.1

Item No	Design Bases	Design Criteria	Design Review Comment	Additional Information
0001.00	SSC_1.6	SSC_1.7	SSC_1.8	SSC_1.9

Functions, Hazards, Initiating Events, Event Tree Subsequent Events

event tree	EventTree_1.12
function	Backup Power
hazard	Hazards_1.10
initiating event	InitiatingEvents_1.11

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

Item Number:	0002.00
SSC ID:	SSC_2.1
SSC Description:	SSC_2.2
Mode of Operation:	Manual
System:	SSC_2.3
Subsystem:	SSC_2.4
Important to Safety	
DOE Determination:	Y
Staff Determination:	Y
Additional Information:	SSC_2.5
Functions:	Criticality Control

Software Validation Test Report (SVTR)

SVTR#: 4-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.4.1	Test Series Name: Int. Events - FMEA

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Additional input is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database, and that severe events are correctly distinguished from non-severe events.

Test Procedure: Tested in accordance with section 6.4.1.2 of the SVTP for PCSA Tool Version 3.0. No data was entered for "DOE Safeguards and Controls" since it does not exist for version 3.0. Data was entered into "Preventative and Mitigative Features" which did not exist when the SVTP was written. An "Effect on other Functional Areas" checkbox was also added for version 3.0, and data was entered similar to the "Severe Events" checkbox. The extra data entered is located in the FMEA Additional Input Table found in Attachment 1.

Test Results

The user input appears correctly on the PCSA FMEA Report after exiting and re-entering the PCSA Tool. The severe events are correctly distinguished from non-severe events.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 12, 2004

Attachment 1

FMEA Additional Input Table

Data Entry Field	Record 1	Record 2
Preventative and Mitigative Features	FMEA_1.5	FMEA_2.5
Effect on other Functional Areas	(Yes) FMEA_1.8	(No) FMEA_2.8

PCSA FMEA Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Identification: **a) Item No** **b) Component**	**Failure Mode**	**Cause of Failure**	**Effect of Failure**	**Preventive and Mitigative Features**	**Severe Events**	**Effect on other Functional Areas**	**Additional Information**
a) 0001.00	FMEA_1.2	FMEA_1.3	FMEA_1.4	FMEA_1.5	Y	Y	FMEA_1.6
b) FMEA_1.1					FMEA_1.7	FMEA_1.8	
a) 0002.00	FMEA_2.2	FMEA_2.3	FMEA_2.4	FMEA_2.5	N	N	FMEA_2.6
b) FMEA_2.1					FMEA_2.7	FMEA_2.8	

Software Validation Test Report (SVTR)

SVTR#: 4-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta R)
Test ID: 6.4.2	Test Series Name: Int. Events - What If

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaR installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Additional input is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database, and that severe events are correctly distinguished from non-severe events

Test Procedure: Tested in accordance with section 6.4.2.2 of the SVTP for PCSA Tool Version 3.0. No data was entered for "DOE Safeguards" since it does not exist for version 3.0, therefore data was entered into "Preventative and Mitigative Features" which did not exist when the SVTP was written. A "Effect on other Functional Areas" checkbox was also added for version 3.0, and data was entered similar to the "Severe Events" checkbox. The extra data entered is located in the What If Additional Input Table found in Attachment 1.

Test Results

The user input appears correctly on the PCSA What If Report after exiting and re-entering the PCSA Tool. The severe events are correctly distinguished from non-severe events.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 17, 2004

Attachment 1

What If Additional Input Table

Data Entry Field	Record 1	Record 2
Preventative and Mitigative Features	WhatIf_1.4	WhatIf_2.4
Effect of other Functional Areas	(No) WhatIf_1.7	(Yes) WhatIf_2.7

PCSA 'What If' Analysis Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Identification:

Item No What If	Causes	Consequences	Preventive and Mitigative Features	Severe Events	Effect on Other Fuctional Areas	Additional Info
0001.00	WhatIf_1.2	WhatIf_1.3	WhatIf_1.4	N	N	WhatIf_1.5
WhatIf_1.1				WhatIf_1.6	WhatIf_1.7	
0002.00	WhatIf_2.2	WhatIf_2.3	WhatIf_2.4	Y	Y	WhatIf_2.5
WhatIf_2.1				WhatIf_2.6	WhatIf_2.7	

Software Validation Test Report (SVTR)

SVTR#: 4-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.4.3	Test Series Name: Int. Events - Energy Method

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Additional input is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none.
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database, and that severe events are correctly distinguished from non-severe events

Test Procedure: Tested in accordance with section 6.4.3.2 of the SVTP for PCSA Tool Version 3.0. Data was entered into "Preventative and Mitigative Features" which did not exist when the SVTP was written. An "Effect on other Functional Areas" checkbox was also added for version 3.0, and data was entered similar to the "Severe Events" checkbox. The extra data entered is located in the Energy Method Additional Input Table found in Attachment 1.

Test Results

The user input appears correctly on the PCSA Energy Analysis Report after exiting and re-entering the PCSA Tool. The severe events are correctly distinguished from non-severe events.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 2, 2004

Attachment 1

Energy Method Additional Input Table

Data Entry Field	Record 1	Record 2
Preventative and Mitigative Features	EnergyAnal_1.3	EnergyAnal_2.3
Effect of other Functional Areas	(Yes) EnergyAnal_1.6	(No) EnergyAnal_2.6

PCSA Energy Method Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

EventCategory	Identification: a) Item No b) Event Name	Cause of Event	Preventive and Mitigative Features	Severe Events	Effect on other Functional Areas	Additional Information
Collision/Crushing	a) **0001.00**	EnergyAnal_1.2	EnergyAnal_1.3	Y	Y	EnergyAnal_1.4
	b) EnergyAnal_1.1			EnergyAnal_1.5	EnergyAnal_1.6	
Explosion/Implosion	a) **0001.00**	EnergyAnal_2.2	EnergyAnal_2.3	N	N	EnergyAnal_2.4
	b) EnergyAnal_2.1			EnergyAnal_2.5	EnergyAnal_2.6	

Software Validation Test Report (SVTR)

SVTR#: 4-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.4.4	Test Series Name: Int. Events - HRA

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation Version

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Additional input is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database, and that severe events are correctly distinguished from non-severe events

Test Procedure: Tested in accordance with section 6.4.4.2 of the SVTP for PCSA Tool Version 3.0. No data was entered for "DOE Safeguards and Controls" since it does not exist for version 3.0. Data was entered into "Preventative and Mitigative Features" which did not exist when the SVTP was written. An "Effect on other Functional Areas" checkbox was also added for version 3.0, and data was entered similar to the "Severe Events" checkbox. The extra data entered is located in the HRA Additional Input Table found in Attachment 1.

Test Results

The user input appears correctly on the PCSA What If Report after exiting and re-entering the PCSA Tool. The severe events are correctly distinguished from non-severe events.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

Attachment 1:

HRA Additional Input Table

Data Entry Field	Record 1	Record 2
Preventative and Mitigative Features	HRA_1.6	HRA_2.6
Effect of other Functional Areas	(No) HRA_1.9	(Yes) HRA_2.9

PCSA HRA Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Identification: a) Item No b) Category c) Human Action	Human Failure Event	Performance Shaping Factors	Recovery Action	Effect of Failure	Preventive and Mitigative Features	Severe Events	Effect on other Functional Areas	Additional Information
a) 0001.00	HRA_1.2	HRA_1.3	HRA_1.4	HRA_1.5	HRA_1.6	N	N	HRA_1.7
b) A						HRA_1.8	HRA_1.9	
c) HRA_1.1								
a) 0002.00	HRA_2.2	HRA_2.3	HRA_2.4	HRA_2.5	HRA_2.6	Y	Y	HRA_2.7
b) C2						HRA_2.8	HRA_2.9	
c) HRA_2.1								

Software Validation Test Report (SVTR)

SVTR#: 4-5	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.4.5	Test Series Name: Int. Events - Severe Events

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation Version

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test. Additional input is shown in Attachment 1.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the severe events previously entered are displayed correctly.

Test Procedure: Tested in accordance with section 6.4.5.2 of the SVTP for PCSA Tool Version 3.0. In addition, remarks were entered for the FMEA, What If, Energy Method, and HRA severe event forms. The extra data entered is located in the Severe Events Additional Input Table found in Attachment 1.

Test Results

The severe events are correctly displayed from previous entries in the FMEA, What If, Energy Method, and HRA Reports.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

Attachment 1:

Severe Events Additional Input Table

Form	Remarks
Severe Events List for 'FMEA'	FMEA_1.8
Severe Events List for 'What If'	WhatIf_2.7
Severe Events List for 'Energy Method'	EnergyAnal_1.6
HRA Severe Events	HRA_2.9

PCSA Severe Events Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Type / Item No	Description	Remarks
ENRG_0001.00	Ev.Cat. Collision/Crushing: EnergyAnal_1.1 EnergyAnal_1.2	EnergyAnal_1.6
FMEA_0001.00	FMEA_1.1 FMEA_1.2	FMEA_1.8
HRA__0002.00	Cat. C2: HRA_2.1 HRA_2.2	HRA_2.9
What_0002.00	WhatIf_2.1 WhatIf_2.2	WhatIf_2.7

Software Validation Test Report (SVTR)

SVTR#: 5-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.5.1	Test Series Name: Freq. Analysis - Initiating Event

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database, and the event is correctly labeled as "likely", "unlikely", or "not included".

Test Procedure: Tested in accordance with section 6.5.1.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The user input appears correctly on the PCSA Initiating Event Report after exiting and re-entering the PCSA Tool. The events are correctly labeled as "likely", "unlikely", or "not included".

Test Evaluation (Pass/Fail): Pass

Notes: Manual Data was checked in place of DOE Event. EXHZ_Ex1 was selected for Hazard ID.

Tester: Troy Maxwell	Date: August 9, 2004

PCSA Initiating Event Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Identification

Item Event Hazard	Man.	Description	Frequency	Include for Sequence Analysis	Additional Info	Uncertainty	Time Periods Preclosure Operational
0001.00	Y	InitEvent_1.3	1.10E-02	Y	InitEvent_1.7	Y	100
InitEvent_1.1			InitEvent_1.5	InitEvent_1.6		InitEvent_1.4	100
EXHZ_Ex1							
0002.00	N	InitEvent_2.3	1.10E-06	N	InitEvent_2.7	N	100
InitEvent_2.1			InitEvent_2.5	InitEvent_2.6			100
EXHZ_Ex1							
0003.00	N	InitEvent_3.3	1.10E-06	N	InitEvent_3.7	Y	100
InitEvent_3.1			InitEvent_3.5	InitEvent_3.6		InitEvent_3.4	100
EXHZ_Ex1							

Software Validation Test Report (SVTR)

SVTR#: 5-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta U)
Test ID: 6.5.2	Test Series Name: Freq. Analysis - Event Tree

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaU installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database.

Test Procedure: Tested in accordance with section 6.5.2.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The user input appears correctly on the PCSA Event Tree Report after exiting and re-entering the PCSA Tool. Event_Tree 1.4 is not shown in the Crystal Report for Record 1 since 'Manual Data' is selected for 'InitEvent_1.1'.

Test Evaluation (Pass/Fail): Pass

Notes: Data entry field 'Material at Risk' was added for version 3.0. The input data for this field is located in Attachment 1.

Tester: Troy Maxwell	Date: September 9, 2004

Attachment 1:

Input Data: Event Tree

Data Entry Field	Record 1	Record 2
Material at Risk	Event Tree_1.9	Event Tree_2.9
Safety System or SSC	-	SSC_1.1

PCSA Event Tree Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Scenario a) Item No. b) ID c) Incl for P/A	Initiating Event a) ID b) Frequency	Item No	Subsequent Event	Safety System or SSC	Probability	Uncertainty	Linking
a) 0001.00	a) InitEvent_1.1						
b) Event Tree_1.1	b) 1.10E-02						
c) N							
	Saphire Data Path:						
	Material at Risk: Event Tree_1.9						
	Event Scenario: Event Tree_1.2						
	Additional Information: Event Tree_1.3						
	---						
a) 0002.00	a) InitEvent_2.1	**0001.00**	**Sub_2.5**	SSC_1.1	1.00E-02	**Y**	**F**
b) Event Tree_2.1	b) 1.10E-06		Subsequent_2.6			Subsequent_2.7	Subsequent_2.8
c) Y							
	Saphire Data Path: Event Tree_2.4						
	Material at Risk: Event Tree_2.9						
	Event Scenario: Event Tree_2.2						
	Additional Information: Event Tree_2.3						

PCSA Event Tree Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Scenario ID: Event Tree_2.1 **Initiating Event ID:** InitEvent_2.1

Item No	Subsequent Event	Safety System or SSC	Probability	Uncertainty	Linking
0001.00	**Sub_2.5**	SSC_1.1	1.00E-02	**Y**	**F**
	Subsequent_2.6			Subsequent_2.7	Subsequent_2.8

Software Validation Test Report (SVTR)

SVTR#: 5-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta U)
Test ID: 6.5.3	Test Series Name: Freq. Analysis - Fault Tree

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaU installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database.

Test Procedure: Tested in accordance with section 6.5.3.2 of the SVTP for PCSA Tool Version 3.0. In addition, data was entered into the Fault Tree Event Table for Record 1. The additional input data is located in Attachment 1.

Test Results

The user input appears correctly on the PCSA Fault Tree Report and Fault Tree Event Report after exiting and re-entering the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: September 9, 2004

Attachment 1:

Input Data: Fault Tree Event Table

Data Entry Field	Record 1	Record 2
Event Name	Fault Tree_1.5	N/A
Type of Event	Fault Tree_1.6	N/A
Description	Fault Tree_1.7	N/A
Probability	0.002	N/A
Uncertainty	Fault Tree_1.8	N/A
Additional Info.	Fault Tree_1.9	N/A

PCSA Fault Tree Report

Project: SVTP

Functional ID: A.1.2.3

Description: Node A
Node A1
Node A2
Node A3

Item No	Top Event Name and Description	P/F	Pt. Estimate	Mean Median	5% 95%	Saphire Data Path	Additional Information
0001.00	Fault Tree_1.1	P	2.00E-03	3.00E-03	5.00E-03	Fault Tree_1.4	Fault Tree_1.3
Events	Fault Tree_1.2			4.00E-03	6.00E-03		
0002.00	Fault Tree_2.1	F	2.00E-04	3.00E-04	5.00E-04	Fault Tree_2.4	Fault Tree_2.3
Events	Fault Tree_2.2			4.00E-04	6.00E-04		

PCSA Fault Tree Event Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Top Event: Fault Tree_1.1

Item No	Event Name	Type of Event	Probability	Uncertainty	Description	Additional Info
0001.00	Fault Tree_1.5	Fault Tree_1.6	2.00E-03	Fault Tree_1.8	Fault Tree_1.7	Fault Tree_1.9

Software Validation Test Report (SVTR)

SVTR#: 5-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.5.4	Test Series Name: Freq. Analysis - Event Sequence

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user input is stored correctly in the database.

Test Procedure: Tested in accordance with section 6.5.4.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The user input appears correctly on the PCSA Event Sequence Report after exiting and re-entering the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: Public Dose and Worker Dose were selected for Records 1 and 2 respectively.

Tester: Troy Maxwell	Date: August 2, 2004

PCSA Event Sequence Report

Project: SVTP

Description: Node A
Node A1
Node A2
Node A3

Functional ID: A.1.2.3

Item No	Ev. Scen. ID	Ev. Seq. ID/ Frequency	Appl./ Category	Description	End State	Additional Info	Expected # Events	Probability of Occurrence
0001.00	Event Tree_1.1	EventSeq_1.1	P	EventSeq_1.2	EventSeq_1.3	EventSeq_1.4	1	
		1.00E-02	1					
0002.00	Event Tree_2.1	EventSeq_2.1	W	EventSeq_2.2	EventSeq_2.3	EventSeq_2.4		9.52E-02
		1.00E-03	2					

Software Validation Test Report (SVTR)

SVTR#: 6-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta S)
Test ID: 6.6	Test Series Name: SAPHIRE

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaS installed, SAPHIRE Version 6.80

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies that the PCSA Tool can invoke the SAPHIRE module.

Test Procedure: Tested in accordance with section 6.6.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The SAPHIRE program was invoked and the SAPHIRE window was displayed. The PCSA Tool menu and forms were still available for user access and SAPHIRE was available after the PCSA Tool was closed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 18, 2004

Software Validation Test Report (SVTR)

SVTR#: 7-1-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.7.1	Test Series Name: Conseq. - Worker Dose, Worker Internal, Pool

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data generated from the User Specified input values is calculated correctly and the dose changes for changes in the input parameters.

Test Procedure: Tested in accordance with section 6.7.1.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The generated values from the Worker Dose Form for Inhalation, Submersion, and Skin agree within 5% of the calculated values. The dose changed as expected when the input parameters were altered. The formulas, from the PCSA Users Manual ver. 2.0, for the Inhalation, Submersion, and Skin were input into an EXCEL spreadsheet included in the Appendix. There are two EXCEL spreadsheets used to validate the calculations: WorkerDosefromPoolRelease2min.xls and WorkerDose.xls. Both spreadsheets produced results within 5% of the PCSA Tool.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

Appendix

Test Results from Table 6.7.1-1, 1st row input

Fuel Assem. Breached	8
Gaseous Release Frac.	0.4
Inhalation Rate	0.000333
Air Mixing Volume	1059.1
Time Spent	2
Fuel Type	PWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	1.10E+02	1.23E+10	4.09E+06
Ar39	3.39E-05	3.79E+03	1.26E+00
Kr85	1.06E+03	1.19E+11	3.95E+07
I129	1.95E-02	2.18E+06	7.26E+02
Pb212(Rn220)	2.74E-02	9.26E+01	1.02E+03
Pb214(Rn222)	8.28E-07	9.26E+01	3.08E-02

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	8.50E-01	4.89E-05	
		7.01E-10	4.75E-07
		1.86E-01	1.84E+01
	4.09E-01		
	5.58E-01		
	7.80E-07		
Totals	1.82E+00	1.86E-01	1.84E+01

Row 1 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	1.82E+00	1.86E-01	1.85E+01
EXCEL	1.82E+00	1.86E-01	1.84E+01
Percent Difference	**0.17%**	**0.04%**	**0.30%**

Test Results from Table 6.7.1-1, 2nd row input

Fuel Assem. Breached	8
Gaseous Release Frac.	0.4
Inhalation Rate	0.000333
Air Mixing Volume	1059.1
Time Spent	2
Fuel Type	BWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	4.25E+01	4.75E+09	1.58E+06
Ar39	1.44E-05	1.61E+03	5.36E-01
Kr85	3.83E+02	4.28E+10	1.43E+07
I129	7.61E-03	8.51E+05	2.83E+02
Pb212(Rn220)	1.16E-02	3.60E+01	4.32E+02
Pb214(Rn222)	3.22E-07	3.60E+01	1.20E-02

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	3.28E-01	1.89E-05	
		2.98E-10	2.02E-07
		6.72E-02	6.66E+00
	1.59E-01		
	2.36E-01		
	3.04E-07		
Totals	7.24E-01	6.72E-02	6.66E+00

Row 2 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	7.24E-01	6.71E-02	6.65E+00
EXCEL	7.24E-01	6.72E-02	6.66E+00
Percent Difference	**0.03%**	**0.20%**	**0.21%**

Test Results from Table 6.7.1-1, 3rd row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.4
Inhalation Rate	0.000333
Air Mixing Volume	1059.1
Time Spent	2
Fuel Type	PWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	1.10E+02	2.46E+10	8.19E+06
Ar39	3.39E-05	7.58E+03	2.52E+00
Kr85	1.06E+03	2.37E+11	7.89E+07
I129	1.95E-02	4.36E+06	1.45E+03
Pb212(Rn220)	2.74E-02	1.85E+02	2.04E+03
Pb214(Rn222)	8.28E-07	1.85E+02	6.16E-02

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	1.70E+00	9.78E-05	
		1.40E-09	9.49E-07
		3.72E-01	3.69E+01
	8.17E-01		
	1.12E+00		
	1.56E-06		
Totals	3.63E+00	3.72E-01	3.69E+01

Row 3 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	3.63E+00	3.73E-01	3.69E+01
EXCEL	3.63E+00	3.72E-01	3.69E+01
Percent Difference	**0.10%**	**0.23%**	**0.03%**

Test Results from Table 6.7.1-1, 4th row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.2
Inhalation Rate	0.000333
Air Mixing Volume	1059.1
Time Spent	2
Fuel Type	BWR

Intermed. Results	Ci/Assem	Air Conc.	Inhalation
H3	4.25E+01	4.75E+09	1.58E+06
Ar39	1.44E-05	1.61E+03	5.36E-01
Kr85	3.83E+02	4.28E+10	1.43E+07
I129	7.61E-03	8.51E+05	2.83E+02
Pb212(Rn220)	1.16E-02	3.60E+01	4.32E+02
Pb214(Rn222)	3.22E-07	3.60E+01	1.20E-02

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results	Inhalation	Submersion	Skin
	3.28E-01	1.89E-05	
		2.98E-10	2.02E-07
		6.72E-02	6.66E+00
	1.59E-01		
	2.36E-01		
	3.04E-07		
Totals	7.24E-01	6.72E-02	6.66E+00

Row 4 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	7.24E-01	6.71E-02	6.65E+00
EXCEL	7.24E-01	6.72E-02	6.66E+00
Percent Difference	**0.03%**	**0.20%**	**0.21%**

Test Results from Table 6.7.1-1, 5th row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.2
Inhalation Rate	3.33E-03
Air Mixing Volume	1059.1
Time Spent	2
Fuel Type	PWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	1.10E+02	1.23E+10	4.09E+07
Ar39	3.39E-05	3.79E+03	1.26E+01
Kr85	1.06E+03	1.19E+11	3.95E+08
I129	1.95E-02	2.18E+06	7.26E+03
Pb212(Rn220)	2.74E-02	9.26E+01	1.02E+04
Pb214(Rn222)	8.28E-07	9.26E+01	3.08E-01

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	8.50E+00	4.89E-05	
		7.01E-10	4.75E-07
		1.86E-01	1.84E+01
	4.09E+00		
	5.58E+00		
	7.80E-06		
Totals	1.82E+01	1.86E-01	1.84E+01

Row 5 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	1.82E+01	1.86E-01	1.85E+01
EXCEL	1.82E+01	1.86E-01	1.84E+01
Percent Difference	**0.17%**	**0.04%**	**0.30%**

Test Results from Table 6.7.1-1, 6th row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.2
Inhalation Rate	3.33E-03
Air Mixing Volume	528.05
Time Spent	2
Fuel Type	BWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	4.25E+01	9.53E+09	3.17E+07
Ar39	1.44E-05	3.23E+03	1.08E+01
Kr85	3.83E+02	8.59E+10	2.86E+08
I129	7.61E-03	1.71E+06	5.68E+03
Pb212(Rn220)	1.16E-02	7.22E+01	8.66E+03
Pb214(Rn222)	3.22E-07	7.22E+01	2.40E-01

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	6.59E+00	3.79E-05	
		5.97E-10	4.04E-07
		1.35E-01	1.34E+01
	3.20E+00		
	4.74E+00		
	6.09E-06		
Totals	1.45E+01	1.35E-01	1.34E+01

Row 6 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	1.45E+01	1.34E-01	1.33E+01
EXCEL	1.45E+01	1.35E-01	1.34E+01
Percent Difference	**0.17%**	**0.63%**	**0.50%**

Test Results from Table 6.7.1-1, 7th row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.2
Inhalation Rate	3.33E-03
Air Mixing Volume	528.05
Time Spent	4
Fuel Type	PWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	1.10E+02	2.47E+10	8.21E+07
Ar39	3.39E-05	7.60E+03	2.53E+01
Kr85	1.06E+03	2.38E+11	7.91E+08
I129	1.95E-02	4.37E+06	1.46E+04
Pb212(Rn220)	2.74E-02	1.86E+02	2.05E+04
Pb214(Rn222)	8.28E-07	1.86E+02	6.18E-01

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	3.41E+01	1.96E-04	
		2.81E-09	1.90E-06
		7.46E-01	7.40E+01
	1.64E+01		
	2.24E+01		
	3.13E-05		
Totals	7.29E+01	7.46E-01	7.40E+01

Row 7 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	7.29E+01	7.47E-01	7.41E+01
EXCEL	7.29E+01	7.46E-01	7.40E+01
Percent Difference	**0.03%**	**0.08%**	**0.16%**

Test Results from Table 6.7.1-1, 8th row input

Fuel Assem. Breached	16
Gaseous Release Frac.	0.2
Inhalation Rate	3.33E-03
Air Mixing Volume	528.05
Time Spent	4
Fuel Type	BWR

Intermed. Results

	Ci/Assem	Air Conc.	Inhalation
H3	4.25E+01	9.53E+09	3.17E+07
Ar39	1.44E-05	3.23E+03	1.08E+01
Kr85	3.83E+02	8.59E+10	2.86E+08
I129	7.61E-03	1.71E+06	5.68E+03
Pb212(Rn220)	1.16E-02	7.22E+01	8.66E+03
Pb214(Rn222)	3.22E-07	7.22E+01	2.40E-01

Dose Conv. Fact.	Inhalation	Submersion	Skin
H3	1.73E-11	1.19E-15	N/A
Ar39	N/A	5.54E-14	3.75E-11
Kr85	N/A	4.70E-13	4.66E-11
I129	4.69E-08	N/A	N/A
Rn219	N/A	N/A	N/A
Pb212(Rn220)	4.56E-08	N/A	N/A
Pb214(Rn222)	2.11E-09	N/A	N/A
	9.46E-08	5.27E-13	8.41E-11

Dose Results

	Inhalation	Submersion	Skin
	1.32E+01	7.58E-05	
		1.19E-09	8.09E-07
		2.70E-01	2.67E+01
	6.40E+00		
	9.48E+00		
	1.22E-05		
Totals	2.91E+01	2.70E-01	2.67E+01

Row 8 Input(Table 6.7.1-1)	**Inhalation**	**Submersion**	**Skin**
PCSA Tool Version 3.0	2.90E+01	2.70E-02	2.67E+00
EXCEL	2.91E+01	2.70E-02	2.67E+00
Percent Difference	**0.17%**	**0.14%**	**0.12%**

Software Validation Test Report (SVTR)

SVTR#: 7-2-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.7.2.1.1	Test Series Name: Conseq. - RSAC, Deterministic

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaP installed, pcsa_prob, RSAC Version 6.2

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data generated from the Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) values is calculated correctly.

Test Procedure: Tested in accordance with section 6.7.2.1.1.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The RSAC input agrees with the information contained on the PCSA Tool input form. The output doses displayed by the PCSA Tool agree with the output generated by the standalone RSAC module. The TEDE displayed by the PCSA Tool may differ from that displayed in the rsac output file. For these cases, hand calculations were used to verify that the TEDE from the RSAC output file and the PCSA Tool calculated TEDE values are within 5%. Extracted output data may be seen in the appendix. Crystal Report input values were verified by RSAC6.out input values.

Test Evaluation (Pass/Fail): Pass

Notes: The "Inoperative" option was located under "Release Fraction by Group" and not "Hepa, Bldg. Discharge, Others" for Test Case D.

Tester: Troy Maxwell	Date: August 9, 2004

Appendix

RSAC Public Analysis: 'Test Case A'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Totals

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	2.22E-06	2.22E-06	2.22E-06	2.22E-06	2.22E-06	2.22E-06	0
INGESTION	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05	0
GROUND SURFACE	7.64E-08	7.64E-08	7.64E-08	7.64E-08	7.64E-08	7.64E-08	0
SUBMERSION	1.56E-07	1.56E-07	1.56E-07	1.56E-07	1.56E-07	1.56E-07	0
TEDE	2.76E-05	2.76E-05	2.76E-05	2.76E-05	2.76E-05	2.76E-05	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-1A_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIRIMMERS	TOTAL
22380 U-238	1.29E-14	3.86E-18	1.37E-20	-	1.29E-14
902340 Th-234	3.23E-18	3.50E-18	2.07E-19	-	6.94E-18
922340 U-234	6.40E-14	1.91E-17	8.29E-20	-	6.40E-14
902300 Th-230	1.68E-22	1.19E-23	3.66E-23	-	2.16E-22
862220 Rn-222	- -	0.00E+00	-	0.00E+00	
842180 Po-218	- -	6.40E-18	-	6.40E-18	
822140 Pb-214	1.25E-12	5.94E-14	1.76E-13	-	1.49E-12
832140 Bi-214	6.55E-13	1.50E-15	1.02E-12	-	1.68E-12
822100 Pb-210	2.12E-15	1.28E-16	9.77E-20	-	2.24E-15
832100 Bi-210	4.91E-20	1.14E-19	1.88E-19	-	3.51E-19
952430 Am-243	7.12E-12	7.58E-14	1.98E-16	-	7.20E-12
932390 Np-239	4.06E-17	1.53E-17	5.61E-18	-	6.15E-17
942390 Pu-239	5.76E-11	4.04E-13	1.12E-17	-	5.80E-11
922350 U-235	5.85E-16	1.77E-19	1.61E-19	-	5.85E-16
902310 Th-231	3.99E-21	8.69E-22	2.01E-20	-	2.50E-20
862190 Rn-219	-	-	0.00E+00	-	0.00E+00
822110 Pb-211	1.23E-14	0.00E+00	1.62E-18	-	1.23E-14
832110 Bi-211	-	-	1.56E-18	-	1.56E-18
852110 At-211	6.74E-17	1.58E-18	6.47E-20	-	6.90E-17
832070 Bi-207	8.06E-24	5.80E-24	2.53E-21	-	2.54E-21
812070 Tl-207	- -	1.94E-20	-	1.94E-20	
SUBTOTALS	***2.22E-06***	***2.51E-05***	***7.64E-08***	-	2.74E-05

FINITE MODEL CLOUD GAMMA ***1.56E-07***

TOTAL ***2.76E-05***

RSAC Public Analysis: 'Test Case B'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Totals

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	5.72E-06	5.72E-06	5.72E-06	5.72E-06	5.72E-06	5.72E-06	0
INGESTION	6.44E-05	6.44E-05	6.44E-05	6.44E-05	6.44E-05	6.44E-05	0
GROUND SURFACE	1.81E-07	1.81E-07	1.81E-07	1.81E-07	1.81E-07	1.81E-07	0
SUBMERSION	4.33E-07	4.33E-07	4.33E-07	4.33E-07	4.33E-07	4.33E-07	0
TEDE	7.07E-05	7.07E-05	7.07E-05	7.07E-05	7.07E-05	7.07E-05	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-1B_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIR IMMERS	TOTAL
922380 U-238	3.09E-14	9.27E-18	8.48E-20	-	3.09E-14
902340 Th-234	7.76E-18	4.91E-19	1.28E-18	-	9.53E-18
922340 U-234	1.68E-13	5.03E-17	2.18E-19	-	1.68E-13
902300 Th-230	4.42E-22	3.14E-23	2.29E-22	-	7.03E-22
862220 Rn-222	- -	0.00E+00	-	0.00E+00	
842180 Po-218	- -	1.64E-17	-	1.64E-17	
822140 Pb-214	3.22E-12	1.52E-13	4.53E-13	-	3.82E-12
832140 Bi-214	1.68E-12	3.86E-15	2.62E-12	-	4.31E-12
842140 Po-214	- -	3.02E-20	-	3.02E-20	
822100 Pb-210	5.43E-15	3.30E-16	2.51E-19	-	5.76E-15
832100 Bi-210	1.26E-19	2.93E-19	4.83E-19	-	9.02E-19
952430 Am-243	1.48E-11	1.57E-13	4.10E-16	-	1.50E-11
932390 Np-239	8.43E-17	3.18E-17	1.16E-17	-	1.28E-16
942390 Pu-239	1.53E-10	1.07E-12	2.98E-17	-	1.54E-10
922350 U-235	1.47E-15	4.45E-19	4.04E-19	-	1.47E-15
902310 Th-231	1.00E-20	2.22E-21	5.05E-20	-	6.28E-20
912310 Pa-231	0.00E+00	0.00E+00	- -	0.00E+00	
862190 Rn-219	- -	0.00E+00	-	0.00E+00	
822110 Pb-211	2.64E-14	0.00E+00	3.49E-18	-	2.64E-14
832110 Bi-211	- -	3.35E-18	-	3.35E-18	
852110 At-211	1.45E-16	3.39E-18	1.39E-19	-	1.48E-16
832070 Bi-207	1.73E-23	1.25E-23	5.44E-21	-	5.47E-21
812070 Tl-207	- -	4.17E-20	-	4.17E-20	
SUBTOTALS	***5.72E-06***	***6.44E-05***	***1.81E-07***	-	7.03E-05

FINITE MODEL CLOUD GAMMA ***4.33E-07***

TOTAL ***7.08E-05*** *

5.72E-06 + 6.44E-05 + 1.81E-07 + 4.33E-07 = 7.07E-05

* Percent Diff. ((7.08E-05 - 7.07E-05) / 7.08E-05)100 = 0.09%

RSAC Public Analysis: 'Test Case C'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Totals

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	2.22E-06	2.22E-06	2.22E-06	2.22E-06	2.22E-06	2.22E-06	0
INGESTION	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05	0
GROUND SURFACE	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	0
SUBMERSION	1.56E-07	1.56E-07	1.56E-07	1.56E-07	1.56E-07	1.56E-07	0
TEDE	2.75E-05	2.75E-05	2.75E-05	2.75E-05	2.75E-05	2.75E-05	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-1C_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIR IMMERS	TOTAL
842180 Po-218	- -	6.40E-18	-	6.40E-18	
822140 Pb-214	1.25E-12	5.94E-14	1.76E-13	-	1.49E-12
832140 Bi-214	6.55E-13	1.50E-15	1.02E-12	-	1.68E-12
822100 Pb-210	2.12E-15	1.28E-16	9.77E-20	-	2.24E-15
832100 Bi-210	4.91E-20	1.14E-19	1.88E-19	-	3.51E-19
862190 Rn-219	- -	0.00E+00	-	0.00E+00	
822110 Pb-211	1.23E-14	0.00E+00	1.62E-18	-	1.23E-14
832110 Bi-211	- -	1.56E-18	-	1.56E-18	
852110 At-211	6.74E-17	1.58E-18	6.47E-20	-	6.90E-17
832070 Bi-207	8.06E-24	5.80E-24	2.53E-21	-	2.54E-21
812070 Tl-207	- -	1.94E-20	-	1.94E-20	
SUBTOTALS	***2.22E-06***	***2.51E-05***	***6.96E-08***	-	2.74E-05

FINITE MODEL CLOUD GAMMA ***1.56E-07***

TOTAL ***2.75E-05***

RSAC Public Analysis: 'Test Case D'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Totals

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	0
INGESTION	2.69E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	0
GROUND SURFACE	3.45E-05	3.45E-05	3.45E-05	3.45E-05	3.45E-05	3.45E-05	0
SUBMERSION	1.77E-06	1.77E-06	1.77E-06	1.77E-06	1.77E-06	1.77E-06	0
TEDE	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.06E-04	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-1D_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIR IMMERS	TOTAL
942420 Pu-242	1.24E-08	5.01E-12	4.59E-15	-	1.24E-08
942380 Pu-238	2.44E-05	1.70E-07	1.19E-11	-	2.46E-05
922380 U-238	4.12E-10	1.24E-13	1.13E-15	-	4.13E-10
902340 Th-234	1.04E-13	6.55E-15	1.71E-14	-	1.27E-13
912340 Pa-234	2.91E-19	2.07E-18	7.56E-15	-	7.56E-15
912341 Pa-234m	- -	3.90E-20	-	3.90E-20	
922340 U-234	2.25E-09	6.73E-13	2.92E-15	-	2.25E-09
902300 Th-230	2.96E-18	4.19E-19	3.06E-18	-	6.44E-18
862220 Rn-222	- -	0.00E+00	-	0.00E+00	
842180 Po-218	- -	6.62E-17	-	6.62E-17	
822140 Pb-214	8.23E-12	3.43E-14	1.82E-12	-	1.01E-11
832140 Bi-214	2.50E-12	1.56E-14	1.05E-11	-	1.31E-11
842140 Po-214	- -	1.22E-19	-	1.22E-19	
822100 Pb-210	3.35E-15	3.09E-16	2.51E-19	-	3.65E-15
832100 Bi-210	3.45E-20	2.66E-19	1.63E-18	-	1.93E-18
952430 Am-243	1.98E-07	2.11E-09	5.49E-12	-	2.00E-07
932390 Np-239	1.13E-12	4.26E-13	1.56E-13	-	1.71E-12
942390 Pu-239	2.04E-06	1.43E-08	3.99E-13	-	2.06E-06
922350 U-235	1.97E-11	5.95E-15	5.41E-15	-	1.97E-11
902310 Th-231	1.38E-16	2.98E-17	6.77E-16	-	8.45E-16
912310 Pa-231	1.69E-19	1.77E-19	- -	3.46E-19	
862190 Rn-219	- -	0.00E+00	-	0.00E+00	
822110 Pb-211	1.90E-13	0.00E+00	2.52E-17	-	1.91E-13
832110 Bi-211	- -	2.41E-17	-	2.41E-17	
852110 At-211	3.64E-16	8.53E-18	3.50E-19	-	3.73E-16
832070 Bi-207	1.89E-23	3.04E-23	1.33E-20	-	1.33E-20
812070 Tl-207	- -	2.90E-19	-	2.90E-19	
SUBTOTALS	***1.01E-04***	***2.69E-04***	***3.45E-05***	-	4.04E-04

FINITE MODEL CLOUD GAMMA ***1.77E-06***

TOTAL ***4.06E-04***

Software Validation Test Report (SVTR)

SVTR#: 7-2-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.7.2.1.2	Test Series Name: Conseq. - RSAC, Deterministic, User Specified

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaP installed, pcsa_prob, RSAC Version 6.2

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data generated from the User Specified input values is calculated correctly.

Test Procedure: Tested in accordance with section 6.7.2.1.2.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The RSAC input agrees with the information contained on the PCSA Tool input form. The output doses displayed by the PCSA Tool agree with the output generated by the standalone RSAC module. The TEDE displayed by the PCSA Tool may differ from that displayed in the rsac output file. For these cases, hand calculations were used to verify that the TEDE from the RSAC output file and the PCSA Tool calculated TEDE values are within 5%. Extracted output data may be seen in the appendix. Crystal Report input values were verified by RSAC6.out input values.

Test Evaluation (Pass/Fail): Pass

Notes: Setting the HEPA Filtration to "Inoperative" was provided under "Release Fraction by Group" and not under "Hepa, Bldg. Discharge, Others" for Test Case B User.

Tester: Troy Maxwell	Date: August 6, 2004

Appendix:

RSAC Public Analysis: 'TestCaseA_User'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Total

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	3.10E-11	3.10E-11	3.10E-11	3.10E-11	3.10E-11	3.10E-11	0
INGESTION	2.09E-13	2.09E-13	2.09E-13	2.09E-13	2.09E-13	2.09E-13	0
GROUND SURFACE	1.06E-17	1.06E-17	1.06E-17	1.06E-17	1.06E-17	1.06E-17	0
SUBMERSION	5.16E-21	5.16E-21	5.16E-21	5.16E-21	5.16E-21	5.16E-21	0
TEDE	3.12E-11	3.12E-11	3.12E-11	3.12E-11	3.12E-11	3.12E-11	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-2A_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIR IMMERS	TOTAL
922340 U-234	4.15E-12	2.11E-14	5.35E-18	-	4.17E-12
902300 Th-230	1.09E-20	7.73E-22	5.61E-27	-	1.17E-20
942390 Pu-239	2.69E-11	1.88E-13	5.25E-18	-	2.71E-11
922350 U-235	8.80E-25	9.87E-26	0.00E+00	-	9.79E-25
SUBTOTALS	***3.10E-11***	***2.09E-13***	***1.06E-17***	-	3.12E-11

FINITE MODEL CLOUD GAMMA ***5.16E-21***

TOTAL ***3.12E-11***

RSAC Public Analysis: 'TestCaseB_User'

RSAC Input | RSAC Output

Summary Results | Inhalation | Ingestion | Ground Surface | Totals

Pathway	Mean Dose per Event Sequence (rem)	Minimum	5th	50th	95th	Maximum	Number
INHALATION	1.48E-08	1.48E-08	1.48E-08	1.48E-08	1.48E-08	1.48E-08	0
INGESTION	4.99E-09	4.99E-09	4.99E-09	4.99E-09	4.99E-09	4.99E-09	0
GROUND SURFACE	3.40E-08	3.40E-08	3.40E-08	3.40E-08	3.40E-08	3.40E-08	0
SUBMERSION	4.28E-11	4.28E-11	4.28E-11	4.28E-11	4.28E-11	4.28E-11	0
TEDE	5.38E-08	5.38E-08	5.38E-08	5.38E-08	5.38E-08	5.38E-08	0

Plot by Pathway: Dose by Pathway with Total | Dose by Pathway

Plot by Radionuclide: Inhalation | Ingestion | Ground Surface | Combined

Data extracted from 7-2-2B_Rsac6.out:

NUCLIDE	INHALATION	INGESTION	GROUND SUR	AIR IMMERS	TOTAL
270600 Co- 60	1.48E-08	4.99E-09	3.40E-08	-	5.37E-08
922340 U-234	2.07E-12	1.05E-14	2.67E-18	-	2.08E-12
902300 Th-230	5.45E-21	3.86E-22	2.80E-27	-	5.83E-21
SUBTOTALS	***1.48E-08***	***4.99E-09***	***3.40E-08***	-	5.37E-08

FINITE MODEL CLOUD GAMMA ***4.28E-11***

TOTAL ***5.37E-08 **

1.48E-08 + 4.99E-09 + 3.40E-08 + 4.28E-11 = 5.38E-08

* Percent Diff. ((5.37E-08 - 5.38E-08) / 5.38E-07)100 = 0.25%

Software Validation Test Report (SVTR)

SVTR#: 7-2-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.7.2.1.3	Test Series Name: Conseq. - RSAC, Advanced Input

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaP installed, RSAC Version 6.2

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the information generated by the RSAC standalone module and placed in the rsac6.out file is the information the user entered as input in rsac6.in.

Test Procedure: Tested in accordance with section 6.7.2.1.3.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The information generated from the RSAC standalone module correctly displayed the test input in the rsac6.out file. Data extracted from 7-2-3_RSAC6.out are shown in the appendix.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 6, 2004

Appendix:

```
* Dose Calcs for inhalation, ingestion, ground surface, & submersion
# Released Activities (Ci) for PWR, BWR, or User Specified SNF
2000, 1
TH231, 1.20E-12
U234, 2.40E-12

U235, 1.80E-12
2999
# Meteorological data
5000, 0
5001, 3.0, 40.0, 1420.0, 1.29e+03, 0.0, 1
5002, 0.001, 0.01, 0.0, 0.001, 0.001
5101, 11000.0
5201, 1.0, 0.0
5400, 2, 0.0, 0.0
5410, 1, 6, 0
5999
# INHALATION Dose Calculation
7000, 1, 1, 1, 0, 1
7001, 3.33e-04, 0.0, 0, 0
7003, 1.0, 3
7999
# INGESTION Dose Calculation
7000, 3, 1, 1, 0, 1
7001, 0, 0.0, 1.0, 0
7004, 0, 2, 7.0, 7.0
7051, 23.8, 15.0, 3.7, 4.1, 0.76, 1.0
7052, 0.57, 0.2, 1.0, 0.0021, 7, 7, 1.0
7053, 225.0, 14.0, 1.0, 16.0, 2.0, 20.0
7054, 0.4, 0.43, 14.0, 3.0, 1.23, 4.9
7055, 0.5, 0.33, 0.5, 0.33
7999
# GROUND SURFACE Dose Calculation
7000, 4, 1, 1, 0, 1
7001, 0, 0.0, 1.0, 0.7
7999
# Submersion Dose Calc for a FINITE plume
9000, 0, 0.0
10000
```

Software Validation Test Report (SVTR)

SVTR#: 7-2-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.7.2.1.4	Test Series Name: Conseq. - RSAC, Probabilistic, Four Realizations

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaP installed, pcsa_lhs, pcsa_lhsinp, pcsa_prob, RSAC Version 6.2

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the dose generated from the probabilistic run can also be computed from four deterministic runs.

Test Procedure: Tested in accordance with section 6.7.2.1.4.1 of the SVTP for PCSA Tool Version 3.0.

Test Results

A Probabilistic run of four realizations was performed, data was extracted and reentered into four deterministic runs, and the data calculated from the deterministic runs is within 5% of the probabilistic run.

The percent difference results are shown in Attachment 1.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 6, 2004

Attachment 1

% Diff.	Prob.	Det. Avg.	Det. 1	Det. 2	Det. 3	Det. 4
0.5%	5.27E-10	5.24E-10	3.32E-11	1.68E-09	3.29E-10	5.43E-11
0.4%	7.11E-11	7.08E-11	4.48E-12	2.27E-10	4.44E-11	7.33E-12
0.1%	3.59E-15	3.59E-15	2.26E-16	1.15E-14	2.25E-15	3.71E-16
0.3%	8.76E-20	8.73E-20	5.51E-21	2.80E-19	5.48E-20	9.04E-21
0.4%	5.98E-10	5.96E-10	3.77E-11	1.91E-09	3.73E-10	6.16E-11

Software Validation Test Report (SVTR)

SVTR#: 7-2-5	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P - 10 realization scenario, Beta U - 100 realization scenario)
Test ID: 6.7.2.1.5	Test Series Name: Conseq. - RSAC, Probabilistic, Ten Realizations

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaP, Beta U, installed, pcsa_lhs, pcsa_lhsinp, pcsa_prob, RSAC Version 6.2

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the values from the lhs.out fall within the range of values specified for the probabilistic parameter input distributions for Release Fraction by Group and Meteorological Data.

Test Procedure: Tested in accordance with section 6.7.2.1.5.2 of the SVTP for PCSA Tool Version 3.0. Performed a subsequent test comparing 100-realization sample sets to target CDFs and used PCSA Tool Version BetaU for this test.

Test Results

A Probabilistic run of ten realizations was performed. The values from the lhs.out file fall with the range of the two specified probabilistic input parameters. The output data is shown in attachment 1. The values from lhs.out from the 100-realization test fall along the target CDF plots as shown in attachment 2.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: September 13, 2004

Attachment 1:

Calculations to verify value is within specified range. The lower LHS data is subtracted from the specified input while the specified input is subtracted from the higher LHS data. Hence all positive values in the two far right columns indicate the LHS output falls within the range of specified user input.

Realization #	Release Fraction	# - 2.0E-6	2.4E-4 - #
1	2.18E-06	1.76E-07	2.38E-04
2	6.65E-06	4.65E-06	2.33E-04
3	1.81E-05	1.61E-05	2.22E-04
4	5.29E-06	3.29E-06	2.35E-04
5	9.02E-06	7.02E-06	2.31E-04
6	3.12E-06	1.12E-06	2.37E-04
7	4.05E-06	2.05E-06	2.36E-04
8	7.76E-05	7.56E-05	1.62E-04
9	2.92E-05	2.72E-05	2.11E-04
10	1.50E-05	1.30E-05	2.25E-04

Realization #	Avg. Wind Vel.	# - 0.978	13.2 - #
1	2.73	1.75	10.47
2	4.77	3.80	8.43
3	1.53	0.55	11.67
4	2.34	1.36	10.86
5	1.91	0.93	11.29
6	3.81	2.83	9.39
7	2.93	1.95	10.27
8	6.14	5.17	7.06
9	10.99	10.01	2.21
10	1.78	0.80	11.42

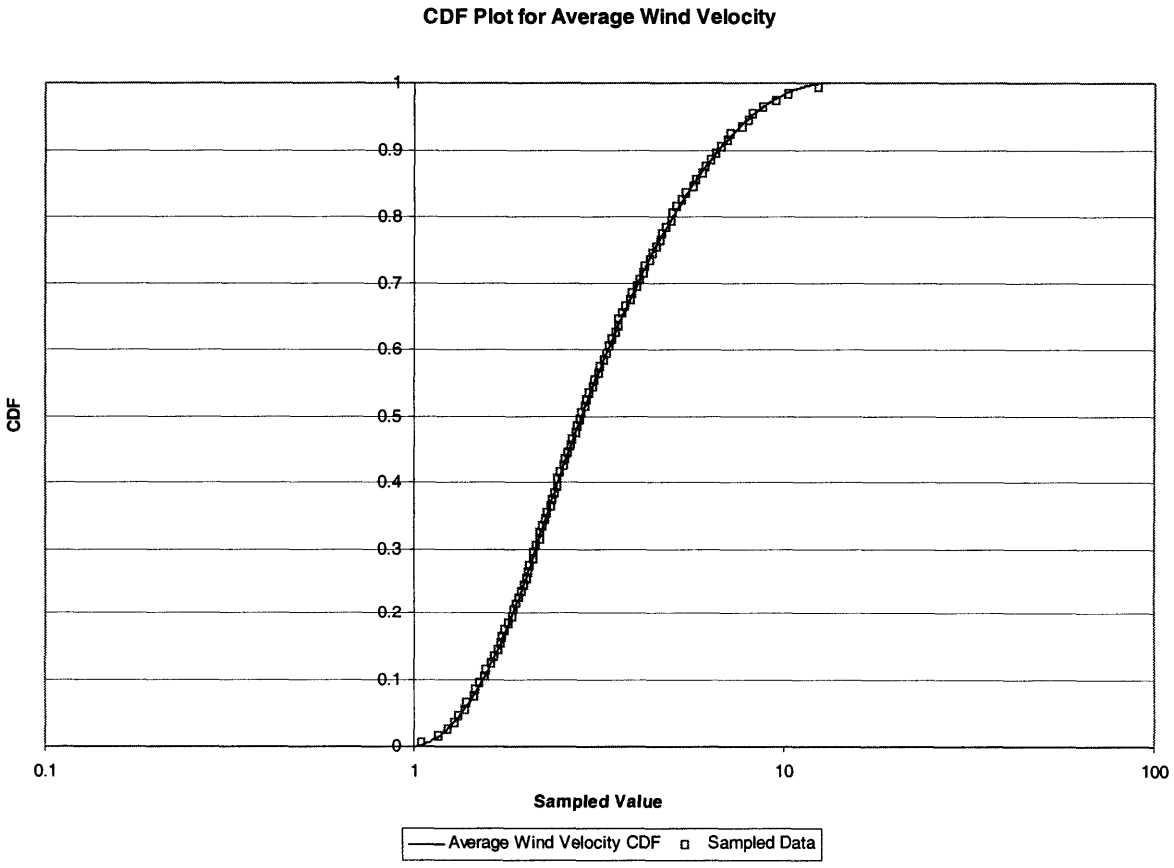
LHS output data:

1	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.04E-05	0.00E+00	2.18E-06	2.73E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
2	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.74E-06	0.00E+00	6.65E-06	4.77E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01

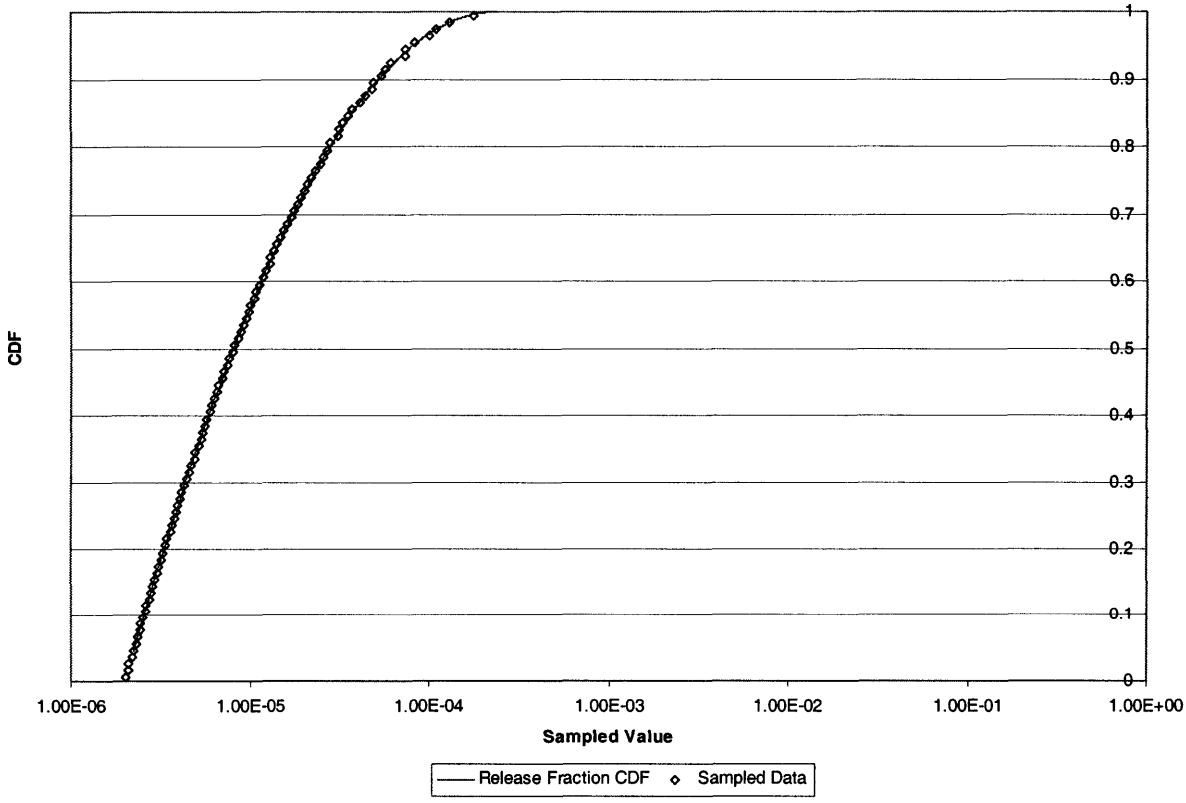
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
3	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.15E-05	0.00E+00	1.81E-05	1.53E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
4	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.21E-04	0.00E+00	5.29E-06	2.34E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
5	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.27E-05	0.00E+00	9.02E-06	1.91E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
6	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.28E-06	0.00E+00	3.12E-06	3.81E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01

5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
7	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.74E-05	0.00E+00	4.05E-06	2.93E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
8	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.03E-05	0.00E+00	7.76E-05	6.14E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
9	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.05E-06	0.00E+00	2.92E-05	1.10E+01	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01
10	55			
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.57E-05	0.00E+00	1.50E-05	1.78E+00	1.42E+03
2.00E-02	1.00E-02	0.00E+00	6.00E-03	2.30E-02
6.00E+00	3.33E-04	0.00E+00	1.00E+00	0.00E+00
1.00E+00	7.00E+00	7.00E+00	2.38E+01	1.50E+01
3.70E+00	4.10E+00	7.60E-01	1.00E+00	5.70E-01
2.00E-01	1.00E+00	2.10E-03	3.50E+00	3.50E+00
1.00E+00	2.25E+02	1.40E+01	1.00E+00	1.60E+01
2.00E+00	2.00E+01	4.00E-01	4.30E-01	1.40E+01
3.00E+00	1.23E+00	4.90E+00	5.00E-01	3.30E-01
5.00E-01	3.30E-01	0.00E+00	1.00E+00	7.00E-01

Attachment 2:



CDF Plot for Release Fraction for Other Particulates and Fuel Fines



Software Validation Test Report (SVTR)

SVTR#: 7-2-6	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.7.2.2.1	Test Series Name: Conseq. - MELCOR, PWR

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine GRIFFON, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed, MELCOR 1.8.5

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies the input files to the MELCOR modules contain the parameters identified as input within the PCSA Tool and the output extracted from the MELCOR output file by the PCSA Tool is the actual data from the MELCOR output file.

Test Procedure: Tested in accordance with section 6.7.2.2.1.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

Test results are located in the Appendix.

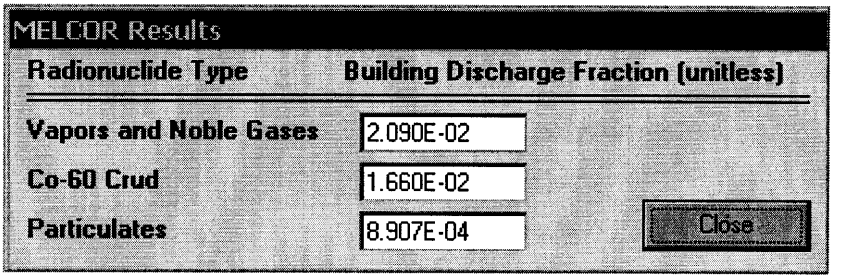
The data from Table 6.7.2-11 of the SVTP for PCSA Tool Version 3.0 was input into MELCOR. The input file contains the same data entered into the PCSA Tool. The output data from the 8MEL.OUT and MELCOR output is identical to the results from section 6.7.2.2.1.3 of the SVTP for PCSA Tool Version 3.0.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

Appendix

	Output
Screen Output Results	 MELCOR Results Radionuclide Type — Building Discharge Fraction (unitless) Vapors and Noble Gases: 2.090E-02 Co-60 Crud: 1.660E-02 Particulates: 8.907E-04 Close
Output from 8mel.out	RADIOACTIVE RADIONUCLIDE FRACTIONAL DISTRIBUTION CLASS TYPE01 TYPE09 1 9.791E-01 2.090E-02 2 9.991E-01 8.908E-04 3 9.991E-01 8.930E-04 4 9.791E-01 2.094E-02 5 9.991E-01 8.942E-04 6 9.991E-01 8.907E-04 7 9.834E-01 1.660E-02 8 9.991E-01 8.906E-04 9 9.991E-01 8.942E-04 10 9.991E-01 8.907E-04 11 9.991E-01 8.908E-04 12 9.991E-01 8.907E-04 13 0.000E+00 0.000E+00 14 0.000E+00 0.000E+00 15 0.000E+00 0.000E+00 16 0.000E+00 0.000E+00 17 9.999E-01 6.327E-05

PWR

```
*
*EOR* MELGEN
*
TITLE     'WHB Assembly Cell'
*
*********
* FILES *
*********
*
OUTPUTFILE   8melg.OUT
DIAGFILE     8melg.DIA
RESTARTFILE  8mel.RST
*
*  initial time step
DTTIME  0.1      * default initial dt=1
**
*******************************************************************
*******************************************************************
*                              NCG INPUT
*******************************************************************
*******************************************************************
*
NCG001    N2    4                          * MATERIAL 4 IS N2
NCG002    O2    5                          * MATERIAL 5 IS O2
NCG333    H2    6                          * MATERIAL 6 IS H2
*
*******************************************************************
*******************************************************************
*                            CVH/FL INPUT
*******************************************************************
*******************************************************************
*
**************************
*  CONTROL VOLUME INPUT  *
**************************
*
*
CV10100   'ASSEMBLY CELL#1' 2    1    1      * NON-EQL, HORZ, CV id
CV10101     2      0                         * POOL ALLOWED, NO FOG
CV10103  268.0 (LxW) = 20x13.4 = 268         * FLOW AREA (LxW)
CV101A0     3                                * POOL/ATM INPUT
CV101A1  PVOL 1.0130E05  RHUM 0.5  TATM 305.0  * P = 1 ATM, HUMID, T(K)
CV101A3    MLFR.4   0.8   MLFR.5  0.2        * 0.8 N2, 0.2 O2
CV101B0    0.0      0.0                      * bottom (m); vol (m^3)
CV101B1  0.5    134.0                       * CEILING m; VOL m^3
*
CV10200   'ASSEMBLY CELL#2' 2    1    1      * NON-EQL, HORZ, CV id
CV10201     2      0                         * POOL ALLOWED, NO FOG
CV10203  268.0                               * FLOW AREA (LxW)
CV102A0     3                                * POOL/ATM INPUT
CV102A1  PVOL 1.0130E05  RHUM 0.5  TATM 305.0  * P = 1 ATM, HUMID, T(K)
CV102A3    MLFR.4    0.8   MLFR.5  0.2       * 0.8 N2, 0.2 O2
CV102B0  0.5    0.0                     * bottom (m); vol (m^3)
CV102B1  15.0    3886.0                      * CEILING m; VOL m^3
*
CV10300   'ASSEMBLY CELL#3' 2    1    1      * NON-EQL, HORZ, CV id
CV10301     2      0                         * POOL ALLOWED, NO FOG
```

room length

indoor temperature

```
CV10303  268.0                                  * FLOW AREA (LxW)
CV103A0     3                                    * POOL/ATM INPUT
CV103A1  PVOL 1.0130E05  RHUM 0.5  TATM 305.0  * P = 1 ATM, HUMID, T(K)
CV103A3    MLFR.4   0.8   MLFR.5  0.2          * 0.8 N2, 0.2 O2
CV103B0  15.0    0.0                       * bottom (m); vol (m^3)
CV103B1  15.24    64.3200000000001                      * CEILING m; VOL m^3
*
*
CV90000   ENVIRONMENT      2    1    9        * ENVIRONMENT
CV90001   0   -1                              * NORM POOL/FOG,T-INDEP
*                                             * NO POOL
CV900A1  PVOL 1.0130E05  TATM 300.0  TDEW 280.0 * ATM PRESS,T(K),DEW PT(K)
CV900A3    MLFR.4   0.8   MLFR.5  0.2         * 0.8 N2, 0.2 O2
CV900B0    -5.0     0.0                       * Ground Surface at -5 m
CV900B1    45.0     1.0E5                     * Height m; atm vol m^3
*
************************
*      FLOW PATHS      *
************************
*
*                       VOLUMES      JUNCT.ELEV
*                      FROM   TO     FROM    TO
FL20100  LOW_H_FLOW    101   102   0.5   0.5
FL20101  268.0   0.5    1.0                * FLOW A, L, OPEN FRACT
FL20102    0      0                         * NORMAL VERTICAL FLOW
FL20103    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL201S1  268.0   0.5   16.047904191616 8              * SEGMENT A, L, HYD.DIAM.
*
FL20200  HIGH_H_FLOW   102   103   15.0   15.0
FL20201  268.0   0.5    1.0                * FLOW A, L, OPEN FRACT
FL20202    0      0                         * NORMAL VERTICAL FLOW
FL20203    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL202S1  268.0   0.5   16.047904191616 8              * SEGMENT A, L, HYD.DIAM.
*
*                       VOLUMES      JUNCT.ELEV
*                      FROM   TO     FROM    TO
FL12500  VENTOUT      102   900     4.0   40.0
*
FL12501  1.0   36.0    1.0                * FLOW A, L, OPEN FRACT
FL12502    0      0                         * NORMAL VERTICAL FLOW
FL12503    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL12504  7.08   0.0                       * FLOW VEL 30000cfm AIR,POOL
FL125S1  1.0   4.0   1.0                * SEGMENT A, L, HYD.DIAM.
FL125P1  FANA   312.7  14.16  5.0   0    * (x5)MAX PHEAD; RATE-MAX,@MAXP
*
************************
* HEAT STRUCTURE INPUT *
************************
*
HS10001000   5       1       0
HS10001001   'ROOM FLOOR'
HS10001002   0.      0.
HS10001100   -1      1       0.
HS10001101   0.25      5
HS10001200   -1
HS10001201   'NEW CONCRETE'          4
HS10001300   0
```

flow rate

```
HS10001400   0
HS10001600   1       101     EXT     0.5     0.5  * see HSCCCCC400 + 500
HS10001700  268.0  13.4  15.24  * floor area; boundary L; flow perp L
*
HS90001000   5       1       0
HS90001001   'PARKING LOT'
HS90001002   0.      0.
HS90001100   -1      1       0.
HS90001101   2.      5
HS90001200   -1
HS90001201   'NEW CONCRETE'          4
HS90001300   0
HS90001400   0
HS90001600   1       900     EXT     0.5     0.5
HS90001700   5000.    50.    100.  * floor area; boundry L; flow perp L
*
****************************************
* THERMAL PROPERTIES FOR NEW CONCRETE *
****************************************
MPMAT10200   'NEW CONCRETE'
MPMAT10201   THC   821     * THERMAL CONDUCTIVITY VS. TEMPERATURE
MPMAT10202   CPS   822     * SPECIFIC HEAT VS. TEMPERATURE
MPMAT10203   RHO   823     * DENSITY VS. TEMPERATURE
*
TF82100   'THC CONCRETE'   2   1.0   0.0
TF82111   273.15   1.3       10000.0   1.3
*
TF82200   'CPS CONCRETE'   2   1.0   0.0
TF82211   273.15   1200.0    10000.0   1200.0
*
TF82300   'RHO CONCRETE'   2   1.0   0.0
TF82311   273.15   2340.0    10000.0   2340.0
*
*************************
* DECAY HEAT DEFINITION *
*************************
DCHDEFCLS0  ALL
DCHCLS0170  'U Released from Fuel'
DCHCLS0171  FF
DCHCLSNORM  'NO'
*
* ==============================
* REDEFINE DECAY HEATS
* ==============================
ALLOWREPLACE
* Update decay heats
* Input time(s) & decay heat power(W/kg) for each element
*
* Decay heat output was normalized by the entire RN class mass
* and the element fractions were all set to one.
*
*      Element\/  \/ Fraction of Class Mass
DCHNEM0100   'CO' 1.0
DCHNEM0101          0.0  1.4400E-01
DCHNEM0102     200000.0  1.4400E-01
DCHNEM0200   'KR' 1.0
DCHNEM0201          0.0  4.5300E-01
```

```
DCHNEM0202     200000.0  4.5300E-01
DCHNEM0300   'SR' 1.0
DCHNEM0301          0.0  9.4000E01
DCHNEM0302     200000.0  9.4000E01
DCHNEM0400   'Y'  1.0
DCHNEM0401          0.0  4.3700E01
DCHNEM0402     200000.0  4.3700E01
DCHNEM0500   'SB' 1.0
DCHNEM0501          0.0  4.2700E-01
DCHNEM0502     200000.0  4.2700E-01
DCHNEM0600   'CS' 1.0
DCHNEM0601          0.0  2.5600E01
DCHNEM0602     200000.0  2.5600E01
DCHNEM0700   'BA' 1.0
DCHNEM0701          0.0  9.4000E01
DCHNEM0702     200000.0  9.4000E01
DCHNEM0900   'EU' 1.0
DCHNEM0901          0.0  4.3700E01
DCHNEM0902     200000.0  4.3700E01
DCHNEM1000   'PU' 1.0
DCHNEM1001          0.0  8.1000E-01
DCHNEM1002     200000.0  8.1000E-01
DCHNEM1100   'AM' 1.0
DCHNEM1101          0.0  4.3700E01
DCHNEM1102     200000.0  4.3700E01
DCHNEM1200   'CM' 1.0
DCHNEM1201          0.0  4.3700E01
DCHNEM1202     200000.0  4.3700E01
DCHNEM3500   'FF' 1.0
DCHNEM3501          0.0  8.7800E-01
DCHNEM3502     200000.0  8.7800E-01
*
* Zero default decay heats
DCHNEM0800   'PM' 0.0
DCHNEM0801        0.0  0.0
DCHNEM1300   'XE' 0.0
DCHNEM1301        0.0  0.0
DCHNEM1400   'RB' 0.0
DCHNEM1401        0.0  0.0
DCHNEM1500   'I'  0.0
DCHNEM1501        0.0  0.0
DCHNEM1600   'BR' 0.0
DCHNEM1601        0.0  0.0
DCHNEM1700   'TE' 0.0
DCHNEM1701        0.0  0.0
DCHNEM1800   'SE' 0.0
DCHNEM1801        0.0  0.0
DCHNEM1900   'RU' 0.0
DCHNEM1901        0.0  0.0
DCHNEM2000   'RH' 0.0
DCHNEM2001        0.0  0.0
DCHNEM2100   'PD' 0.0
DCHNEM2101        0.0  0.0
DCHNEM2200   'MO' 0.0
DCHNEM2201        0.0  0.0
DCHNEM2300   'TC' 0.0
DCHNEM2301        0.0  0.0
```

```
DCHNEM2400   'NB' 0.0
DCHNEM2401        0.0  0.0
DCHNEM2500   'CE' 0.0
DCHNEM2501        0.0  0.0
DCHNEM2600   'ZR' 0.0
DCHNEM2601        0.0  0.0
DCHNEM2700   'NP' 0.0
DCHNEM2701        0.0  0.0
DCHNEM2800   'LA' 0.0
DCHNEM2801        0.0  0.0
DCHNEM2900   'PR' 0.0
DCHNEM2901        0.0  0.0
DCHNEM3000   'ND' 0.0
DCHNEM3001        0.0  0.0
DCHNEM3100   'U'  0.0
DCHNEM3101        0.0  0.0
DCHNEM3200   'AS' 0.0
DCHNEM3201        0.0  0.0
DCHNEM3300   'SN' 0.0
DCHNEM3301        0.0  0.0
DCHNEM3400   'AG' 0.0
DCHNEM3401        0.0  0.0
*
**********************
* RADIONUCLIDE INPUT *
**********************
*
*        ACTIVATE RN1 PACKAGE
RN1000   0
*
*       NUMSEC NUMCOMP NUMCLS H2O# B2O3# #AERO-S #VAP-S CSI# CHEM#
RN1001    20      17      17    14   13     12       2    16    6
*
RNCC001  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17
*
* AEROSOL MIN AND MAX DIAMETERS; AEROSOL NOMINAL DENSITY
*         DMIN      DMAX   NOM.DENSITY(kg/m^3)
RN1100  1.0000E-08   1.0000E-02     1000.0
*
* PARTICLE SIZE DISTRIBUTION
* --------------------------
* See p. 57-58 of "Commerical SNF Accident Release Fractions" (1999)
* ANL-WHS-SE-000002 REV 00
* MMD = Mass Median Diameter
* GSD = Geometric Standard Deviation
*  Burst Rupture> MMD=150 mircometers, GSD=3.8 (Lorenz et al. 1980)
* Impact Rupture> MMD= 18 mm, GSD=8.18 (Mecham et al. 1981)
* Crud Distrib => MMD= 9.7E-6 m, GSD=1.87 (Sandoval et al. 1991)
*           2=gas,vapor              2=LOGNORMAL
*       CV PHS CLS RFRAC MRATE   TAB DIST
RNVS010  102 2   1  1.0   1.4100E00  555     * Noble Gas, Xe
RNAS020  102 2   2  1.0   3.5500E-05  555   2 * Alkali Metals, Cs
RNAS021                    2.1000E-02  8.18  * MMD(m) GSD
RNAS030  102 2   3  1.0   3.9000E-05  555   2 * Alkaline Earths, Ba
RNAS031                    2.1000E-02  8.18  * MMD(m) GSD
RNVS040  102 2   4  1.0   1.6400E-02  555     * Halogens, I
RNAS050  102 2   5  1.0   5.8100E00  555   2 * Chalcogens
```

released spent nuclear fuel

```
RNAS051                          2.1000E-02  8.18   * MMD(m) GSD
RNAS060  102 2   6  1.0   1.0900E-04  555   2 * Planitoids
RNAS061                          2.1000E-02  8.18   * MMD(m) GSD
RNAS070  102 2   7  1.0   2.3500E-04  555   2 * Early Trans Metals
RNAS071                          9.7000E-06  1.87   * Co CRUD values, MMD(m) GSD
RNAS080  102 2   8  1.0   2.3400E-04  555   2 * Tetravalents
RNAS081                          2.1000E-02  8.18   * MMD(m) GSD
RNAS090  102 2   9  1.0   1.1100E-05  555   2 * Trivalents
RNAS091                          2.1000E-02  8.18   * MMD(m) GSD
RNAS100  102 2  10  1.0   8.0400E-04  555   2 * Uranium
RNAS101                          2.1000E-02  8.18   * MMD(m) GSD
RNAS110  102 2  11  1.0   2.4600E-07  555   2 * More Volatile
RNAS111                          2.1000E-02  8.18   * MMD(m) GSD
RNAS120  102 2  12  1.0   3.7300E-06  555   2 * Less Volatile
RNAS121                          2.1000E-02  8.18   * MMD(m) GSD
RNAS130  102 2  11  1.0   4.8400E-07  555   2 * B, Si, P
RNAS131                          2.1000E-02  8.18   * MMD(m) GSD
RNAS140  101 2  17  1.0   6.1800E02  555   2 * Large SNF particles of U
RNAS141                          5.0000E-02  0.1    * Forced large sizes, MMD(m) GSD
*
* aerosol TF linearly decreasing from 2.0 kg/s to zero in 1 s
*                                 \/ Enter # of Assemblies BELOW
*          TFNAME  NTFPAR  TFSCAL  TFADCN   # Fuel Assemblies Breached
TF55500   AERO-S    2       6.0     0.0
TF55510    0.0      2.0                      *  TIME(s)  RATE(kg/s)
TF55511    1.0      0.0                      *  TIME(s)  RATE(kg/s)
*
* AEROSOL COEFFICIENTS
*
RNACOEF  1  *CALCULATE THE COEFFICIENTS
*
* ADD AEROSOL DEPOSITION SURFACES
*
RNDS001  10001  RHS  FLOOR    *ROOM FLOOR    CV101
RNDS002  90001  RHS  FLOOR    *PARKING LOT   CV900
*
* FLOW THROUGH AREAS FOR DEPOSITION
*       CV_out CV-in  Elev  Area
RNSET001  102  101   0.5   268.0
RNSET002  103  102   15.0   268.0
*
*
. * End of MELGEN Input
*********************************************************************
*EOR* MELCOR
*
*************************
*      MELCOR INPUT      *
*************************
*
TITLE     'WHB Assembly Cell'
*
*********
* FILES *
*********
*
RESTARTFILE  8mel.RST
```

```
OUTPUTFILE   8mel.OUT
PLOTFILE     8mel.PTF
DIAGFILE     8mel.DIA
MESSAGEFILE  8mel.MES
*
CRTOUT
* DTSUMMARY
*
CPULIM    100000.0
CPULEFT       20.0
*
RESTART    0
*
*         TIME     DTMAX   DTMIN     DTEDT   DTPLT   DTRST
TIME1      0.0      0.1   0.0001    9000  9000  9000
TIME2     10.0      0.1   0.0001    9000  9000  9000
TIME3    100.0      0.1   0.0001    9000  9000  9000
TIME4   1000.0      0.1   0.0001    9000  9000  9000
TIME5  10000.0      0.1   0.0001    9000  9000  9000
*
TEND  9000   * elapsed time = 2.5 h
.
```

Software Validation Test Report (SVTR)

SVTR#: 7-2-7	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.7.2.2.2	Test Series Name: Conseq. - MELCOR, BWR

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine GRIFFON, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed, MELCOR 1.8.5

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies the input files to the MELCOR modules contain the parameters identified as input within the PCSA Tool and the output extracted from the MELCOR output file by the PCSA Tool is the actual data from the MELCOR output file.

Test Procedure: Tested in accordance with section 6.7.2.2.2.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

Test results are located in the Appendix.

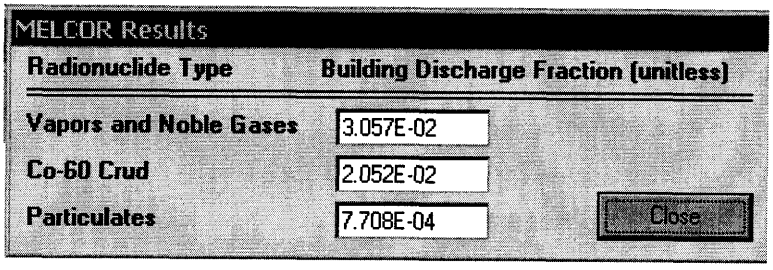
The data from Table 6.7.2-13 of the SVTP for PCSA Tool Version 3.0 was input into MELCOR. The input file contains the same data entered into the PCSA Tool. The output data from the 8MEL.OUT and MELCOR output is identical to the results from section 6.7.2.2.1.3 of the SVTP for PCSA Tool Version 3.0.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 9, 2004

Appendix

	Output
Screen Output Results	 MELCOR Results Radionuclide Type — Building Discharge Fraction (unitless) Vapors and Noble Gases — 3.057E-02 Co-60 Crud — 2.052E-02 Particulates — 7.708E-04 Close
Output from 8mel.out	RADIOACTIVE RADIONUCLIDE FRACTIONAL DISTRIBUTION CLASS TYPE01 TYPE09 1 9.694E-01 3.057E-02 2 9.992E-01 7.753E-04 3 9.992E-01 7.750E-04 4 9.694E-01 3.057E-02 5 9.992E-01 7.707E-04 6 9.992E-01 7.750E-04 7 9.795E-01 2.052E-02 8 9.992E-01 7.733E-04 9 9.992E-01 7.708E-04 10 9.992E-01 7.708E-04 11 9.992E-01 7.707E-04 12 9.992E-01 7.743E-04 13 0.000E+00 0.000E+00 14 0.000E+00 0.000E+00 15 0.000E+00 0.000E+00 16 0.000E+00 0.000E+00 17 9.999E-01 9.695E-05

BWR

```
*
*EOR* MELGEN
*
TITLE     'WHB Assembly Cell'
*
*********
* FILES *
*********
*
OUTPUTFILE   8melg.OUT
DIAGFILE     8melg.DIA
RESTARTFILE  8mel.RST
*
*  initial time step
DTTIME  0.1      * default initial dt=1
**
*******************************************************************
*******************************************************************
*                              NCG INPUT
*******************************************************************
*******************************************************************
*
NCG001    N2    4                          * MATERIAL 4 IS N2
NCG002    O2    5                          * MATERIAL 5 IS O2
NCG333    H2    6                          * MATERIAL 6 IS H2
*
*******************************************************************
*******************************************************************
*                             CVH/FL INPUT
*******************************************************************
*******************************************************************
*
**************************
*  CONTROL VOLUME INPUT  *
**************************
*
*
CV10100   'ASSEMBLY CELL#1' 2    1    1      * NON-EQL, HORZ, CV id
CV10101     2      0                         * POOL ALLOWED, NO FOG
CV10103  268.0 (LxW) = 10 x 26.8 = 268       * FLOW AREA (LxW)
CV101A0     3                                * POOL/ATM INPUT
CV101A1  PVOL 1.0130E05  RHUM 0.5  TATM 297.0  * P = 1 ATM, HUMID, T(K)
CV101A3    MLFR.4   0.8   MLFR.5  0.2        * 0.8 N2, 0.2 O2
CV101B0    0.0      0.0                      * bottom (m); vol (m^3)
CV101B1  0.5    134.0                       * CEILING m; VOL m^3
*
CV10200   'ASSEMBLY CELL#2' 2    1    1      * NON-EQL, HORZ, CV id
CV10201     2      0                         * POOL ALLOWED, NO FOG
CV10203  268.0                               * FLOW AREA (LxW)
CV102A0     3                                * POOL/ATM INPUT
CV102A1  PVOL 1.0130E05  RHUM 0.5  TATM 297.0  * P = 1 ATM, HUMID, T(K)
CV102A3    MLFR.4    0.8   MLFR.5  0.2       * 0.8 N2, 0.2 O2
CV102B0  0.5    0.0                     * bottom (m); vol (m^3)
CV102B1  15.0    3886.0                      * CEILING m; VOL m^3
*
CV10300   'ASSEMBLY CELL#3' 2    1    1      * NON-EQL, HORZ, CV id
CV10301     2      0                         * POOL ALLOWED, NO FOG
```

room width

indoor temperature

```
CV10303  268.0                                  * FLOW AREA (LxW)
CV103A0     3                                    * POOL/ATM INPUT
CV103A1  PVOL 1.0130E05  RHUM 0.5  TATM 297.0  * P = 1 ATM, HUMID, T(K)
CV103A3    MLFR.4   0.8   MLFR.5  0.2          * 0.8 N2, 0.2 O2
CV103B0  15.0    0.0                       * bottom (m); vol (m^3)
CV103B1  15.24    64.3200000000001                    * CEILING m; VOL m^3
*
*
CV90000   ENVIRONMENT      2    1    9        * ENVIRONMENT
CV90001   0   -1                              * NORM POOL/FOG,T-INDEP
*                                             * NO POOL
CV900A1  PVOL 1.0130E05  TATM 300.0  TDEW 280.0 * ATM PRESS,T(K),DEW PT(K)
CV900A3    MLFR.4   0.8   MLFR.5  0.2         * 0.8 N2, 0.2 O2
CV900B0    -5.0     0.0                       * Ground Surface at -5 m
CV900B1    45.0     1.0E5                     * Height m; atm vol m^3
*
************************
*      FLOW PATHS      *
************************
*
*                       VOLUMES      JUNCT.ELEV
*                      FROM   TO     FROM    TO
FL20100  LOW_H_FLOW    101   102   0.5   0.5
FL20101  268.0   0.5    1.0                * FLOW A, L, OPEN FRACT
FL20102    0      0                         * NORMAL VERTICAL FLOW
FL20103    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL201S1  268.0   0.5   14.5652173913043              * SEGMENT A, L, HYD.DIAM.
*
FL20200  HIGH_H_FLOW   102   103   15.0   15.0
FL20201  268.0   0.5    1.0                * FLOW A, L, OPEN FRACT
FL20202    0      0                         * NORMAL VERTICAL FLOW
FL20203    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL202S1  268.0   0.5   14.5652173913043              * SEGMENT A, L, HYD.DIAM.
*
*                       VOLUMES      JUNCT.ELEV
*                      FROM   TO     FROM    TO
FL12500  VENTOUT      102   900     4.0   40.0
*
FL12501  1.0   36.0    1.0                * FLOW A, L, OPEN FRACT
FL12502    0      0                         * NORMAL VERTICAL FLOW
FL12503    1.0    1.0                       * DEFAULT FOR&REV LOSS COEF
FL12504  21.16   0.0                       * FLOW VEL 30000cfm AIR,POOL
FL125S1  1.0   4.0   1.0                * SEGMENT A, L, HYD.DIAM.
FL125P1  FANA   312.7  14.16  5.0   0    * (x5)MAX PHEAD; RATE-MAX,@MAXP
*
************************
* HEAT STRUCTURE INPUT *
************************
*
HS10001000   5       1       0
HS10001001   'ROOM FLOOR'
HS10001002   0.      0.
HS10001100   -1      1       0.
HS10001101   0.25      5
HS10001200   -1
HS10001201   'NEW CONCRETE'          4
HS10001300   0
```

flowrate

```
HS10001400   0
HS10001600   1       101     EXT     0.5     0.5  * see HSCCCCC400 + 500
HS10001700  268.0  26.8  15.24  * floor area; boundary L; flow perp L
*
HS90001000   5       1       0
HS90001001   'PARKING LOT'
HS90001002   0.      0.
HS90001100   -1      1       0.
HS90001101   2.      5
HS90001200   -1
HS90001201   'NEW CONCRETE'          4
HS90001300   0
HS90001400   0
HS90001600   1       900     EXT     0.5     0.5
HS90001700   5000.    50.    100.  * floor area; boundry L; flow perp L
*
***************************************
* THERMAL PROPERTIES FOR NEW CONCRETE *
***************************************
MPMAT10200   'NEW CONCRETE'
MPMAT10201   THC   821     * THERMAL CONDUCTIVITY VS. TEMPERATURE
MPMAT10202   CPS   822     * SPECIFIC HEAT VS. TEMPERATURE
MPMAT10203   RHO   823     * DENSITY VS. TEMPERATURE
*
TF82100   'THC CONCRETE'   2   1.0   0.0
TF82111   273.15   1.3       10000.0   1.3
*
TF82200   'CPS CONCRETE'   2   1.0   0.0
TF82211   273.15   1200.0    10000.0   1200.0
*
TF82300   'RHO CONCRETE'   2   1.0   0.0
TF82311   273.15   2340.0    10000.0   2340.0
*
*************************
* DECAY HEAT DEFINITION *
*************************
DCHDEFCLS0  ALL
DCHCLS0170  'U Released from Fuel'
DCHCLS0171  FF
DCHCLSNORM  'NO'
*
* ==============================
* REDEFINE DECAY HEATS
* ==============================
ALLOWREPLACE
* Update decay heats
* Input time(s) & decay heat power(W/kg) for each element
*
* Decay heat output was normalized by the entire RN class mass
* and the element fractions were all set to one.
*
*      Element\/  \/ Fraction of Class Mass
DCHNEM0100   'CO' 1.0
DCHNEM0101          0.0  1.0300E01
DCHNEM0102     200000.0  1.0300E01
DCHNEM0200   'KR' 1.0
DCHNEM0201          0.0  4.3400E-01
```

```
DCHNEM0202     200000.0  4.3400E-01
DCHNEM0300   'SR' 1.0
DCHNEM0301          0.0  9.2700E01
DCHNEM0302     200000.0  9.2700E01
DCHNEM0400   'Y'  1.0
DCHNEM0401          0.0  4.1100E01
DCHNEM0402     200000.0  4.1100E01
DCHNEM0500   'SB' 1.0
DCHNEM0501          0.0  4.3200E-01
DCHNEM0502     200000.0  4.3200E-01
DCHNEM0600   'CS' 1.0
DCHNEM0601          0.0  2.4700E01
DCHNEM0602     200000.0  2.4700E01
DCHNEM0700   'BA' 1.0
DCHNEM0701          0.0  9.2700E01
DCHNEM0702     200000.0  9.2700E01
DCHNEM0900   'EU' 1.0
DCHNEM0901          0.0  4.1100E01
DCHNEM0902     200000.0  4.1100E01
DCHNEM1000   'PU' 1.0
DCHNEM1001          0.0  4.1600E-01
DCHNEM1002     200000.0  4.1600E-01
DCHNEM1100   'AM' 1.0
DCHNEM1101          0.0  4.1100E01
DCHNEM1102     200000.0  4.1100E01
DCHNEM1200   'CM' 1.0
DCHNEM1201          0.0  4.1100E01
DCHNEM1202     200000.0  4.1100E01
DCHNEM3500   'FF' 1.0
DCHNEM3501          0.0  7.1100E-01
DCHNEM3502     200000.0  7.1100E-01
*
* Zero default decay heats
DCHNEM0800   'PM' 0.0
DCHNEM0801        0.0  0.0
DCHNEM1300   'XE' 0.0
DCHNEM1301        0.0  0.0
DCHNEM1400   'RB' 0.0
DCHNEM1401        0.0  0.0
DCHNEM1500   'I'  0.0
DCHNEM1501        0.0  0.0
DCHNEM1600   'BR' 0.0
DCHNEM1601        0.0  0.0
DCHNEM1700   'TE' 0.0
DCHNEM1701        0.0  0.0
DCHNEM1800   'SE' 0.0
DCHNEM1801        0.0  0.0
DCHNEM1900   'RU' 0.0
DCHNEM1901        0.0  0.0
DCHNEM2000   'RH' 0.0
DCHNEM2001        0.0  0.0
DCHNEM2100   'PD' 0.0
DCHNEM2101        0.0  0.0
DCHNEM2200   'MO' 0.0
DCHNEM2201        0.0  0.0
DCHNEM2300   'TC' 0.0
DCHNEM2301        0.0  0.0
```

```
DCHNEM2400   'NB' 0.0
DCHNEM2401        0.0  0.0
DCHNEM2500   'CE' 0.0
DCHNEM2501        0.0  0.0
DCHNEM2600   'ZR' 0.0
DCHNEM2601        0.0  0.0
DCHNEM2700   'NP' 0.0
DCHNEM2701        0.0  0.0
DCHNEM2800   'LA' 0.0
DCHNEM2801        0.0  0.0
DCHNEM2900   'PR' 0.0
DCHNEM2901        0.0  0.0
DCHNEM3000   'ND' 0.0
DCHNEM3001        0.0  0.0
DCHNEM3100   'U'  0.0
DCHNEM3101        0.0  0.0
DCHNEM3200   'AS' 0.0
DCHNEM3201        0.0  0.0
DCHNEM3300   'SN' 0.0
DCHNEM3301        0.0  0.0
DCHNEM3400   'AG' 0.0
DCHNEM3401        0.0  0.0
*
**********************
* RADIONUCLIDE INPUT *
**********************
*
*        ACTIVATE RN1 PACKAGE
RN1000   0
*
*       NUMSEC NUMCOMP NUMCLS H2O# B2O3# #AERO-S #VAP-S CSI# CHEM#
RN1001    20      17      17    14   13     12       2    16    6
*
RNCC001  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17
*
* AEROSOL MIN AND MAX DIAMETERS; AEROSOL NOMINAL DENSITY
*         DMIN     DMAX   NOM.DENSITY(kg/m^3)
RN1100  1.0000E-08   1.0000E-02     1000.0
*
* PARTICLE SIZE DISTRIBUTION
* --------------------------
* See p. 57-58 of "Commerical SNF Accident Release Fractions" (1999)
* ANL-WHS-SE-000002 REV 00
* MMD = Mass Median Diameter
* GSD = Geometric Standard Deviation
*  Burst Rupture> MMD=150 mircometers, GSD=3.8 (Lorenz et al. 1980)
* Impact Rupture> MMD= 18 mm, GSD=8.18 (Mecham et al. 1981)
* Crud Distrib => MMD= 9.7E-6 m, GSD=1.87 (Sandoval et al. 1991)
*           2=gas,vapor              2=LOGNORMAL
*       CV PHS CLS RFRAC MRATE   TAB DIST
RNVS010  102 2   1  1.0   5.3000E-01  555     * Noble Gas, Xe
RNAS020  102 2   2  1.0   1.3900E-05  555   2 * Alkali Metals, Cs
RNAS021                     1.8000E-02  8.18  * MMD(m) GSD
RNAS030  102 2   3  1.0   1.4800E-05  555   2 * Alkaline Earths, Ba
RNAS031                     1.8000E-02  8.18  * MMD(m) GSD
RNVS040  102 2   4  1.0   6.4100E-03  555     * Halogens, I
RNAS050  102 2   5  1.0   2.4100E00  555   2 * Chalcogens
```

```
RNAS051                          1.8000E-02  8.18  * MMD(m) GSD
RNAS060  102 2   6  1.0   5.8700E-05  555   2 * Planitoids
RNAS061                          1.8000E-02  8.18  * MMD(m) GSD
RNAS070  102 2   7  1.0   1.3000E-03  555   2 * Early Trans Metals
RNAS071                          7.3000E-06  1.87  * Co CRUD values, MMD(m) GSD
RNAS080  102 2   8  1.0   1.9300E-04  555   2 * Tetravalents
RNAS081                          1.8000E-02  8.18  * MMD(m) GSD
RNAS090  102 2   9  1.0   4.8900E-06  555   2 * Trivalents
RNAS091                          1.8000E-02  8.18  * MMD(m) GSD
RNAS100  102 2  10  1.0   3.3400E-04  555   2 * Uranium
RNAS101                          1.8000E-02  8.18  * MMD(m) GSD
RNAS110  102 2  11  1.0   1.0300E-07  555   2 * More Volatile
RNAS111                          1.8000E-02  8.18  * MMD(m) GSD
RNAS120  102 2  12  1.0   3.1200E-06  555   2 * Less Volatile
RNAS121                          1.8000E-02  8.18  * MMD(m) GSD
RNAS130  102 2  11  1.0   1.7400E-07  555   2 * B, Si, P
RNAS131                          1.8000E-02  8.18  * MMD(m) GSD
RNAS140  101 2  17  1.0   3.0600E02  555   2 * Large SNF particles of U
RNAS141                          5.0000E-02  0.1   * Forced large sizes, MMD(m) GSD
*
* aerosol TF linearly decreasing from 2.0 kg/s to zero in 1 s
*                                 \/ Enter # of Assemblies BELOW
*          TFNAME  NTFPAR  TFSCAL  TFADCN
TF55500   AERO-S    2      10.0     0.0
TF55510    0.0      2.0                      *  TIME(s)  RATE(kg/s)
TF55511    1.0      0.0                      *  TIME(s)  RATE(kg/s)
*
* AEROSOL COEFFICIENTS
*
RNACOEF  1  *CALCULATE THE COEFFICIENTS
*
* ADD AEROSOL DEPOSITION SURFACES
*
RNDS001  10001  RHS  FLOOR    *ROOM FLOOR    CV101
RNDS002  90001  RHS  FLOOR    *PARKING LOT   CV900
*
* FLOW THROUGH AREAS FOR DEPOSITION
*       CV_out CV-in  Elev  Area
RNSET001  102  101   0.5   268.0
RNSET002  103  102   15.0   268.0
*
*
. * End of MELGEN Input
*********************************************************************
*EOR* MELCOR
*
*************************
*      MELCOR INPUT      *
*************************
*
TITLE     'WHB Assembly Cell'
*
*********
* FILES *
*********
*
RESTARTFILE  8mel.RST
```

released crud

Fuel Assemblies Breached

```
OUTPUTFILE   8mel.OUT
PLOTFILE     8mel.PTF
DIAGFILE     8mel.DIA
MESSAGEFILE  8mel.MES
*
CRTOUT
* DTSUMMARY
*
CPULIM    100000.0
CPULEFT       20.0
*
RESTART    0
*
*         TIME     DTMAX   DTMIN     DTEDT   DTPLT   DTRST
TIME1      0.0      0.1   0.0001    9000    9000    9000
TIME2     10.0      0.1   0.0001    9000    9000    9000
TIME3    100.0      0.1   0.0001    9000    9000    9000
TIME4   1000.0      0.1   0.0001    9000    9000    9000
TIME5  10000.0      0.1   0.0001    9000    9000    9000
*
TEND  9000   * elapsed time = 2.5 h
.
```

Software Validation Test Report (SVTR)

SVTR#: 8-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.8.1.2	Test Series Name: Safety Assessment - Compliance Assessment

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Input information in accordance with Section 6.8.1 of the SVTP for PCSA Tool Version 3.0.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies that event sequences can be correctly categorized as category 1, category 2, and BCFL event sequences. It also verifies that event sequences can be correctly filtered based on category.

Test Procedure: Tested in accordance with section 6.8.1.1.2 of the SVTP for PCSA Tool Version 3.0; however in Table 6.8.1-1 BWR and PWR default deterministic doses were used. Only public event sequences were evaluated.

Test Results

Test results from spreadsheet calc_8.xls are attached. Event sequences were correctly categorized and filtered into category 1, category 2, and BCFL event sequences and therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: July 30, 2004

Description of Test Results

For an event sequence to be classified as a category 1 event sequence, its expected number of occurrences (defined as the product of its frequency and the operational period) must be greater than or equal to 1. Otherwise, if its probability (defined as 1-exp(-1*frequency*operational period)) is greater than or equal to 0.0001 then it is a category 2 event sequence and below 0.0001 it is a BCFL event sequence. The table below shows that that the first nine event sequences were identified as category 1 event sequences, the tenth was identified as a category 2 event sequence, and the last one was identified as a BCFL event sequence. The attached Performance Assessment Reports show the event sequences were correctly categorized by the PCSA Tool.

Operation Period 50

Event Sequence	Frequency	Expected Number of Events	Category 1	category2	BCFL
1	0.05	2.5	y	n	n
2	0.1	5	y	n	n
3	0.25	12.5	y	n	n
4	0.05	2.5	y	n	n
5	0.1	5	y	n	n
6	0.25	12.5	y	n	n
7	0.05	2.5	y	n	n
8	0.1	5	y	n	n
9	0.25	12.5	y	n	n
10	0.001	0.05	n	y	n
11	0.0000001	0.000005	n	n	y

The attached Performance Assessment Reports also show that the event sequences can be correctly filtered into Category 1, 2, and BCFL event sequences.

Project: valid_8-1

Description: Node A
Level 1

Functional ID: A.1

Item Number	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate Path	Dose, Mean Path	Additional Info
0001.00	evsc001	evseq1	5.00E-02	1		N			
0002.00	evsc001	evseq2	1.00E-01	1		N			
0003.00	evsc001	evseq3	2.50E-01	1		N			
0004.00	evsc001	evseq4	5.00E-02	1		N			
0005.00	evsc001	evseq5	1.00E-01	1		N			
0006.00	evsc001	evseq6	2.50E-01	1		N			
0007.00	evsc001	evseq7	5.00E-02	1		N			
0008.00	evsc001	evseq8	1.00E-01	1		N			
0009.00	evsc001	evseq9	2.50E-01	1		N			
0010.00	evsc001	evseq10	1.00E-03	2		N			
0011.00	evsc001	evseq11	1.00E-07	BCFL		N			

Doses: rem **Frequency: 1/yr**

Project: valid_8-1

Description: Node A
Level 1

Functional ID: A.1

Item Number	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate Path	Dose, Mean Path	Additional Info
0001.00	evsc001	evseq1	5.00E-02	1		N			
0002.00	evsc001	evseq2	1.00E-01	1		N			
0003.00	evsc001	evseq3	2.50E-01	1		N			
0004.00	evsc001	evseq4	5.00E-02	1		N			
0005.00	evsc001	evseq5	1.00E-01	1		N			
0006.00	evsc001	evseq6	2.50E-01	1		N			
0007.00	evsc001	evseq7	5.00E-02	1		N			
0008.00	evsc001	evseq8	1.00E-01	1		N			
0009.00	evsc001	evseq9	2.50E-01	1		N			

Doses: rem **Frequency: 1/yr**

Project: valid_8-1

Description: Node A
Level 1

Functional ID: A.1

Item Number	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate Path	Dose, Mean Path	Additional Info
0010.00	evsc001	evseq10	1.00E-03	2		N			

Doses: rem **Frequency: 1/yr**

Project: valid_8-1

Description: Node A
Level 1

Functional ID: A.1

Item Number	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate Path	Dose, Mean Path	Additional Info
0011.00	evsc001	evseq11	1.00E-07	BCFL		N			

Doses: rem **Frequency: 1/yr**

Software Validation Test Report (SVTR)

SVTR#: 8-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.8.1.2	Test Series Name: Safety Assessment - Compliance Assessment

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP
Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed
Input Data (files, database, mode settings): Input information in accordance with Section 6.8.1 of the SVTP for PCSA Tool Version 3.0 Also used input information from "Analytical and Numerical Solutions of the Expected Number of Occurrences for Combinations of Event Sequences Due to Variability" by R. R. Benke, 2003.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies that the frequency weighted sum and total dose is being calculated correctly for category 1 event sequences. In addition, using the data from Benke, 2003, it verifies that the expected number of combinations calculated from three event sequences agrees with the expected number in Benke, 2003.

Test Procedure: Tested in accordance with section 6.8.1.2.2 of the SVTP for PCSA Tool Version 3.0 except for the combinations of event sequences, the data in Benke, 2003 was used to verify the expected number of combinations calculated. In addition, for this analysis only public results were analyzed both deterministic and probabilistic for frequency-weighted sum calculations with a normal operation dose of 1×10^{-5} rem/yr for the probabilistic case.

Test Results

Test results from spreadsheet calc_8.xls are attached. The frequency * dose values and the frequency weighted dose values agree with spreadsheet calculations. The expected number of combinations agree to within 5% of Benke, 2003 values. Therefore this test was passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 10, 2004

Description of Test Results

For the nine category 1 event sequences, the hand calculated frequency-weighted values and total dose are shown below for deterministic calculations. These values agree with those shown on the attached Performance Assessment Report.

Event Sequence	frequency	dose	frequency * dose	percent contribution
1	0.05	2.76E-05	1.38E-06	2.52%
2	0.1	7.07E-05	7.07E-06	12.93%
3	0.25	2.76E-05	6.90E-06	12.62%
4	0.05	7.07E-05	3.54E-06	6.47%
5	0.1	2.76E-05	2.76E-06	5.05%
6	0.25	7.07E-05	1.77E-05	32.33%
7	0.05	2.76E-05	1.38E-06	2.52%
8	0.1	7.07E-05	7.07E-06	12.93%
9	0.25	2.76E-05	6.90E-06	12.62%
			5.47E-05	

For the nine category 1 event sequences, the hand calculated frequency-weighted values and total dose are shown below for probabilistic calculations. These values agree with those shown on the attached Performance Assessment Report.

Probabilistic Results

Event Sequence	frequency	dose	frequency * dose	percent contribution
1	0.05	4.94E-06	2.47E-07	2.52%
2	0.1	1.27E-05	1.27E-06	12.95%
3	0.25	4.94E-06	1.24E-06	12.59%
4	0.05	1.27E-05	6.35E-07	6.47%
5	0.1	4.94E-06	4.94E-07	5.04%
6	0.25	1.27E-05	3.18E-06	32.37%
7	0.05	4.94E-06	2.47E-07	2.52%
8	0.1	1.27E-05	1.27E-06	12.95%
9	0.25	4.94E-06	1.24E-06	12.59%
			9.81E-06	

For the three event sequences in Benke, 2003, the analytical expected number of combinations was compared to the PCSA Tool generated expected number of combinations and is shown below.

Combination	Analytical Expected Number	PCSA Tool Result	PCSA Tool Result * 30 years	Percent Difference
E[A]	3	0.1	3	0.00%
E[B]	6	0.2	6	0.00%
E[C]	9	0.3	9	0.00%
E[2A]	0.14	4.68E-03	0.1404	0.29%
E[2B]	0.527	1.76E-02	0.528	0.19%
E[2C]	1.12	3.72E-02	1.116	-0.36%
E[A,B]	0.52	1.73E-02	0.519	-0.19%
E[A,C]	0.745	2.48E-02	0.744	-0.13%
E[B,C]	1.43	4.75E-02	1.425	-0.35%
E[3A]	0.0046	1.55E-04	0.00465	1.09%
E[3B]	0.034	1.15E-03	0.0345	1.47%

E[3C]	0.108	3.60E-03	0.108	0.00%
E[A,B,C]	0.134	4.47E-03	0.1341	0.07%
E[2A,B]	0.025	8.48E-04	0.02544	1.76%
E[2A,C]	0.036	1.21E-03	0.0363	0.83%
E[2B,A]	0.05	1.66E-03	0.0498	-0.40%
E[2B,C]	0.136	4.53E-03	0.1359	-0.07%
E[2C,A]	0.105	3.49E-03	0.1047	-0.29%
E[2C,B]	0.2	6.66E-03	0.1998	-0.10%

The expected number of combinations agree to within 5% with the analytical results in Benke, 2003. In addition, on the attached Safety Assessment Combinations Report, the doses from combinations agree with hand calculated doses found by summing contributing event sequence doses within any combination. Also, the maximum combination dose is correctly selected.

Project: svtr_8

Doses: rem
Frequency: 1/yr

Functional ID	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate freq. * dose % contribution	Additional Information
A.1	1	6	2.50E-01	1		N	7.07E-05 1.77E-05 32.33	
A.1	1	8	1.00E-01	1		N	7.07E-05 7.07E-06 12.93	
A.1	1	2	1.00E-01	1		N	7.07E-05 7.07E-06 12.93	
A.1	1	9	2.50E-01	1		N	2.76E-05 6.90E-06 12.62	
A.1	1	3	2.50E-01	1		N	2.76E-05 6.90E-06 12.62	
A.1	1	4	5.00E-02	1		N	7.07E-05 3.54E-06 06.47	
A.1	1	5	1.00E-01	1		N	2.76E-05 2.76E-06 05.05	
A.1	1	7	5.00E-02	1		N	2.76E-05 1.38E-06 02.52	
A.1	1	1	5.00E-02	1		N	2.76E-05 1.38E-06 02.52	

Total Frequency Weighted Dose (rem/yr)	**5.47E-05**
Normal Operation Dose (rem/yr)	**0.00000**
Total Dose (rem/yr)	**5.47E-05**

Project: svtr_8

Doses: rem
Frequency: 1/yr

Functional ID	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Mean freq. * dose % contribution	Additional Information
A.1	1	6	2.50E-01	1		N	1.27E-05 3.18E-06 32.37	
A.1	1	8	1.00E-01	1		N	1.27E-05 1.27E-06 12.95	
A.1	1	2	1.00E-01	1		N	1.27E-05 1.27E-06 12.95	
A.1	1	9	2.50E-01	1		N	4.94E-06 1.24E-06 12.59	
A.1	1	3	2.50E-01	1		N	4.94E-06 1.24E-06 12.59	
A.1	1	4	5.00E-02	1		N	1.27E-05 6.35E-07 06.47	
A.1	1	5	1.00E-01	1		N	4.94E-06 4.94E-07 05.04	
A.1	1	7	5.00E-02	1		N	4.94E-06 2.47E-07 02.52	
A.1	1	1	5.00E-02	1		N	4.94E-06 2.47E-07 02.52	

Total Frequency Weighted Dose (rem/yr)	**9.81E-06**
Normal Operation Dose (rem/yr)	**1.00E-05**
Total Dose (rem/yr)	**1.98E-05**

PCSA Safety Assessment Combinations Report

Project: svtr_8

Expected Number Cutoff: 1.00E-06

Item	Combination Type	Expected Number of Occurrences per year	Dose from Combination (rem)	Combination
1	E[X]	2.00E-01	7.07E-05	B.1-B
2	E[X]	3.00E-01	2.76E-05	B.1-C
3	E[X]	1.00E-01	2.76E-05	B.1-A
4	E[2X]	1.76E-02	1.41E-04	B.1-B B.1-B
5	E[2X]	3.72E-02	5.52E-05	B.1-C B.1-C
6	E[2X]	4.68E-03	5.52E-05	B.1-A B.1-A
7	E[X,Y]	4.75E-02	9.83E-05	B.1-B B.1-C
8	E[X,Y]	1.73E-02	9.83E-05	B.1-B B.1-A
9	E[X,Y]	2.48E-02	5.52E-05	B.1-C B.1-A
10	E[3X]	1.15E-03	2.12E-04	B.1-B B.1-B B.1-B
11	E[3X]	3.60E-03	8.28E-05	B.1-C B.1-C B.1-C
12	E[3X]	1.55E-04	8.28E-05	B.1-A B.1-A B.1-A
13	E[X,Y,Z]	4.47E-03	1.26E-04	B.1-B B.1-C B.1-A
14	E[2X,Y]	4.53E-03	1.69E-04	B.1-B B.1-B B.1-C
15	E[2X,Y]	1.66E-03	1.69E-04	B.1-B B.1-B B.1-A
16	E[2X,Y]	6.66E-03	1.26E-04	B.1-C B.1-C B.1-B
17	E[2X,Y]	3.49E-03	8.28E-05	B.1-C B.1-C B.1-A
18	E[2X,Y]	8.48E-04	1.26E-04	B.1-A B.1-A B.1-B
19	E[2X,Y]	1.21E-03	8.28E-05	B.1-A B.1-A B.1-C

Maximum Combination Dose to Public (from column 4 above) in rem*: 2.12E-04

Normal Operation Dose to Public (rem): 0.00E+00

Aggregate Public TEDE (rem): 2.12E-04

*This is the maximum annual dose to a member of the public from those combinations of event sequences expected to occur at least once before permanent closure (when the cutoff value is set equal to the reciprocal of the preclosure period).

Software Validation Test Report (SVTR)

SVTR#: 8-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.8.1.3	Test Series Name: Safety Assessment - Structures, Systems, and Components Important to Safety

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Input information in accordance with Section 6.8.1 and 6.8.1.3.1of the SVTP for PCSA Tool Version 3.0. For the probabilistic case, entered a normal operation dose of 1.0×10^{-5} rem/yr and a Maximum Dose from SSC Failure of 1.5e-5 rem/yr.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies that the frequency weighted sum and total dose is being calculated correctly for category 1 event sequences.

Test Procedure: Tested in accordance with section 6.8.1.3.2 of the SVTP for PCSA Tool Version 3.0. For this analysis, only public results were analyzed both deterministic and probabilistic for frequency-weighted sum and total dose calculations.

Test Results

Test results from spreadsheet calc_8.xls are attached. Spreadsheet calculations agree with reported values and therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 10, 2004

Description of Test Results

For the nine category 1 event sequences (with event sequence 4 excluded), the spreadsheet calculated frequency-weighted values and total dose are shown below for deterministic calculations. These values agree with those shown on the attached Performance Assessment Report for the deterministic analysis.

Deterministic Results

Event Sequence	frequency	dose	frequency * dose	percent contribution
1	0.015	1.50E-04	2.25E-06	0.25%
2	0.051	1.70E-02	8.67E-04	95.07%
3	0.25	2.76E-05	6.90E-06	0.76%
4 (not included)	0.05	7.07E-05	3.54E-06	0.39%
5	0.1	2.76E-05	2.76E-06	0.30%
6	0.25	7.07E-05	1.77E-05	1.94%
7	0.05	2.76E-05	1.38E-06	0.15%
8	0.1	7.07E-05	7.07E-06	0.78%
9	0.25	2.76E-05	6.90E-06	0.76%
			9.12E-04	

For the nine category 1 event sequences (with event sequence 4 excluded), the hand calculated frequency-weighted values and total dose are shown below for probabilistic calculations. These values agree with those shown on the attached Performance Assessment Report for the probabilistic analysis.

Probabilistic Results

Event Sequence	frequency	dose	frequency * dose	percent contribution
1	0.015	3.70E-03	5.55E-05	85.46%
2	0.051	3.50E-05	1.79E-06	2.75%
3	0.25	4.94E-06	1.24E-06	1.90%
4 (not included)	0.015	1.27E-05	1.91E-07	0.29%
5	0.1	4.94E-06	4.94E-07	0.76%
6	0.25	1.27E-05	3.18E-06	4.89%
7	0.05	4.94E-06	2.47E-07	0.38%
8	0.1	1.27E-05	1.27E-06	1.96%
9	0.25	4.94E-06	1.24E-06	1.90%
			6.49E-05	
normal dose			1.00E-05	
max dose due to SSC Failure			1.50E-05	
total			8.99E-05	

PCSA SSCIS Performance Assessment Report

Project: svtr_8

Doses: rem
Frequency: 1/yr

Category 1 Dose Analysis

Scenario: Point Estimate

Normal Operation Dose: 0.00E+00

Base

Frequency Weighted Sum:	5.47E-05
Total Dose:	5.47E-05

SSC Takeaway Analysis

Frequency Weighted Sum:	9.12E-04
Maximum Dose from SSC:	0.00E+00
Total Dose:	9.12E-04

Functional ID	Event Scen. ID	Event Seq. ID	Event Seq. Frequency	Cate-gory	Description	Dose, PtEst Dose, Mean	Incl f/SA Calc
A.1	1	1	1.50E-02	1		1.50E-04 3.70E-03	Y
	1	2	5.10E-02	1		[redacted] 3.50E-05	Y
	1	3	2.50E-01	1		2.76E-05 4.94E-06	Y
	1	4	1.50E-02	1		7.07E-05 1.27E-05	N
	1	5	1.00E-01	1		2.76E-05 4.94E-06	Y
	1	6	2.50E-01	1		7.07E-05 1.27E-05	Y
	1	7	5.00E-02	1		2.76E-05 4.94E-06	Y

Project: svtr_8

Doses: rem
Frequency: 1/yr

Category 1 Dose Analysis

Scenario: Point Estimate

Normal Operation Dose: 0.00E+00

Base

Frequency Weighted Sum:	5.47E-05
Total Dose:	5.47E-05

SSC Takeaway Analysis

Frequency Weighted Sum:	9.12E-04
Maximum Dose from SSC:	0.00E+00
Total Dose:	9.12E-04

Functional ID	Event Scen. ID	Event Seq. ID	Event Seq. Frequency	Cate-gory	Description	Dose, PtEst Dose, Mean	Incl f/SA Calc
A.1	1	8	1.00E-01	1		7.07E-05 1.27E-05	Y
	1	9	2.50E-01	1		2.76E-05 4.94E-06	Y

PCSA SSCIS Performance Assessment Report

Project: svtr_8

Doses: rem
Frequency: 1/yr

Category 1 Dose Analysis

Scenario: Probabilistic, Mean

Normal Operation Dose: 1.00E-05

Base

Frequency Weighted Sum:	9.81E-06
Total Dose:	1.98E-05

SSC Takeaway Analysis

Frequency Weighted Sum:	6.49E-05
Maximum Dose from SSC:	1.50E-05
Total Dose:	8.99E-05

Functional ID	Event Scen. ID	Event Seq. ID	Event Seq. Frequency	Cate-gory	Description	Dose, PtEst Dose, Mean	Incl f/SA Calc
A.1	1	1	1.50E-02	1		1.50E-04 3.70E-03	Y
	1	2	5.10E-02	1		[redacted] 3.50E-05	Y
	1	3	2.50E-01	1		2.76E-05 4.94E-06	Y
	1	4	1.50E-02	1		7.07E-05 1.27E-05	N
	1	5	1.00E-01	1		2.76E-05 4.94E-06	Y
	1	6	2.50E-01	1		7.07E-05 1.27E-05	Y
	1	7	5.00E-02	1		2.76E-05 4.94E-06	Y

PCSA SSCIS Performance Assessment Report

Project: svtr_8

Doses: rem
Frequency: 1/yr

Category 1 Dose Analysis

Scenario: Probabilistic, Mean

Normal Operation Dose: 1.00E-05

Base

Frequency Weighted Sum:	9.81E-06
Total Dose:	1.98E-05

SSC Takeaway Analysis

Frequency Weighted Sum:	6.49E-05
Maximum Dose from SSC:	1.50E-05
Total Dose:	8.99E-05

Functional ID	Event Scen. ID	Event Seq. ID	Event Seq. Frequency	Cate-gory	Description	Dose, PtEst Dose, Mean	Incl f/SA Calc
A.1	1	8	1.00E-01	1		7.07E-05	Y
						1.27E-05	
	1	9	2.50E-01	1		2.76E-05	Y
						4.94E-06	

Software Validation Test Report (SVTR)

SVTR#: 8-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.8.2.1	Test Series Name: Risk Assessment - Event Scenario Risk

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed, pcsa_ietccdf, pcsa_totrisk

Input Data (files, database, mode settings): Input information in accordance with Section 6.8.2.1.1of the SVTP for PCSA Tool Version 3.0.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: This test verifies the calculations being performed for event scenario risk and total risk. These calculations are being performed within the PCSA Tool itself and the FORTRAN standalone modules: pcsa_ietccdf and pcsa_totrisk.

Test Procedure: Tested in accordance with section 6.8.2.1.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

Test results from spreadsheet calc_8.xls are attached. Calculated consequences and risks agreed with spreadsheet calculations to within 5% and therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 2, 2004

Description of Test Results

Event Scenario Calculations:
Performed event scenario calculations within the PCSA Tool for the Functional ID A.1. For Functional ID A.1, the following summarizes the deterministic dose calculations.

Deterministic Event Sequence	frequency	coefficient	dose	coefficient * dose
1	0.025	2.512520833	2.76E-05	6.92E-05
2	0.3	30.15025	2.76E-05	8.31E-04
				9.00E-04

The value calculated within the PCSA Tool was 8.999e-4 which compares to within 5% with spreadsheet calculations. The actual percentage difference is -0.01%.

Performed event scenario calculations within the PCSA Tool for the for the probabilistic case as well. The following summarizes the probabilistic dose calculations.

	coefficient * dose	cumulative probability index		Percentile
	6.48454E-04	0.1	10	100%
	3.28932E-04	0.2	9	90%
	2.06242E-04	0.3	8	80%
	1.64160E-04	0.4	7	70%
	1.12667E-04	0.5	6	60%
	4.64886E-05	0.6	5	50%
	4.59493E-05	0.7	4	40%
	4.48927E-05	0.8	3	30%
	1.73170E-05	0.9	2	20%
	1.71924E-05	1	1	10%
mean	**1.63229E-04**			

The values within the PCSA Tool compare as follows:
1) Mean: 1.632e-4, percentage difference = -0.02%
2) Minimum: 1.719e-5, percentage difference = -0.01%
3) 5%: 1.719e-5, percentage difference = -0.01%
4) 50%: 4.649e-5, percentage difference = 0.003%
5) 95%: 6.485e-4, percentage difference = 0.01%
6) Maximum: 6.485e-4 = 0.01%

All of these values are within 5% of the spreadsheet calculations. Note the 5 percentile level is taken at the lowest (i.e., 10 percentile level) since only 10 realizations were performed for this test. The 95 percentile level is taken at the highest (i.e., 100% level) for the same reason.

Total Risk Calculations:
Performed total risk calculations within the PCSA Tool for the Functional ID A.1. For Functional ID A.1, the following summarizes the deterministic dose calculations for each of 8 possible combinations.

Scenario(1,2,3)	Calculated Combined Probability	Report Combined Probability	Percentage Difference	Calculated Consequence	Report Consequence	Percentage Difference

nnn	9.512294E-01	9.51E-01	-0.0031%	0	0	0%
nny	1.921611E-02	1.92E-02	-0.0318%	4.17E-05	4.17E-05	-0.0045%
nyn	1.921611E-02	1.92E-02	-0.0318%	1.39E-05	1.39E-05	0.0236%
nyy	3.881912E-04	3.88E-04	-0.0235%	5.57E-05	5.57E-05	0.0025%
ynn	9.560015E-03	9.56E-03	-0.0002%	9.00E-04	9.00E-04	-0.0049%
yny	1.931251E-04	1.93E-04	-0.0130%	9.42E-04	9.42E-04	0.0015%
yyn	1.931251E-04	1.93E-04	-0.0130%	9.14E-04	9.14E-04	0.0043%
yyy	3.901386E-06	3.90E-06	-0.0099%	9.56E-04	9.56E-04	-0.0003%

Scenario(1,2,3)	Calculated Risk	Report Risk	Percentage Difference
nnn	0.000000E+00	0.00E+00	0%
nny	8.021167E-07	8.02E-07	0.00%
nyn	2.674252E-07	2.67E-07	-0.01%
nyy	2.160618E-08	2.16E-08	-0.03%
ynn	8.603478E-06	8.60E-06	-0.01%
yny	1.818632E-07	1.82E-07	-0.03%
yyn	1.764894E-07	1.77E-07	0.01%
yyy	3.728175E-09	3.73E-09	0.00%

The probability, consequence, and risk values within the PCSA Tool are shown on the attached Deterministic Risk Report and agree with the deterministic dose calculations shown above to within 5%.

For Functional ID A.1, the following summarizes the probabilistic dose calculations for just one of the combinations. The combination was chosen arbitrarily as one for event sequence 1 and event sequence 2 occurring but not event sequence 3.

Combined Probability	Consequence for Scenario 1 and Scenario 2 but not Scenario 3	Risk for Scenario 1 and 2 occuring and not scenario 3 equivalent to risk 4 below
0.000193125	1.75E-05	3.37165E-09
	1.76E-05	3.39608E-09
	4.56E-05	8.80404E-09
	4.67E-05	9.01126E-09
	4.72E-05	9.11702E-09
	1.14E-04	2.20955E-08
	1.67E-04	3.21939E-08
	2.09E-04	4.04466E-08
	3.34E-04	6.45078E-08
	6.58E-04	1.27170E-07
mean	**1.66E-04**	**3.20E-08**

The probability, consequence and risk values within the PcSA Tool are shown on the attached Probabilistic Risk Report and are compared as follows:
1) Mean Consequence: 1.658e-4, percentage difference = -0.12%
2) Probability: 1.931e-4, percentage difference = -0.01%
3) Mean Risk: 3.201e-8, percentage difference = 0.03%

The values shown on the Probabilistic Risk Report agree with the spreadsheet calculations to

within 5%.

PCSA Risk Report

Project: valid_8-4 **Type of Run: Deterministic**

Outcome State	Probability	Consequence (rem)	Risk (rem in time period)	Contribution (%)
- - -	9.512E-01	0.000E+00	0.000E+00	0.00E+00
+ - -	9.560E-03	8.999E-04	8.603E-06	8.55E+01
- + -	1.921E-02	1.392E-05	2.674E-07	2.66E+00
- - +	1.921E-02	4.174E-05	8.021E-07	7.97E+00
+ + -	1.931E-04	9.139E-04	1.765E-07	1.75E+00
+ - +	1.931E-04	9.417E-04	1.818E-07	1.81E+00
- + +	3.881E-04	5.566E-05	2.160E-08	2.15E-01
+ + +	3.901E-06	9.556E-04	3.728E-09	3.71E-02
Total Risk			1.006E-05	

PCSA Risk Report

Project: valid_8-4

Type of Run: Probabilistic

Outcome State	Probability	Mean Consequenc (rem)	Mean Risk (rem in time period)	Contribution (%)
- - -	9.512E-01	0.000E+00	0.000E+00	0.00E+00
+ - -	9.560E-03	1.632E-04	1.560E-06	8.55E+01
- + -	1.921E-02	2.524E-06	4.850E-08	2.66E+00
- - +	1.921E-02	7.571E-06	1.455E-07	7.98E+00
+ + -	1.931E-04	1.658E-04	3.201E-08	1.75E+00
+ - +	1.931E-04	1.708E-04	3.298E-08	1.81E+00
- + +	3.881E-04	1.010E-05	3.918E-09	2.15E-01
+ + +	3.901E-06	1.733E-04	6.761E-10	3.71E-02
Total Risk			1.824E-06	

Software Validation Test Report (SVTR)

SVTR#: 9-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.9	Test Series Name: SW Reliability - Software Systems

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data entered into the Software Systems form is displayed correctly after exiting and reentering the PCSA Tool.

Test Procedure: Tested in accordance with section 6.9.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The information entered into the Software Systems form is correctly displayed after exiting the PCSA Tool and reentering.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 10, 2004

PCSA Software Systems Report

Project: SVTP

System ID	Software-1
System name	Software_1
Company	Software_2
Functional areas where this system is used	
Any extant failure data on the software system	Software_3
Characteristics of the software development process	Software_4
Characteristics (especially Maturity Level) of the software development organization	Software_5
Analysis of the requirements specification for the software	Software_6
Identification and evaluation of the software standards used in developing and applying the software, if any	Software_7
Determination of the degree to which the software has been previously used and corrected or the degree to which software components (subsystems and reused software) might be employed	Software_8
Other	Software_9
Functions performed by this system	Software_10
Hardware components controlled	Software_11
Sensors and other input devices (including keyboard, etc.)	Software_12

Project: SVTP

Description of how humans interact with the software system under routine operations and how humans can decide to take action through the software system	Software_13
Is the software system involved in actively controlling the process, in providing standby interaction and/or notification during an upset condition, or both?	Software_14
Is the software system applied to specific types of hardware individually or multiple times, or does it control several types of hardware simultaneously (local vs. global system)?	Software_15
Identification of whether and to what degree fail-safe design approaches have been used in developing the software or specifying its requirements	Software_16
Determination of the degree to which software failures will be mitigated by other safety systems	Software_17
What previously identified initiating events produced by hardware malfunctions (identified by FMEA or What-if analysis) could be produced by software failures, because the identified equipment malfunctions could be generated by software failures	Software_18
What previously unidentified equipment malfunctions could be produced by software failures and lead to an initiating event?	Software_19
What synergestic interactions between hardware, human interactions, and software failures could lead to additional initiating events?	Software_20

Software Validation Test Report (SVTR)

SVTR#: 10-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta R)
Test ID: 6.10.1	Test Series Name: Failure Rate

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaR installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data retrieved from the View Taxonomy is displayed correctly and the information corresponds to that listed in the reference.

Test Procedure: The reference that corresponds to the Letter ID 'C' was removed from the PCSA Tool. Therefore, this test was conducted using the "Electrical Equipment/Generator", with the letter ID 'Q'.

Test Results

The search results for "Electrical Equipment/Generator" were displayed in the 'Search Results for:' form correctly as was the corresponding reference for Letter ID 'Q'. The information corresponds to that listed in the reference.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 18, 2004

Software Validation Test Report (SVTR)

SVTR#: 10-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta R)
Test ID: 6.10.2	Test Series Name: Failure Rate

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaR installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the data retrieved from the Failure Rate Data Search is displayed correctly and that the information corresponds to that listed in the reference.

Test Procedure: The reference corresponding to the number id of 3 was removed from the database. The Test Procedure was conducted by entering 'Pumps' into the 'Failure Rate Data Search' window and inputting 'R' for the letter ID.

Test Results

The search results for 'Pumps' were displayed in the 'Search Results for:' form correctly as was the corresponding reference for Letter ID 'R'. The information corresponds to that listed in the reference.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 18, 2004

Software Validation Test Report (SVTR)

SVTR#: 10-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.10.3	Test Series Name: Failure Rate

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed
Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the Frequency of Failure per year is calculated correctly.

Test Procedure: Tested in accordance with section 6.10.3.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The "Frequency of Failure per year" is calculated as the product of the failure rate and the number of hours or demands placed on the component. The product is correctly calculated as shown in the equations in Appendix A.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 3, 2004

Appendix A

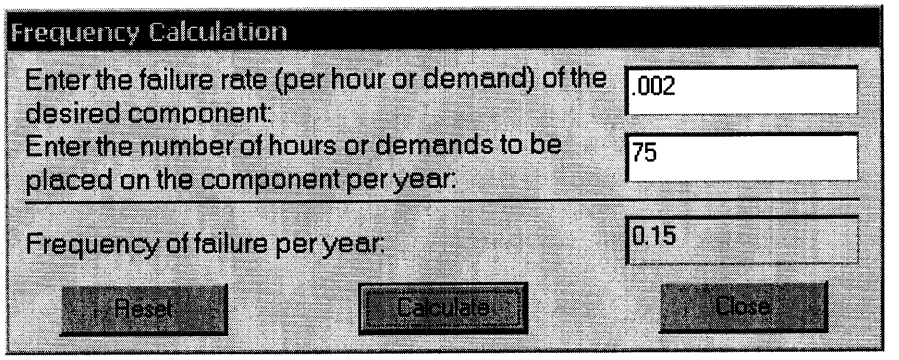


Figure 1 Screen capture of Frequency of failure per year calculation.

Equation 1: A * B = C

A = 0.002
B = 75

0.002 * 75 = 0.15

C = 0.15

Software Validation Test Report (SVTR)

SVTR#: 10-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.10.4	Test Series Name: Failure Rate

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the module is capable of guiding the tester through a series of options and producing an output representing the user input.

Test Procedure: Tested in accordance with section 6.10.4.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The Human Error Probability Generator correctly guided the user through the series of options and produced an output that correctly represented the input. The output is shown in Appendix A.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 3, 2004

Appendix A

Record of User Actions for HEP Generation

Abnormal Event?
No
HEP_A1

Primary Operational Actions?
Yes
HEP_A2

Type of Error?
Omissions
HEP_A3

Written Materials?
No
HEP_A4

Administrative or Recall Error?
Administrative
HEP_A5

Is the human action pursuing:
a general standard procedure?
HEP_A6

Which of the following types of activities is performed?
Implement scheduled shiftly checking or inspection
HEP_A7

Table 20-6, Choice: Initiate a scheduled shiftly checking or inpection function*
HEP = 0.001, EF = 3
From Table, selected by answers to questions

Apply Performance Shaping Factor?
No
HEP_A8

Final HEP = 0.001
EF = 3
End of record

Software Validation Test Report (SVTR)

SVTR#: 11-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.11	Test Series Name: Checklist

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user is able to retrieve the Component Failure Mode Checklist and search for a specific component.

Test Procedure: Tested in accordance with section 6.11.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The Component Mode Failure Checklist successfully displayed the components shown in section 6.11.1 of the SVTP for PCSA Tool Version 3.0 and produced all components pertaining to the user input.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 3, 2004

Software Validation Test Report (SVTR)

SVTR#: 12-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta N)
Test ID: 6.12	Test Series Name: Regs.

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaN installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user is able to view the regulations and navigate through the links within the screen.

Test Procedure: Tested in accordance with section 6.12.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

Regulations 10CFR20 and 10CFR63 were viewed. The links within each regulation functioned properly.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 3, 2004

Software Validation Test Report (SVTR)

SVTR#: 13-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.13	Test Series Name: Help

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Professional

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database created at the start of the test.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: The scope of this test is to verify that the user is able to view the information contained on the About and Disclaimer window.

Test Procedure: Tested in accordance with section 6.13.2 of the SVTP for PCSA Tool Version 3.0.

Test Results

The About window and Disclaimer window were viewed and contained information appropriate to the development of the PCSA Tool software.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: August 10, 2004

Software Validation Test Report (SVTR)

SVTR#: 14-1	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.14	Test Series Name: Worker Dry Form

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☒ comparison with external code (RADTRAD code and Mathematica results)

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0.0 BetaP installed

Input Data (files, database, mode settings): Default PCSA Tool database, pcsademo available on startup

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: Verify the worker dose calculations against independent calculations performed by software RADTRAD and performed in Mathematica as documented in Scientific Notebook 658.

Test Procedure:
The test procedure is identified on Attachment 1

Test Results

Test Results from spreadsheet 14-1.xls are shown on Attachment 2. PCSA Tool generated values agreed to within 5% with Mathematica generated and computer code RADTRAD generated values and therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 6, 2004

Attachment 1

Test Procedure:
1) Open the worker dry form following the menu sequence: Conseq–>Worker Dose–>Worker Internal–>Dry.
2) Under 'Fuel' on the 'Internal Worker Dose' tab, select BWR, PWR, or User Specified.
3) If User Specified fuel is selected, enter inventories for radionuclides under the 'Source Term tab.
4) Modify Group Release Fractions on the 'Release Fraction by Group' tab as required.
5) On the 'Internal Worker Dose' tab, press the 'Calculate Doses' button to calculate the inhalation, submersion, and total dose to the worker.
6) Verify calculated doses against spreadsheet calculated doses.

Attachment 2

Under User Specified input, Total Effective Dose Equivalent (TEDE) values were generated for various radionuclides at arbitrary exposure durations and compared to values documented in Scientific Notebook 658. Two scenarios (abbreviated Scn in the table) were also analyzed: scenario 1 uses a 2,400 %/day ventilation rate of the worker room and scenario 2 uses a 0%/day ventilation rate of the worker room. The PCSA Tool generated values were compared to Mathematica and computer code RADTRAD generated values.

Radio-nuclide	**Scn.**	**Exposure Duration**	**PCSA Tool TEDE**	**Mathematica TEDE**	**Percentage Difference Mathematica**	**RADTRAD TEDE**	**Percentage Difference RADTRAD**
Kr85, 424Ci	1	3.401	1.3468E-04	1.3468E-04	-0.0014%	1.3464E-04	0.0297%
		6.401	2.95E-04	2.95E-04	0.0008%	2.95E-04	0.0169%
Am241, 0.0167Ci	2	8	4.78E+02	4.78E+02	0.0010%	4.78E+02	0.0021%
Y90, 0.237Ci	2	2.501	1.26E-02	1.26E-02	-0.0012%	1.26E-02	-0.0636%

As shown in the table, PCSA Tool generated TEDE values agreed to within 5% with both Mathematica and RADTRAD generated values.

05/28/2004 [illegible]

Comparison between "Mathematica" and RADTRAD calculations for 4 radionuclides.

- Radionuclides : ^{85}Kr, ^{90}Sr, ^{90}Y, and ^{241}Am.

- In the next pages, the results of dose calculations performed with RADTRAD are compared to the ones obtained with "Mathematica 5" (see "Mathematica" - 5th ed., Stephen Wolfram, 2003).

- RADTRAD output is labeled Time(h)/Thyroid(rem)/TEDE(rem); MT stands for Mathematica-Thyroid and MTEDE for Mathematica-TEDE.

- On page 17, equation (8) is used to calculate the dose at the limit $(Q_{01}/V_0) \to (Q_{12}/V_1)$ for ^{241}Am, Scenario #1.

- Scenario description:
  - Scenario #1 : $Q_{01} = 20\%/d$, $Q_{12} = 2400\%/d$
  - Scenario #2 : $Q_{01} = 20\%/d$, $Q_{12} = 0.0\%/d$

- Compartment volumes: $V_1 = V_0 = 1.8 \times 10^5\ ft^3$ (i.e. $5097.032387\ m^3$)

05/28/2009 Integrum

MTEDE

0.401	3.9492521×10^{-6}
0.701	1.1007055×10^{-5}
1.001	2.0561344×10^{-5}
1.301	3.1954262×10^{-5}
1.601	4.4698482×10^{-5}
1.901	5.8433014×10^{-5}
2.201	7.2890454×10^{-5}
2.501	8.7872736×10^{-5}
2.801	1.0323315×10^{-4}
3.101	1.1886305×10^{-4}
3.401	1.3468195×10^{-4}
3.701	1.5063029×10^{-4}
4.001	1.6666393×10^{-4}
4.301	1.8275023×10^{-4}
4.601	1.9886503×10^{-4}
4.901	2.1499044×10^{-4}
5.201	2.3111325×10^{-4}
5.501	2.472237×10^{-4}
5.801	2.6331458×10^{-4}
6.101	2.7938057×10^{-4}
6.401	2.9541777×10^{-4}
6.701	3.114233×10^{-4}
7.001	3.2739506×10^{-4}
7.301	3.4333152×10^{-4}
7.601	3.5923158×10^{-4}
7.901	3.7509444×10^{-4}
8.	3.8032091×10^{-4}
8.001	3.8037368×10^{-4}

MTEDE = (Inhalation Whole Body Dose) + (Air submersion whole body dose);

- Dose Coeff's for inhalation (Sv/Bq) are from FGR No. 11.
- Dose Coeff's for air submersion (Sv/s/Bq/m³), are from FGR No. 12

WR1

Time (hr)	Thyroid (rem)	TEDE (rem)	
0.000	0.0000E+00	0.0000E+00	
0.000	0.0000E+00	6.8967E-13	
0.000	0.0000E+00	3.5432E-12	
0.001	0.0000E+00	3.7327E-11	
0.401	0.0000E+00	3.9365E-06	
0.701	0.0000E+00	1.0987E-05	
1.001	0.0000E+00	2.0536E-05	✓
1.301	0.0000E+00	3.1925E-05	
1.601	0.0000E+00	4.4666E-05	
1.901	0.0000E+00	5.8398E-05	
2.201	0.0000E+00	7.2853E-05	✓
2.501	0.0000E+00	8.7834E-05	
2.801	0.0000E+00	1.0319E-04	
3.101	0.0000E+00	1.1882E-04	✓
3.401	0.0000E+00	1.3464E-04	
3.701	0.0000E+00	1.5059E-04	
4.001	0.0000E+00	1.6662E-04	✓
4.301	0.0000E+00	1.8270E-04	
4.601	0.0000E+00	1.9882E-04	
4.901	0.0000E+00	2.1494E-04	
5.201	0.0000E+00	2.3106E-04	✓
5.501	0.0000E+00	2.4717E-04	
5.801	0.0000E+00	2.6326E-04	
6.101	0.0000E+00	2.7933E-04	✓
6.401	0.0000E+00	2.9537E-04	
6.701	0.0000E+00	3.1137E-04	
7.001	0.0000E+00	3.2734E-04	✓
7.301	0.0000E+00	3.4328E-04	
7.601	0.0000E+00	3.5918E-04	
7.901	0.0000E+00	3.7504E-04	
8.000	0.0000E+00	3.8026E-04	✓

Kr-85

Scenario #1

05/28/2004 [illegible]

MT

0.401	1.6356298×10^{-5}
0.701	4.9942559×10^{-5}
1.001	1.0175165×10^{-4}
1.301	1.7173806×10^{-4}
1.601	2.5985639×10^{-4}
1.901	3.660614×10^{-4}
2.201	4.9030789×10^{-4}
2.501	6.3255084×10^{-4}
2.801	7.9274529×10^{-4}
3.101	9.7084643×10^{-4}
3.401	1.1668096×10^{-3}
3.701	1.38059×10^{-3}
4.001	1.6121434×10^{-3}
4.301	1.8614253×10^{-3}
4.601	2.1283914×10^{-3}
4.901	2.4129976×10^{-3}
5.201	2.7151998×10^{-3}
5.501	3.0349541×10^{-3}
5.801	3.3722167×10^{-3}
6.101	3.7269438×10^{-3}
6.401	4.0990919×10^{-3}
6.701	4.4886174×10^{-3}
7.001	4.8954769×10^{-3}
7.301	5.3196273×10^{-3}
7.601	5.7610252×10^{-3}
7.901	6.2196276×10^{-3}
8.	6.3747346×10^{-3}
8.001	6.3763109×10^{-3}

MTEDE

0.401	1.2267223
0.701	3.7456919
1.001	7.6313735
1.301	1.2880354×10^{1}
1.601	1.9489229×10^{1}
1.901	2.7454605×10^{1}
2.201	3.6773092×10^{1}
2.501	4.7441313×10^{1}
2.801	5.9455897×10^{1}
3.101	7.2813482×10^{1}
3.401	8.7510717×10^{1}
3.701	1.0354425×10^{2}
4.001	1.2091076×10^{2}
4.301	1.396069×10^{2}
4.601	1.5962935×10^{2}
4.901	1.8097482×10^{2}
5.201	2.0363998×10^{2}
5.501	2.2762156×10^{2}
5.801	2.5291625×10^{2}
6.101	2.7952078×10^{2}
6.401	3.0743189×10^{2}
6.701	3.366463×10^{2}
7.001	3.6716077×10^{2}
7.301	3.9897204×10^{2}
7.601	4.3207689×10^{2}
7.901	4.6647207×10^{2}
8.	4.781051×10^{2}
8.001	4.7822332×10^{2}

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	2.5101E-12	1.8826E-07
0.000	1.2897E-11	9.6727E-07
0.001	1.3591E-10	1.0193E-05
0.401	1.6368E-05	1.2276E+00
0.701	4.9964E-05	3.7473E+00
1.001	1.0178E-04	7.6336E+00 ✓
1.301	1.7178E-04	1.2883E+01
1.601	2.5990E-04	1.9493E+01
1.901	3.6612E-04	2.7459E+01
2.201	4.9037E-04	3.6778E+01 ✓
2.501	6.3263E-04	4.7447E+01
2.801	7.9283E-04	5.9462E+01
3.101	9.7094E-04	7.2820E+01 ✓
3.401	1.1669E-03	8.7518E+01
3.701	1.3807E-03	1.0355E+02
4.001	1.6123E-03	1.2092E+02 ✓
4.301	1.8616E-03	1.3962E+02
4.601	2.1285E-03	1.5964E+02
4.901	2.4131E-03	1.8099E+02
5.201	2.7154E-03	2.0365E+02 ✓
5.501	3.0351E-03	2.2763E+02
5.801	3.3724E-03	2.5293E+02
6.101	3.7271E-03	2.7953E+02 ✓
6.401	4.0993E-03	3.0745E+02
6.701	4.4888E-03	3.3666E+02
7.001	4.8957E-03	3.6718E+02 ✓
7.301	5.3198E-03	3.9899E+02
7.601	5.7612E-03	4.3209E+02
7.901	6.2199E-03	4.6649E+02
8.000	6.3747E-03	4.7810E+02 ✓

Am-241

Scenario #2.

05/28/2004 Intagram
MT

0.401	3.4291552×10^{-5}
0.701	9.5574888×10^{-5}
1.001	1.7853548×10^{-4}
1.301	2.7746115×10^{-4}
1.601	3.8812045×10^{-4}
1.901	5.0737888×10^{-4}
2.201	6.3291458×10^{-4}
2.501	7.6300771×10^{-4}
2.801	8.9638441×10^{-4}
3.101	1.0321012×10^{-3}
3.401	1.1694595×10^{-3}
3.701	1.3079417×10^{-3}
4.001	1.4471649×10^{-3}
4.301	1.5868456×10^{-3}
4.601	1.7267738×10^{-3}
4.901	1.8667944×10^{-3}
5.201	2.0067927×10^{-3}
5.501	2.1466837×10^{-3}
5.801	2.286405×10^{-3}
6.101	2.4259105×10^{-3}
6.401	2.5651661×10^{-3}
6.701	2.7041469×10^{-3}
7.001	2.8428346×10^{-3}
7.301	2.9812161×10^{-3}
7.601	3.1192816×10^{-3}
7.901	3.2570243×10^{-3}
8.	3.3024076×10^{-3}
8.001	3.3028659×10^{-3}

MTEDE →

0.401	4.4744739×10^{-2}
0.701	1.2470924×10^{-1}
1.001	2.3295894×10^{-1}
1.301	3.6204039×10^{-1}
1.601	5.0643226×10^{-1}
1.901	6.6204456×10^{-1}
2.201	8.2584765×10^{-1}
2.501	9.9559742×10^{-1}
2.801	1.1696317
3.101	1.3467195
3.401	1.525949
3.701	1.7066451
4.001	1.8883081
4.301	2.070568
4.601	2.2531509
4.901	2.4358544
5.201	2.6185287
5.501	2.8010632
5.801	2.9833761
6.101	3.1654074
6.401	3.3471126
6.701	3.5284593
7.001	3.7094236
7.301	3.8899883
7.601	4.0701407
7.901	4.2498719
8.	4.3090895
8.001	4.3096875

WR1

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	5.9887E-12	7.8142E-09
0.000	3.0767E-11	4.0146E-08
0.001	3.2413E-10	4.2293E-07
0.401	3.4182E-05	4.4602E-02
0.701	9.5408E-05	1.2449E-01
1.001	1.7833E-04	2.3269E-01 ✓
1.301	2.7722E-04	3.6174E-01
1.601	3.8786E-04	5.0612E-01
1.901	5.0711E-04	6.6173E-01
2.201	6.3264E-04	8.2554E-01 ✓
2.501	7.6273E-04	9.9530E-01
2.801	8.9610E-04	1.1694E+00
3.101	1.0318E-03	1.3465E+00 ✓
3.401	1.1692E-03	1.5257E+00
3.701	1.3077E-03	1.7065E+00
4.001	1.4469E-03	1.8882E+00 ✓
4.301	1.5866E-03	2.0705E+00
4.601	1.7265E-03	2.2531E+00
4.901	1.8666E-03	2.4359E+00
5.201	2.0066E-03	2.6186E+00 ✓
5.501	2.1465E-03	2.8012E+00
5.801	2.2862E-03	2.9836E+00
6.101	2.4257E-03	3.1657E+00 ✓
6.401	2.5650E-03	3.3475E+00
6.701	2.7040E-03	3.5289E+00
7.001	2.8427E-03	3.7100E+00 ✓
7.301	2.9811E-03	3.8906E+00
7.601	3.1192E-03	4.0709E+00
7.901	3.2570E-03	4.2507E+00
8.000	3.3023E-03	4.3099E+00 ✓

Sr-90

Scenario #1.

05/28/2004

MT

0.401	4.4944522×10^{-6}
0.701	1.3723402×10^{-5}
1.001	2.7959653×10^{-5}
1.301	4.7190681×10^{-5}
1.601	7.1403992×10^{-5}
1.901	1.0058712×10^{-4}
2.201	1.3472764×10^{-4}
2.501	1.7381316×10^{-4}
2.801	2.1783129×10^{-4}
3.101	2.667697×10^{-4}
3.401	3.2061609×10^{-4}
3.701	3.7935818×10^{-4}
4.001	4.4298372×10^{-4}
4.301	5.1148049×10^{-4}
4.601	5.8483632×10^{-4}
4.901	6.6303905×10^{-4}
5.201	7.4607655×10^{-4}
5.501	8.3393674×10^{-4}
5.801	9.2660754×10^{-4}
6.101	1.0240769×10^{-3}
6.401	1.1263329×10^{-3}
6.701	1.2333635×10^{-3}
7.001	1.3451567×10^{-3}
7.301	1.4617007×10^{-3}
7.601	1.5829835×10^{-3}
7.901	1.7089934×10^{-3}
8.	1.751612×10^{-3}
8.001	1.7520451×10^{-3}

Kr-85

Scenario #2

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	0.0000E+00	6.8972E-13
0.000	0.0000E+00	3.5437E-12
0.001	0.0000E+00	3.7344E-11
0.401	0.0000E+00	4.4976E-06
0.701	0.0000E+00	1.3729E-05
1.001	0.0000E+00	2.7967E-05 ✓
1.301	0.0000E+00	4.7199E-05
1.601	0.0000E+00	7.1414E-05
1.901	0.0000E+00	1.0060E-04
2.201	0.0000E+00	1.3474E-04 ✓
2.501	0.0000E+00	1.7383E-04
2.801	0.0000E+00	2.1784E-04
3.101	0.0000E+00	2.6678E-04 ✓
3.401	0.0000E+00	3.2063E-04
3.701	0.0000E+00	3.7937E-04
4.001	0.0000E+00	4.4300E-04 ✓
4.301	0.0000E+00	5.1149E-04
4.601	0.0000E+00	5.8485E-04
4.901	0.0000E+00	6.6305E-04
5.201	0.0000E+00	7.4609E-04 ✓
5.501	0.0000E+00	8.3394E-04
5.801	0.0000E+00	9.2661E-04
6.101	0.0000E+00	1.0241E-03 ✓
6.401	0.0000E+00	1.1263E-03
6.701	0.0000E+00	1.2334E-03
7.001	0.0000E+00	1.3452E-03 ✓
7.301	0.0000E+00	1.4617E-03
7.601	0.0000E+00	1.5830E-03
7.901	0.0000E+00	1.7090E-03
8.000	0.0000E+00	1.7515E-03 ✓

05/28/2004 [illegible]

MT

0.401	3.9025553×10^{-5}
0.701	1.1916109×10^{-4}
1.001	2.427755×10^{-4}
1.301	4.0976015×10^{-4}
1.601	6.2000667×10^{-4}
1.901	8.7340698×10^{-4}
2.201	1.1698532×10^{-3}
2.501	1.5092379×10^{-3}
2.801	1.8914537×10^{-3}
3.101	2.3163936×10^{-3}
3.401	2.7839508×10^{-3}
3.701	3.294019×10^{-3}
4.001	3.8464917×10^{-3}
4.301	4.4412632×10^{-3}
4.601	5.0782277×10^{-3}
4.901	5.7572798×10^{-3}
5.201	6.4783143×10^{-3}
5.501	7.2412264×10^{-3}
5.801	8.0459113×10^{-3}
6.101	8.8922648×10^{-3}
6.401	9.7801827×10^{-3}
6.701	1.0709561×10^{-2}
7.001	1.1680297×10^{-2}
7.301	1.2692286×10^{-2}
7.601	1.3745425×10^{-2}
7.901	1.4839613×10^{-2}
8.	1.5209685×10^{-2}
8.001	1.5213446×10^{-2}

^{90}Sr

Scenario #2

MTEDE →

0.401	5.0921819×10^{-2}
0.701	1.5548529×10^{-1}
1.001	3.1678142×10^{-1}
1.301	5.3466845×10^{-1}
1.601	8.0900499×10^{-1}
1.901	1.13965
2.201	1.5264628
2.501	1.969303
2.801	2.4680307
3.101	3.0225062
3.401	3.6325901
3.701	4.2981437
4.001	5.0190283
4.301	5.7951056
4.601	6.6262377
4.901	7.512287
5.201	8.4531165
5.501	9.4485891
5.801	1.0498568×10^{1}
6.101	1.1602918×10^{1}
6.401	1.2761502×10^{1}
6.701	1.3974186×10^{1}
7.001	1.5240833×10^{1}
7.301	1.656131×10^{1}
7.601	1.7935481×10^{1}
7.901	1.9363212×10^{1}
8.	1.9846094×10^{1}
8.001	1.9851002×10^{1}

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	5.9891E-12	7.8148E-09
0.000	3.0772E-11	4.0152E-08
0.001	3.2427E-10	4.2312E-07
0.401	3.9055E-05	5.0960E-02
0.701	1.1921E-04	1.5556E-01
1.001	2.4285E-04	3.1689E-01 ✓
1.301	4.0986E-04	5.3482E-01
1.601	6.2013E-04	8.0921E-01
1.901	8.7356E-04	1.1399E+00
2.201	1.1700E-03	1.5268E+00 ✓
2.501	1.5095E-03	1.9698E+00
2.801	1.8917E-03	2.4686E+00
3.101	2.3167E-03	3.0232E+00 ✓
3.401	2.7843E-03	3.6335E+00
3.701	3.2944E-03	4.2992E+00
4.001	3.8470E-03	5.0203E+00 ✓
4.301	4.4418E-03	5.7966E+00
4.601	5.0789E-03	6.6280E+00
4.901	5.7580E-03	7.5144E+00
5.201	6.4791E-03	8.4556E+00 ✓
5.501	7.2421E-03	9.4514E+00
5.801	8.0469E-03	1.0502E+01
6.101	8.8934E-03	1.1607E+01 ✓
6.401	9.7815E-03	1.2766E+01
6.701	1.0711E-02	1.3979E+01
7.001	1.1682E-02	1.5246E+01 ✓
7.301	1.2694E-02	1.6567E+01
7.601	1.3747E-02	1.7942E+01
7.901	1.4842E-02	1.9371E+01
8.000	1.5211E-02	1.9853E+01 ✓

05/28/2004 [illegible]

MT

0.401	1.43722×10^{-5}
0.701	4.0057159×10^{-5}
1.001	7.4827476×10^{-5}
1.301	1.1628908×10^{-4}
1.601	1.6266851×10^{-4}
1.901	2.1265204×10^{-4}
2.201	2.6526654×10^{-4}
2.501	3.1979119×10^{-4}
2.801	3.7569209×10^{-4}
3.101	4.3257383×10^{-4}
3.401	4.9014356×10^{-4}
3.701	5.4818444×10^{-4}
4.001	6.0653592×10^{-4}
4.301	6.6507916×10^{-4}
4.601	7.2372623×10^{-4}
4.901	7.8241205×10^{-4}
5.201	8.4108855×10^{-4}
5.501	8.9972018×10^{-4}
5.801	9.582807×10^{-4}
6.101	1.0167508×10^{-3}
6.401	1.0751162×10^{-3}
6.701	1.1333665×10^{-3}
7.001	1.191494×10^{-3}
7.301	1.2494932×10^{-3}
7.601	1.30736×10^{-3}
7.901	1.3650916×10^{-3}
8.	1.3841129×10^{-3}
8.001	1.384305×10^{-3}

MTEDE

0.401	1.077915
0.701	3.0042869
1.001	5.6120607
1.301	8.7216813
1.601	1.2200139×10^{1}
1.901	1.5948903×10^{1}
2.201	1.989499×10^{1}
2.501	2.3984339×10^{1}
2.801	2.8176907×10^{1}
3.101	3.2443037×10^{1}
3.401	3.6760767×10^{1}
3.701	4.1113833×10^{1}
4.001	4.5490194×10^{1}
4.301	4.9880937×10^{1}
4.601	5.4279467×10^{1}
4.901	5.8680904×10^{1}
5.201	6.3081641×10^{1}
5.501	6.7479013×10^{1}
5.801	7.1871053×10^{1}
6.101	7.6256309×10^{1}
6.401	8.0633715×10^{1}
6.701	8.5002487×10^{1}
7.001	8.9362051×10^{1}
7.301	9.371199×10^{1}
7.601	9.8052001×10^{1}
7.901	1.0238187×10^{2}
8.	1.0380847×10^{2}
8.001	1.0382287×10^{2}

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	2.5100E-12	1.8825E-07
0.000	1.2895E-11	9.6714E-07
0.001	1.3585E-10	1.0189E-05
0.401	1.4326E-05	1.0745E+00
0.701	3.9987E-05	2.9990E+00
1.001	7.4739E-05	5.6054E+00 ✓
1.301	1.1619E-04	8.7141E+00
1.601	1.6256E-04	1.2192E+01
1.901	2.1253E-04	1.5940E+01
2.201	2.6514E-04	1.9886E+01 ✓
2.501	3.1966E-04	2.3975E+01
2.801	3.7556E-04	2.8167E+01
3.101	4.3244E-04	3.2433E+01 ✓
3.401	4.9001E-04	3.6751E+01
3.701	5.4805E-04	4.1104E+01
4.001	6.0640E-04	4.5480E+01 ✓
4.301	6.6494E-04	4.9871E+01
4.601	7.2359E-04	5.4269E+01
4.901	7.8227E-04	5.8670E+01
5.201	8.4095E-04	6.3071E+01 ✓
5.501	8.9958E-04	6.7469E+01
5.801	9.5814E-04	7.1861E+01
6.101	1.0166E-03	7.6246E+01 ✓
6.401	1.0750E-03	8.0623E+01
6.701	1.1332E-03	8.4992E+01
7.001	1.1914E-03	8.9352E+01 ✓
7.301	1.2494E-03	9.3701E+01
7.601	1.3072E-03	9.8041E+01
7.901	1.3650E-03	1.0237E+02
8.000	1.3840E-03	1.0380E+02 ✓

Am-241

Scenario #1

05/28/2009

0.401	2.8982821×10^{-4}
0.701	8.0612017×10^{-4}
1.001	1.502808×10^{-3}
1.301	2.3308967×10^{-3}
1.601	3.254218×10^{-3}
1.901	4.2460746×10^{-3}
2.201	5.2867632×10^{-3}
2.501	6.3617444×10^{-3}
2.801	7.4602924×10^{-3}
3.101	8.574497×10^{-3}
3.401	9.6985272×10^{-3}
3.701	1.0828087×10^{-2}
4.001	1.1960015×10^{-2}
4.301	1.3091984×10^{-2}
4.601	1.4222289×10^{-2}
4.901	1.5349679×10^{-2}
5.201	1.6473238×10^{-2}
5.501	1.7592302×10^{-2}
5.801	1.870639×10^{-2}
6.101	1.9815154×10^{-2}
6.401	2.0918348×10^{-2}
6.701	2.2015801×10^{-2}
7.001	2.3107394×10^{-2}
7.301	2.419305×10^{-2}
7.601	2.5272719×10^{-2}
7.901	2.6346376×10^{-2}
8.	2.6699362×10^{-2}
8.001	2.6702924×10^{-2}

RW (05-28-09)

MT →

RW (05-28-09)

← MTEDE

0.401	6.571902×10^{-8}
0.701	1.8278907×10^{-7}
1.001	3.4076417×10^{-7}
1.301	5.2853464×10^{-7}
1.601	7.3789925×10^{-7}
1.901	9.6280437×10^{-7}
2.201	1.1987822×10^{-6}
2.501	1.442536×10^{-6}
2.801	1.6916335×10^{-6}
3.101	1.9442812×10^{-6}
3.401	2.1991569×10^{-6}
3.701	2.4552865×10^{-6}
4.001	2.7119529×10^{-6}
4.301	2.9686289×10^{-6}
4.601	3.2249274×10^{-6}
4.901	3.4805648×10^{-6}
5.201	3.7353337×10^{-6}
5.501	3.9890833×10^{-6}
5.801	4.2417044×10^{-6}
6.101	4.4931185×10^{-6}
6.401	4.7432697×10^{-6}
6.701	4.992119×10^{-6}
7.001	5.2396395×10^{-6}
7.301	5.4858137×10^{-6}
7.601	5.7306305×10^{-6}
7.901	5.974084×10^{-6}
8.	6.0541239×10^{-6}
8.001	6.0549317×10^{-6}

Y-90

Scenario #1

WR1

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	1.1510E-14	5.0760E-11
0.000	5.9133E-14	2.6078E-10
0.001	6.2295E-13	2.7473E-09
0.401	6.5547E-08	2.8907E-04
0.701	1.8257E-07	8.0515E-04
1.001	3.4055E-07	1.5019E-03 ✓
1.301	5.2836E-07	2.3301E-03
1.601	7.3778E-07	3.2537E-03
1.901	9.6277E-07	4.2459E-03
2.201	1.1988E-06	5.2870E-03 ✓
2.501	1.4427E-06	6.3625E-03
2.801	1.6919E-06	7.4615E-03
3.101	1.9447E-06	8.5762E-03 ✓
3.401	2.1997E-06	9.7008E-03
3.701	2.4559E-06	1.0831E-02
4.001	2.7127E-06	1.1963E-02 ✓
4.301	2.9695E-06	1.3096E-02
4.601	3.2259E-06	1.4227E-02
4.901	3.4817E-06	1.5354E-02
5.201	3.7365E-06	1.6479E-02 ✓
5.501	3.9904E-06	1.7598E-02
5.801	4.2431E-06	1.8713E-02
6.101	4.4947E-06	1.9822E-02 ✓
6.401	4.7449E-06	2.0926E-02
6.701	4.9939E-06	2.2024E-02
7.001	5.2415E-06	2.3116E-02 ✓
7.301	5.4878E-06	2.4202E-02
7.601	5.7327E-06	2.5282E-02
7.901	5.9762E-06	2.6356E-02
8.000	6.0562E-06	2.6709E-02 ✓

05/28/2004 [illegible]

MT

0.401	7.4788114×10^{-8}
0.701	2.2786615×10^{-7}
1.001	4.6324685×10^{-7}
1.301	7.8018941×10^{-7}
1.601	1.1779582×10^{-6}
1.901	1.6558225×10^{-6}
2.201	2.2130569×10^{-6}
2.501	2.8489407×10^{-6}
2.801	3.5627586×10^{-6}
3.101	4.3537998×10^{-6}
3.401	5.2213588×10^{-6}
3.701	6.1647347×10^{-6}
4.001	7.1832317×10^{-6}
4.301	8.2761587×10^{-6}
4.601	9.4428294×10^{-6}
4.901	1.0682562×10^{-5}
5.201	1.1994681×10^{-5}
5.501	1.3378513×10^{-5}
5.801	1.4833391×10^{-5}
6.101	1.6358652×10^{-5}
6.401	1.7953639×10^{-5}
6.701	1.9617698×10^{-5}
7.001	2.135018×10^{-5}
7.301	2.315044×10^{-5}
7.601	2.5017839×10^{-5}
7.901	2.6951741×10^{-5}
8.	2.7604415×10^{-5}
8.001	2.7611045×10^{-5}

MTEDE →

0.401	3.2982392×10^{-4}
0.701	1.0049151×10^{-3}
1.001	2.0429703×10^{-3}
1.301	3.4407223×10^{-3}
1.601	5.1949268×10^{-3}
1.901	7.3023618×10^{-3}
2.201	9.7598275×10^{-3}
2.501	1.2564146×10^{-2}
2.801	1.5712163×10^{-2}
3.101	1.9200743×10^{-2}
3.401	2.3026774×10^{-2}
3.701	2.7187167×10^{-2}
4.001	3.1678853×10^{-2}
4.301	3.6498783×10^{-2}
4.601	4.1643931×10^{-2}
4.901	4.7111291×10^{-2}
5.201	5.289788×10^{-2}
5.501	5.9000734×10^{-2}
5.801	6.5416908×10^{-2}
6.101	7.2143481×10^{-2}
6.401	7.9177551×10^{-2}
6.701	8.6516236×10^{-2}
7.001	9.4156673×10^{-2}
7.301	1.0209602×10^{-1}
7.601	1.1033146×10^{-1}
7.901	1.1886018×10^{-1}
8.	1.2173855×10^{-1}
8.001	1.2176779×10^{-1}

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	1.1511E-14	5.0763E-11
0.000	5.9141E-14	2.6082E-10
0.001	6.2323E-13	2.7485E-09
0.401	7.4887E-08	3.3026E-04
0.701	2.2809E-07	1.0059E-03
1.001	4.6364E-07	2.0447E-03 ✓
1.301	7.8079E-07	3.4434E-03
1.601	1.1788E-06	5.1987E-03
1.901	1.6570E-06	7.3074E-03
2.201	2.2145E-06	9.7662E-03 ✓
2.501	2.8508E-06	1.2572E-02
2.801	3.5650E-06	1.5722E-02
3.101	4.3564E-06	1.9212E-02 ✓
3.401	5.2245E-06	2.3040E-02
3.701	6.1683E-06	2.7203E-02
4.001	7.1874E-06	3.1697E-02 ✓
4.301	8.2808E-06	3.6519E-02
4.601	9.4481E-06	4.1667E-02
4.901	1.0688E-05	4.7137E-02
5.201	1.2001E-05	5.2927E-02 ✓
5.501	1.3386E-05	5.9032E-02
5.801	1.4841E-05	6.5452E-02
6.101	1.6367E-05	7.2181E-02 ✓
6.401	1.7963E-05	7.9219E-02
6.701	1.9628E-05	8.6561E-02
7.001	2.1361E-05	9.4204E-02 ✓
7.301	2.3162E-05	1.0215E-01
7.601	2.5030E-05	1.1039E-01
7.901	2.6965E-05	1.1892E-01
8.000	2.7617E-05	1.2179E-01 ✓

Y-90

Scenario #2

MT 05/28/2004 [illegible]

Dose_Scen_1_EqualQtoV.nb

0.401	1.6338096×10^{-5}
0.701	4.9845409×10^{-5}
1.001	1.0146911×10^{-4}
1.301	1.7111853×10^{-4}
1.601	2.5870332×10^{-4}
1.901	3.6413349×10^{-4}
2.201	4.8731936×10^{-4}
2.501	6.2817161×10^{-4}
2.801	7.8660125×10^{-4}
3.101	9.6251963×10^{-4}
3.401	1.1558384×10^{-3}
3.701	1.3664696×10^{-3}
4.001	1.5943256×10^{-3}
4.301	1.8393189×10^{-3}
4.601	2.1013627×10^{-3}
4.901	2.3803703×10^{-3}
5.201	2.6762552×10^{-3}
5.501	2.9889315×10^{-3}
5.801	3.3183135×10^{-3}
6.101	3.6643158×10^{-3}
6.401	4.0268534×10^{-3}
6.701	4.4058414×10^{-3}
7.001	4.8011956×10^{-3}
7.301	5.2128318×10^{-3}
7.601	5.6406662×10^{-3}
7.901	6.0846154×10^{-3}
8.	6.2346408×10^{-3}
8.001	6.2361651×10^{-3}

Am-241

$$\frac{Q_{01}}{V_0} = \frac{Q_{12}}{V_1}$$

(to check eq. (8) from p. 5)

MTEDE →

WR1

Time (hr)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00
0.000	2.5101E-12	1.8826E-07
0.000	1.2897E-11	9.6727E-07
0.001	1.3591E-10	1.0193E-05
0.401	1.6350E-05	1.2262E+00
0.701	4.9865E-05	3.7399E+00
1.001	1.0150E-04	7.6123E+00
1.301	1.7116E-04	1.2837E+01
1.601	2.5875E-04	1.9406E+01
1.901	3.6419E-04	2.7314E+01
2.201	4.8738E-04	3.6554E+01
2.501	6.2824E-04	4.7118E+01
2.801	7.8668E-04	5.9001E+01
3.101	9.6261E-04	7.2195E+01
3.401	1.1559E-03	8.6695E+01
3.701	1.3666E-03	1.0249E+02
4.001	1.5944E-03	1.1958E+02
4.301	1.8394E-03	1.3796E+02
4.601	2.1015E-03	1.5761E+02
4.901	2.3805E-03	1.7854E+02
5.201	2.6764E-03	2.0073E+02
5.501	2.9891E-03	2.2418E+02
5.801	3.3185E-03	2.4889E+02
6.101	3.6645E-03	2.7484E+02
6.401	4.0270E-03	3.0203E+02
6.701	4.4060E-03	3.3045E+02
7.001	4.8014E-03	3.6010E+02
7.301	5.2130E-03	3.9098E+02
7.601	5.6409E-03	4.2307E+02
7.901	6.0848E-03	4.5636E+02
8.000	6.2347E-03	4.6761E+02

ose_Scen_1_EqualQtoV.nb

0.401	1.2253572
0.701	3.7384057
1.001	7.6101836
1.301	1.283389×10^{1}
1.601	1.9402749×10^{1}
1.901	2.7310011×10^{1}
2.201	3.6548952×10^{1}
2.501	4.7112871×10^{1}
2.801	5.8995094×10^{1}
3.101	7.2188972×10^{1}
3.401	8.6687881×10^{1}
3.701	1.0248522×10^{2}
4.001	1.1957442×10^{2}
4.301	1.3794892×10^{2}
4.601	1.5760221×10^{2}
4.901	1.7852777×10^{2}
5.201	2.0071914×10^{2}
5.501	2.2416987×10^{2}
5.801	2.4887352×10^{2}
6.101	2.7482369×10^{2}
6.401	3.02014×10^{2}
6.701	3.3043811×10^{2}
7.001	3.6008967×10^{2}
7.301	3.9096238×10^{2}
7.601	4.2304997×10^{2}
7.901	4.5634615×10^{2}
8.	4.6759806×10^{2}
8.001	4.6771239×10^{2}

Software Validation Test Report (SVTR)

SVTR#: 14-2	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta P)
Test ID: 6.14	Test Series Name: Worker Downwind Dose

Test Method

☐ code inspection
☐ output inspection
☐ hand calculation
☒ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0.0 BetaP installed

Input Data (files, database, mode settings): Default PCSA Tool database, pcsademo available on startup

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: Verify the worker dose calculations against independent spreadsheet calculations.

Test Procedure:
The test procedure is identified on Attachment 1

Test Results

Test Results from spreadsheet 14-2.xls are shown on Attachment 2. PCSA Tool generated values agreed to within 5% with spreadsheet values and therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 9, 2004

Attachment 1

Test Procedure:
1) Open the worker downwind dose form.
2) Enter values for the Stack Height, Building Height, Building Width (depending on option), Receptor Distance, Stack Diameter (depending on option), and Flow Rate (depending on option) corresponding to the displacement zone, wake zone, and cavity zone.
3) Compare values displayed by the PCSA Tool to spreadsheet calculated values.

Attachment 2

As shown in the following table, all values generated by the PCSA Tool agreed to within 5% with spreadsheet calculations. Within the PCSA Tool, the cavity, wake, and displacement zones were selected for various receptor distances and results were compared to spreadsheet calculations.

Receptor Distance	Zone	Calculated Results	PCSA Tool Results	Percentage Difference
1	Receptor on building	3.9432E-02	3.9400E-02	-0.0813%
2	Receptor on building	3.9432E-02	3.9400E-02	-0.0813%
20	Receptor on building	1.1166E-02	1.1200E-02	0.3052%
100	Cavity zone off building	1.39E-03	1.3900E-03	-0.2735%
10	Cavity zone off building	1.39E-03	1.3900E-03	-0.2735%
5000	Wake Zone	5.71E-06	5.71E-06	0.0101%
10000	Wake Zone	2.61E-06	2.61E-06	0.0694%
100	Displacement Zone	0.00E+00	0.0000E+00	0.0000%
2000	Displacement Zone	1.87E-09	1.87E-09	0.0000%
20000	Displacement Zone	5.31E-07	5.31E-07	0.0000%

DRAFT FOR DISCUSSION

Approach for Implementing Downwind Worker Dose Model

Please consider this approach as DRAFT for discussion.

There are at least three configurations involving the worker, obstacle, and source that may be of interest in preclosure repository safety:

1. The source and obstacle are located at the same location; the worker may be collocated or located downwind.
2. The source is upstream from the obstacle; the worker is collocated or downwind of the obstacle.
3. The source is upstream from the obstacle; the worker and obstacle(s) are collocated.

See Figure 1 for a diagram of these configurations. Case 1 most closely resembles the configurations discussed in IAEA Safety Series 19, where the source and obstacle are collocated.

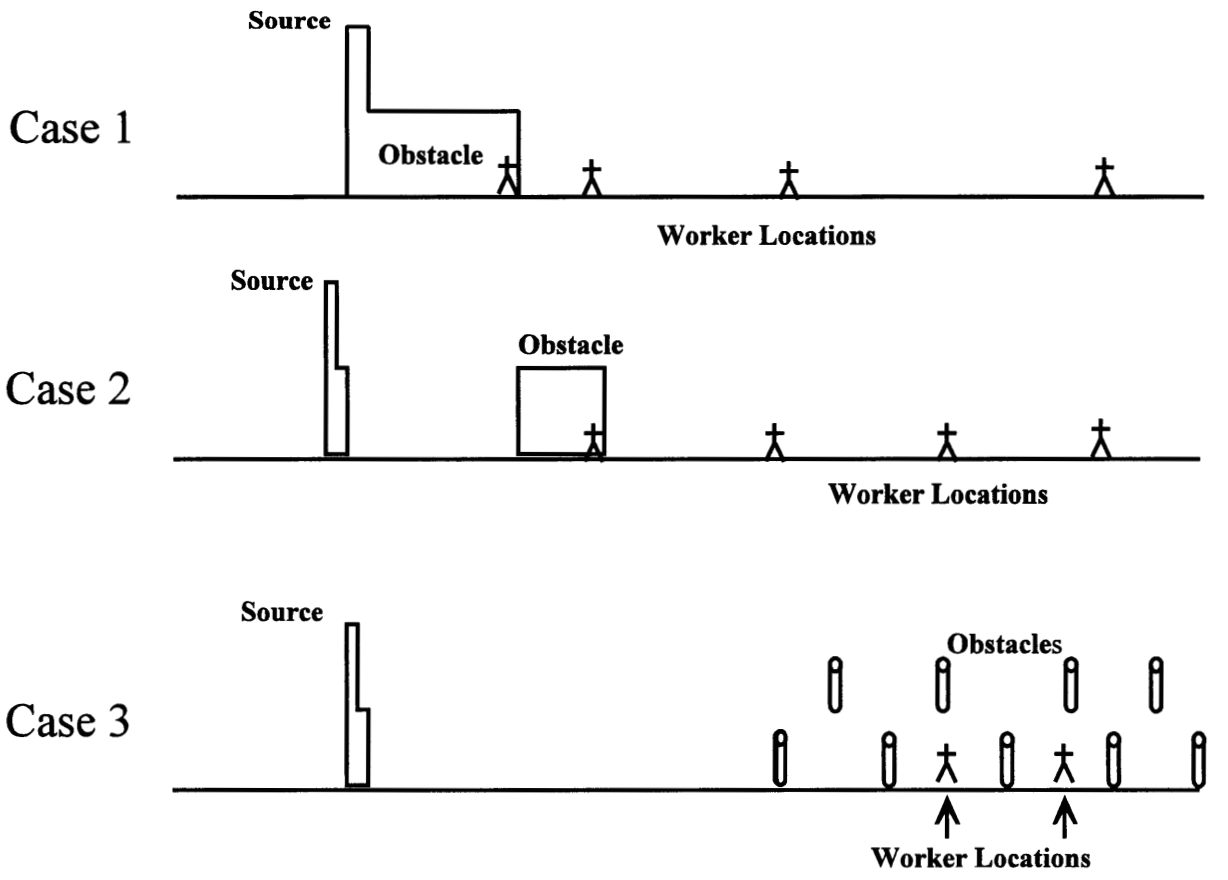


Figure 1. Three configurations for worker dose.

This may be an important configuration in repository safety analysis. Case 2 considers the situation, that may present for some workers at the repository, where there is one or more buildings intervening between the worker and the source. In this configuration, the downwind building is likely to cause increased mixing of the contaminant plume. For this reason, the doses calculated from this configuration are likely to be bounded by other configurations.[1] Case 3 is directed at considering the storage area, where there may be a large number of obstacles with workers in the space between the obstacles. Because the contaminant plume will flow through this array of objects, mixing with uncontaminated air may be greatly reduced by a channeling effect. This configuration may require a different approach. **This initial implementation of downwind worker dose will consider Case 1 only.**

To adapt the IAEA approach, we must recognize the following. The IAEA approach was developed to consider chronic (long-term) releases from a facility prior to licensing and operation. The focus of the IAEA analysis is routine releases from a facility and whether such releases induce acceptable concentrations for receptors downwind of the releases. To the contrary, we are concerned with acute, accidental releases. As we proceed, some parts of the IAEA approach may need to be modified to account for this difference. Another assumption based on the intent of the IAEA approach is that the source is on the building which creates the wake; however, the source may be elevated to a height that is substantially greater than the building height. This would be an expected configuration for a facility routinely allowing releasing from a stack.

The IAEA document defines three zones determined by the flow of air over and around the building: (1) displacement zone, (2) wake zone, and (3) cavity zone as shown in Figure 2 (Figure 4 in the IAEA document). The displacement zone is a region some distance downwind from the building, where the concentration is relatively unaffected by the building and its wake. Since the source is considered to be at some elevation, the contaminant plume must travel some distance before it reaches ground level. The displacement zone begins approximately at the point where the contaminant plume first touches down to ground level. This assumes a ground-level receptor,

---

[1]There may be slightly higher concentrations immediately downwind of the building in its cavity zone, because contaminants will be recirculated in a finite volume. However, the obstacle building is likely to be 65 to 100 m downwind of the source building. For a nominal building height of 34m and width between 135m and 150m the cavity zone is likely to extend no more than $2.5xA^{1/2}$, which is approximately equal to 2.5x70.7m = 175m. Thus a receptor in the cavity zone is likely to be 2 to 3 times the distance of the obstacle building from the source building. If a worker is within the cavity zone, his dose will be significantly higher than the dose to a worker at the same distance, but not in the cavity zone. This is because the worker in the cavity zone will experience a concentration close to that ahead of the obstacle (say the 75 m concentration), while the worker in the plume with no obstruction will experience the concentration at up to 175m. At these small distances, such changes will cause significant changes in concentration. However, the dose to a worker between the source and obstacle building will be higher than either of these.

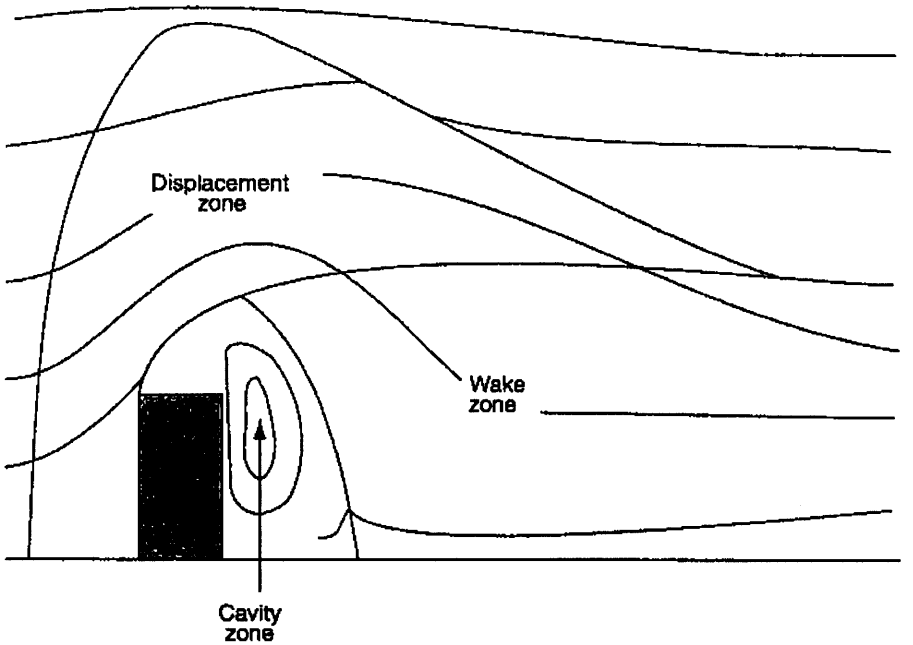


Figure 2. Air flow around a building, showing the three main zones of flow: displacement zone, wake zone and cavity zone.

which is consistent with this worker dose scenario. The cavity zone is immediately leeward of the building. Because contaminants may become trapped in the cavity zone (an attached vortex), the concentration in the cavity zone is strongly affected by the presence of the building. Concentration in the wake zone, which is essentially between the displacement zone and cavity zone, are reduced over what might be expected if no building were present. This is because the building provides additional turbulent mixing which reduces the concentration.

A receptor may be located at ground level and at any distance, x, downwind from the building. This distance, x, will determine in which of these three zones the receptor is located; depending on the zone, a different model is used for estimating concentration. The IAEA approach for determining zones is illustrated in Figure 3 (Figure 5 in the IAEA document). To implement this approach in the PCSA Tool a number of sequential windows will need to be used. At various points in this discussion these windows will be indicated.

WINDOW 1.

The user must specify the building height in meters, H_B, and the source height in meters, H_S. These numbers must be zero or greater.

If $H_S > 2.5 \cdot H_B$ then go to Window 2; if $H_S \leq 2.5 \cdot H_B$ then go to Window 3.

WINDOW 2.

The plume does not touch down until after the wake zone. Use the RSAC model with a receptor

elevation equal to zero. The user must specify the distance between the building and the receptor, x, in meters; then proceed with the RSAC calculation. Values for $x \leq 2.5 \cdot H_B$ will

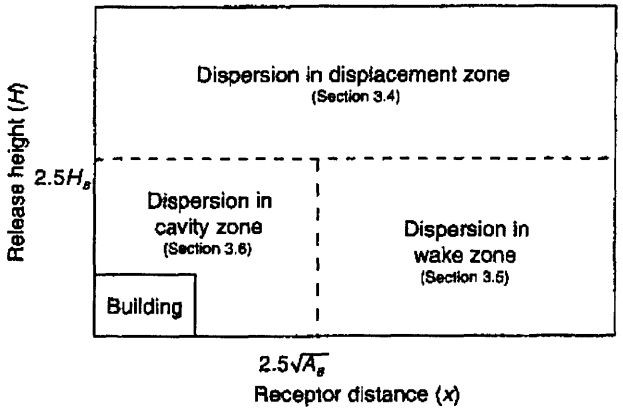


Figure 3. *Relationship between release height and receptor distance for determination of the type of dispersion model to be used.*

probably not yield meaningful results (the receptor is located closer to the building before the location where the plume touches down; after all, this is why releases are elevated). Consider providing a warning if a close distance is chosen or do not allow a calculation for small distances ($x \leq 2.5 \cdot H_B$).

Window 3.

Input the building width or length, W_B, in meters. This could also be whatever length the user desires to characterize the dimension of the building in the direction perpendicular to the direction of the wind. A bigger W_B will produce a bigger cross-wind area, which will increase the size of the cavity zone; i.e., bigger buildings have bigger trapped vortex zones. Calculate:

$$A_B = W_B \cdot H_B \quad (m^2)$$

Input the receptor distance, x, in meters. Calculate the quantity:

$$Q_B = 2.5 \cdot [A_B]^{1/2}$$

If $x \leq Q_B$, then go to Window 4.

If $x > Q_B$, then go to Window 5.

Window 4.

Is the receptor on the same surface of the building as the release? For example, is the receptor on

the roof with a roof vent releasing radionuclides; or is the receptor at a window on the side of a building that has a vent releasing radionuclides?
If yes, then go to Window 6.
If no, then go to Window 7.

Window 6.
Input the diameter of the vent or stack, D_S, in meters.
If $x \leq 3 \cdot D_S$, then go to Window 8
If $x > 3 \cdot D_S$, then go to Window 9.

Window 8.
Input the flow rate, V, in m^3/s, through the vent emitting radionuclides.
Run RSAC using the standard release (whatever that has been determined to be) at a distance of 100m, **but assume a ground level release (H_B=0)**. Extract the numerical value of chi/Q, in s/m^3, from the RSAC run, as well as the dose from each pathway and organ. Calculate the scaling factor:

$$F_V = 1/\{V \cdot [chi/Q]\}$$

Multiply the dose from each pathway and organ by the scaling factor; the results are the pathway and organ doses for this case (V - vent). Sum the pathway doses to obtain the total dose for this case.
This essentially assumes the receptor has his head in the stack and is breathing undiluted contaminated air as it is released from the vent; he may also get a dose from immersion.

Window 9.
Remember that for this screen the distance from the receptor to source should be:

$$3 \cdot D_S < x \leq Q_B$$

and the receptor should be on the same side of the building as the release vent.
Run RSAC using the standard release (whatever that has been determined to be) at a distance of 100m, **but assume a ground level release (H_B=0)**. Extract the numerical value of: (1) chi/Q, in s/m^3, from the RSAC run, (2) the mean wind speed, U_A, in m/s, as well as (3) the dose from each pathway and organ. Calculate the scaling factor:

$$F_S = 30/\{U_A \cdot x^2 \cdot [chi/Q]\}$$

Multiply the dose from each pathway and organ by the scaling factor; the results are the pathway and organ doses for this case (S - side). Sum the pathway doses to obtain the total dose for this case.
This essentially assumes the releases from the vent may be recirculated close to the side of the building ; because of zones of stagnation and building wakes, high concentrations, hence doses, may be experienced.
Consider adding a test to assure that the correction factor can be no higher than F_V computed in Window 8.

Window 7.
This receptor is in the cavity zone, but is not on the same side of the building as the vent.
Run RSAC using the standard release (whatever that has been determined to be) at a distance of

100m, **but assume a ground level release (H_B=0)**. Extract the numerical value of: (1) chi/Q, in s/m^3, from the RSAC run, (2) the mean wind speed, U_A, in m/s, as well as (3) the dose from each pathway and organ. Let $L_B = \min\{W_B, H_B\}$ Calculate the scaling factor:

$$F_C = 1/\{U_A \cdot \pi \cdot L_B \cdot K \cdot [chi/Q]\}$$

Where K=1m and is included to make the units consistent. Multiply the dose from each pathway and organ by the scaling factor; the results are the pathway and organ doses for this case (C - cavity). Sum the pathway doses to obtain the total dose for this case.

This essentially assumes the releases from the vent or stack are recirculated in the cavity zone; the quantity of radioactivity released per unit time (Q) is diluted by a flow equal to the product of π m and L_B (the smallest dimension of the building facing the wind) and U_A (the wind speed).

Consider adding a test to assure that the correction factor can be no higher than F_V computed in Window 8.

Consider adding a test to assure that the distance from the stack does not exceed the building dimension in that direction.

Window 5.

This receptor is in the wake zone. For this case x must be within certain limits:

$$\cancel{2.5 \cdot H_B} \geq x > Q_B = 2.5 \cdot [A_B]^{1/2}$$

For an ordinary Gaussian plume the concentration at ground level is given by:

$$C=(Q/U) \cdot [\exp-\{(h/\sigma_z)^2\}]/[\pi\ \sigma_z\ \sigma_y];$$

What we will assume for the wake zone is that the release is at ground level (this increases the concentration), but the vertical dispersion coefficient is increased (this decreases the concentration). Therefore: Run RSAC using the standard release (whatever that has been determined to be) at the distance x, **but assume a ground level release (H_B=0)**. Extract the numerical value of: (1) chi/Q, in s/m^3, from the RSAC run, (2) the value of the vertical dispersion coefficient, σ_z , (sigz in the RSAC output), as well as (3) the dose from each pathway and organ. Compute the quantity:

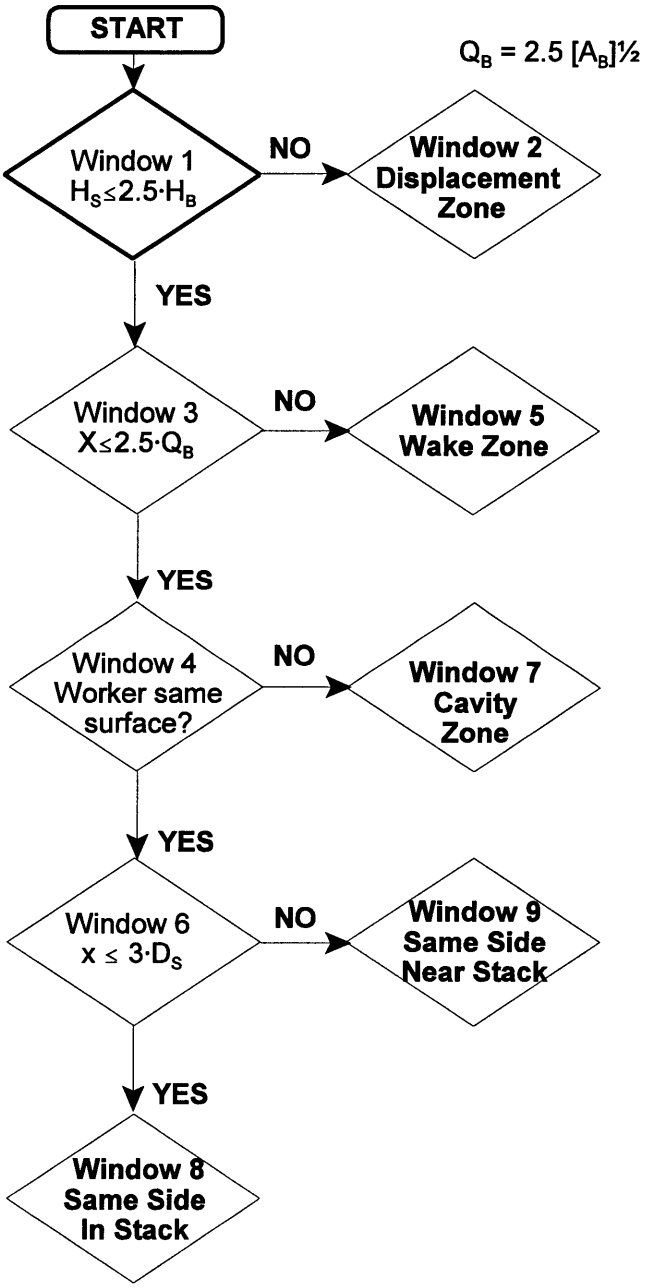
$$\sigma_{zmod} = [(\sigma_z)^2 + (A_B/\pi)]^{1/2}$$

Compute the scaling factor:

$$F_W = \sigma_z / \sigma_{zmod}$$

Multiply the dose from each pathway and organ by the scaling factor; the results are the pathway and organ doses for this case (W - wake). Sum the pathway doses to obtain the total dose for this case.

DRAFT FOR DISCUSSION



Software Validation Test Report (SVTR)

SVTR#: 14-3	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta Q)
Test ID: 6.14	Test Series Name: Display Images

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0.0 BetaQ installed

Input Data (files, database, mode settings): Default PCSA Tool database, pcsademo available on startup

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: Verify images can be added, viewed and deleted.

Test Procedure:
From the main menu, images–>DOE, open the images form. Verify that one or more images can be viewed. Add a new jpg image to the review section by opening the images–>Review form. Delete the image just added and verify it is removed from the screen.

Test Results

Verified that the North Portal Plan and Typical Design Drawing Electrical Single Line could be viewed. These images were viewed in Microsoft Photo Editor. Added a jpg image of a screen capture to the images, review screen and subsequently removed it. Since images could be viewed, added, and deleted, this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 12, 2004

Software Validation Test Report (SVTR)

SVTR#: 14-4	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta R)
Test ID: 6.14	Test Series Name: Highlight Doses and Dose Rates Above Limits (Performance Assessment)

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine pitor, Windows XP

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0.0 BetaR installed

Input Data (files, database, mode settings): A new database is created on startup containing as a minimum category 1 and category 2 event sequences for both the public and worker.

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: Verify doses and dose rates are highlighted when above limits

Test Procedure:
For the public and workers, enter doses and in the case of the noninvolved worker, enter dose rates for event sequences. Verify the doses and dose rates are highlighted when above the limits identified in attachment 1.

Test Results

Doses and dose rates are highlighted in accordance with attachment 1 and are shown on the attached reports; therefore this test passed.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: George Adams	Date: August 17, 2004

Attachment 1

Type	Category	Limit
Public	1	0.015 rem
Public	2	5 rem
Worker Involved	1	5 rem
Worker Noninvolved	1	100 mrem
Worker Noninvolved	1	2 mrem/hr (dose rate)

Project: svtp14-4

Doses: rem
Frequency: 1/yr

Functional ID	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Man	Dose, Pt. Estimate freq. * dose % contribution	Additional Information
A.1	1	2	1.00E-01	1		Y	[redacted] 1.51E-03 50.17	category 1
A.1	1	1	1.00E-01	1		Y	1.50E-02 1.50E-03 49.83	category 1

Total Frequency Weighted Dose (rem/yr)	**3.01E-03**
Normal Operation Dose (rem/yr)	**0.00000**
Total Dose (rem/yr)	**3.01E-03**

Project: svtp14-4

Doses: rem
Frequency: 1/yr

Functional ID	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Internal External TEDE freq. * dose % contribution	Additional Information
A.1	1	1	1.00E-01	1		5.00E+00 [redacted] [redacted] 1.00E+00 66.62	category 1
A.1	1	2	1.00E-01	1		2.50E+00 2.51E+00 [redacted] 5.01E-01 33.38	category 1

Total Frequency Weighted Dose (rem/yr)	**1.50E+00**
Normal Operation Dose (rem/yr)	**0.00000**
Total Dose (rem/yr)	**1.50E+00**

Project: svtp14-4

Doses: rem
Frequency: 1/yr

Functional ID	Event Scenario Identifier	Event Sequence Identifier	Event Sequence Frequency	Cat.	Description	Internal (Facility) External (Facility) TEDE (Facility) freq. * dose % contribution Dose Rate (rem/hr)	Additional Information
A.1	1	2	1.00E-01	1		1.00E-01 [redacted] [redacted] 2.01E-02 50.12 [redacted]	category 1
A.1	1	1	1.00E-01	1		1.00E-01 1.00E-01 [redacted] 2.00E-02 49.88 2.00E-03	category 1

Total Frequency Weighted Dose (rem/yr)	**4.01E-02**
Normal Operation Dose (rem/yr)	**0.00000**
Total Dose (rem/yr)	**4.01E-02**

Software Validation Test Report (SVTR)

SVTR#: 14-5	Project #: 20.060002.01.103
Software Name: PCSA Tool	Version: 3.0 (Beta T)
Test ID: 6.14	Test Series Name: Saving the System Log and Database

Test Method

☐ code inspection
☒ output inspection
☐ hand calculation
☐ spreadsheet
☐ graphical
☐ comparison with external code

Test Environment Setup

Hardware (platform, peripherals): Machine griffon, Windows 2000 Workstation

Software (OS, compiler, libraries, auxiliary codes or scripts): PCSA Tool Version 3.0.0 BetaT installed

Input Data (files, database, mode settings): The default PCSA Demo database is available on startup

Assumptions, constraints, and/or scope of test:
Assumptions or constraints: none
Scope of the test: Verifies the System Log is updated when the user exits from the current project

Test Procedure:
Tested in accordance with attachment 1

Test Results

The System Log was updated as required in attachment 1 and the database was updated as required in accordance with attachment 1.

Test Evaluation (Pass/Fail): Pass

Notes: None.

Tester: Troy Maxwell	Date: September 3, 2004

Attachment 1

The following table is used to test the System Log and Database update functionality within the PCSA Tool.

Test	Verified	Status
1) Save on exit	Verify a new entry can be placed in the System Log. Verify the database changes were saved.	Pass
2) Intermediate save only and exit	Verify a new entry can be placed in the System Log. Verify only the intermediate changes were saved.	Pass
3) No saves and exit	Verify no new entry is requested for the System Log.	Pass
4) Save and then open or create a new project	Verify a new entry can be placed in the System Log. Verify the database changes were saved.	Pass
5) Intermediate save only and then open or create a new project	Verify a new entry can be placed in the System Log. Verify only the intermediate changes were saved.	Pass
6) No saves and then open or create a new project	Verify no new entry is requested for the System Log.	Pass

Software Change Reports (SCRs)

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*):	**2. Software Title and Version:**	**3. Project No:**
431	PCSA Tool, Version 3.0.0 (BetaE)	20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Project Tree Module

A) The tree structure needs to remain at the current level after the user specifies a level. Also, there needs to be expand and collapse buttons added so that the entire tree can be seen or only the portion of the tree down to the selected level is seen.
B) Multiple people may perform analysis therefore, in order to keep track of the changes different users make, each user needs to have the capability to log their actions.
C) Need to add a Crystal Report

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Added collapse and expand buttons to the Project Tree form.
B) Added logging capability for which a log table was added to the database. A user is required to log their changes if they saved changes and previously logged data is present.
C) Crystal Report was added showing the Project Tree information

8. Implemented by:	**Date:**
Al Lozano, G. Adams, D. Stead	April 20, 2004

9.	**Pass**	**Fail**	**Description of Acceptance Tests:**
1.	☑	☐	The Project Tree remains at the current level after the user selects a node on the tree.
2.	☑	☐	Command Buttons perform their intended function. Note especially the expand and collapse buttons.
3.	☑	☐	Text fields update correctly.
4.	☑	☐	"Functional Area Descriptions" form allows the user to enter information for a level. The information is stored and can later be retrieved and updated.
5.	☑	☐	"Crystal Report" captures the information on the form. (Note any missing Information.)
6.	☑	☐	Log feature works correctly as follows: 1) When the user saves changes during a session, the log form opens to allow the user to log their changes. 2) When the log form opens, if no entries are currently logged, then an entry is optional; otherwise, an entry is required.

Note: Comments on testing are included as Attachment 1.

10. Tested by: Brandi L. Winfrey	**Date:** April 22, 2004

CNWRA Form TOP-5 (05/2000)

ATTACHMENT 1

Test	Comments
1 – Tree remains at current level after node selection	**PASSED**
2 – Command Buttons Expand and Collapse	**PASSED**
3 – Text Fields update correctly	**PASSED**
4 – Define Levels, Add Level, Edit Selection, Delete Selection	**PASSED** • Define Levels Button allows the user to define the levels of the Project Tree. The effect of defining these levels can be seen by setting the levels, closing the project tree, opening the "Initiating Event Form" and viewing the selected levels in the upper right text screen. • Clicking on the "Add Level button creates a level number. This is applied to the new level with the "Apply" button. • The "Edit Selection" button is used to label the 1st through 4th levels as well as add optional remarks. • When a level is selected and the "Delete Selection" button is clicked, the selected level is removed from both the Project Tree and the Report.
5 – Show Report	**PASSED** Note: It is cumbersome to compare the report with the tree because when the report is active, the tree is not, so you cannot scroll to the unseen levels without closing the report. Also, the screen containing the tree is not extendable to allow full view of the tree.
6 – Log on exit	**PASSED** Note: The log form opens AFTER the program prompts you to save with a pop-up dialog. Even if you elect not to save, the log form will appear. This is supposed to happen.
Additional Comments:	
When setting the Project Tree levels with the "Define Levels" button, it would be useful for this information to show up on the Report as a column header instead of "1st Level", "2nd Level", etc… In version BetaE, the report was upgraded to show the levels defined.	

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 432	2. Software Title and Version: PCSA Tool, Version 3.0.0 (Beta G)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): System Description Module

A) Need to have a new form (System Description) with several tabs for the user to have available for describing the system to include the following:
   1) Description and functions (Function tab)
   2) Facility operations and procedures (Operation Sequence tab)
   3) Characterization of the waste (Waste Characterization tab)
   4) Human actions (Human Actions tab)
   5) Description of shielding and worker location (Shielding tab)
   6) Software systems used (Software System tab)
   7) Fire hazard data (Fire Hazards tab)
   8) General information (General tab)
   9) Assumptions (Assumptions tab)

B) Need to add Crystal Reports for each of the tabs.

C) Need to add the capability for the user to select images from the Shielding tab. Also, the user needs to have the capability to add and remove images to and from the database

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Added the System Description Form to include the following tabs: Function, Operation Sequence, Waste Characterization, Human Actions, Shielding, Software System, Fire Hazards, General, Assumptions

B) Added Crystal Reports showing the information on each of the tabs.

C) Within the shielding tab of the System Description form, the user has the capability of viewing images that have been entered into the database. The user can add, view, and remove images using a new "Images" form added under the "Images" menu item.

8. Implemented by:	Date:
M. Silliman, D. Stead, G. Adams	May 7, 2004

9.	Pass	Fail	Description of Test
1	☑	☐	Form controls function correctly.
2	☑	☐	Command Buttons perform their intended function
3	☑	☐	Crystal Reports capture the information on the tabs. (Note any missing Information.)
4	☑	☐	Images can be selected from the shielding tab and can be added, viewed, and removed from the Images form.

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Brandi L. Winfrey	Date: May 10, 2004

CNWRA Form TOP-5 (05/2000)

SCR 432 Attachment 1

Test 4 - Shielding Tab says to "Double-click on image name...", but in order to get the image to display, the user has to double-click on **Image Type**. Also, to add or remove images, one must go to the drop down menu on the main toolbar outside of the System Description dialog. To see the change implemented, the System Description dialog window must be closed and then re-opened. This was corrected in version BetaF.

Results for testing Action commands for Tests 1-3 are shown below.

Action Command	**Expected Result & Comment**	**(P/F)**
Function	Opens the Function input window.	P
Operation Sequence	Opens the Operation Sequence input window.	P
Waste Characterization	Opens the Waste Characterization input window.	P
Human Actions	Opens the Human Actions input window.	P
Shielding	Opens the Shielding input window.	P
Software System	Opens the Software System input window.	P
Fire Hazards	Opens the Fire Hazards input window.	P
General	Opens the General input window.	P
Assumptions	Opens the Assumptions input window.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Prompts the user with an "Assumption" input box (I).	P
Edit Record	Allows the user to alter information in the current window in the selected field.	P
Copy Record	Copies selected record in the current window, giving it a new item number.	P
Delete Record	Deletes selected records in the current window.	P
Show Report	Displays the user input in report format.	P

Close	Closes the "System Description/Assumptions" window. Closes the entire System Description window, not just the Assumptions window.	P
Apply	Adds the user input into the System Description, Assumptions window.	P
Cancel	Closes the "Assumption" input box while not retaining any user input.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record A.	Prompts the user with an "Data" input box (I).	P
Edit Record A.	Allows the user to alter information in the current window.	P
Copy Record A.	Copies selected record in the current window, giving it a new item number.	P
Delete Record A.	Deletes selected records in the current window.	P
Add Record B.	Prompts the user with an "Data" input box (I).	P
Edit Record B.	Allows the user to alter information in the current window.	P
Copy Record B.	Copies selected record in the current window, giving it a new item number.	P
Delete Record B.	Deletes selected records in the current window.	P
Edit Record/Update	Allows the user to edit and update References and Additional Information in the "System Description/Human Actions" window.	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/Human Actions" window. Closes the entire System Description window, not just the Human Actions window.	P
OK	Adds the user input into the System Description/Human Actions window.	P

Cancel	Closes the "Assumption" input box while not retaining any user input.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record/Update	Allows the user to enter and update data in the "System Description/Waste Characterization" window. Note: if there are multiple records entered, when the Update button is clicked, the record is updated, and the screen jumps to the LAST record. This is NOT an error, but also not standard practice (the record being updated should remain the current record in view). This was corrected in version BetaG.	P
Edit Record	Allows the user to alter information in the current window.	P
Scroll Arrows	Scrolls back and forward through available records, one at a time, jump to the first or last record.	P
Delete Record	Prompts the user with a "Delete Record?" option (I).	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/Waste Characterization" window.	P
Yes	Deletes the selected record. Note: It DOES delete the record, but does NOT delete the text from the screen when there is only one record available. This should be corrected. This was corrected in version BetaG.	P
No	Closes the "Delete Record?" window and does not delete the selected record.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record/Update	Allows the user to enter and update data in the "System Description/Operation Sequence" window.	P
Edit Record	Allows the user to alter information in the current window.	P
Delete Record	Prompts the user with a "Delete Record?" option (I).	P

Show Report	Displays the user input in report format.	P
Scroll Arrows	Scrolls back and forward through available records, one at a time, jump to the first or last record.	P
Close	Closes the "System Description/Operations Sequence" window.	P
Yes	Deletes the selected record.	P
No	Closes the "Delete Record?" window and does not delete the selected record.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Edit Record/Update	Allows the user to enter and update data in the "System Description/Operation Sequence" window.	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/Function" window.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Edit/Update	Allows the user to enter and update data in the "System Description/Operation Sequence" window.	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/General" window.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record/Update	Allows the user to enter and update data in the "System Description/Operation Sequence" window.	P
Edit Record	Allows the user to alter information in the current window.	P
Delete Record	Prompts the user with a "Delete Record?" option (I).	P
Show Report	Displays the user input in report format.	P

Close	Closes the "System Description/Fire Hazards" window.	P
Yes	Deletes the selected record.	P
No	Closes the "Delete Record?" window and does not delete the selected record.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Prompts the user with a "Data" window (I).	P
Edit Record	Allows the user to alter information in the current window.	P
Copy Record	Allows the user to copy the selected record and give it a new Item No.	P
Delete Record	Deletes the selected record.	P
Edit/Update	Allows the user to input data in the References and Additional Information text box.	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/Software System" window.	P
OK	Applies the user input to the System Description/Software System window.	P
Cancel	Closes the System Description/Software System window not retaining any changes.	P

Action Command	**Expected Result & Comment**	**(P/F)**
Add Record/Update	Allows the user to enter and update data in the "System Description/Shielding" window.	P
Edit Record	Allows the user to alter information in the current window.	P

Scroll Arrows	Scrolls back and forward through available records, one at a time, jump to the first or last record.	P
Delete Record	Prompts the user with a "Delete Record?" option (I).	P
Show Report	Displays the user input in report format.	P
Close	Closes the "System Description/Shielding" window.	P
Yes	Deletes the selected record.	P
No	Closes the "Delete Record?" window and does not delete the selected record.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*):	**2. Software Title and Version:**	**3. Project No:**
433	PCSA Tool, Version 3.0.0 (BetaB)	20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Hazard Analysis Module

A) Need to add Crystal Reports to the Internal Events forms to include: Failure Modes and Effects Analysis (FMEA), What-If, Human Reliability Analysis (HRA), Energy Method, and Severe Events forms. For FMEA, What-If, HRA, and Energy Method, this includes the form itself, the table associated with the form, and the severe events list. For the Severe Events form there is just one associated Crystal Report.
B) Need to add Crystal Reports to the External Events forms to include: Naturally Occurring and Human-Induced Events form and the individual external event edit form.

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Added the Crystal Reports to the forms and tables for FMEA, What-If, HRA, and Energy Method. Added Crystal Reports to the severe events list associated with each of these forms.
B) Added a Crystal Report to the Severe Events table.
C) Added Crystal Reports to the External Events forms.

Item not implemented: Forms and tables for Fire Hazard Analysis were not implemented in the PCSA Tool. At the current time, there is insufficient information to include Fire Hazard Analysis. If time permits, it will be included under a separate SCR.

8. Implemented by:	**Date:**
G. Adams	March 8, 2004

9. Pass	**Fail**	**Description of Acceptance Tests:**
1 ☑	☐	Command Buttons perform their intended function.
2 ☑	☐	Text fields update correctly. Note any field length limitations.
3 ☑	☐	"Crystal Report" captures the information on the forms. (Note any missing Information.)

Note: Additional information including in Attachment I.

10. Tested by: Troy Maxwell	**Date:** April 12, 2004

CNWRA Form TOP-5 (05/2000)

Attachment I

Int. Events/FMEA		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Activates the text box to add a record.	P
Delete Record	Deletes the record currently displayed and prompts the user.	P
Edit Record	Allows the user to modify any data in the form.	P
Show Report	Displays the information input into the System Description form in report format.	P
FMEA Table/Form	Toggles between FMEA Form and FMEA Table windows.	P
Close	Closes the window and returns to the main project screen retaining any changes made.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Copy Record (FMEA Table only)	Copies information of the entire row into another row. Copy Record is only available in the FMEA Table.	P

Int. Events/What If		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Activates the text box to add a record.	P
Delete Record	Deletes the record currently displayed and prompts the user.	P
Edit Record	Allows the user to modify any data in the form.	P
Show Report	Displays the information input into the System Description form in report format.	P
What If Table/Form	Toggles between What If Form and What If Table windows.	P
Close	Closes the window and returns to the main project screen retaining any changes made.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected.	P

Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Copy Record (FMEA Table only)	Copies information of the entire row into another row. Copy Record is only available in the What If Table.	P

Int. Events/Energy Method		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Activates the text box to add a record.	P
Delete Record	Deletes the record currently displayed and prompts the user.	P
Edit Record	Allows the user to modify any data in the form.	P
Show Report	Displays the information input into the System Description form in report format.	P
FMEA Table/Form	Toggles between Energy Analysis Form and Energy Analysis Table windows.	P
Close	Closes the window and returns to the main project screen retaining any changes made.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Copy Record (FMEA Table only)	Copies information of the entire row into another row. Copy Record is only available in the Energy Anal. Table.	P

Int. Events/Human Reliability Analysis		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Activates the text box to add a record.	P
Delete Record	Deletes the record currently displayed and prompts the user.	P
Edit Record	Allows the user to modify any data in the form.	P
Show Report	Displays the information input into the System Description form in report format.	P
HRA Table/Form	Toggles between HRA Form and HRA Table windows.	P
Close	Closes the window and returns to the main project screen retaining any changes made.	P

Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Copy Record (HRA Table only)	Copies information of the entire row into another row. Copy Record is only available in the HRA Table.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 434	2. Software Title and Version: PCSA Tool, Version 3.0.0 (BetaE)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Frequency Analysis Module

A) Need to upgrade standalone Saphire software to version 6.77.
B) Categorization of initiating events needs to be modified to identify three different categories: 'Likely,' 'Unlikely,' and 'Not Included.' The classification of event sequences needs to be modified to be strictly consistent with the definitions of Category 1 and Category 2 event sequences in 10 CFR Part 63.
C) Need to add a seismic fragility form with associated database and report capability.
D) Need to add Crystal Reports to the Initiating Event, Event Tree, Fault Tree, and Event Sequence forms.

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) The current version of the Saphire software is 6.70. The upgrade to version 6.77 was not completed due to time constraints.
B) Modified the Initiating Event form to classify initiating events as 'Likely', 'Unlikely,' and 'Not Included.' The criteria is as follows: Given the same operational period of 100 years, a likely event will occur with a frequency of 1.00e-2 or greater, an unlikely event will occur with a frequency less than 1.00e-2 but at least 1.01e-6, and a 'not included' event will occur with a frequency less than 1.01e-6.
C) Modified the Event Sequence form to classify event sequences as category 1, category 2, and BCFL. The criteria is as follows: Given the same operational period of 100 years, a category 1 event sequence will occur with a frequency of 1.00e-2 or greater, a category 2 event sequence will occur with a frequency less that 1.00e-2 but at least 1.01e-6, and a BCFL event sequence will occur with a frequency less than 1.01e-6.
D) A seismic fragility form was not added due to time constraints.
E) Crystal Reports were added to the Initiating Event, Event Tree, Fault Tree, and Event Sequence forms.

8. Implemented by:	Date:
D. Stead, G. Adams, M. Silliman	March 30, 2004

9.	Pass	Fail	Description of Acceptance Tests:
1	☑	☐	The classification of initiating events and event sequences is performed correctly.
2	☑	☐	Command Buttons perform their intended function.
3	☑	☐	All form controls update correctly.
5	☑	☐	Crystal Reports capture the information on the forms. (Note any missing Information.)

Note: Additional information included in Attachment I.

10. Tested by: Troy Maxwell	Date: April 21, 2004

CNWRA Form TOP-5 (05/2000)

Attachment I

Freq. Analysis/Initiating Event		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record (Form/Table)	Activates the text box to add a record.	P
Delete Record (Form/Table)	Deletes the record currently displayed and prompts the user.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected..	P
Edit Record (Table)	Allows the user to modify any data in the form.	P
Show Report (Form/Table)	Displays the information input into the Initiating Event Form in report format.	P
Init. Table/Form	Toggles between Init. Form and Init. Table windows.	P
Edit Record (Table)	Allows the user to edit input in the Initiating Event Table.	P
Copy Record (Table)	Copies information of the entire row into another row. Copy Record is only available in the Initiating Event Table.	P
Close (Form/Table)	Closes the window and returns to the main project screen retaining any changes made.	P

Freq. Analysis/Event Tree/Event Scenario		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Scenario	Activates the text boxes in the Event Scenario section and allows the user to add a scenario.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected..	P
Delete Scenario	Deletes the scenario currently displayed and prompts the user.	P
Show Report	Displays the information input into the Event Tree Form Form/Event Scenario in report format.	P

Close	Closes the window and returns to the main project screen retaining any changes made.	P

Freq. Analysis/Event Tree/Subsequent Events		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Allows the user to add a record to the Subsequent Events section of the Event Tree Form.	P
Edit Record	Allows the user to edit a record to the Subsequent Events section of the Event Tree Form.	P
Copy Record	Allows the user to copy a record to the Subsequent Events section of the Event Tree Form.	P
Delete Record	Allows the user to delete a record to the Subsequent Events section of the Event Tree Form.	P
Show Report	Displays the information input into the Event Tree Form Form/Subsequent Events in report format.	P
Close	Closes the Event Tree Form.	P

Freq. Analysis/Fault Tree		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record (Form/Table)	Activates the text boxes in the Fault Tree Form and allows the user to add a scenario.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected..	P
Delete Record (Form/Table)	Deletes the scenario currently displayed and prompts the user.	P
Show Report (Form/Table)	Displays the information input into the Fault Tree Form in report format.	P
Event Table	Displays the Fault Tree Event Table.	P
Edit Record (Table)	Allows the user to modify any data in the form.	P
Copy Record (Table)	Allows the user to copy any data in the form.	P
Close (Table)	Closes the Table window and returns to the Form window.	P
Close (Form)	Closes the window and returns to the main project screen retaining any changes made.	P

Freq. Analysis/Event Sequence		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record (Form/Table)	Activates the text boxes in the Event Sequence Form and allows the user to add a scenario.	P
Update Record	Applies and saves any new information or changes made. Update Record is displayed if Add Record or Edit Record have been selected.	P
Cancel	Returns the user to the default form display screen without retaining user input. Cancel is displayed if Add Record or Edit Record have been selected..	P
Delete Record (Form/Table)	Deletes the scenario currently displayed and prompts the user.	P
Show Report (Form/Table)	Displays the information input into the Event Sequence Form in report format.	P
Event Seq. Form/Table	Toggles between the Event Sequence Form and Table.	P
Edit Record (Table)	Allows the user to modify any data in the form.	P
Copy Record (Table)	Allows the user to copy any data in the form.	P
Close (Table)	Closes the Table window and returns to the Form window.	P
Close (Form/Table)	Closes the window and returns to the main project screen retaining any changes made.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 435	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (BetaE)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Consequence Analysis Module

A) Need to add Crystal Reports for both RSAC input and output. The RSAC output Crystal Reports will include graphics.
B) Need to upgrade RSAC to Version 6.2. Version 6.1 will not execute on Windows XP machines. Version 6.1 executes on both Windows NT and Windows XP machines.
C) Incorporate MACCS2. The capability will be added to manually enter consequence analysis runs from MACCS2. This capability will extend to packages other than MACCS2.
D) Need to give the user the capability to enter Normal Operation Dose and descriptive information for that dose.

5. Change Requested by: Name: B. Dasgupta, R. Benke Date: July 10, 2003	**6. Change Authorized by (*Software Developer*):** Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Crystal Reports were added for both RSAC input and RSAC output. For RSAC output, graphs were added showing the doses by pathway and radionuclide.
B) RSAC was upgraded to Version 6.2. The Software Validation Test Report for RSAC Version 6.2 was completed in January, 2004.
C) Incorporated a Manual Data entry capability into consequence analysis. The user will have the capability to enter deterministic dose values for consequence analyses they conduct offline.
D) Added a Normal Operation Dose form for the public.

8. Implemented by: D. Stead, G. Adams	**Date:** April 13, 2004

9. Pass	**Fail**	**Description of Acceptance Tests:**
1 ☑	☐	Tabular data can be edited. Note especially data type and any size restrictions on entered data.
2 ☑	☐	Command Buttons perform their intended function.
3 ☑	☐	Text fields update correctly.
4 ☑	☐	Consequence results can be manually entered. Note any limitations on entering data manually.
5 ☑	☐	RSAC can be invoked and runs to completion. It can be invoked in deterministic and probabilistic mode for BWR, PWR, and User Specified Fuel Types. In addition it can be invoked using the Advanced RSAC Input option.
6 ☑	☐	Crystal Reports capture the information on the input and output forms. (Note any missing information.)
7 ☑	☐	The Normal Operation Dose form allows the user to enter the Normal Operation Dose and associated descriptive text.

Note: Additional information is included in Attachment I.

10. Tested by: R. Janetzke	**Date:** April 28, 2004

Attachment 1

The following acceptance test tables are for SCR 435 Version BetaB.

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; PWR	
Field	Co-60	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	1.2
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; Probabilistic; Deterministic	
Field	Type of Run	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	F; Error 13	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Release Fraction...	
Field	Release Fraction	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP=<1	0.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004
Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Release Fraction...	
Field	Release Fraction	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP=<1	1.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis
Button Sequence	Release Fraction...; Probabilistic; Deterministic
Field	Release Fraction

Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	F; Values are changed to default values rather than those in the project file.	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Bldg discharge...	
Field	Vapors...	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP=<1	1.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Bldg. Discharge...; Probabilistic	
Field	Number...	
Types Accepted (I=integer, R=real, T=text):	I	**New Value**

Range Accepted (N = all negatives, Z = zero, P = all positives):	P	2
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Release Fraction; Pool; Restore all defaults	
Field	Release in	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		Pool
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	F; Does not restore "Air" as default value.	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Meterological	
Field	Input value; mixing layer height.	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP=<3000	3000.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Inhalation dose	
Field	Input value; inhalation...	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	3.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Inhalation dose	
Field	Input value; Activity mean...	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	P>0.1	0.1
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis
Button Sequence	Ground Surface...
Field	Inpu tvalue; decay time...

Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	10.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Ground Surface	
Field	Input value; Building...	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP=<1.0	0.2
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Submersion...	
Field	Input value; decay time	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**

Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	10.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Ingestion...	
Field	Input value; Time crops...	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	P>0.04	17.
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; Fuel type	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		"User Specified"
Archive File	scr435-1.mdb	

Restorable	yes
Status (P=pass, F=fail)	F; Does not run RSAC when supplied with PWR default values.

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Restore all defaults; Perform An...	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P; RSAC runs	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	PWR; Perform An...	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P; RSAC runs.	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-7-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Probabilistic; Fuel Selection/... ; BWR; Bldg D...; Perform An...	
Field	Number of R...	
Types Accepted (I=integer, R=real, T=text):	I	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	P	2
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P; RSAC runs.	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; PWR; Bldg...; Perform An...	
Field	Number of R...	
Types Accepted (I=integer, R=real, T=text):	I	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	P	2
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P; RSAC runs	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; User SPec...; Probabilistic; Perform An...	
Field	Co-60	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**

Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	6.57
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	F; No RSAC input file created.	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->Normal Operation...		**Date:** 4-7-2004

Dialogue Window	Public Normal Operation Dose	
Button Sequence		
Field	Normal Operation Dose	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	F; Focus is not on an active field.	

Dialogue Window	Public Normal Operation Dose	
Button Sequence	Edit; Normal Oper...	
Field		
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	10.

Archive File	scr435-1.mdb
Restorable	yes
Status (P=pass, F=fail)	P

Dialogue Window	Public Normal Operation Dose	
Button Sequence	Edit; Description	
Field		
Types Accepted (I=integer, R=real, T=text):	T	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		test
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->Advanced RSAC Input		**Date:** 4-8-2004
Dialogue Window	Deterministic RSAC Run for Advanced User	
Button Sequence	Edit Exist...; Run Adv...	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	F; RSAC does not run to completion.	

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq. -> Public... -> RSAC -> RSAC-> Perfor...		**Date:** 4-9-2004

Dialogue Window	RSAC Most Recent Analysis
Button Sequence	RSAC Input; Show Report
Field	All
Archive File	scr435-1.mdb
Comments	All fields in the report have corresponding values on the screen.
Status (P=pass, F=fail)	P

Dialogue Window	RSAC Most Recent Analysis
Button Sequence	RSAC Output; Inhalation; Show Report
Field	All
Archive File	scr435-1.mdb
Comments	Reports do not correspond to the tab selected.
Status (P=pass, F=fail)	F; Could possibly remove the "Show Report" button from these boxes to disable attempts to show data from these tabs.

GUI Test Worksheet

Project: PCSATool(BetaB)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Pefrom....-> Curent Level... -> Public		**Date:** 4-9-2004

Dialogue Window	Results Table - Functional ID E.3.3	
Button Sequence	double click on Dose Pt.Est. For manual data ; Apply	
Field	Editing Results Table - Functional ID E.3.3	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	NZP	1.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	F; Receive Error 76 after editing and selecting 'Apply'.	

The following acceptance test tables are for SCR 435 Version BetaE, and are comprised of the tests that failed for the BetaB version.

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-28-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; Probabilistic; Deterministic	
Field	Type of Run	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Release Fraction...; Probabilistic; Deterministic	
Field	Release Fraction	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P; Values do not change to default values, but keep those in the project file.	

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Release Fraction; Pool; Restore all defaults	
Field	Release in	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		Pool
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P; Does restore "Air" as default value.	

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC		**Date:** 4-28-2004

Dialogue Window	RSAC: New or Modified Analysis	
Button Sequence	Fuel Selection/... ; Fuel type	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		"User Specified"
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P; Does run RSAC when supplied with PWR default values.	

Dialogue Window	RSAC: New or Modified Analysis
Button Sequence	Fuel Selection/... ; User SPec...; Probabilistic; Perform An...

Field	Co-60	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	ZP	6.57
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P; RSAC input file is created.	

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->Normal Operation...		**Date:** 4-28-2004

Dialogue Window	Public Normal Operation Dose	
Button Sequence		
Field	Normal Operation Dose	
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		
Archive File	scr435-1.mdb	
Restorable		
Status (P=pass, F=fail)	P; Focus is on an active field.	

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->Advanced RSAC Input		**Date:** 4-28-2004

Dialogue Window	Deterministic RSAC Run for Advanced User	
Button Sequence	Edit Exist...; Run Adv...	
Field		
Types Accepted (I=integer, R=real, T=text):		**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):		

Archive File	scr435-1.mdb
Restorable	
Status (P=pass, F=fail)	P; RSAC does run to completion.

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Conseq.->Public Dose->RSAC->RSAC-> Perfor...		**Date:** 4-28-2004

Dialogue Window	RSAC Most Recent Analysis
Button Sequence	RSAC Output; Inhalation; Show Report
Field	All
Archive File	scr435-1.mdb
Comments	
Status (P=pass, F=fail)	P; The "Show Report" button from these boxes was removed to disable attempts to show data from these tabs.

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 435	**Tester:** Janetzke
Root Test Box: Perform...-> Current Level... -> Public		**Date:** 4-28-2004

Dialogue Window	Results Table - Functional ID E.3.3	
Button Sequence	double click on Dose Pt.Est. For manual data ; Apply	
Field	Editing Results Table - Functional ID E.3.3	
Types Accepted (I=integer, R=real, T=text):	IR	**New Value**
Range Accepted (N = all negatives, Z = zero, P = all positives):	NZP	1.0
Archive File	scr435-1.mdb	
Restorable	yes	
Status (P=pass, F=fail)	P; No error after editing and selecting 'Apply'.	

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 436	2. Software Title and Version: PCSA Tool, Version 3.0.0 (BetaE)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Safety Analysis Module

A) Need to add Crystal Reports to the Safety Analysis Module. The Crystal Report needs to display information for Category 1, Category 2, and BCFL event sequences.

B) Category 1 event sequences that exceed 0.015 rem need to be highlighted, and Category 2 event sequences that exceed 5.0 rem need to be highlighted.

C) Need to modify the calculation for combinations of event sequences to reflect the work conducted by R. Benke and submitted in the journal article to *Risk Analysis*: {Benke, R. "Analytical and Numerical Solutions of the Expected Number of Occurrences for Combinations of Event Sequences due to Variability." San Antonio, TX: Center for Nuclear Waste Regulatory analyses. 2003.} A maximum of 3 combinations will be considered.

D) For compliance assessment on category 1 event sequences, the total frequency weighted dose will be calculated and displayed, and the contribution percent of each category 1 event sequence to the total frequency weighted dose will be displayed.

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Date: B. Dasgupta, R. Benke	Date: B. Dasgupta
Date: July 10, 2003	Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Crystal Report was added to display event sequences to include Category 1, Category 2, and BCFL event sequences from compliance assessment. For category 1 event sequences, doses which exceed 0.015 rem are highlighted on the Crystal Report. For category 2 event sequences, doses which exceed 5.0 rem are highlighted on the Crystal Report.

B) For Category 1 compliance assessment, the calculation for combinations of event sequences was added to a maximum of 3 combinations. A Crystal Report was added for combinations.

C) From a compliance assessment of category 1 event sequences, the total frequency weighted dose is calculated and displayed along with the event sequence percent contribution to the total frequency weighted dose. Single category 1 event sequences that exceed 0.015 rem are highlighted. In addition category 2 event sequences that exceed 5 rem are highlighted.

8. Implemented by:	Date:
D. Stead, G. Adams	April 21, 2004

9.	Pass	Fail	Description of Acceptance Tests:
1	☑	☐	Category 1 event sequences exceeding 0.015 rem and Category 2 event sequences exceeding 5.0 rem are highlighted on both the compliance assessment table and the Crystal Report.
2	☑	☐	The total frequency weighted dose is calculated and displayed on both the category 1 compliance assessment form and the Crystal Report. The event sequence percent contribution to the total frequency weighted dose is also calculated and displayed correctly.
3	☑	☐	Form controls update correctly.
4	☑	☐	Command buttons perform their intended function.
5	☑	☐	Crystal Reports capture the information on the form. (Note any missing Information.)
6	☑	☐	The PCSA Tool generates comparable output to that generated and displayed in the journal article discussed in Section 4. Note any differences in output.

(Note any additional testing and include as an attachment.)

10. Tested by: R. Janetzke	Date: April 28, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

The following acceptance test tables are for SCR 436 Version BetaC.

GUI Test Worksheet

Project: PCSATool(BetaC)	**SCR:** 436	**Tester:** Janetzke
Root Test Box: Proj. Tree -> E.3.3 -> Done -> Perform.		**Date:** 4-13-2004

Results Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 1; Search...
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Edit category 1 Dose PtEst manual data to be 0.0150 and 0.0151.
Status (P=pass, F=fail)	P; All category 1 dose fields>0.015 are highlighted in both table and report.

Dialogue Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 2; Search...
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Edit category 2 Dose PtEst manual data to be 5.0.
Status (P=pass, F=fail)	P; Category 2 dose fields = 5.0 are not highlighted in either the table or report.

Dialogue Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 2; Search...

Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Edit category 2 Dose PtEst manual data to be 5.01.
Status (P=pass, F=fail)	P; Category 2 dose fields > 5.0 are highlighted in both the table and report.

GUI Test Worksheet

Project: PCSATool(BetaC)	**SCR:** 436	**Tester:** Janetzke
Root Test Box: Proj. Tree -> E.3.3 -> Done -> Perform.		**Date:** 4-13-2004

Results Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 1; Search...; Show Report
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Dose is calculated and displayed correctly in table and report..
Status (P=pass, F=fail)	F; Some fields disappear under the cursor icon on the report, table is OK.

Dialogue Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 1; Search...; Probabilistic; Show Report
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Characters are missing from the label for "Total Frequency Weighted Dose" on the report for the probabilistic case.
Status (P=pass, F=fail)	F

GUI Test Worksheet

Project: PCSATool(BetaC)	**SCR:** 436	**Tester:** Janetzke
Root Test Box: Proj. Tree -> A.1 -> Done -> Perform.		**Date:** 4-13-2004

Dialogue Window	Results Table Project View Base Case
Button Sequence	Proj....; Safety...; Public; Compliance...; 1; Search...; set cutoff to 0; Calculate
Field	Expected Number
Archive File	scr436.mdb
Comments	Data from "Analytical and Numerical Solutions of the Expected Number of Occurrences for Combinations of Event Sequences Due to Variability", R. Benke, 2003.
Status (P=pass, F=fail)	F; Expected Number is a factor 30 less than that in the reference article. Table and Report column headings should be changed to "Expected Number of Occurrences per year".

The following acceptance test tables are for SCR 436 Version BetaE and are comprised of the tests that failed for the BetaC version.

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 436	**Tester:** Janetzke
Root Test Box: Proj. Tree -> E.3.3 -> Done -> Perform.		**Date:** 4-28-2004

Results Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 1; Search...; Show Report
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Dose is calculated and displayed correctly in table and report..
Status (P=pass, F=fail)	P; Some fields disappear under the cursor icon on the report when run on the ALBY machine. This is assumed to be limited to this machine only, since the test ran correctly on two other machines.

Dialogue Window	Results Table Project View Base Case
Button Sequence	Current Lev..;Public; edit Dose PtEst; Close Perform.; Proj....; Safety...; Public; Compliance...; 1; Search...; Probabilistic; Show Report
Field	Dose PtEst
Archive File	PCSADemo.mdb
Comments	Characters are no longer missing from the label for "Total Frequency Weighted Dose" on the report for the probabilistic case.
Status (P=pass, F=fail)	P

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SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*):	**2. Software Title and Version:**	**3. Project No:**
437	PCSA Tool, Version 3.0.0 (BetaG)	20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Risk analysis Module

A) Need to add Crystal Reports for both Deterministic and Probabilistic risk assessment to include the graphical display of probabilistic risk results.
B) Need to show the percentage contribution of each event to risk.

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Crystal Reports were added to display risk assessment output results. Report for probabilistic assessment includes a graphical display of the results.
B) The Risk Assessment output results were modified to show the percentage contribution of each event to risk.

8. Implemented by:	**Date:**
G. Adams, M. Silliman, T. Maxwell	May 7, 2004

9.	**Pass**	**Fail**	**Description of Acceptance Tests:**
1	☑	☐	The Crystal Reports capture the information on the form. (Note any missing Information.)
2	☑	☐	The percentage contribution of each event to risk is correctly calculated for both deterministic and probabilistic assessment.

Note: See Attachments 1 and 2 for comments and additional testing.

10. Tested by: Brandi L. Winfrey	**Date:** May 10, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

TEST 1: Crystal Reports Capture All Info in Report		
Action Command	**Expected Result & Comment**	**(P/F)**
Deterministic Risk	Calculate Deterministic Risk. A window will appear stating that the calculation is in progress, and when complete, the results will display in a table (I).	P
Probabilistic Risk	Calculate Deterministic Risk. A window will appear stating that the calculation is in progress, and when complete, the results will display as a graph (I) (II).	P
Double click on "Dose, PtEst"	Opens a window that calculates Event dose using a deterministic scenario calculation (III).	P
Double click on "Dose, Mean"	Opens a window that calculates Event dose using a probabilistic scenario calculation (III).	P
I. Common Buttons		
Show Report	Generate a Crystal Report. Expect all column headers to be displayed on report as well as identical reported results. For Probabilistic Report, Additional options are given (IV). Note: It would be useful for the report to state that the results are Deterministic or Probabilistic depending on which report is generated. This change was implemented in version BetaG.	P
Done	Closes the Crystal Report and returns to the Risk Analysis window.	P
II. Probabilistic Buttons		
View Table/Graph	Toggles between viewing the Graph of CCDF Output for Total Risk and the Probabilistic Results Table	P
III. Scenario Calculation		
Event Dose	Calculates Event Deterministic Dose (if "Dose, PtEst" was double clicked) or the Mean Dose (if "Dose, Mean" was double clicked) and shows the results in the previously empty text box on the same window.	P

Done	Closes the Event Dose calculation window. If no calculation was performed, an error message will appear stating that the calculation failed. This is expected.	P
IV. Do you wish to see the plot with data?		
Yes	A Crystal Report is generated that contains the CCDF OUTPUT For Total Risk graph as well as the data it was generated from. Note: the wording of this question should be changed to "Would you like to see the data with the plot?" since it is the data which is the optional item. This change was implemented in version BetaG.	P
No	A Crystal Report is generated that contains ONLY the CCDF OUTPUT For Total Risk graph.	P

TEST 2: % Contribution of Event Risk is Correctly Calculated		
Calculation Type	**Expected Result & Comment**	**(P/F)**
Deterministic	Risk = Probability * Consequence Total Risk = the sum of all risks %Contribution = (Risk/Total Risk) * 100 Risk calculations are 1/1000 off, however since % contribution is only considered to 2 significant digits this does not affect % Contribution accuracy. (see Attachment 2 for Excel spreadsheet) This is due to round off error.	P
Probabilistic	Risk = Probability * Consequence Total Risk = the sum of all risks %Contribution = (Risk/Total Risk) * 100 Risk calculations are 1/1000 off, however since % contribution is only considered to 2 significant digits this does not affect % Contribution accuracy. (see Attachment 2 for Excel spreadsheet) This is due to round off error.	P

Attachment 2

Deterministic Results:

Note: cells highlighted in [redacted] have differences in accuracy.

Data and Results obtained from PCSATool version 3.0.0 (BetaD)				Results Calculated by Excel	
Probability	Consequence (rem)	Risk (rem in time period)	Contribution (%)	Risk (rem in time period)	Contribution (%)
9.274E-01	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
8.084E-03	2.766E-05	2.236E-07	3.05E-01	2.236E-07	3.05E-01
1.141E-04	1.944E-03	2.218E-07	3.02E-01	2.218E-07	3.02E-01
7.317E-06	8.032E-01	5.877E-06	8.00E+00	5.877E-06	8.00E+00
7.317E-06	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
7.317E-06	3.784E-01	[redacted]	3.77E+00	[redacted]	3.77E+00
3.596E-03	2.923E-04	1.051E-06	1.43E+00	1.051E-06	1.43E+00
3.596E-03	7.505E-04	2.699E-06	3.68E+00	2.699E-06	3.68E+00
3.596E-03	4.284E-03	1.541E-05	2.10E+01	1.541E-05	2.10E+01
3.596E-03	1.669E-03	6.002E-06	8.17E+00	6.002E-06	8.17E+00
3.596E-03	4.284E-03	1.541E-05	2.10E+01	1.541E-05	2.10E+01
3.596E-03	1.273E-06	[redacted]	6.23E-03	[redacted]	6.23E-03
3.596E-03	4.358E-05	1.567E-07	2.13E-01	1.567E-07	2.13E-01
2.557E-02	2.682E-04	[redacted]	9.34E+00	[redacted]	9.34E+00
1.147E-02	1.100E-03	1.262E-05	1.72E+01	1.262E-05	1.72E+01
3.135E-05	3.200E-04	1.003E-08	1.37E-02	1.003E-08	1.37E-02
3.135E-05	7.782E-04	2.440E-08	3.32E-02	2.440E-08	3.32E-02
3.135E-05	4.312E-03	1.352E-07	1.84E-01	1.352E-07	1.84E-01
3.135E-05	1.697E-03	[redacted]	7.24E-02	[redacted]	7.24E-02
3.135E-05	4.312E-03	1.352E-07	1.84E-01	1.352E-07	1.84E-01
3.135E-05	2.894E-05	[redacted]	1.24E-03	[redacted]	1.24E-03
3.135E-05	7.124E-05	2.233E-09	3.04E-03	2.233E-09	3.04E-03
2.229E-04	2.958E-04	[redacted]	8.98E-02	[redacted]	8.98E-02
1.000E-04	1.128E-03	1.128E-07	1.54E-01	1.128E-07	1.54E-01
3.145E-06	2.213E-03	[redacted]	9.48E-03	[redacted]	9.48E-03
1.411E-06	3.045E-03	[redacted]	5.85E-03	[redacted]	5.85E-03
1.395E-05	1.043E-03	[redacted]	1.98E-02	[redacted]	1.98E-02
1.395E-05	4.577E-03	[redacted]	8.69E-02	[redacted]	8.69E-02
1.395E-05	1.961E-03	[redacted]	3.73E-02	[redacted]	3.73E-02
1.395E-05	4.577E-03	[redacted]	8.69E-02	[redacted]	8.69E-02
1.395E-05	2.936E-04	[redacted]	5.58E-03	[redacted]	5.58E-03
1.395E-05	3.359E-04	[redacted]	6.38E-03	[redacted]	6.38E-03
9.915E-05	5.605E-04	5.557E-08	7.57E-02	5.557E-08	7.57E-02
4.449E-05	1.393E-03	[redacted]	8.44E-02	[redacted]	8.44E-02
1.395E-05	5.035E-03	[redacted]	9.56E-02	[redacted]	9.56E-02
1.395E-05	2.419E-03	[redacted]	4.60E-02	[redacted]	4.60E-02
1.395E-05	5.035E-03	[redacted]	9.56E-02	[redacted]	9.56E-02
1.395E-05	7.518E-04	[redacted]	1.43E-02	[redacted]	1.43E-02
1.395E-05	7.941E-04	[redacted]	1.51E-02	[redacted]	1.51E-02
9.915E-05	1.019E-03	1.010E-07	1.38E-01	1.010E-07	1.38E-01
4.449E-05	1.851E-03	8.235E-08	1.12E-01	8.235E-08	1.12E-01

1.395E-05	5.953E-03	[redacted]	1.13E-01	[redacted]	1.13E-01
1.395E-05	8.569E-03	1.195E-07	1.63E-01	1.195E-07	1.63E-01
1.395E-05	4.286E-03	[redacted]	8.14E-02	[redacted]	8.14E-02
1.395E-05	4.328E-03	[redacted]	8.22E-02	[redacted]	8.22E-02
9.915E-05	4.553E-03	4.514E-07	6.15E-01	4.514E-07	6.15E-01
4.449E-05	5.385E-03	2.396E-07	3.26E-01	2.396E-07	3.26E-01
1.395E-05	5.953E-03	[redacted]	1.13E-01	[redacted]	1.13E-01
1.395E-05	1.670E-03	[redacted]	3.17E-02	[redacted]	3.17E-02
1.395E-05	1.712E-03	2.388E-08	3.25E-02	2.388E-08	3.25E-02
9.915E-05	1.937E-03	1.921E-07	2.62E-01	1.921E-07	2.62E-01
4.449E-05	2.769E-03	1.232E-07	1.68E-01	1.232E-07	1.68E-01
1.395E-05	4.286E-03	[redacted]	8.14E-02	[redacted]	8.14E-02
1.395E-05	4.328E-03	[redacted]	8.22E-02	[redacted]	8.22E-02
9.915E-05	4.553E-03	4.514E-07	6.15E-01	4.514E-07	6.15E-01
4.449E-05	5.385E-03	2.396E-07	3.26E-01	2.396E-07	3.26E-01
1.395E-05	4.485E-05	[redacted]	8.52E-04	[redacted]	8.52E-04
9.915E-05	2.695E-04	2.672E-08	3.64E-02	2.672E-08	3.64E-02
4.449E-05	1.102E-03	[redacted]	6.68E-02	[redacted]	6.68E-02
9.915E-05	3.118E-04	3.091E-08	4.21E-02	3.091E-08	4.21E-02
4.449E-05	1.144E-03	5.090E-08	6.93E-02	5.090E-08	6.93E-02
3.163E-04	1.369E-03	[redacted]	5.90E-01	[redacted]	5.90E-01
2.757E-06	1.396E-03	[redacted]	5.24E-03	[redacted]	5.24E-03
1.227E-06	1.661E-03	[redacted]	2.77E-03	[redacted]	2.77E-03
1.227E-06	2.119E-03	[redacted]	3.54E-03	[redacted]	3.54E-03
1.227E-06	5.653E-03	[redacted]	9.44E-03	[redacted]	9.44E-03
1.227E-06	3.037E-03	3.726E-09	5.07E-03	3.726E-09	5.07E-03
1.227E-06	5.653E-03	[redacted]	9.44E-03	[redacted]	9.44E-03
1.227E-06	1.370E-03	[redacted]	2.29E-03	[redacted]	2.29E-03
1.227E-06	1.412E-03	[redacted]	2.36E-03	[redacted]	2.36E-03
Total Risk		7.342E-05			

Probabilistic Results:

Note: cells highlighted in [redacted] have differences in accuracy.

[redacted]				**Results Calculated by Excel**	
[redacted]	[redacted]	[redacted]	[redacted]	Mean Risk (rem in time period)	Contribution (%)
9.274E-01	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
8.084E-03	4.957E-06	[redacted]	3.75E-01	[redacted]	3.75E-01
1.141E-04	3.484E-04	3.975E-08	3.71E-01	3.975E-08	3.72E-01
7.317E-06	1.439E-01	1.053E-06	9.84E+00	1.053E-06	9.84E+00
7.317E-06	2.441E-02	1.786E-07	1.67E+00	1.786E-07	1.67E+00
7.317E-06	2.641E-02	1.932E-07	1.81E+00	1.932E-07	1.81E+00
3.596E-03	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
3.596E-03	5.239E-05	1.884E-07	1.76E+00	1.884E-07	1.76E+00
3.596E-03	2.991E-04	1.076E-06	1.01E+01	1.076E-06	1.01E+01
3.596E-03	7.674E-04	2.760E-06	2.58E+01	2.760E-06	2.58E+01
3.596E-03	2.991E-04	1.076E-06	1.01E+01	1.076E-06	1.01E+01

GUI Test Worksheet

Project: PCSATool(BetaE)	**SCR:** 436	**Tester:** Janetzke
Root Test Box: Proj. Tree -> A.1 -> Done -> Perform.		**Date:** 4-28-2004

Dialogue Window	Results Table Project View Base Case
Button Sequence	Proj....; Safety...; Public; Compliance...; 1; Search...; set cutoff to 0; Calculate
Field	Expected Number
Archive File	scr436.mdb
Comments	Data from "Analytical and Numerical Solutions of the Expected Number of Occurrences for Combinations of Event Sequences Due to Variability", R. Benke, 2003.
Status (P=pass, F=fail)	P; Table and Report column headings were changed to "Expected Number of Occurrences per year".

3.596E-03	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
3.596E-03	3.042E-06	1.094E-08	1.02E-01	1.094E-08	1.02E-01
2.557E-02	4.028E-05	1.030E-06	9.63E+00	1.030E-06	9.63E+00
1.147E-02	2.156E-04	2.473E-06	2.31E+01	2.473E-06	2.31E+01
3.135E-05	4.957E-06	1.554E-10	1.45E-03	1.554E-10	1.45E-03
3.135E-05	5.734E-05	1.798E-09	1.68E-02	1.798E-09	1.68E-02
3.135E-05	3.040E-04	[redacted]	8.91E-02	[redacted]	8.91E-02
3.135E-05	7.723E-04	2.421E-08	2.26E-01	2.421E-08	2.26E-01
3.135E-05	3.040E-04	[redacted]	8.91E-02	[redacted]	8.91E-02
3.135E-05	4.957E-06	1.554E-10	1.45E-03	1.554E-10	1.45E-03
3.135E-05	7.999E-06	2.508E-10	2.34E-03	2.508E-10	2.34E-03
2.229E-04	4.523E-05	1.008E-08	9.42E-02	1.008E-08	9.42E-02
1.000E-04	2.205E-04	2.205E-08	2.06E-01	2.205E-08	2.06E-01
3.145E-06	3.887E-04	[redacted]	1.14E-02	[redacted]	1.14E-02
1.411E-06	5.640E-04	[redacted]	7.44E-03	[redacted]	7.44E-03
1.395E-05	5.239E-05	[redacted]	6.83E-03	[redacted]	6.83E-03
1.395E-05	2.991E-04	[redacted]	3.90E-02	[redacted]	3.90E-02
1.395E-05	7.674E-04	[redacted]	1.00E-01	[redacted]	1.00E-01
1.395E-05	2.991E-04	[redacted]	3.90E-02	[redacted]	3.90E-02
1.395E-05	0.000E+00	0.000E+00	0.00E+00	0.000E+00	0.00E+00
1.395E-05	3.042E-06	[redacted]	3.96E-04	[redacted]	3.97E-04
9.915E-05	4.028E-05	[redacted]	3.73E-02	[redacted]	3.73E-02
4.449E-05	2.156E-04	[redacted]	8.96E-02	[redacted]	8.96E-02
1.395E-05	3.515E-04	[redacted]	4.58E-02	[redacted]	4.58E-02
1.395E-05	8.197E-04	1.143E-08	1.07E-01	1.143E-08	1.07E-01
1.395E-05	3.515E-04	[redacted]	4.58E-02	[redacted]	4.58E-02
1.395E-05	5.239E-05	[redacted]	6.83E-03	[redacted]	6.83E-03
1.395E-05	5.543E-05	[redacted]	7.22E-03	[redacted]	7.23E-03
9.915E-05	9.266E-05	9.187E-09	8.59E-02	9.187E-09	8.59E-02
4.449E-05	2.679E-04	1.192E-08	1.11E-01	1.192E-08	1.11E-01
1.395E-05	1.066E-03	1.487E-08	1.39E-01	1.487E-08	1.39E-01
1.395E-05	5.981E-04	[redacted]	7.80E-02	[redacted]	7.80E-02
1.395E-05	2.991E-04	[redacted]	3.90E-02	[redacted]	3.90E-02
1.395E-05	3.021E-04	[redacted]	3.94E-02	[redacted]	3.94E-02
9.915E-05	3.393E-04	[redacted]	3.14E-01	[redacted]	3.14E-01
4.449E-05	5.146E-04	[redacted]	2.14E-01	[redacted]	2.14E-01
1.395E-05	1.066E-03	1.487E-08	1.39E-01	1.487E-08	1.39E-01
1.395E-05	7.674E-04	[redacted]	1.00E-01	[redacted]	1.00E-01
1.395E-05	7.704E-04	[redacted]	1.00E-01	[redacted]	1.00E-01
9.915E-05	8.076E-04	[redacted]	7.48E-01	[redacted]	7.48E-01
4.449E-05	9.829E-04	4.373E-08	4.09E-01	4.373E-08	4.09E-01
1.395E-05	2.991E-04	[redacted]	3.90E-02	[redacted]	3.90E-02
1.395E-05	3.021E-04	[redacted]	3.94E-02	[redacted]	3.94E-02
9.915E-05	3.393E-04	[redacted]	3.14E-01	[redacted]	3.14E-01
4.449E-05	5.146E-04	[redacted]	2.14E-01	[redacted]	2.14E-01
1.395E-05	3.042E-06	[redacted]	3.96E-04	[redacted]	3.97E-04
9.915E-05	4.028E-05	[redacted]	3.73E-02	[redacted]	3.73E-02
4.449E-05	2.156E-04	[redacted]	8.96E-02	[redacted]	8.96E-02
9.915E-05	4.332E-05	4.295E-09	4.01E-02	4.295E-09	4.01E-02
4.449E-05	2.186E-04	[redacted]	9.09E-02	[redacted]	9.09E-02

3.163E-04	2.558E-04	[redacted]	7.56E-01	[redacted]	7.56E-01
2.757E-06	2.608E-04	[redacted]	6.72E-03	[redacted]	6.72E-03
1.227E-06	2.558E-04	[redacted]	2.93E-03	[redacted]	2.93E-03
1.227E-06	3.082E-04	[redacted]	3.53E-03	[redacted]	3.53E-03
1.227E-06	5.549E-04	[redacted]	6.36E-03	[redacted]	6.36E-03
1.227E-06	1.023E-03	1.255E-09	1.17E-02	1.255E-09	1.17E-02
1.227E-06	5.549E-04	[redacted]	6.36E-03	[redacted]	6.36E-03
1.227E-06	2.558E-04	[redacted]	2.93E-03	[redacted]	2.93E-03
1.227E-06	2.589E-04	[redacted]	2.97E-03	[redacted]	2.97E-03
Total Risk		1.070E-05			

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*):	**2. Software Title and Version:**	**3. Project No:**
438	PCSA Tool, Version 3.0.0 (BetaA)	20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Structures, Systems, and Components Important to Safety.

A) Add a new form to allow the user to enter Structures, Systems, and Components (SSCs).
B) Add the capability to identify SSCs important to safety.
C) Add Crystal Report capability for SSCs.

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: B. Dasgupta, R. Benke Date: July 10, 2003	Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Added an SSC input form under the System menu item to allow the user to specify SSCs and their design bases and criteria. In addition, added linkage on the Design Bases and Design Criteria tab of this form to associate hazards, initiating events, and event tree subsequent events with these design bases and design criteria.
B) Added a Crystal Report to the SSC input form to allow the user to display SSCs and their design bases and design criteria.
C) Added a View SSCs form to allow the user to enter selection criteria for SSCs and then display the requested SSCs.
D) Added the capability to select SSCs during takeaway analysis.

8. Implemented by:	**Date:**
B. Stead, G. Adams, M. Silliman	March 16, 2004

9.	**Pass**	**Fail**	**Description of Acceptance Tests:**
1	☑	☐	Command Buttons perform their intended function.
2	☑	☐	Form controls update correctly.
3	☑	☐	Crystal Reports capture the information on the form. (Note any missing Information.)
4	☑	☐	User has the capability to select SSCs during takeaway analysis.
5	☑	☐	User has the capability to view SSCs and filter those displayed by entering selection criteria.

Note: Additional information in Attachment 1.

10. Tested by: Troy Maxwell	**Date:** April 6, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

System/SSCs/General		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Allows the user to enter information in the current window.	P
Delete Record	Deletes the current record.	P
Edit Record	Allows the user to edit the current record.	P
Show Report	Displays the information in report format.	P
Close	Closes the System/SSCs/General window	P
Add/Functions	Allows the user to enter information in the functions section of the System/SSCs/General window.	P
Edit/Functions	Allows the user to edit the information in the functions section of the System/SSCs/General window.	P
Delete/Functions	Deletes the selection in the functions section of the System/SSCs/General window.	P

System/SSCs/Design Basis and Design Criteria		
Action Command	**Expected Result & Comment**	**(P/F)**
Add Record	Allows the user to enter information in the current window.	P
Edit Record	Allows the user to edit the current record.	P
Copy Record	Allows the user to copy the current record.	P
Delete Record	Deletes the current record.	P
Show Report	Displays the information in report format.	P
Close	Closes the System/SSCs/General window	P
Add/Functions	Allows the user to enter information in the Functions section of the System/SSCs/General window.	P
Edit/Functions	Allows the user to edit the information in the Functions section of the System/SSCs/General window.	P
Delete/Functions	Deletes the selection in the Functions section of the System/SSCs/General window.	P
Add/Hazards	Allows the user to enter information in the Hazards section of the System/SSCs/General window.	P

Edit/Hazards	Allows the user to edit the information in the Hazards section of the System/SSCs/General window.	P
Delete/Hazards	Deletes the selection in the Hazards section of the System/SSCs/General window.	P
Add/Initiating Events	Allows the user to enter information in the Initiating Events section of the System/SSCs/General window.	P
Edit/Initiating Events	Allows the user to edit the information in the Initiating Events section of the System/SSCs/General window.	P
Delete/Initiating Events	Deletes the selection in the Initiating Events section of the System/SSCs/General window.	P
Add/Event Tree	Allows the user to enter information in the Event Tree section of the System/SSCs/General window.	P
Edit/Event Tree	Allows the user to edit the information in the Event Tree section of the System/SSCs/General window.	P
Delete/Event Tree	Deletes the selection in the Event Tree section of the System/SSCs/General window.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 506	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (BetaE)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s):
frmRSAC_Main, frmResultsTable, frmResultsSSCITSTable, mdlYMPModule1

A) Add highlighting of fixed-parameter cells in RSAC Input grids; fix problem when starting tool if database was not saved the last time the tool was run and an RSAC run had been made, the Input and Output data would no longer be 'in sync'. Add code to avoid an error when loading an older saved RSAC run with the 'Release Fraction Source' data missing, and to set the 'Valid Input/Output Pair' flag in database to False if there was an error loading a run. Set default tabs to be shown first when frmRSAC_Main loads.

5. Change Requested by: Name: B. Dasgupta, R. Benke Date: July 10, 2003	**6. Change Authorized by (*Software Developer*):** Name: B. Dasgupta Date: July 10, 2003

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):
Added code to highlight RSAC input grid cells with fixed values with grey color. A grid reference parameter was added to 'gChangeGridCellColor', and existing calls in 'frmResultsTable' and 'frmResultsSSCITSTable' were modified to include the grid reference. The subroutine 'CopySavedRSACTable' has been put back into use to load RSAC output data from the database when the form ('frmRSAC_Main') or a saved run is loaded, rather than reading the output files, to prevent the 'input/output out of sync' condition. Added code to warn user that the 'Release Fraction Source' was missing when loading a saved run, rather than generating an error and aborting the load process when partially completed. Added code to set 'Valid Input/Output Pair' to False on error. Added code to set the default tabs to be shown first when frmRSAC_Main loads.

8. Implemented by: D. Stead	**Date:** April 21, 2004

9.	**Pass**	**Fail**	**Description of Acceptance Tests:**
1.	☑	☐	Load the Main RSAC form by selecting 'Conseq. -> Public Dose -> RSAC -> RSAC from the main menu. If the input and output data are 'in sync' (output data is valid and corresponds to the input data), the 'RSAC Output' tab will be shown, with the 'Summary Results' subtab data displayed. Click the 'RSAC Input' tab, modify any data field on any subtab, and the 'RSAC Output' tab should be disabled.
2.	☑	☐	Do a deterministic RSAC analysis, exit the PCSA Tool and answer 'Yes' to the 'Save?' question. Restart the tool, and do a probabilistic analysis; exit the tool without saving. Restart the tool, verify that the deterministic data is still shown on the output tab. Repeat this test by first doing a probabilistic run and afterwards a deterministic run.
3.	☑	☐	Verify that all fixed-value RSAC input parameters are highlighted in their grids with a grey background color. If these values are double-clicked, an error message should appear stating that they cannot be edited. [These can be identified by scrolling right in the grids, to the 'MinValue' column, which will show 'FIXED' for fixed-value parameters.]
4.	☑	☐	Verify that cell highlighting (for high doses) occurs in the Results Table (Compliance Assessment) and Results Table (Takeaway Analysis – Category Search) for category 1 event sequences that exceed 0.015 rem and category 2 event sequences that exceed 5 rem. If necessary, set doses manually to test this feature.
5.	☑	☐	Verify the 'Load Saved Analysis' button loads a saved deterministic run and probabilistic run, and for each case, the RSAC output tab is shown.
6.	☑	☐	Verify that 'Load Saved Analysis' shows an error if a subdirectory is selected that has no 'RSAC_Run.mdb' file in it.

Note: Comments on testing are included as Attachment 1.

10. Tested by: Troy Maxwell	**Date:** April 27, 2004

ATTACHMENT 1

Test	Comments
PASSED	Load the Main RSAC form by selecting 'Conseq. -> Public Dose -> RSAC -> RSAC from the main menu. If the input and output data are 'in sync' (output data is valid and corresponds to the input data), the 'RSAC Output' tab will be shown, with the 'Summary Results' subtab data displayed. Click the 'RSAC Input' tab, modify any data field on any subtab, and the 'RSAC Output' tab should be disabled.
PASSED	Do a deterministic RSAC analysis, exit the PCSA Tool and answer 'Yes' to the 'Save?' question. Restart the tool, and do a probabilistic analysis; exit the tool without saving. Restart the tool, verify that the deterministic data is still shown on the output tab. Repeat this test by first doing a probabilistic run and afterwards a deterministic run.
PASSED	Verify that all fixed-value RSAC input parameters are highlighted in their grids with a grey background color. If these values are double-clicked, an error message should appear stating that they cannot be edited. [These can be identified by scrolling right in the grids, to the 'MinValue' column, which will show 'FIXED' for fixed-value parameters.]
PASSED	Verify that cell highlighting (for high doses) occurs in the Results Table (Compliance Assessment) and Results Table (Takeaway Analysis - Category Search) for category 1 event sequences that exceed 0.015 rem and category 2 event sequences that exceed 5 rem. If necessary, set doses manually to test this feature.
PASSED	Verify the 'Load Saved Analysis' button loads a saved deterministic run and probabilistic run, and for each case, the RSAC output tab is shown.
PASSED	Verify that 'Load Saved Analysis' shows an error if a subdirectory is selected that has no 'RSAC_Run.mdb' file in it.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 507	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta J)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): mdlYMPModule1, frmEditRSACInput, frmEditRSACLHS

mdlYMPModule1: Fix a cell highlighting problem in which no highlighting occurs if the column number is 0, in which case the entire row is supposed to be highlighted.

frmEditRSACInput, frmEditRSACLHS: Field name text would not wrap to a second line for very long field names.

frmFaultTreeEventTable, frmSELTable, frmSSC_Data, frmResultsSSCITSTable, frmWhatIfSELTable, frmHRATable, frmHRA_SELTable, frmEnergyAnalSELTable, frmEnergyAnalysisTable, frmEventSequenceTable.frm:

Entire row would not be highlighted after editing an entry in the grid.

5. Change Requested by: Name: G. Adams Date: April 5, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams Date: April 5, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

mdlYMPModule1: Changed code in 'gHighlightGridCellOrRow' to accept column number >= 0.

frmEditRSACInput, frmEditRSACLHS: Made GUI property changes, including setting Word Wrap property to True on labels to allow long field names to wrap to a second line.

All other listed forms: Changed call to '' to set the column number to '0' to indicate that the entire row is to be highlighted.

8. Implemented by: D. Stead	**Date:** June 2, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify that an entire row is highlighted after editing a cell in a grid by editing a field in the grid. After clicking '*Apply*' to update the entry, the entire line for the field edited should be highlighted. This applies to all 'table' (grid-based) forms under the '*Int. Events*' and '*Freq. Analysis*' menus, the '*SSC Data*' form, and grids on some tabs of the '*System Description*' form.
2	☑	☐	Verify that on editing text on the RSAC Input form, that long field names requiring word wrapping (continuation to a second line in the field name label on the editing popup) display the entire field name. The longest entry in the database is currently '*Stored (other) vegetable consumption rate (wet kg/yr) includes fruits and grains*' in the '*RSAC Ingestion Dose*' table, which can be found on the '*Ingestion Dose*' tab. To verify word wrapping in the label caption, edit the '*Input Value*' for this field; you should see the entire field name visible on the field name label above the editing text box. This should be tested for both deterministic and probabilistic cases (which use different editing forms).

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Brandi L. Winfrey	**Date:** 6/10/2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

System / System Description - *Int. Events* menu		
Action Command	**Expected Results & Comment**	**(P/F)**
Edit Record / double click	Verify that an entire row is highlighted after editing a cell in a grid by editing a field in the grid (Assumption I). Notes: 1) First add an Item using the FMEA Form, What If Form, Energy Method Form, and HRA Forms. Then, go to the respective Severe Events form to perform editing. 2) The only editable field on the Severe Events form is the "Remarks" field. 3) When the Remarks field is edited the first 18 characters are visible under the Remark column on the Severe Events form, and the entire remark is visible on the report. 4) There is a 3 character minimum entry requirement per response under the Component Description, What If, Event Name, Human Action, Justification, and Explanation fields.	P
System / System Description - *Freq. Analysis* menu		
Action Command	**Expected Results & Comment**	**(P/F)**
Edit Record / double click	Verify that an entire row is highlighted after editing a cell in a grid by editing a field in the grid. Notes: 1) First add an Item using the Initiating Event, Event Tree, Fault Tree, and Event Sequence Forms. Then go to the respective Event Sequence Table (Assumption II) to perform editing. 2) The only fields on the Event Sequence Table that can be edited are 'EvSeq ID', 'P W B', 'EvSeq Freq', 'Description', 'End State', and 'Additional Info'	P
System / System Description - *SSC Data* form		
Action Command	**Expected Results & Comment**	**(P/F)**
Edit Record / double click	Verify that an entire row is highlighted after editing a cell in a grid by editing a field in the grid. Notes: 1) The SSC data form is available under the System dropdown menu under SSCs. 2) Under the Design Bases and Design Criteria tab on the SSC Data form, add a record and edit any or all of the editable cells to obtain the desired results.	P
System / System Description – *System Description* tabs		
Action Command	**Expected Results & Comment**	**(P/F)**
Edit Record / double click	Verify that an entire row is highlighted after editing a cell in a grid by editing a field in the grid Notes: 1) Open the System Description tabs under the System dropdown menu. For each of the following tabs, add a record and then edit the record to obtain the desired results: Human Actions, Software System, Assumptions,	P

System / System Description – *RSAC Input Form*		
Action Command	**Expected Results & Comment**	**(P/F)**
deterministic	Verify that on editing text on the RSAC Input form, that long field names requiring word wrapping (continuation to a second line in the field name label on the editing popup) display the entire field name. The longest entry in the database is currently '*Stored (other) vegetable consumption rate (wet kg/yr) includes fruits and grains*' in the '*RSAC Ingestion Dose*' table, which can be found on the '*Ingestion Dose*' tab. To verify word wrapping in the label caption, edit the '*Input Value*' for this field; you should see the entire field name visible on the field name label above the editing text box. Notes: 1) To find long field names to verify, simply click and drag the right edge of the Input Parameter column to expand the names. Find a few long names, double click on their Input Values to have the Edit RSAC Input dialog open, and verify that the entire Input Parameter Name is visible above the editing text box.	P
probabilistic	Verify that on editing text on the RSAC Input form, that long field names requiring word wrapping (continuation to a second line in the field name label on the editing popup) display the entire field name. The longest entry in the database is currently '*Stored (other) vegetable consumption rate (wet kg/yr) includes fruits and grains*' in the '*RSAC Ingestion Dose*' table, which can be found on the '*Ingestion Dose*' tab. To verify word wrapping in the label caption, edit the '*Input Value*' for this field; you should see the entire field name visible on the field name label above the editing text box. Notes: same as for deterministic, above.	P
I. Assumption		
Apply	After clicking '*Apply*' to update the entry, the update will be implemented and the entire line for the field edited should be highlighted.	P
Cancel	Update not implemented, line not highlighted. In effect, no changes made.	P
II. Assumption		
Init Event Table	After clicking the 'Init *Event Table*' button the Initiating Event Table becomes available for editing.	P
Event Table	After clicking the '*Event Table*' button the Fault Tree Event Table becomes available for editing.	P
Event Seq Table	After clicking the 'Event Seq Table' button the Event Sequence Table becomes available for editing.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*):	2. Software Title and Version:	3. Project No:
508	PCSA Tool, Version 3.0.0 (BetaL)	20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): SSC Important to Safety Module, Project Tree Module, Frequency Analysis Module

A) Correct a display error on the current grid in which design bases do not display when no records are available on form frmSSC_ViewAll and allow resizing of the grid.
B) Add an intermediate database to allow the log entries to be stored even if the user decides not to save the current working database.
C) Update Crystal Reports to use the gSetLevelDescriptions subroutine instead of the in-line code.
D) The last column in the risk assessment grid is cutoff.
E) Correct an error on the Current Level Results Table and the FMEA Severe Events List in which a grid element could not be edited if the user previously added an entry on another form.

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Date: G. Adams	Date: April 5, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

A) Modified the SSC_ViewAll form grdCurrent to show a column 0 to allow resizing within the grid. Added lblSelection to the form. Also corrected an error, which occurred when the user clicked on the SSC grid to display design bases and there were no rows in the SSC grid.
B) An intermediate database was added to allow the user to store log entries.
C) Updated frmCrystalEventSequence, frmCrystalFMEA to use subroutine gSetLevelDescriptions.
D) Expanded the column width of the last column in the risk assessment grid to display the column heading correctly.
E) Corrected the following forms to allow the user to edit a grid entry: the Results Table (frmResultsTable), Results SSCITS Table (frmResultsSSCITSTable) and the FMEA Severe Events List (frmSelTable)

8. Implemented by:	Date:
G. Adams, T. Maxwell	July 19, 2004

9. Description of Acceptance Tests:

Test	Pass	Fail	Description of Test
1	☑	☐	Form controls function correctly.
2	☑	☐	Command and filtering functions work correctly to view SSCs.
3	☑	☐	Crystal Reports (Event Sequence and FMEA) capture the information and show the current selected level.
4	☑	☐	The heading displays correctly for the last column on the risk assessment grid.
5	☑	☐	The results table, SSCITS table, and FMEA Severe Events List allow the user to edit a grid entry after previously adding on another form.

(Note any additional testing and include as an attachment.)

10. Tested by:	Date:
B. Winfrey	July 21, 2004

ATTACHEMNT 1

Action Command	Expected Result & Comment	(P/F)
Add/Update Record	Add makes the fields editable so that the user can add an SSC to the database. Update adds the information in the fields to the database as an SSC. Note: Add three SSCs: 1)Mode of Operation = Manual 2)Important to Safety by DOE determination, and 3)Important to Safety by Staff determination Note: This test only passes if the results table, SSCITS table, and FMEA Severe Events List can be correctly edited after an SSC has been added.	P
Edit Record	Allows the user to edit a record after previously adding.	P
Show Report	Crystal Reports captures the information and displays the user input in report format. The report should include a Description in the upper right corner of the current selected Functional Area level.	P
Cancel	Cancels the action. Does not make any changes to the database.	P

Action Command	Expected Result & Comment	(P/F)
Edit Record	Allows the user to edit a grid entry after previously adding on another form. This button works correctly on all subareas including: FMEA, What If, Energy Method, HRA, and Severe Events (ALL) for tables under both the form and severe events subcategories.	P
Show Report	Crystal Reports captures the information and displays the user input in report format. All subareas under the Int. Events dropdown menu should include the Functional Area Description for the current selected level in the upper right area of the Report. These subareas include: FMEA, What If, Energy Method, HRA, and Severe Events (ALL) under both the form and severe events subcategories.	P

Action Command	Expected Result & Comment	(P/F)
Refresh	Does nothing for this form. Not part of this SCR, but something that was noticed during testing.	N/A
Edit Record	The results table allows the user to edit a grid entry after previously adding on another form.	P
Show Report	Crystal Reports captures the information and displays the user input in report format. The report should include a Functional Area Description for the current selected level in the upper right area. Both the involved and noninvolved subcategories should be tested.	P

Action Command	Expected Result & Comment	(P/F)
Functional ID	Command and filtering functions work correctly to view SSCs. Displays SSCs for the current Functional ID or for all Functional IDs depending on which is selected.	P

Mode of Operation	Command and filtering functions work correctly to view SSCs. Displays SSCs based on the mode of operation selected	P
DOE	Command and filtering functions work correctly to view SSCs. If selected, dispays SSCs if they are Important to Safety by DOE determination.	P
Staff	Command and filtering functions work correctly to view SSCs. If selected, dispays SSCs if they are Important to Safety by Staff determination. Note: if they are important to safety by staff determination, they should also be important by DOE determination. If not, the ITS columns for DOE and Staff will both be highlighted in RED.	P
Close	Closes the "View Selected SSCs" window.	P
	Go to the System/SSCs dropdown menu and delete all SSCs. Now re-open the Perform./Project Results/Display SSCs to open the View Selected SSCs window. With no SSCs entered in the database, all grids should display properly with no data in them.	P

Action	Expected Result & Comment	(P/F)
Use the scroll bar to scroll to the far right end of the table.	The heading displays correctly for the last column "NoneFilesOnly" on the risk assessment grid.	P

Action	Expected Result & Comment	(P/F)
Close PCSA Tool using the File/Exit command.	Expected result is that the log will be saved, but the changes to the database will not. Close and save all changes using the File/Exit command so that an initial log database will be created. Re-open the demo file in PCSA Tool and close it again. This time, do not save the file. PCSA Tool should exit without prompting for a log entry. Now open PCSA Tool and click on save. Make a few changes (such as entering a new SSC) and exit. Click "No" when prompted to save changes. You should then be prompted to save a log entry. Make the entry and verify with MS Access that the entry was saved upon exit.	P

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 509	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta M)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Consequence Analysis Module, Safety Assessment Module

Consequence Analysis Module: Develop new Worker form labeled "Worker Dry" to distinguish it from the worker dose for the pool.
Safety Assessment Module: Add tables showing the involved and noninvolved worker. Include SSC takeaway analysis. Add associated Crystal Reports

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: B. Dasgupta Date: April 5, 2004	Name: G. Adams Date: April 5, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

The description of changes is included on Attachment 1.

8. Implemented by: D. Stead, G. Adams, T. Maxwell	**Date:** July 9, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Form controls for both the worker dry form and the performance assessment/takeaway analysis forms function correctly.
2	☑	☐	Command Buttons perform their intended function
3	☑	☐	Crystal Reports capture the information on the forms. (Note any missing Information.)
4	☑	☐	Calculated worker dry dose values agree with hand/spreadsheet calculated values.
5	☑	☐	The involved worker category 1 doses are highlighted in both the form and Crystal Report when above 5 rem. This includes takeaway analysis.
6	☑	☐	The noninvolved worker category 1 doses are highlighted in both the form and Crystal Report when above 100 mrem for dose or 2 mrem/hr for dose rate. This includes takeaway analysis forms.

Note: Additional testing and comments can be found on Attachment 2.

10. Tested by: Brandi L. Winfrey	**Date:** July 29, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

Changes to Worker Dry Form:
The Worker Dry form was developed, based initially on part of the RSAC Main form, and 5 database tables were added to support it. The tables are based on similar RSAC tables, and are named:
'WkrDry_CrudInventory', 'WkrDry_FuelInformation', 'WkrDry_GeneralInput',
'WkrDry_GroupReleaseFractions', and 'WkrDry_RadionuclideInv'.
This form uses 'frmEditRSACInput' to edit parameters displayed in grids. The Dose Conversion Factors (DCFs) were obtained from EPA Federal guidance reports 11 and 12 (EPA 402-R-93-081 and EPA-520/1-88-020). The DCFs obtained were given in Sv/Bq, and were entered into the database table as-is. They are converted to rem/Ci and saved to separate database fields when the form is loaded. The user can see both values in the grid on the 'Source Term' tab, but the original Sv/Bq units are shown in 'grayed' cells. Likewise, the decay constants are computed from the Half Lives, and saved in a separate database field; the Half Lives are also 'grayed'. The Half Life data (with all values given in seconds) was obtained from Los Alamos National Laboratory's internet site at:
http://t2.lanl.gov/data/decayd.html (address current as of 5/27/04).

Changes to Performance Assessment:
Added Involved Worker and Noninvolved Worker Performance assessment forms. The user enters doses directly on the current level results forms. In addition, the user has the capability of performing takeaway analyses from the worker level forms.

Crystal Report Additions:
Added Crystal Reports to the Performance Assessment forms to include Takeaway Analysis and the Worker Dry form.

Attachment 2

Action Command	Expected Result & Comment	(P/F)
Internal Worker Dose		
Units for Rates	Radio buttons will convert Leakage and Ventilation rates to either m^3/s or %/day. Only one button can be selected at a time.	P
Fuel Type	Radio buttons will set the fuel type to BWR, PWR, or User Specified. The type should change to the value selected. Only one value can be selected at a time.	P
Restore Point Estimates to Defaults	This will return all values on the Internal Worker Dose tab to their default values and the Calculated Dose table will close.	P
Calculate Doses	Calculated worker dry dose values agree with hand/spreadsheet calculated values. Notes: 1) Under the Internal Worker Dose tab, set the Units for Rates to %/day, Ventilation Rate of the Worker Room to 2400.0, number of decimal places to display to 8, and Fuel type to User Specified. 2) Enter Inventory (column 1) values under the Source Term tab for the following Radionuclides: Note: User Specified fuel type must be selected on the Internal Worker Dose tab in order to edit this table. Double click on the cell under the Inventory (Ci/Assembyl) column to open it for editing. • Kr85 = 4.24e+02 • Sr90 = 2.37e-01 • Y90 = 2.37e-01 • Am241 = 1.67e-02 3) Set the Release Fraction to 1.00e+00 for all groups under the Release Fraction by Group tab by double clicking on the cell to be modified under the Release Fraction column. 4) Under the Internal Worker Dose tab, set the Exposure Duration to the following times: 1.001, 2.201, 3.101, 4.001, 5.201, 6.101, 7.001, and 8.000. Calculate the Doses for each radionuclide individually for each of the times and calculate the total dose for all radio nuclides at each time. The individual radionuclide inhalation and submersion dose rates should be displayed in the dose table and total values for submersion and inhalation dose rates should be displayed in the Totals (rem) text blocks below the dose table. 5) Using Excel, create a spreadsheet that will calculate the dose for each radionuclide at each of the times and compare the "hand calculations" done by Excel to the calculations performed by PCSA Tool. There should be no difference (see Attachment 3). 6) Run the same radio nuclides for the same times with the Ventilation Rate of the Worker Room set to zero and compare the output calculations. There should be no difference between PCSA Tool and hand calculations (see Attachment 3).	P
Number of Decimal Places to Display	Will change the number of decimal places displayed in the dose calculations table. Minimum is 2 and Maximum is 8.	P
Source Term		
Restore Point Estimates to Defaults	This will return the Inventory (Ci/Assembly) column back to the default values. If User Specified fuel type is selected under the Internal Worker Dose tab, the default value is 0.00e+00 for all radio nuclides. This button is disabled under the PWR and BWR fuel types.	P

Release Fraction by Group		
Restore Point Estimates to Defaults	This will return the Release Fraction column back to the default values. The default values are the same for all fuel types.	**P**
Restore All Defaults	Will restore all edited values in all three tabs (Internal Worker Dose, Source Term, and Release Fraction by Group) to their default values.	**P**
View Notes	View dose calculation data sources and references.	**P**
Show Report	Show Crystal Reports PCSA Conseq. Worker Dry report with the following sub-reports: Output Doses, Rooms, Fuel, Source Term, and Release Fraction by Group. Note: If no calculations have been performed, the report will still be generated, showing all input values, but no Output Doses report will be generated.	**P**
Close	Closes the "frmWorkerDry" window. Closes the entire Consequence Analysis Module window.	**P**

Action Command	**Expected Result & Comment**	**(P/F)**
Takeaway	Opens the Results Table for Project View SSCIS Case (SSC takeaway analysis) for the Public, Involved Worker or Noninvolved Worker. See Project View SSCIS table (below).	**P**
Refresh	Refresh table to show all events instead of just the selected events.	**P**
Compliance Assessment	Brings up a Category Search dialog that allows the user to display records for categories 1, 2, or BCFL. Category 1: enter a cutoff for expected number of events and click on calculate. This will open an Event Sequences dialog window that selects event sequences within a specified cutoff for expected number of events. Clicking on the "Calculate" button within this window will generate a table of Event Combinations along with the maximum combination dose, normal operation dose, and aggregate TEDE for the listed combinations. Clicking on the "Done" button in this window will show a Results table with all Category 1 events. For the public scenario this table has with it, two radio buttons to select between displaying deterministic and probabilistic results. The results for Frequency Weighted, Normal Operation, and Total Dose are displayed for the Public, Involved, and Noninvolved Worker.	**P**
Edit Record	Not selectable. The user is not allowed to edit on this form but could do so if they were instead on the Current Level Results form.	**P**
Show Report	Crystal Reports capture the information on the forms.	**P**
Close	Closes the Results Table – Project View Base Case – Public/Involved/Noninvolved Worker window. Closes the entire Performance Assessment Module window.	**P**

Results Table - Project View SSCIS Case - [Public/Involved/Noninvolved Worker]

Action Command	**Expected Result & Comment**	**(P/F)**
SSC Select/Update	Allows SSC selection based on SSCs available in the database. Selection can be made based on Functional ID, Mode of Operation, ITS by DOE and ITS by Staff. When the Edit button is selected, the Update button will institute changes made to	**P**

	the Additional Information.	
SSC Edit	Allows editing of Additional Information for the selected SSC.	**P**
Refresh	Updates the Results Table after a Category Search is performed. It repopulates the table with default data for all of the Categories.	**P**
Category Search	Allows the Results Table to list only results for Category 1, Category 2, or BCFL. When Category 1 is selected under Public, a dialog window "Category 1 Event Sequences" appears that allows either Point Estimate or Probabilistic Mean Dose Type to be calculated. • Clicking the Calculate button under Annual Dose due to SSC Failure causes the calculation to be performed based on the Dose Type selected as well as the value entered in the text box for the Maximum Dose from SSC Failure. • If the value entered is greater than 1.49e-02, the Total Dose field is highlighted RED for Point Estimate and Mean Probabilistic results in both the Category 1 Event Sequences window and the main Project View SSCIS Case window. Under the Involved Worker scenario, when the Maximum Dose is 5 rem or greater, it is highlighted red in the Category 1 Event Sequence window, the main Project View window, and in the Crystal Report. Under the Noninvolved Worker when the Maximum Dose greater than 1.00e-01 rem (e.g., 1.01e-01 rem), it is highlighted red in the Event Sequences window, the Project View window, and the Report.	**P**
Edit Record	Allows the user to edit the 'Inclf/SA Calc', ;EvSeq Freq', and 'Internal' and 'External' Doses columns. The noninvolved worker category 1 doses are highlighted in both the form and Crystal Report when above 100 mrem for dose or 2 mrem/hr for dose rate. This includes takeaway analysis forms. The involved worker and public category 1 doses are highlighted in both the form and Crystal Report when above 5 rem. This includes takeaway analysis. When they are highlighted on the form, they ARE highlighted on the Report.	**P**
Show Report	Crystal Reports capture the information on the forms.	**P**
Close	Closes the Results Table – Project View Base Case – Public/Involved/Noninvolved Worker window. Closes the entire Performance Assessment Module window.	**P**

Attachment 3

Values from Excel Spreadsheet WorkerDry.xls

PCSA Tool Calculations for individual radionuclides

Time (t)	Kr85		Sr90		Y90		Am241	
	Submersion	Inhalation	Submersion	Inhalation	Submersion	Inhalation	Submersion	Inhalation
1.001	2.79597E-05	0.00000E+00	9.88926E-10	3.16781E-01	2.47737E-08	2.04295E-03	7.56991E-09	7.63137E+00
2.201	1.34728E-04	0.00000E+00	4.76530E-09	1.52646E+00	1.18351E-07	9.75971E-03	3.64769E-08	3.67731E+01
3.101	2.66770E-04	0.00000E+00	9.43563E-09	3.02251E+00	2.32835E-07	1.92005E-02	7.22271E-08	7.28135E+01
4.001	4.42984E-04	0.00000E+00	1.56684E-08	5.01903E+00	3.84148E-07	3.16785E-02	1.19927E-07	1.20911E+02
5.201	7.46077E-04	0.00000E+00	2.63889E-08	8.45312E+00	6.41457E-07	5.28972E-02	2.02000E-07	2.03640E+02
6.101	1.02408E-03	0.00000E+00	3.62212E-08	1.16029E+01	8.74835E-07	7.21426E-02	2.77270E-07	2.79521E+02
7.001	1.34516E-03	0.00000E+00	4.75787E-08	1.52408E+01	1.14177E-06	9.41555E-02	3.64204E-07	3.67161E+02
8.000	1.75161E-03	0.00000E+00	6.19554E-08	1.98461E+01	1.47624E-06	1.21737E-01	4.74255E-07	4.78105E+02

Hand Calculations for individual Radionuclides

Time (t)	Kr85		Sr90		Y90		Am241	
	Submersion	Inhalation	Submersion	Inhalation	Submersion	Inhalation	Submersion	Inhalation
1.001	2.79597E-05	0.00000E+00	9.88926E-10	3.16781E-01	2.47737E-08	2.04295E-03	7.56991E-09	7.63137E+00
2.201	1.34728E-04	0.00000E+00	4.76530E-09	1.52646E+00	1.18351E-07	9.75971E-03	3.64769E-08	3.67731E+01
3.101	2.66770E-04	0.00000E+00	9.43563E-09	3.02251E+00	2.32835E-07	1.92005E-02	7.22271E-08	7.28135E+01
4.001	4.42984E-04	0.00000E+00	1.56684E-08	5.01903E+00	3.84148E-07	3.16785E-02	1.19937E-07	1.20911E+02
5.201	7.46077E-04	0.00000E+00	2.63889E-08	8.45312E+00	6.41457E-07	5.28971E-02	2.02000E-07	2.03640E+02
6.101	1.02408E-03	0.00000E+00	3.62219E-08	1.16029E+01	8.74826E-07	7.21426E-02	2.77270E-07	2.79521E+02
7.001	1.34516E-03	0.00000E+00	4.75787E-08	1.52408E+01	1.14178E-06	9.41555E-02	3.64204E-07	3.67161E+02
8.000	1.75161E-03	0.00000E+00	6.19554E-08	1.98461E+01	1.47624E-06	1.21737E-01	4.74255E-07	4.78105E+02

Verification against individual calculations

Time (t)	PCSA Tool			Hand Calculations			Percent Difference		
	Submersion	Inhalation	TOTAL	Submersion	Inhalation	TOTAL	Submersion	Inhalation	Total
1.001	2.79930E-05	7.95020E+00	7.95023E+00	2.79930E-05	7.95020E+00	7.95023E+00	0.000%	0.000%	0.000%
2.201	1.34887E-04	3.83093E+01	3.83094E+01	1.34887E-04	3.83093E+01	3.83094E+01	0.000%	0.000%	0.000%
3.101	2.67084E-04	7.58552E+01	7.58555E+01	2.67084E-04	7.58552E+01	7.58555E+01	0.000%	0.000%	0.000%
4.001	4.43503E-04	1.25961E+02	1.25962E+02	4.43503E-04	1.25962E+02	1.25962E+02	0.000%	0.000%	0.000%
5.201	7.46946E-04	2.12146E+02	2.12147E+02	7.46946E-04	2.12146E+02	2.12147E+02	0.000%	0.000%	0.000%
6.101	1.02527E-03	2.91196E+02	2.91197E+02	1.02527E-03	2.91196E+02	2.91197E+02	0.000%	0.000%	0.000%
7.001	1.34671E-03	3.82496E+02	3.82497E+02	1.34671E-03	3.82496E+02	3.82497E+02	0.000%	0.000%	0.000%
8.000	1.75362E-03	4.98073E+02	4.98075E+02	1.75362E-03	4.98073E+02	4.98075E+02	0.000%	0.000%	0.000%

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 510	2. Software Title and Version: PCSA Tool, Version 3.0.0 (Beta P)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Consequence Analysis Module (RSAC); frmRSAC_Main, frmReadRSAC, frmLaunchRSAC, mdlYMPModule1, MDI_PCSA_Frm1, new form frmRSAC_WkrInput.

Add Downwind Worker Dose Model to the PCSA Tool's RSAC interface.

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Name: G. Adams Date: June 17, 2004	Name: G. Adams Date: June 17, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

Added new module frmRSAC_WkrInput to 'walk' the user through to the proper calculation mode, according to the recommended flow from Norm Eisenberg. Modified code in frmRSAC_Main, frmReadRSAC, frmLaunchRSAC, mdlYMPModule1, and MDI_PCSA_Frm1 to accommodate the new mode of operation. Added a new batch file, 'RSAC6wkr.bat', in the \Tools directory, to run RSAC directly, bypassing 'PCSAProb.exe', which returns an error message since there is no Ingestion dose for worker mode (RSAC substitutes a single line with "NO DOSE CALCULATED" for the set of dose values normally returned). New subroutines were added to read RSAC's output file directly, and bypass Ingestion, Inhalation, or Ground Surface data segments for which no dose was calculated. Doses and dose totals are saved to the 'WkrRSAC_OUTPUT' table.

Added Crystal Report to display the input and output for the RSAC run associated with the Downwind Worker Dose calculations.

8. Implemented by:	Date:
D. Stead, G. Adams	August 5, 2004

9.	Pass	Fail	Description of Test
1	☑	☐	Manipulate the RSAC controls in accordance with the steps identified in Attachment 1, and verify the operation of the form.
2	☑	☐	Verify that a sample of the doses generated for the displacement zone, wake zone, and cavity zone are being retrieved from the rsac output file, are correctly scaled, and displayed.
3	☑	☐	Verify that RSAC can be run for the Public. Verify that runs can be saved and retrieved. Verify that parameters can be changed.

Note: Additional testing and comments can be found on Attachment 2.

10. Tested by: Troy Maxwell	Date: August 6, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

1) Verify that the "RSAC Worker Dose Options" form is loaded by selecting 'Conseq. -> Worker Dose -> RSAC from the main menu.
2) Enter '100' for Stack Height, and '30' for Building Height. Click 'Next'. Verify a new frame is displayed to enter the Receptor Distance. Then enter '75' for Receptor Distance, and click 'Next'. Verify that an error message box is displayed.
3) Click 'OK' on the error message box, and change the value for Receptor Distance to '1000'. Verify that a new frame is displayed, with "Receptor is in the Displacement Zone".
4) Click 'Next'; verify that the "RSAC Worker Dose Options" form disappears, and the "RSAC: New or Modified Analysis" form appears showing the "RSAC Input" and "Fuel Selection / Assemblies Breached" tabs.
5) Click on the "Meteorological Data" tab, and verify that the value for "Stack release height (m)" is 100.0 (as entered earlier) and that its cell background is 'grayed'. Verfy that the value for "Downwind distance (m)" is 1000.0 (as entered earlier) and that its cell background is 'grayed'. Verify that the cell backgrounds for "Building height" and "Building width" are also 'grayed'.
6) Click 'Perform Analysis'; verify that the form disappears, RSAC runs, and (after a several seconds) the form reappears with the "RSAC Output" tab shown, with the output data.

Attachment 2

Verified the Worker Dry form performs the steps indicated on attachment 1. The error message displayed for step 2 is: "The Receptor Distance is less than or equal to 2.5 times the Building Height. This case is invalid." In step 3, after 1000 is entered for the Receptor Distance, the next frame displays, "Receptor is in the Displacement Zone." Verified the meteorological data tab appears as required in step 5. After performing an analysis, the RSAC Output doses are displayed.

On the summary tab, the following values were observed:
Inhalation: 9.38e-18
Ground surface: 3.38e-19
Submersion: 2.39e-7
TEDE: 2.39e-7

In the RSAC6 output file, the following values were observed:
Inhalation: 9.38e-18
Ground surface: 3.38e-19
Submersion: 2.39e-7
TEDE: 2.39e-7

The results from the file compare to the results displayed on the summary tab.

Performed a series of tests and compared dose results to spreadsheet calculations. The following summarizes the tests and test results:

Displacement Zone	
Building Width (Wb)	150
Building Height (Hb)	34
Stack Height (Hs)	86
Receptor Location (X)	500

Line 5001 under Meteorological Data in RSAC output file includes the 86 m stack height

RSAC Dose	
Inhalation	8.10E-30
Ground Surface	0.00E+00
Air Submersion	3.06E-07
Total	3.06E-07

The PCSA Tool displays the above values under Summary Results

Checked doses from the output file and compared to the PCSA Tool Display

	output	display
H3 inhalation	7.29E-30	7.29E-30
CEDE inhalation	8.10E-30	8.10E-30

Wake Zone

Building Width (Wb)	150
Building Height (Hb)	34
Stack Height (Hs)	34
Receptor Location (X)	500
Area Building Ab	5100
Qb	178.5357

Since the receptor location is greater than Qb, wake zone

Chi/Q	7.34E-04
sigma z	7.92E+00
sigma zmod	41.06185
Fw	1.93E-01

Check of doses displayed by PCSA Tool

	RSAC	Scaled	Display	Percentage Difference
TEDE	3.41E-04	6.58E-05	6.56E-05	-0.24%
Inhalation Bone Sur	3.06E-04	5.90E-05	5.90E-05	-0.01%
Inhalation Pu240	1.41E-08	2.72E-09	2.72E-09	0.04%

Cavity Zone on Building in Stack

Building Width (Wb)	150
Building Height (Hb)	34
Stack Height (Hs)	34
Receptor Location (X)	1
Diameter of Stack	0.5
3 * Diameter of Stack	1.5
Flowrate through vent [m^3/s]	11.32674
Area Building Ab	5100
Qb	178.5357

Since the receptor location is greater than Qb, wake zone

Chi/Q	1.12E-02
Fv	7.92E+00

Check of doses displayed by PCSA Tool

	RSAC	Scaled	Display	Percentage Difference
TEDE	5.15E-03	4.08E-02	4.08E-02	0.05%
Inhalation CEDE	4.98E-03	3.94E-02	3.94E-02	-0.08%
Ground Surface lungs	9.47E-05	7.50E-04	7.50E-04	0.02%
Ground Surface Pb212	1.40E-09	1.11E-08	1.11E-08	0.13%

Cavity Zone on Building Away from Stack

Building Width (Wb)	150
Building Height (Hb)	34
Stack Height (Hs)	34
Wind Speed (Ua)	3
Receptor Location (X)	50
Diameter of Stack	0.5
3 * Diameter of Stack	1.5
Flowrate through vent [m^3/s]	11.32674
Area Building Ab	5100
Qb	178.5357

Since the receptor location is greater than Qb, wake zone

Chi/Q	1.12E-02
Fs	3.59E-01
Fv	7.92E+00

Check of doses displayed by PCSA Tool

	RSAC	Scaled	Display	Percentage Difference
TEDE	5.15E-03	1.85E-03	1.85E-03	0.13%
Inhalation CEDE	4.98E-03	1.79E-03	1.79E-03	0.19%
Inhalation R Marrow	4.56E-03	1.64E-03	1.64E-03	0.25%
Ground Surface Co60	1.52E-05	5.45E-06	5.45E-06	-0.05%

Cavity Zone not on Building

Building Width (Wb)	150
Building Height (Hb)	34
Stack Height (Hs)	34
Wind Speed (Ua)	3
Receptor Location (X)	50
Flowrate through vent [m^3/s]	11.32674
Area Building Ab	5100
Qb	178.5357
Lb	34

Since the receptor location is greater than Qb, wake zone

Chi/Q	1.12E-02
Fc	2.80E-01

Check of doses displayed by PCSA Tool

	RSAC	Scaled	Display	Percentage Difference
TEDE	5.15E-03	1.44E-03	1.44E-03	-0.10%
Inhalation CEDE	4.98E-03	1.39E-03	1.39E-03	-0.27%

Ground Surface B Surface	4.47E-04	1.25E-04	1.25E-04	-0.09%
Total Pu239	1.29E-07	3.61E-08	3.61E-08	-0.01%

For all of the tests shown above, the calculated (scaled) dose values agreed with the displayed value to within 1 percent and therefore these tests passed.

Also ran tests with RSAC for the public. Verified that RSAC runs could be saved and retrieved. Changed average wind velocity on the meteorological tab and verified that the changed value was in the output file.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 511	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta N)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): pcsa_prob.f, pcsa_ietccdf.f, pcsa_totrisk.f, and sort.f, project tree module, consequence analysis module

The pcsa_prob.f, pcsa_ietccdf.f, and pcsa_totrisk.f files contain a proprietary sort routine, sortqr. In order to release the PCSA Tool software, the sort routine needs to be redeveloped internally.

Remove references to the SysDescription table that is no longer in the database.

5. Change Requested by: Name: G. Adams G Adams Date: July 19, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams G Adams Date: July 19, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

Replaced subroutine sortqr with subroutine sort_index developed internally. The sortqr routine performed a quick sort, the sort_index routine performs a sequential sort. Subroutine sort_index was placed in file sort.f and is used by each of the three other FORTRAN modules.

Removed references to the SysDescription table in the project tree module and the consequence analysis module.

8. Implemented by: G. Adams G Adams	**Date:** July 19, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify the pcsa_prob module generates equivalent output in version BetaN of the PCSA Tool when compared to the output generated in version BetaK (prior to the change).
2	☑	☐	Verify the pcsa_ietccdf module generates equivalent output in version BetaN of the PCSA Tool when compared to the output generated in version BetaK (prior to the change).
3	☑	☐	Verify the pcsa_totrisk module generates equivalent output in version BetaN of the PCSA Tool when compared to the output generated in version BetaK (prior to the change).
4	☑	☐	Verify that a new database can be created and a new project tree established. Verify that an RSAC run can be saved and restored. These two areas of the database formerly referenced the SysDescription table.

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Troy Maxwell	**Date:** July 29, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

pcsa_prob: Verified that the output files generated by module pcsa_prob through a 100-realization test run of the PCSA Tool consequence module were equivalent between version BetaN and BetaK. The following files were checked: allccdf.dat, ccdfcomb.dat, pcsastat.out, and pcsastat.txt. The only difference between version BetaK and BetaN for files allccdf.dat and ccdfcomb.dat was the date/time stamp in the files. The files pcsastat.out and pcsastat.txt differ internally in the realization selected to represent the 50th percentile. This occurs because more than one consequence module realization generated the same value. The values for the 50th percentile are the same between version BetaK and BetaN even though the realization selected differs; therefore, the files are equivalent between version BetaK and BetaN.

pcsa_ietccdf: Verified that the output files generated by module pcsa_ietccdf were equivalent between version BetaN and BetaK. This test was conducted using the pcsademo database which is the same database in version BetaN and BetaK in which a mean dose calculation was performed. The following files were checked: allccdf.dat and pcsastat.txt. The file pcsastat.txt is identical between the two versions. The only difference in file allccdf.dat between the two versions is the date/time stamp in the file. Therefore, the files are equivalent between version BetaK and BetaN.

pcsa_totrisk: Verified that the output files generated by module pcsa_totrisk were equivalent between version BetaN and BetaK. This test was conducted using the pcsademo database which is the same database in version BetaN and BetaK. A probabilistic risk assessment was performed. The following files were checked: pcsastat.txt, totrisk.out, and trallccdf.dat. The pcsastat.txt and totrisk.out files are identical between version BetaK and BetaN. The trallccdf.dat files differ only in the date/time stamp. Therefore, the files are equivalent between version BetaK and BetaN.

A new database, pcsa_test, was created. A new project tree could be created for this database. A deterministic RSAC run could be saved and restored.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 512	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta P)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): performance assessment module

The takeaway analysis Crystal Report does not display the scenario (probabilistic or point estimate). Modify the Crystal Report to show the scenario.

If a Crystal Report is exported after a risk assessment is performed, a subsequent risk assessment could not be done because the default drive is changed when the Crystal Report is exported.

5. Change Requested by: Name: G. Adams G Adams Date: August 1, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams G Adams Date: August 1, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

Added the scenario to the performance assessment takeaway analysis Crystal Report.

Modified the software to issue a Change Drive (ChDrive) command prior to issuing a Change Directory (ChDir) command. This ensures that the default drive is correct before a directory is changed.

8. Implemented by: G. Adams G Adams	**Date:** August 4, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify that the Crystal Report for performance assessment takeaway analysis correctly displays the scenario.
2	☑	☐	Verify that a risk assessment can be performed after exporting a Crystal Report.

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Troy Maxwell	**Date:** August 6, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

The performance assessment takeaway analysis Crystal Report correctly displayed the "Point Estimate" scenario for the deterministic assessment and the "Probabilistic, Mean" scenario for the probabilistic assessment.

Verified that a Crystal Report could be exported (saved to a temp directory) and afterwards, a risk assessment could be performed.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 513	2. Software Title and Version: PCSA Tool, Version 3.0.0 (Beta Q)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): performance assessment module, frequency analysis module, software systems, help menu, about screen

Performance Assessment Module: Need to include only those event sequences that are included under event scenarios marked to be included for performance assessment

Frequency Analysis Module: Modify the Initiating Event Crystal Report to correct the font for time periods and uncertainty, Modify the Event Sequence Crystal Report to add the Applicability of the Event (P, W, B)

Software Systems: Add a Crystal Report for Software Systems, Correct the form to require a system id and description and ensure that they are unique

For the help menu, refer to the User's Guide instead of menu help

For the About box, update the contact information to include Robert Johnson and George Adams

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Name: G. Adams G Adams	Name: G. Adams G Adams
Date: August 6, 2004	Date: August 6, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

Modified the performance assessment module results tables and associated Crystal Reports to only include event sequences for event scenarios marked to be included for performance assessment.

Updated the Initiating Event and Event Sequences Crystal Reports.

Added a Software Systems Crystal Report and corrected the form to require a system id and system description and ensure that they are unique.

The help menu refers to the User's Guide and the About Box has the new contact information

8. Implemented by:	Date:
G. Adams G Adams	August 10, 2004

9.	Pass	Fail	Description of Test
1	☑	☐	Only event sequences under event scenarios marked for inclusion in performance assessment are included in the results tables.
2	☑	☐	Initiating Event and Event Sequences reports have been updated.
3	☑	☐	Software Systems Crystal report reflects screen information entered, note any missing information. Also unique System IDs and System Descriptions are required on the Software Systems form.
4	☑	☐	The help menu refers to the User's Guide and the About Box has the new contact information

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Troy Maxwell	Date: August 10, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

TEST1:
Entered the following Event Sequences and verified that the Public and Worker Results Tables displayed the event sequences and calculated the correct combined frequency-weighted sums when different event scenarios were marked to be included for performance assessment.

Functional ID	Event Scenario ID	Initiating Event Frequency	Event Sequence ID	Event Sequence Frequency
A.1	1	0.01	1	0.2
			2	0.3
B.1	2	0.015	3	0.1
B.1	3	0.015	4	0.4

Initially, all event scenarios are marked to be included for frequency analysis. The following is a comparison between the expected frequency-weighted sums and the actual values for the public, involved worker, and noninvolved worker.

Public

Event Sequence		Frequency	Dose Pt Est	Frequency * Dose	Dose Mean	Frequency * Dose
	1	0.2	2.76E-05	5.52E-06	5.00E-06	1.00E-06
	2	0.3	7.07E-05	2.12E-05	1.28E-05	3.84E-06
	3	0.1	2.76E-05	2.76E-06	5.00E-06	5.00E-07
	4	0.4	7.07E-05	2.83E-05	1.28E-05	5.12E-06
Frequency-Weighted Sum				5.78E-05		1.05E-05
PCSA Tool				5.78E-05		1.05E-05

Involved and Non-Involved Worker

Event Sequence		Frequency	TEDE	Frequency * Dose
	1	0.2	7.00E-01	1.40E-01
	2	0.3	3.00E-01	9.00E-02
	3	0.1	7.00E-01	7.00E-02
	4	0.4	3.00E-01	1.20E-01
Frequency-Weighted Sum				4.20E-01
PCSA Tool				4.20E-01

Event Scenario 1 is then marked as no longer included for performance assessment and the following is a comparison between the expected frequency-weighted sums and the actual values for the public, involved worker, and non-involved worker.

Without Event Scenario 1
Public

Event Sequence	Frequency	Dose Pt Est	Frequency * Dose	Dose Mean	Frequency * Dose
3	0.1	2.76E-05	2.76E-06	5.00E-06	5.00E-07
4	0.4	7.07E-05	2.83E-05	1.28E-05	5.12E-06
Frequency-Weighted Sum			3.10E-05	5.00E-06	5.62E-06
PCSA Tool			3.10E-05	1.28E-05	5.62E-06

Involved and Non-Involved Worker

Event Sequence	Frequency	TEDE	Frequency * Dose
3	0.1	7.00E-01	7.00E-02
4	0.4	3.00E-01	1.20E-01
Frequency-Weighted Sum			1.90E-01
PCSA Tool			1.90E-01

The current level results, performance assessment, combinations, and takeaway analysis forms and Crystal Reports no longer show event sequences 1 and 2 when event scenario 1 is no longer marked to be included in performance assessment as required.

TEST2:
The Initiating Event Crystal Report shows the correct fonts for uncertainty and time periods, the Event Sequences Crystal Report shows the Applicability of the Event as required.

TEST3:
The Software Systems Crystal Report reflects the information entered on the screen. No missing information is noted. Also, unique System IDs and System Descriptions (Names) were required.

TEST4:
The help menu refers to the User's Guide even though the User's Guide is not yet included and the About Box has updated contact information for George Adams and Robert Johnson.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 514	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta R)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Hazard Analysis Module (WhatIf, Energy Method), Frequency Analysis Module (Fault Tree, Event Tree), Images, Failure Probability, Software Reliability

1) Change the tab order to flow left to right top to bottom on text and memo fields on the WhatIf, Energy Method, Fault Tree, Event Tree and software reliability forms.
2) Add a set of new images to the database.
3) On the failure probability form, do not require the user to enter a letter id. Also remove data associated with deleted references.
4) On the downwind worker dose form, when the worker is on the same surface of the building as the stack, modify the frame captions and notes to indicate this as well as whether the worker is in or near the stack flow.
5) On the system description waste characterization tab and fire hazards tab, modify text fields to have a maximum length of 15 characters.

5. Change Requested by: Name: G. Adams G Adams Date: August 11, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams G Adams Date: August 11, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

Modified the tab order on the WhatIF, Energy Method, Fault Tree, and Event Tree forms, added images to the database, modified the failure probability form to no longer require a letter id and removed data associated with deleted references.
Added new images to the database identified in Attachment 1. Also modified the images grids to allow variable row heights because some of the captions for the images were long.
Modified the downwind worker dose form to reflect that the worker is on the same surface of the building as the stack and is in or near the stack flow.
Modified the system description tabs to limit the size of text fields to 15 characters.

8. Implemented by: G. Adams G Adams	**Date:** August 16, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	WhatIf, Energy Method, Fault Tree, Event Tree, and software reliability text and memo tab order flows left to right and top to bottom.
2	☑	☐	Images can be accessed from the database and associated drawing directory. Long image captions are visible.
3	☑	☐	Failure probability form no longer requires a letter id. Also a check of data in the failure probability database shows that data does not appear for removed references.
4	☑	☐	When the worker is on the same surface of the building as the stack, the frame caption and notes reflect this as well as whether the worker is in or near the stack flow.
5	☑	☐	Text fields on the waste characterization and fire hazards tabs are limited to 15 characters.

Note: Additional testing and comments can be found on Attachment 2.

10. Tested by: Troy Maxwell	**Date:** August 16, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

The following images were added for the underground operations:

1) u1.jpg, Locomotives and Waste Package Transporter Approaching the North Portal
2) u2.jpg, Waste Package Transportation Equipment Traveling Along Main Drift
3) u3.jpg, Waste Package Transporter and Its Components
4) u4.gif, Access Main Tunnel, Turnout, and Emplacement Drift Layout
5) u5.jpg, Locomotive Operations at Emplacement Drift Turnout
6) u6.jpg, Waste Package Emplacement Sequence in Drift, #1
7) u7.jpg, Waste Package Emplacement Sequence in Drift, #2
8) u8.jpg, Waste Package Emplacement Sequence in Drift, #3
9) u9.jpg, Docked Transporter with Pallet and Waste Package on Transporter's Open Deck and Emplacement Gantry Approaching the Docking Area for Pickup
10) u10.jpg, Bottom/Side Lift Emplacement Gantry – End View within Emplacement Drift
11) u11.jpg, Bottom/Side Lift Emplacement Gantry – Perspective View

Attachment 2

TEST1:
On the WhatIf, Energy Method, Fault Tree, and Event Tree forms, verified the tab order for text and memo fields from left to right and top to bottom.

TEST2:
New images were added to the database. Verified the images identified in Attachment 1 could be viewed. Verified the long captions for the images were visible.

TEST3:
Verified the failure probability form no longer requires a letter id. Also opened the probprac.mdb file and within the Probability and Sheet1 table, verified that where references no longer existed, data was also no longer present.

TEST4:
Verified that when the worker is on the same surface of the building as the stack that the frame caption and notes reflect this and they reflect that the worker is in or near the stack flow. When the receptor distance was within 3 * the stack diameter, the worker was in the stack flow; otherwise, the worker was near the stack flow.

TEST5:
Verified that on the Waste Characterization tab that Material Type, Material Container, and Material Amount were limited to 15 characters. Verified on the Fire Hazards tab that presence of combustible material was limited to 15 characters.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 531	2. Software Title and Version: PCSA Tool, Version 3.0.0 (Beta S)	3. Project No: 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): SAPHIRE software

The SAPHIRE standalone software is invoked by the PCSA Tool. SAPHIRE needs to be upgraded from version 6.70 to version 6.80.

5. Change Requested by:	6. Change Authorized by (*Software Developer*):
Name: G. Adams Date: August 16, 2004	Name: G. Adams Date: August 16, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

SAPHIRE software was upgraded from version 6.70 to version 6.80. The SaphireProjects\Demo directory was also upgraded to contain the version 6.80 demo project.

8. Implemented by:	Date:
G. Adams	August 17, 2004

9.	Pass	Fail	Description of Test
1	☑	☐	The same Event Tree and Fault Tree Graphics are displayed for the Demo, YMP1, and Ymp1_ATS1 projects between version 6.70 (PCSA Tool Version BetaR) and version 6.80 (PCSA Tool Version BetaS).

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Troy Maxwell	Date: August 18, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

Within SAPHIRE, from the help menu, verified that version 6.80 was being tested in version BetaS and compared to version 6.70 of BetaR.

Verified the following graphics appeared the same between version BetaR and BetaS for projects Demo, YMP1, and Ymp1_ATS1:

Demo:
Event Tree – LOSP
Fault Tree – CCS
Fault Tree – ECS

YMP1:
Fault Tree – YOKE-DROP

Ymp1_ATS1:
Event Tree – CASK-DROP-CD1

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 537	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta T)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): SSC Data form, System Log, System Description, Worker Dry, Normal Operation Dose

1) If no SSC is selected after a subsequent event is entered, then it is not possible to add a new SSC on the SSC Data form.
2) If a new project is opened or created when one is already open, the System Log should be displayed when leaving the current project. When the next project is opened, the System Log should be displayed for this project.
3) On the System Description form, for the Operation Sequence tab, if no records exist for this tab, then the Edit Record button is not visible. In addition for the Function tab and the Human Actions tab, the Edit Record button should instead be labeled 'Edit.'
4) On the worker dry form, if point estimates are restored after doses are calculated or if a different release fraction source is selected, then the doses displayed may not be correct for the input.

5. Change Requested by:	**6. Change Authorized by (*Software Developer*):**
Name: G. Adams G Adams	Name: G. Adams G Adams
Date: August 30, 2004	Date: August 30, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

1) Corrected the SSC Data form to no longer search for an empty string when comparing SSC identifiers.
2) When a project is already open and the user tries to open a new project or create a new project, the System Log/System Log Entry forms are displayed on leaving the existing project. When the next project is subsequently opened, its System Log is displayed if there are any records to display.
3) For the System Description form, Operation Sequence tab, made the Edit Record button visible regardless of whether or not operation sequence records existed. In addition, for the Function tab and the Human Actions tab, changed the Edit Record button to instead display 'Edit.'
4) Modified the Worker Dry form to clear output doses after the user restores point estimates to defaults and after a release fraction source is selected.

8. Implemented by:	**Date:**
G. Adams G Adams	September 2, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	SSCs may be added on the SSC Data form after a subsequent event has been added and no SSC is selected for the subsequent event.
2	☑	☐	The System Log/System Log Entry forms appear when the user leaves the current project to open or create a new project. The System Log form appears when the next project is subsequently opened if any log entries exist.
3	☑	☐	For the System Description form, Operation Sequence tab, the Edit Record button appears whether or not operation sequence records exist. The Function tab and Human Actions tab display Edit buttons where previously Edit Record buttons appeared.
4	☑	☐	Calculated doses are cleared on the Worker Dry form when point estimates are restored to defaults and a release fraction source is selected.

Note: Additional testing and comments can be found on Attachment 1.

10. Tested by: Troy Maxwell	**Date:** September 3, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

Test 1:
Added a subsequent event to an event scenario within the PCSA Demo database. Did not select an SSC for this subsequent event. Closed the form and opened the SSC Data form. Verified that an SSC could be added on the SSC Data form and afterwards, this new SSC could be selected for the added subsequent event.

Test 2:
Evaluated a series of scenarios to verify the operation of the System Log/System Log Entry forms.

Scenario 1: Verified display of System Log/System Log Entry forms
Opened the PCSA Demo database with no log entries. Verified that the PCSA Tool opened without displaying the System Log. Made no changes and chose to create a new database named test1. Chose not to save on exit and verified that on exiting, the System Log/System Log Entry forms were not displayed. Within the new database, built a project tree. Chose to exit, and when prompted, saved changes and exited. Verified that the System Log/System Log Entry forms displayed on exiting and entered a log entry test message.

Scenario 2: Verified that the System Log/System Log Entry is updated when a new database is opened and that the intermediate saves from the existing database are retained.
Opened the test1 database from the previous scenario. Verified that the System Log displayed when the database was opened since log entries were present. Modified the database by adding an initiating event. Saved the changes. Modified the database again by adding an event scenario. Chose to open the PCSA Demo database. When prompted to save the test1 database, chose not to save. Verified that the System Log/System Log Entry form appears. Made a new test entry in the System Log. After the PCSA Demo database opened, chose to open the test1 database. Verified that the System Log displayed with the log entries previously entered. Verified that the initiating event was present but the event scenario was not since only an intermediate save was performed prior to opening the PCSA Demo database. Exited the tool without saving. Verified that no System Log/System Log Entry form appeared.

Scenario 3: Verified that the System Log and other database changes are saved when a new database is opened and the existing database is saved on exit.
Opened the test1 database from the previous scenario. Verified the System Log displayed with the log entries from the previous scenario. Modified the database by adding an event scenario. Chose to open the PCSA Demo database. When prompted to save the test1 database, chose to save. Verified that the System Log/System Log Entry form appears. Made a new test entry in the System Log. After the PCSA Demo database opened, chose to open the test1 database. Verified that the System Log displayed with the log entries previously entered. Verified that the event scenario entered and saved was also present. Exited the tool without saving. Verified that no System Log/System Log Entry form appeared.

Test 3:
Verified on the System Description form, Operation Sequence tab, that the Edit Record button displayed when no operation sequence records were in the database and one record was in the database. Without records, the Edit Record button was disabled and with a record, the Edit Record button was enabled.

Test 4:
Verified on the Worker Dry form that after doses are calculated, if the user chooses to Restore All Defaults or Restore Point Estimates to Defaults from any of the three tabs that the calculated doses are no longer displayed. Also verified that after doses are calculated, if the user selects a release fraction source, the calculated doses are no longer displayed.

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 539	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta U)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): SSC Data Crystal Report, Event Tree Crystal Report, and Fault Tree Crystal Report

1) Data for the 'Additional Information' field does not appear on the SSC Data Crystal Report.
2) The 'Saphire Data Path' and 'Include for Performance Assessment' fields do not appear on the Event Tree Crystal Report.
3) The 'Saphire Data Path' field does not appear on the Fault Tree Crystal Report.

5. Change Requested by: Name: G. Adams Date: September 7, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams Date: September 7, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

1) Added the 'Additional Information' field to the SSC Data Crystal Report.
2) Added the 'Saphire Data Path' and 'Include for Performance Assessment' fields to the Event Tree Crystal Report.
3) Added the 'Saphire Data Path' field to the Fault Tree Crystal Report.

8. Implemented by: G. Adams	**Date:** September 8, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify that data entered for Additional Information appears on the SSC Data Crystal Report.
2	☑	☐	Verify that data entered for 'Saphire Data Path' and 'Include for Performance Assessment' appear on the Event Tree Crystal Report.
3	☑	☐	Verify that data entered for 'Saphire Data Path' appears on the Fault Tree Crystal Report.

Note: none

10. Tested by: Troy Maxwell	**Date:** September 9, 2004

CNWRA Form TOP-5 (05/2000)

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 540	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta V)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): SSC Data Form and Crystal Report

1) The SSC Design Bases and Design Criteria Crystal Report displays "Functions, Hazards, Initiating Events, and Event Tree Subsequent Events" for multiple SSC IDs. It should display this information for only one SSC ID.
2) When editing an SSC, the SSC ID text field should not be enabled when design bases and design criteria exist for an SSC; otherwise, the link between the former SSC ID and design bases and design criteria is broken.
3) The Design Bases and Design Criteria tab should not be enabled when an SSC is being added or edited from the General tab.

5. Change Requested by: Name: G. Adams Date: September 10, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams Date: September 10, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

1) Updated the SSC Design Bases and Design Criteria Crystal Report to match SSC ID when retrieving records from the database for "Functions, Hazards, Initiating Events, and Event Tree Subsequent Events."
2) For the case where an SSC is being edited, modified the SSC Data form to no longer enable the SSC ID text field when design bases and design criteria exist for the SSC.
3) Disabled the Design Bases and Design Criteria tab when an SSC is being added or edited.

8. Implemented by: G. Adams	**Date:** September 10, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify that when "Functions, Hazards, Initiating Events, or Event Tree Subsequent Events" are entered for multiple SSCs that the Design Bases and Design Criteria Crystal Report shows only the information that applies to the applicable SSC.
2	☑	☐	Verify that when an SSC is edited from the General tab and design bases and design criteria exist for that SSC, the SSC ID text field is disabled. Also, verify that if an SSC is not selected for use within an Event Tree Subsequent Event and no design bases and design criteria exist for that SSC, then the SSC ID may be edited.
3	☑	☐	Verify that the Design Bases and Design Criteria tab is disabled when an SSC is being added or edited.

Note: none

10. Tested by: Troy Maxwell	**Date:** September 13, 2004

CNWRA Form TOP-5 (05/2000)

SOFTWARE CHANGE REPORT (SCR)

1. SCR No. (*Software Developer Assigns*): 541	**2. Software Title and Version:** PCSA Tool, Version 3.0.0 (Beta W)	**3. Project No:** 20.06002.01.103

4. Affected Software Module(s), Description of Problem(s): Risk Assessment (frmRiskAssessment, frmRiskEventSequence, frmRiskResults)

1) The pcsa_ietccdf code generates an error message for 100-realization scenarios in which one of the pathways is 'None.' This error was shown for event scenario CTS-ES-01 of the PCSA Demo database.
2) The Risk Assessment form does not update the number of realizations in probabilistic risk assessment for event scenarios in which all event sequences have 'None' selected for the consequence path. In addition, for the case of all event sequences of 'None,' the probabilistic risk assessment generates an overflow error.

5. Change Requested by: Name: G. Adams Date: September 13, 2004	**6. Change Authorized by (*Software Developer*):** Name: G. Adams Date: September 13, 2004

7. Description of Change(s) or Problem Resolution (*If changes not implemented, please justify*):

1) When file lhs.inp is generated, reformatted the output to the file to allow the FORTRAN code to correctly read the number of realizations.
2) Modified the risk assessment form to check the number of realizations after the user performs an event scenario risk calculation.
3) Modified the calculation of percent contribution to check for a zero total risk.

8. Implemented by: G. Adams	**Date:** September 15, 2004

9.	**Pass**	**Fail**	**Description of Test**
1	☑	☐	Verify the test results obtained on SVTR 8-4 are obtained with Version BetaW of the PCSA Tool.
2	☑	☐	Verify that the PCSA Demo database for Event Scenario CTS-ES-01 no longer shows an error message for the 100-realization scenario.
3	☑	☐	Verify that when additional event sequences are added to the SVTR 8-4 base test in which the additional event sequences have 'None' selected for the consequence path that the same risk results obtained under test 1 are obtained.
4	☑	☐	Verify the risk assessment form will modify the number of realizations for those scenarios in which all event sequences have 'None' selected.
5	☑	☐	Verify that the percent contributions are zero when the total risk is zero

Note: Test Results are documented on attachment 1.

10. Tested by: Troy Maxwell	**Date:** September 16, 2004

CNWRA Form TOP-5 (05/2000)

Attachment 1

Test 1: Compared the risk and consequence values from SVTR8-4 to the values generated within version BetaW and verified the results were in agreement. Also generated deterministic and probabilistic reports as an attachment which show agreement to the SVTR8-4 results.

Test 2: Verified that by initially setting the Number of realizations to 1 for the 'None' files event sequence and then recalculating the event scenario risk that the resulting lhs.inp file is formatted to be read by the FORTRAN software by a 4x, I12 format statement. And verified through a DOS window that the FORTRAN software no longer generates an error message indicating that the number of realizations are not in agreement.

Test 3: Verified that with the addition of one event sequence to event scenario 1 in which the consequence paths for deterministic and probabilistic are both designated 'None' that the same results from Test 1 are obtained.

Test 4: Setup the form to have two event scenarios with 'None' selected and a third which set the number of realizations. Verified that when the number of realizations for the third scenario was modified that the risk assessment form updated the number of realizations for the other two as well.

Test 5: Set all event sequences to have 'None' for the deterministic and probabilistic consequence paths. Verified that when the deterministic and probabilistic risk was calculated that the percent contributions were all zero.

PCSA Risk Report

Project: scr541

Type of Run: Deterministic

Outcome State	Probability	Consequence (rem)	Risk (rem in time period)	Contribution (%)
- - -	9.512E-01	0.000E+00	0.000E+00	0.00E+00
+ - -	9.560E-03	8.999E-04	8.603E-06	8.55E+01
- + -	1.921E-02	1.392E-05	2.674E-07	2.66E+00
- - +	1.921E-02	4.174E-05	8.021E-07	7.97E+00
+ + -	1.931E-04	9.139E-04	1.765E-07	1.75E+00
+ - +	1.931E-04	9.417E-04	1.818E-07	1.81E+00
- + +	3.881E-04	5.566E-05	2.160E-08	2.15E-01
+ + +	3.901E-06	9.556E-04	3.728E-09	3.71E-02
Total Risk			1.006E-05	

PCSA Risk Report

Project: scr541

Type of Run: Probabilistic

Outcome State	Probability	Mean Consequenc (rem)	Mean Risk (rem in time period)	Contribution (%)
- - -	9.512E-01	0.000E+00	0.000E+00	0.00E+00
+ - -	9.560E-03	1.632E-04	1.560E-06	8.55E+01
- + -	1.921E-02	2.524E-06	4.850E-08	2.66E+00
- - +	1.921E-02	7.571E-06	1.455E-07	7.98E+00
+ + -	1.931E-04	1.658E-04	3.201E-08	1.75E+00
+ - +	1.931E-04	1.708E-04	3.298E-08	1.81E+00
- + +	3.881E-04	1.010E-05	3.918E-09	2.15E-01
+ + +	3.901E-06	1.733E-04	6.761E-10	3.71E-02
Total Risk			1.824E-06	