CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TECHNICAL OPERATING PROCEDURE

Proc. TOP-18

Revision __ Change ____

Page ____ of ____

SOFTWARE RELEASE NOTICE

1. SRN Number: PA-SRN-287

2. Project Title: Diablo Canyon Spent Fuel Storage Facility | Project No.20.06003.03.31

3. SRN Title: MCNP 4C2

4. Originator/Requestor: Oleg Povetko | Date: 01/27/2003

5. Summary of Actions

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

6. Validation Status

- □ Validated
- □ Limited Validation
- √ Not Validated — Explain: To be determined

7. Persons Authorized Access

Name	Read Only/Read-Write	Addition/Change/ Delete
Oleg Povetko	Read Only	N/A

8. Element Manager Approval: Gordon Wittmeyer Date: 1/27/03

9. Remarks:

CNWRA Form TOP-6

SOFTWARE SUMMARY FORM

01. Summary Date: January 27, 2003	02. Summary prepared by (Name and phone) Oleg Povetko (210)522-5258	03. Summary Action: New
04. Software Date:	05. Short Title: MCNP 4C2	
06. Software Title: MCNP, version 4C2		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:
11. Submitting Organization and Address: CNWRA/SwRI 6220 Culebra Road San Antonio, TX 78228		12. Technical Contact(s) and Phone: Oleg Povetko (CNWRA) (210) 522-5258

13. Software Application:MCNP is a general-purpose, continuous-energy, generalized geometry, time-dependent, coupled neutron-photon-electron Monte Carlo transport code system. Energy ranges are 0-60 MeV for neutrons (data generally only available up to 20 MeV) and 1 keV - 1 GeV for photons and electrons. MCNP4C2 is a version upgrade for MCNP4A which is currently controlled under TOP-018. The changes from version 4A to 4C2 include: photonuclear physics model addition, interactive plotting, implementing macrobody surfaces and others. The code utilizes the ASCII DLC-200/MCNPDATA data library which is included in the software package and installed along with the code.

14. Computer Platform Windows-based personal computer	15. Computer Operating System: Windows-95/NT or later	16. Programming Language(s): N/A	17. Number of Source Program Statements: N/A
18. Computer Memory Requirements: Not available	19. Tape Drives: N/A	20. Disk Units: 940 MB of hard disk space	21. Graphics: Windows-based Minimum VGA graphics card

22. Other Operational Requirements None

23. Software Availability: √ Available ☐ Limited ☐ In-House ONLY	24. Documentation Availability: √ Available ☐ Preliminary ☐ In-House ONLY
25. Software User: Oleg Povetko Oleg S Povetko	Date: 01/29/2003

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

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→*ACQUIRED SOFTWARE NOT TO BE MODIFIED*←

Software Title/Name: MCNP 4C2

Version: 4C2

Demonstration workstation: Paladin

Operating System: Windows NT

User: Oleg Povetko

NOTE: Acquired software may or may not meet all requirements and will be evaluated on a case-by-case basis.

Installation Testing [TOP-018, Section 5.6]

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

Yes: ☑ No: ☐ N/A: ☐

Computer Platforms: PC Operating Systems: Windows NT

Location of ~~Acceptance~~ Test Results: See enclosed memo Povetko to Mabrito, January 21, 2003 & CD.

Comments:. Revised 7/3/02

Software Output [TOP-018, Section 5.5.4]

Is 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: 05/22/02 17:08:41

Name/Version Displayed: MCNP 4C2

Comments:

NOTE: Output identification content and format is typically taken as is.

Medium Documentation [TOP-018, Section 5.5.6]

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:

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→*ACQUIRED SOFTWARE NOT TO BE MODIFIED*←

User Documentation [TOP-018, Section 5.5.7]

Is there a Users' Manual for the software and is it up-to-date?
Yes: ☑ No: ☐ N/A: ☐

User's Manual Version and Date:
Comments:

Are there basic instructions for the *installation* and *use* of the software?
Yes: ☑ No: ☐ N/A: ☐

Location of Instructions: See enclosed memo Povetko to Mabrito dated January 21, 2003 & MCNP4C2 Notes
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: 01/29/03

Is the list of files attached to the Software Summary Form complete and accurate?
Yes: ☑ No: ☐ N/A: ☐

Comments:

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: See enclosed CD.
Comments:

Have all the script/make files and executable files been submitted to the Software Custodian?
Only the executable files are being submitted.

Yes: ☑ No: ☐ N/A: ☐

Location of executable files: See enclosed CD.
Comments:

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
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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: 287

Comments:

Software Validation [TOP-018, Section 5.10]

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

Yes: ☐ No: ☑ N/A: ☐

Version and Date of SVTP: ___

Date Reviewed and Approved via QAP-002: ___

Comments: NCNP, 4A classified as cat. II with validation due Sept. 2003.

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

Yes: ☐ No: ☑ N/A: ☐

Version and Date of SVTR: ____

Date Reviewed and Approved via QAP-002: _____

Comments.:

Additional Comments:

01/29/2003
Software Evaluator/User/Date

01/30/03
Software Custodian/Date

```
 Volume in drive D is MCNP4C2
 Volume Serial Number is ECA0-7969

Directory of D:\

701ALLCP 00          4,122  06-06-01  6:20a 701ALLCP.00
C701DOS0 EXE    16,903,243  06-04-01  7:08a C701DOS0.EXE
C701TAR0 GZ     13,330,060  06-04-01  8:11a C701TAR0.GZ
D200DOS2 EXE   268,238,353  03-01-01  8:03a D200DOS2.EXE
D200TAR2 GZ    274,994,967  02-12-01  7:09a D200TAR2.GZ
DOC            <DIR>        06-11-01  1:22a DOC
READ4C2  TXT        18,592  06-01-01  5:48a READ4C2.TXT
README   1ST         8,180  06-06-01  6:11a README.1ST
README   RSI         4,096  12-31-99  6:00a README.RSI
         8 file(s)    573,501,613 bytes

Directory of D:\DOC

.              <DIR>                       .
..             <DIR>                       ..
C701     PDF     3,485,698  06-07-01  3:28a C701.PDF
D200     PDF    12,711,321  03-05-01  5:36a D200.PDF
         2 file(s)     16,197,019 bytes

Total files listed:
        10 file(s)    589,698,632 bytes
         3 dir(s)               0 bytes free
```

TO: Bruce Mabrito
FROM: Oleg Povetko
SUBJECT: TOP-018 for MCNP-4C2
DATE: January 21, 2003

Software Application: MCNP is a general-purpose, continuous-energy, generalized geometry, time-dependent, coupled neutron-photon-electron Monte Carlo transport code system. Energy ranges are 0-60 MeV for neutrons (data generally only available up to 20 MeV) and 1 keV - 1 GeV for photons and electrons. MCNP4C3 is a version upgrade for MCNP4A which is currently controlled under TOP-018. The changes from version 4A to 4C2 include: photonuclear physics model addition, interactive plotting, implementing macrobody surfaces and others. The code utilizes the ASCII DLC-200/MCNPDATA data library which is included in the software package and installed along with the code.

It was acquired from ORNL (Oak Ridge National Laboratory) RSICC (Radiation Safety Information Computational Center), P.O. Box 2008, Oak Ridge, TN 37831-6362. Phone: (865)574-6182. Fax: (865)574-6182. Email: pdc@ornl.gov. URL: http://www-rsicc.ornl.gov/rsic.html.

Installation of MCNP4C2.

MCNP4C2/MCNPDATA software package was successfully installed on Paladin machine following included instructions:

Expanding files from the distribution CD will create a subdirectory called "mcnp4c2" that includes the code system plus the new la150u photonuclear library and associated documentation in the "xs" subdirectory under "mcnp4c2". The mcnp4c2\xsdir file includes lines for the new la150u as well as the other MCNP libraries distributed in the DLC-200 package.

DLC-200 cross sections will expand to a "xs" subdirectory under "mcnp".

QUICK START on PC

The MCNP4C2 code system is transmitted in a compressed file for PC users running Windows 9x or NT or 2000. PKware 2.60 was used to create the self-extracting compressed files. Note that the mcnp executables are not Windows applications; they must be run from a DOS prompt.

The PC distribution contains executables for MCNP4C2 and MAKXSF, which were built with the Digital Visual Fortran 6.0 Professional Edition and Lahey/Fujitsu Fortran 95 Compiler Release 5.50h Professional edition. Both X11 graphics and DVF QuickWin and Lahey Winteracter graphics are supported. See the Readme4c2.txt file for details details on compiling and on software

requirements.

Insert distribution CD-ROM and access CD drive.
Double-click on the file c701dos0.exe to expand mcnp4c2 + la150u to mcnp4c2.
Double-click on the file d200dos2.exe to expand cross sections to mcnp\xs.
Ensure that "Recreate Subdirectories" option is checked and change drives
if desired. Then click OK to create an MCNP4C2 subdirectory and extract files.

Open a DOS window and compile as instucted in README.TXT or copy an MCNP
executable from the EXE subdirectory and run test cases by invoking the
DOS commands below:

cd \mcnp4c2
copy exe\mcnp4.dvq mcnp.exe (copy DVF-compiled MCNP with dynamically
allcoated storage & QuickWin graphics0)

One must move the DLC-200 mcnp\xs cross sections to mcnp4c2\xs. You may edit
the datapath statement in mcnp4c2\xsdir to tell MCNP where to find DLC-200
cross sections.

Installation test results.

MCNP4C2 comes with 34 test files (contrary to a number of 32 indicated in README.1ST file)
that implement a wide range of the code features when executed.
Test cases use TESTDIR and TESTLIB1. Test files are stored in /samples directory.
In order to run test cases batch file runsamps was executed.
Two output files were generated for each test case.
Results of test runs are programmatically compared with results of the same cases executed by the
developer and provided on the installation CD. Results of file comparison are documented in dif* files.
After execution 68 dif* files were examined to verify that the test cases were run successfully.
Additional visual inspection of various portions of generated and provided output files verified
that corresponding output files contained the same results.

Additional test case from Reused Soil Scenario Analysis project was run using both MCNP4A and
MCNP4C2 codes.
Input file:

tr137i*

Description of the case:

Objective:
To calculate gamma component of the external dose to the truck operator caused by irradiation of gamma rays from the contaminated soil in cargo box.
Model description:
Truck cargo box is modeled as stainless steel box, truck cab is modeled as a stainless steel sphere. Truck operator is modeled as a 70-kg sphere positioned in the center of the cab for truck types 2-4. Truck dimensions are presented in Table 1. Truck type 4 was examined in the test case (file tr137i).

Based on visual inspection of various portions of the output files, the two versions of the software produced the same results. Results are not identical due to Monte Carlo sampling of the input parameters.

Table 1. Truck Parameters for the Truck Operator Scenario				
	P2 Truck Operator Truck Types			
Parameter	Type 1 (Pickup truck)	Type 2 (Light/Medium Truck)	Type 3 (Standard dump truck)	Type 4 (Heavy dump truck)
Cargo box length	6.5'	8'	10'	17'
Cargo box width	5.025'	6'	7'	7'
Height of soil in cargo box front "shining plane"[1]	1.2'	2.5'	3'	4'
Cargo box wall thickness	0.089 mm	0.476 mm	0.476 mm	0.476 mm
Volume of soil in cargo box	1306997 cm3	3754568.594 cm3	6225079.679 cm3	15357142 cm3
Mass of soil in cargo box	2,091 kg	6,007 kg	9,960 kg	24,571 kg
Sphere cab diameter	80 cm	80 cm	100 cm	100 cm
Sphere cab wall thickness	0.089 mm	0.089 mm	0.089 mm	0.089 mm
Position of the operator in the cab	Shifted 30 cm down and 5.02 cm back from the cab center towards cargo box	Center of the cab	Center of the cab	Center of the cab
Distance from the center of the modeled operator to the "shining plane"[1]	30.4 cm	81.476 cm	101.476 cm	101.484 cm

[1]Front plain surface of the hauled soil closest to the receptor

Attached:
1 cdrom, MCNP4C2/MCNPDATA software
1 cdrom, installation test results