MOL.19980622.0637

30033-2003 Rev 01
April 1998
QA: L

INFORMATION ONLY

SOFTWARE QUALIFICATION REPORT
for
MCNP Version 4B2
A General Monte Carlo N-Particle Transport Code

CSCI: 30033 V4B2LV
DI: 30033-2003 Rev. 01
MI: 30055-M72-001, 30056-M03-001, 30057-M03-001

Prepared by: _____ **Date** 4/17/98
Sedat Goluoglu
Waste Package Design

Prepared by: _____ **Date** 4/17/98
John A McClure
Waste Package Design

Concurrence by: _____ for **Date** 4/17/98
Robert Morgan
EA Manager, Nevada

Approved by: _____ **Date** 4.17.98
T.W. Doering, Manager
Waste Package Design

Civilian Radioactive Waste Management System
Management and Operating Contractor

9902240242 990107
PDR WASTE
WM-11 PDR
102.2

INFORMATION ONLY

CHANGE HISTORY

Revision Number	Effective Date	Description of and Reason for Revision
0	1/22/98	Initial Issue
1	4/17/98	Install/qualify MCNP4B2 with fixes and establish new baseline with revision of the SQR. Revise CSCI: MCNP V4B2LV and 30033 V4B2LV. Cancel prior media numbers 30033-M03-001, 30033-M03-002, 30033-M03-004, 30033-M72-003, 30033-M72-005 and reissue new media numbers 30055-M72-001 for PC, 30056-M03-001 for HP, 30057-M03-001 for Sun platforms that includes shielding validation problems and coincident surface fix. Incorporates shielding addendum (DCN 01) and all prior platforms. Incorporates LV.WP.SG.02/98-033, LV.WP.JAM.02/98-035, LV.WP.JAM.02/98-039.

INFORMATION ONLY

Table of Contents

Page

1.0 INTRODUCTION 1
1.1 Purpose 1
1.2 Software Description 2
1.2.1 MCNP4B2 Computational Methods 2
1.2.2 MCNP4B2 Cross Section Libraries 3
1.3 Functional Requirements 3
1.3.1 General Requirements 4
1.3.2 Input/Output Requirements 4
1.3.3 Hardware/Software Platform Requirements 5
1.3.4 Computational Methods/Algorithm Requirements 6
1.3.5 Other Requirements 7
1.4 Description Of Validation 7
1.5 Additional Documentation And References 8

2.0 INSTALLATION 9
2.1 MCNP4B2 Installation Procedure 9
2.1.1 HP Unix Based Workstation 9
2.1.2 PC DESKTOP COMPUTERS 10
2.1.3 SUN Ultra-2 Unix Based Workstation 11
2.2 MCNP4B2 Installation Verification 12
2.2.1 Installation Test Case Description 12
2.2.2 Results of Installation Test Cases 14
2.3 Cross Section Library Installation 15

3.0 VALIDATION 16
3.1 MCNP4B2 Criticality Validation Tests 16
3.1.1 Rodded Lattices 16
3.1.2 Mixed Oxide Fuel 33
3.1.3 Criticality Benchmarks 53
3.1.4 Results of Validation for the HP 9000 and SUN Ultra-2 Workstations 53
3.1.5 Results of MCNP4B2 Criticality Validation Cases For PC 55
3.2 Results Of Cross Section Installation Tests 58
3.3 MCNP4B2 Shielding Validation Tests 59
3.3.1 Simple Benchmark Problems 59

3.3.2 Results of Simple Benchmark Problems 59
3.3.3 Multidimensional Cask Benchmark 63
3.3.4 Multidimensional Cask Benchmark Results 66
3.4 Conclusions of MCNP4B2 Shielding Validation Tests 66

4.0 RECOMMENDATIONS 67

5.0 ATTACHMENTS 69

Attachment I: Software Acquisition Correspondence I-1

Attachment II: Installation Information/Notes II-1

Attachment III: MCNP4B2 Directory And File Listing III-1

Attachment IV: Table of Contents of Electronic Medias MOY-980421-19 (MI: 30056-M03-001), MOY-980421-18 (MI: 30057-M03-001), and MOY-980421-20 (MI: 30055-M72-001). IV-1

Attachment V: List of Output Files Archived on Electronic Media MOY-980414-11 (verification, validation, and regression testing files) V-1

Attachment VI: Execution Instructions VI-1

Attachment VII: Regression Testing Correspondence VII-1

INFORMATION ONLY

INFORMATION ONLY

1.0 INTRODUCTION

1.1 Purpose

This Software Qualification Report (SQR) is an update to the SQR for MCNP4B with the implementation of current QAP-SI-0 procedures and updates to the code package as mentioned in Reference 11. This SQR documents the verification and validation process for the installation of the MCNP4B2 code package. This process includes validation of the criticality and neutron/gamma shielding capabilities of the code. Since no modifications are needed for implementation by the Waste Package Operations (WPO) of the Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O), this code is classified as acquired software. The MCNP4B package was provided on a CD by Los Alamos National Laboratory (LANL) where it is maintained under the LANL MCNP Quality Assurance Plan (Ref. 2). Verification and validation of the MCNP4B code by the developer is documented in Reference 15. The update file (fix file) to correct a code error was obtained electronically from LANL (www-xdiv.lanl.gov/XCI/PROJECTS/MCNP/world/fix4b2) to produce MCNP4B2, after receiving a notice of the error. The software acquisition correspondence is given in Attachment I. This software package is needed to support current analyses for the waste package/engineered barrier system of the Monitored Geological Repository. If additional computer platforms are required in the future, validation will be documented in revisions/addenda to this SQR.

The MCNP4B2 code package was developed by LANL. Generally, MCNP4B2 performs three dimensional neutron or gamma transport calculations for complex systems. For the analysis required for the waste package/engineered barrier system, the primary use will be for criticality analyses for spent nuclear fuel and other fissile material systems. Also, shielding calculations for the neutron and gamma sources contained in the waste package will be performed to determine the internal and external effects of the radiation.

The sample installation test cases accompanying the code package exercise these neutron and gamma transport capabilities to ensure they are all functioning correctly. The sample cases will be used to verify correct installation and operation of the MCNP4B2 code package. Additional criticality benchmark test cases are provided to validate computations performed by the MCNP4B2 code package. This type of validation method using additional benchmark test cases is an established practice in the MCNP Software Quality Assurance Plan at LANL (Ref. 2). MCNP4B2 also provides the capability to transport electrons (beta particles) for shielding problems, but this capability is not required for waste package analyses.

In the current configuration, the MCNP4B2 code package, which is physically residing on the QUICHE HP 9000/C160 series workstation and PC desktop computers, uses nuclear cross sections based on the ENDF/B-V and ENDF/B-VI (Ref. 14) libraries.

INFORMATION ONLY

1.2 Software Description

A full description of the MCNP4B2 code package is provided in the MCNP4B user manual (Ref. 1). The following excerpts will provide a general description.

> "MCNP is a general-purpose Monte Carlo N-Particle code that can be used for neutron, photon, electron, or coupled neutron/photon/electron transport, including the capability to calculate eigenvalues for critical systems. The code treats arbitrary three-dimensional configurations of materials in geometric cells bounded by first-degree and second-degree surfaces and fourth-degree elliptical tori."

> "Pointwise cross-section data are used. For neutrons, all reactions given in a particular cross-section evaluation (such as ENDF/B-VI) are accounted for. Thermal neutrons are described by both the free gas and $S(\alpha,\beta)$ models."

> "Important standard features that make MCNP very versatile and easy to use include a powerful general source, criticality source, and surface source; both geometry and output tally plotters; a rich collection of variance reduction techniques; a flexible tally structure; and an extensive collection of cross-section data."

More detailed theoretical and operational information can be obtained in the MCNP4B user manual.

Chapter 1 provides an overview of the complete system, the theoretical basis of the code, and tips for efficient use of the code.

Chapter 2 describes the geometry and cross section features of the code, and also provides details of the implementation of the theoretical basis of the code. The criticality capability of the code (to calculate the effective multiplication factor, k_{eff}) is described as is the capability for shielding calculations.

Chapter 3 provides detailed descriptions of the input required to create a model for MCNP4B2, including the geometric description capabilities and the material properties. Chapter 4 provides example problem input and descriptions, and Chapter 5 provides output for these samples.

1.2.1 MCNP4B2 Computational Methods

The MCNP4B2 code package uses the Monte Carlo methodology to perform transport calculations. The Monte Carlo numerical method simulates and records the behavior of individual particles within a system. This mathematical approach applies random selections of particle transport characteristics and interactions based on probabilities, cross sections, and system geometry. The behavior of the simulated particles is extrapolated to describe the average behavior of all of the particles within the

INFORMATION ONLY

system. The Monte Carlo method as applied to neutrons in an MCNP criticality calculation is based upon following a number of individual neutrons through their various transport experiences such as scattering, fission, absorption, or leakage. The fission process is regarded as the birth event that separates generations of neutrons. A generation is the lifetime of a neutron from birth by fission to death by either escape, parasitic capture, or absorption leading to fission. The average behavior of the sample set of neutrons is used to describe the average behavior of the system with regard to the number of neutrons in successive generations (i.e. neutron multiplication factor, k_{eff}).

MCNP4B2 calculates three k_{eff} estimates for each cycle in a given problem.

1) the collision estimate,

2) the absorption estimate, and

3) the track length estimate.

A detailed description of the three k_{eff} estimates may be found in Chapter 2 of the MCNP4B user manual. According to statisticians at the Los Alamos National Laboratory,

> "the three-combined k_{eff} estimator is the best final estimate from an MCNP calculation (Ref. 1). The confidence interval based on the three statistically combined k_{eff} estimates is the recommended result to use for all final k_{eff} confidence interval quotations because all of the available information has been used in the final result."

1.2.2 MCNP4B2 Cross Section Libraries

The MCNP4B2 code package is qualified with an associated set of cross section libraries based on ENDF/B-V and ENDF/B-VI nuclear data.

The cross section library installation procedure and validation of correct operation is provided in Sections 2.3 and 3.2, respectively. Validation of ENDF/B-V and ENDF/B-VI library cross sections is achieved by experimental benchmark test cases that exercise the MCNP4B2 cross section library.

1.3 Functional Requirements

The MCNP4B2 code package has the capability to perform criticality and shielding calculations. Shielding calculations include neutron, gamma, electron, and (n,gamma) sources. MCNP4B2 accomplishes these calculations with a well established computer source code and cross section data libraries. The criticality capability and neutron and gamma shielding capabilities are installed and tested using developer supplied test cases and additional benchmark tests. The electron transport capabilities are installed but have not been tested. Upon requirement of additional capabilities, or

version/revision changes, the SQR shall be revised to include the required test cases and the revised SQR will be submitted to the Software Configuration Manager (SCM) per QAP-SI-0.

1.3.1 General Requirements

The MCNP4B2 code package generates data to support waste package performance activities (WBS 1.2.2) related to criticality and shielding. The system can perform the following analyses:

1) three dimensional criticality analyses;

2) three dimensional shielding analyses for neutron sources;

3) three dimensional shielding analyses for gamma sources; and

4) three dimensional shielding analyses for gamma sources produced by neutron interactions (coupled n-gamma problems).

Examples of analyses that can be supported by the MCNP4B2 system are:

1) evaluation of criticality for various waste package designs within the range of acceptable fuel types, including plutonium materials,

2) evaluation of the neutron and gamma-ray fluence and dose rate on the waste container materials and environment, and

MCNP4B2 requires that the user provide data which describe the materials and geometry which define the desired problem. MCNP4B2 also provides a Graphical User Interface (GUI) that provides interactive plotting of geometry models and tallies.

1.3.2 Input/Output Requirements

Input to MCNP4B2 is provided by keyboard text entry via a text input file identified on the command line. The desired outfile is also identified on the command line. Problems may be stopped, and later re-started through the use of a "CONTINUE" run which uses a problem history file named "runtpe" and a source distribution file "srctp". This feature is useful when the calculated results of a run are not statistically adequate, and continuing the problem run can improve the statistics to acceptable values. MCNP4B2 input/output requirements include:

1) MCNP4B2 instructions regarding housekeeping functions such as print options;

2) Cross section library specifications;

INFORMATION ONLY

3) Model geometry in three dimensions; and

4) Material specifications for the regions in the geometrical model.

MCNP4B2 can use a variety of cross section libraries which are provided with the code. The library used for each isotope specified in the material specifications of the geometrical model is defined by an extension of the isotope identifier. Hence, isotope cross sections may be retrieved by MCNP4B2 from a single or several libraries at the user's discretion. A user may employ either ENDF/B-V or ENDF/B-VI cross section libraries available in the MCNP4B2 code package as required. Additional cross section libraries for the Unix based workstations are maintained in the subdirectory attached to the main MCNP directory on the QUICHE HP 9000/C160 workstation. The ENDF/B-V and ENDF/B-VI cross section library for the desktop PC version is maintained in a sub-directory of the main MCNP directory on each PC.

MCNP4B2 provides a hard copy listing in ASCII format of the output that contains a listing of the input file, the interpretation of the problem model, and the calculational results. In addition, ASCII tally files and binary data files containing the problem history and source distribution information are produced.

1.3.3 Hardware/Software Platform Requirements

The current package, MCNP4B2, is distributed for implementation on a variety of computer platforms including the HP 9000/735, HP 9000/C160, and HP 9000/C180, and SUN Ultra-2 computers. The HP version is a Unix based system that is optimized for the 9000 series computers without software modifications. The SUN version is also a Unix based system that is optimized for the SUN Ultra-2 workstations without software modifications. Additionally, the current MCNP4B2 package is implemented on a desktop computer platform with an MS-DOS operating system, version 5.10 or higher. Software updates required for installation of the MCNP4B2 code package were source corrections contained in the file "install.fix", dated 09/22/97, obtained from LANL. Installation options appropriate to the HP 9000/C180, HP 9000/C160, HP 9000/735, SUN Ultra-2 and the desktop computer were used. Two versions of the code package were installed on the WPO desktop PCs having differing memory sizes. The version with smaller memory size (standard) requires 32 Meg of memory; the larger version requires 64 Meg of memory.

The MCNP4B2 software, as acquired, is configured for installation on a HP 9000 series Unix workstation, SUN Ultra-2 Unix workstation, and PC desktop computer. There are no limitations on the number of users or CPUs on which the software can be installed for the WPO in Las Vegas, Nevada.

In the WPO, the MCNP4B2 code package is installed on a hard disk drive located on the QUICHE HP 9000/C160 workstation. This disk drive is also mounted as part of a Network File Server (NFS)

INFORMATION ONLY

which allows any CPU connected to the NFS to access the hard disk. The network is composed of HP 9000/735 class machines using the HP-UX V9.07 Unix based operating system and HP 9000/C160 and HP 9000/C180 class machines using the V10.20 Unix based operating system. In the verification and validation process, installation test cases and benchmark test cases are run using the NFS mount on the workstation QUICHE. However, both types of test problems are run on the HP 9000/735, HP 9000/C160 and HP 9000/C180 CPUs to test the operating systems and workstation environments for satisfactory operation. Future additions of HP 9000/735, HP 9000/C160 or HP 9000/C180 class machines shall not require a re-qualification effort if they use one of the above listed operating systems. If a computer is added to the network that does not conform to the specified requirements the following shall be completed: (1) the test cases shall be performed on the new machine, (2) this SQR shall be revised to include the additional computer specifications and test case results, and (3) the new SQR shall be provided to the SCM to be included in the software baseline package as specified in the M&O procedure QAP-SI-0.

The code package is also installed on a hard disk drive (/usr2/mcnp4b) located on the SUN Ultra-2 Unix workstation using Solaris 2.6 operating system. In the verification and validation process, installation test cases and benchmark test cases are run using the executable and cross section libraries located in /usr2/mcnp4b and /usr2/mcnp4b/xslib directories, respectively.

The MCNP4B2 code package is installed on a hard drive in a GATEWAY2000 P5-166 PC desktop computer running under the Windows 95 operating system. In the verification and validation process, installation test cases and benchmark test cases are run on one of the WPO PC desktop computers. A subset of the verification and validation test cases are run on all other WPO PC desktop computers accessing the code to verify the correct operation of the code on these computers. Future additions of PC desktop computers shall not require a full re-qualification effort if they use the above listed operating system. If a computer is added to the network that does not conform to the specified requirements the following shall be completed: (1) the test cases shall be performed on the new machine, (2) this SQR shall be revised to include the additional computer specifications and test case results, and (3) the new SQR shall be provided to the SCM to be included in the software baseline package as specified in the M&O procedure QAP-SI-0.

1.3.4 Computational Methods/Algorithm Requirements

The software will at a minimum be required to perform the following tasks, as necessary, and have the appropriate computational algorithms included in the source code:

1) Determine the system k_{eff} for complex geometries using Monte Carlo methods;

2) Provide appropriate cross section libraries; and

3) Perform three dimensional neutron and gamma-ray shielding calculations.

INFORMATION ONLY

The MCNP4B2 package meets these requirements and is commonly used for problems similar to Waste Package problems.

1.3.5 Other Requirements

There are no additional user requirements or code requirements (internal, external, or user) because the inputs are all provided by an analyst and the MCNP4B2 system does not interface with other codes. The user is responsible for independently collecting any materials or geometry information the MCNP4B2 code package may require. For configuration control, the users shall have only a read/execute privilege to the code. There are no hardware requirements beyond those stated in Section 1.3.3 above.

1.4 Description Of Validation

Correct installation of the MCNP4B2 code package is first verified by running the installation test cases which are based on specific criticality and shielding problems for neutron and gamma radiation provided with the software by the developer. The acceptance criteria for qualification of the MCNP4B2 code package requires agreement of numerical results within the statistical accuracy of the calculations. Test case results should not deviate significantly from the vender supplied results for the same test case. Deviate significantly for this situation means that numerical results do not agree to within the fifth significant figure for deterministic calculations. For statistical calculations, results should agree within the statistical uncertainty of the cases. Differences larger than this specified criteria must be documented. After verification of correct installation, validation testing is implemented by running benchmark test cases from published sources to insure that the MCNP4B2 code provides correct answers for problems of the type required for the WPO program.

The input and significant results of the MCNP4B2 verification test cases and validation benchmark cases are provided in this SQR. Complete results of the computer calculations are not presented here due to the large volume of data printed in the computer outputs and because the full output listing is not of primary relevance to the validation effort. The complete results of the computer calculations are available on electronic medias, MOY-980421-19 (MI: 30056-M03-001) for HPs, MOY-980421-18 (MI: 30057-M03-001) for the SUN and MOY-980421-20 (MI: 30055-M72-001) for PCs.

Validation of the ENDF/B-V and ENDF/B-VI based cross section libraries are performed by benchmark test case comparisons. The results based on the ENDF/B-VI library were compared with the results of a number of other data libraries for infinite medium simulations of all nuclides (Ref. 8). Additional testing by LANL included a number of experimental benchmarks consisting of pulsed sphere experiments (Ref. 9) and iron benchmark analyses (Ref. 10). Thus, benchmark test cases of this type are suitable for confirming correct installation of the cross section libraries for use with the MCNP4B2 code package.

INFORMATION ONLY

1.5 Additional Documentation And References

Additional software documents and references for installation and qualification activities of the MCNP4B2 software package are listed below:

1. "MCNP4B, A General Monte Carlo N-Particle Transport Code", LA-12625-M Version 4B, Prepared by the Radiation Transport Group, X-6, Los Alamos National Laboratory, March, 1997.

2. "MCNP Software Quality Assurance Plan", LA-13138, Los Alamos National Laboratory, April, 1996.

3. "MCNPDAT6, MCNP4A Standard Neutron Cross Sections (Based on ENDF/B-VI), Photon Interaction, and Electron Data Libraries", DLC-181, Radiation Safety Information Computational Center Data Library Collection, Oak Ridge National Laboratory, December, 1994.

4. "Critical Separation Between Subcritical Clusters of 2.35 Wt% and 4.31 Wt% ^{235}U Enriched UO_2 Rods In Water With Fixed Neutron Poisons", PNL-2438, Battelle Pacific Northwest Laboratories, October, 1977.

5. "Reference Problem Set to Benchmark Analysis Methods for Burnup Credit Applications (Draft)", ORNL/TM-12295, Computing Applications Division ORNL, November, 1993.

6. Whalen, Daniel J., David A. Cardon, Jennifer L. Uhle, and John S. Hendricks, "MCNP: Neutron Benchmark Problems", LA-12212, LANL, November, 1991.

7. Wagner, John C., James E. Sisolak, and Gregg W. McKinney, "MCNP: Criticality Safety Benchmark Problems", LA-12415, LANL, October, 1992.

8. Court, John D., John S. Hendricks, and Stephanie C. Frankle, "MCNP ENDF/B-VI Validation: Infinite Media Comparisons of ENDF/B-VI and ENDF/B-V", LA-12887, LANL, December, 1994.

9. Court, John D., Ronald C. Brockhoff, and John S. Hendricks, "Lawrence Livermore Pulsed Sphere Benchmark Analysis of MCNP ENDF/B-VI", LA-12885, LANL, December, 1994.

10. Court, John D., and John S. Hendricks, "Benchmark Analysis of MCNP ENDF/B-VI Iron", LA-12884, LANL, December, 1994.

INFORMATION ONLY

11. J.S. Hendricks, "MCNP4B", LANL memorandum XTM:JSH-97-13 (U), January 29, 1997.

12. Ueki, K. and Ohashi, A., "Neutron Shielding Ability of KRAFTON N2 - Mannan - KRAFTON N2 Sandwich-Type Material and Others", Proceedings of New Horizons in Radiation Protection and Shielding Topical Meeting, Pasco, WA, 1992.

13. Broadhead, B. L.; Tang, J. S.; Childs, R. L.; Parks, C. V.; Taniuchi, H., "Evaluation of Shielding Analysis Methods in Spent Fuel Cask Environments", EPRI TR-104329. Palo Alto, California: Electric Power Research Institute, 1995.

14. Hendricks, John S., Stephanie C. Frankle, and John D. Court, "ENDF/B-VI Data for MCNP", LA-12891, LANL, December, 1994.

15. Hendricks, John S., and John D. Court, "MCNP4B Verification and Validation", LA-13181, LANL, August, 1996.

No additional documentation other than listed above is required to qualify the MCNP4B2 code package for use on the HP 9000 series workstations, SUN Ultra-2 workstations, or the PC desktop computers. The above listing of documentation is also sufficient for the installation of the ENDF/B-VI cross section library in the MCNP4B2 baseline.

2.0 INSTALLATION

The MCNP4B2 code package, as received, was compiled on a HP 9000 series Unix based workstation and a PC desktop personal computer. The installation procedures provide guidelines for installation on the HP 9000 series workstations and on the PC desktop systems in the WPO. Installation procedures are described in Attachment II.

2.1 MCNP4B2 Installation Procedure

The MCNP4B electronic software package was transmitted to the WPO on a CD. The CD contains a file named 'READMAAG' that provides instructions for installation of the package on the HP machine.

2.1.1 HP Unix Based Workstation

The MCNP4B2 code package is installed by S. Goluoglu of the WPO following the instructions for removal from the media and installation. The code is installed on the WPO HP Unix workstation (CRWMS M&O #102878), identified as OPUS. The files were transferred from the CD to the local

INFORMATION ONLY

directory '/users/goluoglu/mcnp4b'. The information in the 'READMAAG' file in the 'INSTALL' directory was then followed to install the code. Attachment II contains a copy of the READMAAG file used for the installation. The code package was then moved to '/opt/neut/MCNP4B' to allow general access by all local WPO Unix machines.

The MCNP4B2 installation process is controlled by a script (install) which makes the necessary platform-dependentadjustments. The script also executes other scripts (makemcnp) to incorporate latest fixes to the code. Since acquisition of the code package, the developers have released a fix file to fix the bugs they found after the release of the code package. This fix file is downloaded from the developers' web site (http://www-xdiv.lanl.gov/XCI/PROJECTS/MCNP/world/fix4b2) and copied onto a file called "install.fix". The version that incorporates these latest fixes is called MCNP4B2 as opposed to the original release which is called MCNP4B. The installation process can be duplicated by executing this script (install) with the file named 'answer' (which was created during the installation) as an input file, and the new 'install.fix' file as a fix file. The files 'answer' and 'install.fix' are listed in Attachment II. A listing of all the MCNP4B2 executable and library files currently contained in the mcnp directory and its subdirectories is provided in Attachment III. These files have been placed under the control of the appropriate systems administrator to provide write protection on these files.

Based upon the review of the installation procedure provided with the code, a comparison with the files loaded onto the HP 9000/735 workstation and the installation procedure, and the results of the verification cases described in the following section, the following conclusions are made:

1) the complete MCNP4B2 code system has been installed on HP9000 work stations as directed by the supplier and is accessible to all CPUs via a NFS;

2) the program has been tested on the HP 9000/735 workstations with V9.07 Unix operating system, HP 9000/C160 and the HP 9000/C180 workstations using the V10.2 Unix operating systems; and

3) that the MCNP4B2 code package is functioning correctly on these workstations.

2.1.2 PC DESKTOP COMPUTERS

The MCNP4B electronic software package was transmitted to the WPO on a CD. The CD contains a file named 'READMAAG', dated 02/10/97, that provides instructions for installation of the package on DOS systems. This version contains the ENDF/B-IV cross section data as the file "testlib1" used for the transmittal test cases. The ENDF/B-V and ENDF/B-VI cross section data are provided in separate files included with the transmittal package. The code installation procedure includes the installation of the cross section libraries.

INFORMATION ONLY

The PC version of the code was installed by J. A. McClure of the WPO using the instructions provided in the code package. The code was installed on the WPO GATEWAY2000 P5-166 PC desktop computer (CRWMS M&O #110837) using the WINDOWS 95/MS-DOS 6.22 operating system. Two versions of the MCNP4B2 code were compiled on the desktop PC differing only in the size of the memory block specified for the code as part of the installation process. The standard version labeled "mcnp4b2.exe", uses 4,000,000 bytes of memory and the large version, labeled "mcnp4b2x.exe", uses 9,600,000 bytes of memory.

Attachment II provides the complete installation procedure of the MCNP4B2 code package and cross section data files on the PC desktop computer. The installation consists of three parts executed in sequence: system setup, compilation of the source code, and validation with test problems. All the files created in the installation and validation process reside in the d:\mcnp4b directory and c:\tmpspace directory. Cross sections reside in the d:\mcnp4b.xc directory. A listing of all the executable and library files in the d:\mcnp4b and d:\mcnp4b.xc directories required for running actual criticality and shielding problems is provided in Attachment III. These files and directory contents are controlled per QAP-SI-3. All the MCNP4B2 source code shall be removed from the qualified PC platform.

The MCNP4B2 installation process is controlled by a script (install.bat) which makes the necessary platform-dependent adjustments. The script also executes other scripts (makemcnp.bat) to incorporate the latest fixes into the code. Since acquisition of the code package, the developers have released a fix file to incorporate corrections made after the release of the code package. This fix file is downloaded from the developers' web site and copied onto a file called "install.fix". No changes were made to the developers' "install.fix" file except to change the version name and compilation date. The installation process can be duplicated by executing this script (install.bat) with the file named 'answer' (which was created during the installation) as an input file, and the new 'install.fix' file as a fix file. The files 'answer' and 'install.fix' are listed in Attachment II.

Based upon the review of the installation procedure provided with the code, a comparison with the files loaded onto the PC and the installation procedure, and the results of the validation cases described in the following section, it is judged that MCNP4B2 has been installed on the GATEWAY2000 P5-166 PC as directed by the developer, and that the criticality and shielding capabilities are functioning correctly.

2.1.3 SUN Ultra-2 Unix Based Workstation

The procedure for installation of MCNP Version 4B2 on SUN Unix workstations running under Solaris 2.6 is the same as the procedure for Unix based workstations described in detail in Section 2.1.1 and Attachment II. MCNP4B2 executable and cross section libraries are placed in the directories/usr2/mcnp4b and /usr2/mcnp4b/xslib, respectively, on OTIS (CRWMS M&O #115491).

INFORMATION ONLY

A listing of all the MCNP4B2 executable and library files currently contained in the mcnp directory and its subdirectories is provided in Attachment III. These files have been placed under the control of the appropriate systems administrator to provide write protection on these files.

2.2 MCNP4B2 Installation Verification

As described in installation instructions provided with the MCNP4B code package, the developer supplied test cases for the criticality and neutron/gamma shielding will be used for the code verification. Since this sequence provides statistical results, the acceptance criteria stated in the Section 1.4 requires agreement of numerical results within the statistical accuracy of the calculations. Differences larger than this criteria must be documented. The verification and validation test cases were run on the installation systems except for the desktop PC. The executable program files from the installation computer (GATEWAY2000 P6-166, CRWMS M&O #110837) were transferred to desktop Dell PowerEdge 2000 PCs with larger memory for verification and validation testing.

2.2.1 Installation Test Case Description

Twenty-nine developer supplied test cases are included with the MCNP4B package. They are briefly described in Table 2.2.1-1 and electronic copies of both the input and output files are included in the code package. Since an electronic copy of the output is provided with the code package, verification of results is simplified by use of the 'diff' command on the Unix operating system, and by the 'fc' (file comparison) command on the PC MS-DOS system in the Windows 95 operating system. This is a sophisticated system command that compares two files and lists those lines that must be changed in the files to bring them into agreement. A review of the list produced by this command will provide an accurate and complete validation of the MCNP4B2 code package based on the comparison of sample case results.

For the HP 9000 workstations, SUN Ultra-2 workstation, and PC's, the sample problems exercise the capabilities of the MCNP4B2 code. The sample problems provide a considerable amount of output, even with conservative printout requests. Thus, the output listings for these cases will be archived on electronic medias MOY-980421-19 (MI: 30056-M03-001) for HPs, MOY-980421-18 (MI: 30057-M03-001) for the SUN and MOY-980421-20 (MI: 30055-M72-001) for PCs. All significant differences noted in the 'diff' file will be included and discussed.

TABLE 2.2.1-1
Description of the 29 MCNP4B2 Installation Test Cases

Problem	Particle	Description
1	Neutron	Simple neutron problem to test some basic operations of mcnp
2	Neutron	Three different tallies of the same physical quantity
3	Neutron	Many features of the general source
4	Photon	Photons
5	Neutron	Toroidal tokamak
6	Neutron	Cutoffs, flagging, and variance reduction features
7	Neutron	Generate surface source for problem 8
8	Neutron, Photon, Electron	Use surface source from problem 7
9	Neutron	kcode in complicated cells and sdef
10	Neutron, Photon	General test problem /x6code/gtprob
11	Neutron, Photon	Intertwined super pretzels with S(α, β), mode n p
12	Neutron	Porosity tool model
13	Neutron	Check of the volume calculator, rotational symmetry cases
14	Neutron	Test general source in repeated structures
15	Neutron	Test filled lattice and skewed lattice
16	Photon	Test general source in a lattice
17	Neutron, Photon	kcode in a rectangular finite lattice
18	Neutron	kcode in a hexagonal prism lattice
19	*	Multigroup Boltzmann-Fokker-Planck ver. of problem 20
20	Electron, Photon	Continuous-energy electron version of problem 19
21	Photon	Electron-photon problem - generates surface source for problem 22

INFORMATION ONLY

Problem	Particle	Description
22	Photon	Electron-photon ssr from problem 21
23	Photon, Electron	Forward 80 group electron-photon detector chip problem
24	Neutron	Reflecting lattice. 15x15 at 3.75 w/o ^{235}U enrichment
25	Neutron	Continuation with kcode 250 .7 1 4
26	Neutron	Continuation with kcode 200 1 10 55
27	Neutron	Fission surface source from problem 9
28	Neutron	Coupled Neutron-Photon Adjoint Problem
29	Neutron	ssr from problem 7; copy of inp08 to test auger production

2.2.2 Results of Installation Test Cases

Satisfactory agreement between the results of the sample problems executed on the OPUS HP9000/735 workstation, OTIS SUN Ultra-2 workstation, the PC desktop computers (Dell PowerEdge 2000: 112110 and Dell PowerEdge 2000: 112113), and those included with the installation package sent by the developer verify the correct installation of the MCNP4B2 code package and confirm that the criticality and shielding capabilities are functioning correctly. Any differences in output files that were noted consisted of a unit change in the 5th or 6th significant digit of particular values which is considered insignificant. In all cases, these minor differences occurred in intermediate calculational steps and were determined to be the result of differences in numerical processing (round-off) inherent in the CPU architecture of the HP 9000/735, SUN Ultra-2 workstation and/or PC systems. These differences were determined to be insignificant.

Installation test cases 1-29 were also run on the SPUDS HP 9000/C180 workstation. This approach assured correct performance of the code for both operating systems and both types of CPUs.

The results of the installation test cases for the SPUDS HP 9000/C180 workstation, the OPUS HP 9000/735 workstation, the OTIS SUN Ultra-2 workstation, and the desktop Dell PowerEdge 2000 PCs indicate that MCNP4B2 code package is operating correctly on all four systems. No significant differences were determined in output comparisons on all four systems.

2.3 Cross Section Library Installation

The cross section libraries for use in MCNP4B2 are readily available in the data package DLC-189 supplied by RSICC. However, these ASCII cross section files increase the execution times considerably. Therefore, a conversion utility program, named "makxsf", is used to convert these ASCII cross section files into BINARY. A "makxsf" file is created along with MCNP4B2 executable during a successful installation of MCNP4B2. The "makxsf" program reads and processes the cross section files according to the input parameters given in a "specs" file which is also included in the cross section package. Input to the "makxsf" program also includes a cross section directory file, "xsdir1", specifying which cross sections to process. Output includes binary cross section files and a new directory "xsdir2". The final BINARY cross section files and the "xsdir" file (renamed or copied from the "xsdir2" file) are then used in all future calculations. The description of the cross section files are given in the "README" file supplied by the MCNP4B2 developers. Instructions for accessing these cross sections and the results of test cases utilizing these cross sections are included.

3.0 VALIDATION

A series of benchmark experiments are analyzed to insure that the MCNP4B2 code package provides correct answers for problems of the type required for the waste package design program. These benchmark test cases are selected from published experiments and do not include the verification test cases supplied by the developer. Supplementary test cases for validation provided by the software developer are not required. Regression testing of previously baselined software is not required. The agreement noted by this comparison provides the validation for the MCNP4B2 code package for design applications consistent with the type of problems analyzed by the WPO.

Descriptions of the benchmark test cases used in the validation of the MCNP4B2 code package installed on the HP 9000 workstations, SUN Ultra-2 workstation and the PC desktop computers are described in detail in the following sections. The results of the execution of the software validation, including the extent to which the results agree with the acceptance criteria are given in Sections 3.1, 3.2 and 3.3.

3.1 MCNP4B2 Criticality Validation Tests

3.1.1 Rodded Lattices

Critical Configurations of Subcritical Clusters of 2.35 Wt% Enriched UO_2 Rods in Water with Fixed Neutron Absorber Plates

This section includes four unique critical configurations (Ref. 4) each consisting of three fuel assemblies of various size arranged in a row with various absorber plates positioned between them.. The fuel assemblies in each critical experiment contained 2.35 Wt% U-235 enriched UO_2 fuel rods with a square pitch of 2.032 cm. The absorber plates placed between the fuel assemblies were either BORAL, aluminum, or stainless steel. One experiment did not use absorber plates. These critical experiments demonstrate MCNP4B2's ability to accurately predict the critical multiplication factor (k_{eff}) for configurations containing light-water reactor fuel separated by absorber plates as is often found in waste package designs. The general configuration for the four experiments is shown is Figure 3.1.1-1.

The fuel rod description is shown in Figure 3.1.1-2. The UO_2 composition used in the MCNP4B2 models is shown in Table 3.1.1-1. The 1100, 5052-H32, and 6061 aluminum compositions used in the MCNP4B2 models are shown in Table 3.1.1-2. The acrylic spacer grids and base plate shown in Figure 3.1.1-1 were modeled as plexiglass. Substituting plexiglass for acrylic in the models will have an insignificant effect on the critical multiplication factor of the configurations due the limited reactivity worth of the spacer grids and base plate. The plexiglass composition used in the models is shown in Table 3.1.1-3.

Table 3.1.1-1
2.35 Wt% U-235 Enriched UO_2 Composition (9.20 g/cc)

Element/Isotope	Weight Percent
U-234	0.0049
U-235	2.0715
U-238	86.0741
Oxygen	11.8495

Table 3.1.1-2
Aluminum Compositions

Element/Isotope	Weight Percent	
	Type 6061 Aluminum (2.6989 g/cc)	Type 5052-H32 Aluminum (2.70 g/cc)
Aluminum	96.93	96.4
Carbon	1.0	2.5
Silicon	0.6	0.25
Titanium	0.15	—
Chromium	0.195	0.25
Manganese	0.15	0.1
Iron	0.7	0.4
Copper	0.275	0.1

Table 3.1.1-3
Plexiglass Composition (1.18 g/cc)

Element/Isotope	Atom Density (atoms/b-cm)
Hydrogen	0.05678
Carbon	0.03549
Oxygen	0.01420

The first experiment, designated EXP1, consisted of three 20 x 16 fuel rod lattices separated by water only. The rod-to-rod spacing between the fuel lattices was 8.39 cm. The configuration was uniformly surrounded by a 30 cm water reflector. This configuration's x-y plane, x-z plane, and y-z plane cross-sectional views obtained from the MCNP4B2 plotting sequence are presented in Figures 3.1.1-3, -4, -5, respectively.

The second experiment, designated EXP2, consisted of a 20 x 16 fuel rod lattice positioned between two 22 x 16 fuel rod lattices. The rod-to-rod spacing between the fuel lattices was 5.05 cm. BORAL absorber plates were positioned between the center and outer fuel lattices. The absorber plates were positioned 0.645 cm from the cell boundaries of the center assembly. The BORAL absorber plates were 36.5 cm wide, 91.5 cm long, and 0.713 cm thick. The 0.713 cm thickness includes a 0.102 cm thick aluminum cladding on both sides of the B_4C-Al absorber material. The BORAL composition used in the MCNP4B2 model is shown in Table 3.1.1-4. The configuration was uniformly surrounded by a 30 cm water reflector. This configuration's x-y plane, x-z plane, and y-z plane cross-sectional views obtained from the MCNP plotting sequence are presented in Figures 3.1.1-6, -7, -8, respectively.

Table 3.1.1-4
BORAL Absorber Plate Composition (2.49 g/cc)

Element/Isotope	Weight Percent
Carbon	7.97
Aluminum	63.0
Iron	0.33
Boron-10	5.28
Boron-11	23.42

The third experiment, designated EXP3, consisted of three 20 x 16 fuel rod lattices. The rod-to-rod spacing between the fuel lattices was 8.67 cm. Type 6061 aluminum absorber plates were positioned between the center and outer fuel lattices. Table 3.1.1-2 shows the type 6061 aluminum composition used in the MCNP4B2 model. The absorber plates were positioned 0.645 cm from the cell boundaries of the center assembly. The aluminum absorber plates were 35.6 cm wide, 91.5 cm long, and 0.625 cm thick. The configuration was uniformly surrounded by a 30 cm water reflector. This configuration's x-y plane, x-z plane, and y-z plane cross-sectional views obtained from the MCNP plotting sequence are presented in Figures 3.1.1-9, -10, -11, respectively.

The fourth experiment, designated EXP4, consisted of three 20 x 16 fuel rod lattices. The rod-to-rod spacing between the fuel lattices was 6.88 cm. Type 304 stainless steel absorber plates were positioned between the center and outer fuel lattices. Table 3.1.1-5 shows the type 304 stainless steel composition used in the MCNP4B2 model. The absorber plates were positioned 0.645 cm from the cell boundaries of the center assembly. The aluminum absorber plates were 35.6 cm wide, 91.5 cm long, and 0.485 cm thick. The configuration was uniformly surrounded by a 30 cm water reflector. This configuration's x-y plane, x-z plane, and y-z plane cross-sectional views obtained from the MCNP plotting sequence are presented in Figures 3.1.1-12 and -13, respectively.

Table 3.1.1-5
Type 304 Stainless Steel Composition (7.9 g/cc)

Element/Isotope	Weight Percent
Carbon	0.08
Nitrogen	0.40
Silicon	1.0
Phosphorous	0.045
Sulfur	0.03
Chromium	19.0
Manganese	2.0
Iron	67.245
Cobalt	0.20
Nickel	10.0

INFORMATION ONLY

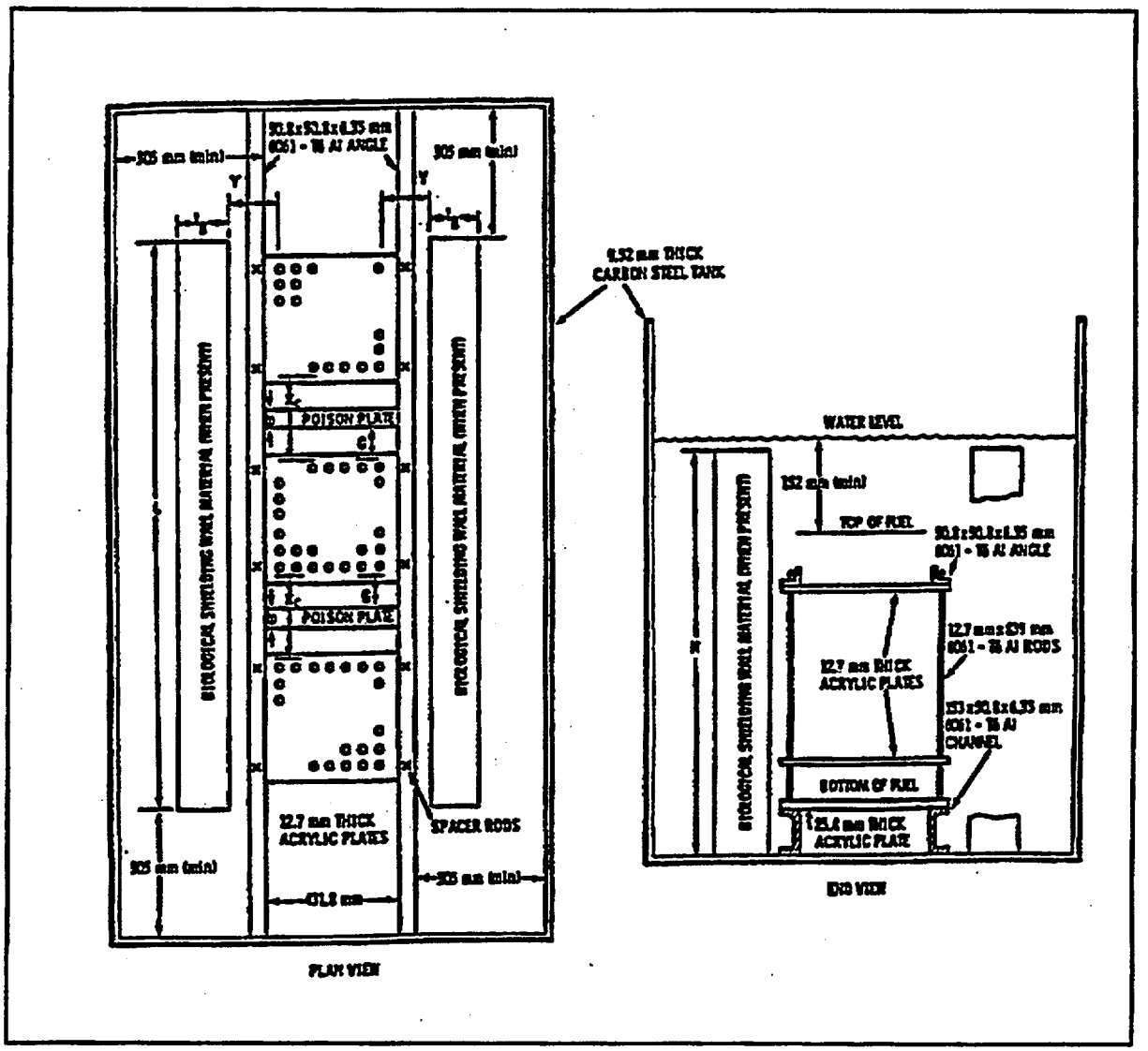
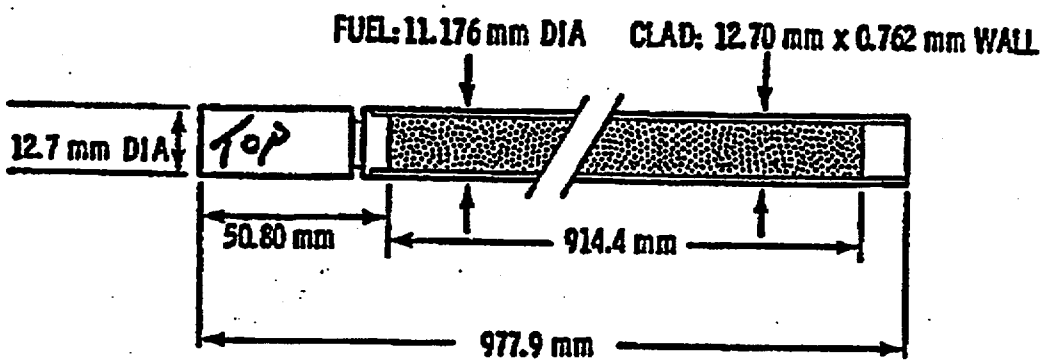


Figure 3.1.1-1 Absorber Plate Experimental Setup

INFORMATION ONLY

DESCRIPTION OF 2.35 wt% ^{235}U ENRICHED UO_2 RODS



CLADDING: 6061 ALUMINUM TUBING SEAL WELDED WITH A LOWER END PLUG OF 5052-H32 ALUMINUM AND A TOP PLUG OF 1100 ALUMINUM

TOTAL WEIGHT OF LOADED FUEL RODS: 917 gm (AVERAGE)

LOADING:

825 gm OF UO_2 POWDER/ROD, 726 gm OF U/ROD, 17.08 gm OF U-235/ROD
ENRICHMENT - 2.35 ± 0.05 w/o U-235
FUEL DENSITY - 9.20 mg/mm^3 (84% THEORETICAL DENSITY)

Figure 3.1.1-2 Absorber Plate Experiments' Fuel Rod Description

INFORMATION ONLY

```
 01/07/98 20:43:26
CRITICAL EXPERIMENT No. 1.
 (p2438x05). 2.35w/o with Mo
 Absorber Plates
probid =   01/07/98 20:43:11
basis:
( 1.000000,  .000000,  .000000)
(  .000000, 1.000000,  .000000)
origin:
(      .00,      .00,     5.00)
extent = (   200.00,   200.00)
```

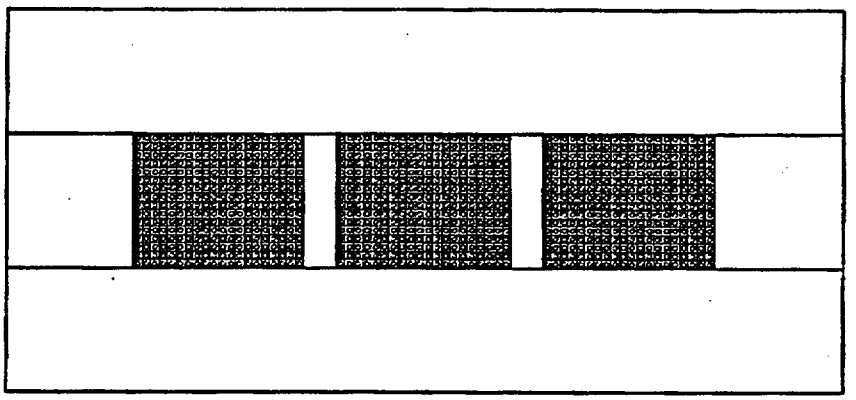


Figure 3.1.1-3 MCNP Plot: EXP1 x-y plane cross-section

01/07/98 10:43:52
CRITICAL EXPERIMENT No. 1.
(p243tx05). 2.35w/o with No
Absorber Plates
probid = 01/07/98 10:43:11
basis:
(1.000000, .000000, .000000)
(.000000, .000000, 1.000000)
origin:
(.00, 5.00, 5.00)
extent = (100.00, 100.00)

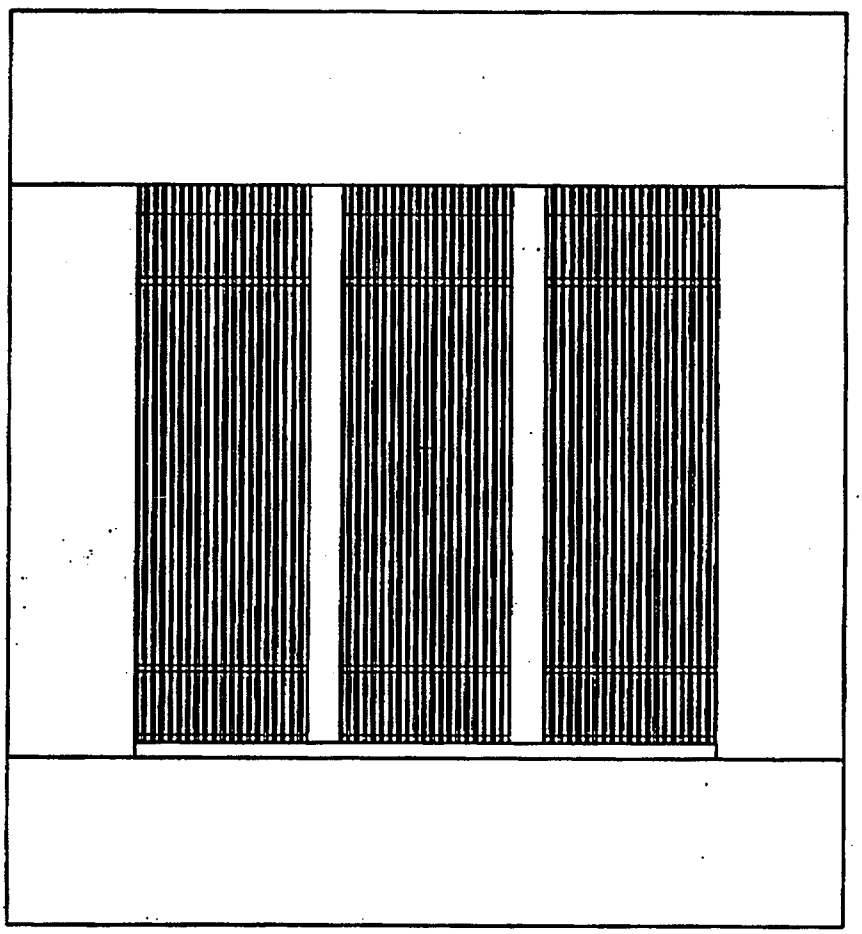


Figure 3.1.1-4 MCNP Plot: EXP1 x-z plane cross-section

01/07/98 10:44:11
CRITICAL EXPERIMENT No. 1.
(p2430x05). 2.35w/o with No
Absorber Plates
probid = 01/07/98 10:43:11
basis:
(.000000, 2.000000, .000000)
(.000000, .000000, 1.000000)
origin:
(5.00, 5.00, 5.00)
extent = (100.00, 100.00)

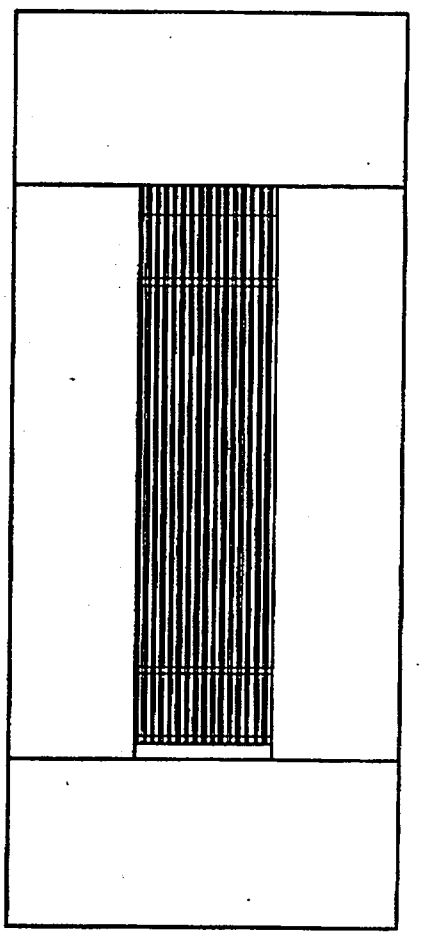


Figure 3.1.1-5 MCNP Plot EXP1 y-z plane cross-section

INFORMATION ONLY

01/07/98 10:44:49
CRITICAL EXPERIMENT No. 2.
(p343tx17). 2.35w/o with Boral
Absorber Plates
probid = 01/07/98 10:44:36
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(.00, .00, 5.00)
extent = (100.00, 100.00)

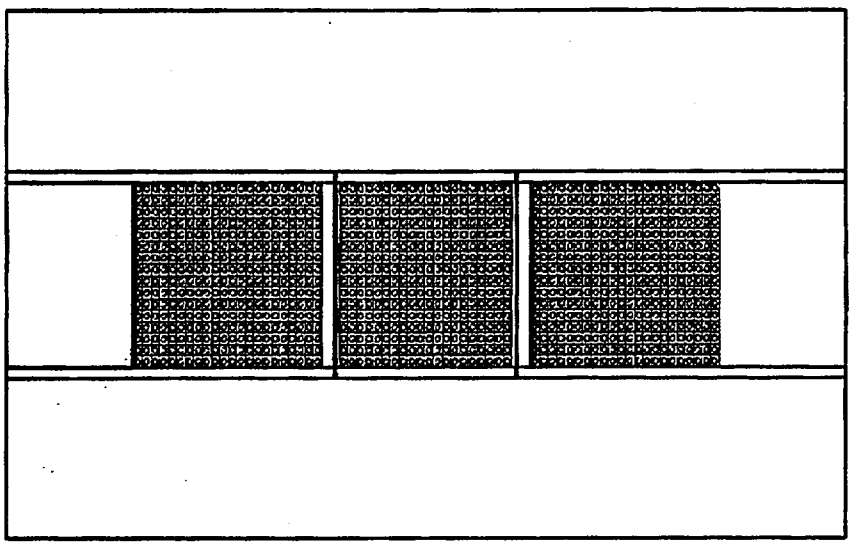


Figure 3.1.1-6 MCNP Plot: EXP2 x-y plane cross-section

01/07/98 10:45:14
CRITICAL EXPERIMENT No. 2.
(p243tx17). 2.35w/o with Boral
Absorber Plates
probid = 01/07/98 10:44:36
basis:
(1.000000, .000000, .000000)
(.000000, .000000, 1.000000)
origin:
(.00, 5.00, 5.00)
extent = (100.00, 100.00)

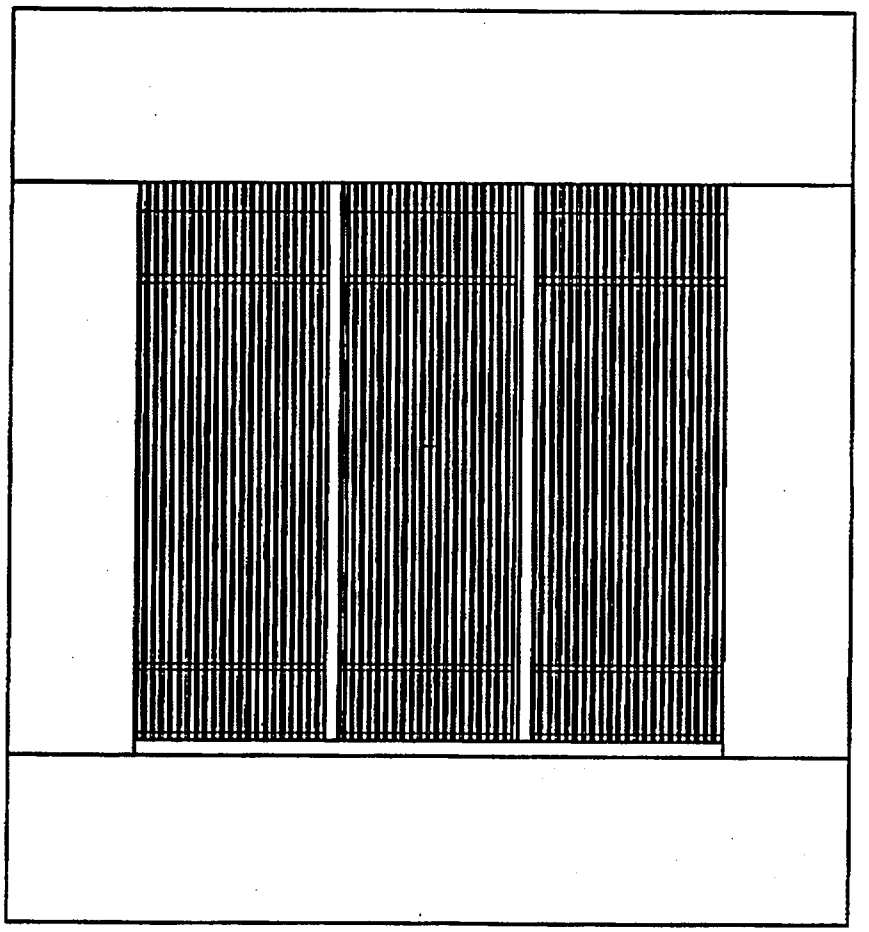


Figure 3.1.1-7 MCNP Plot: EXP2 x-z plane cross-section

01/07/98 10:45:31
CRITICAL EXPERIMENT No. 2.
(p243tx17). 2.35w/o with Boral
Absorber Plates
probid = 01/07/98 10:44:36
basis:
(.000000, 2.000000, .000000)
(.000000, .000000, 1.000000)
origin:
(5.00, 5.00, 5.00)
extent = (100.00, 100.00)

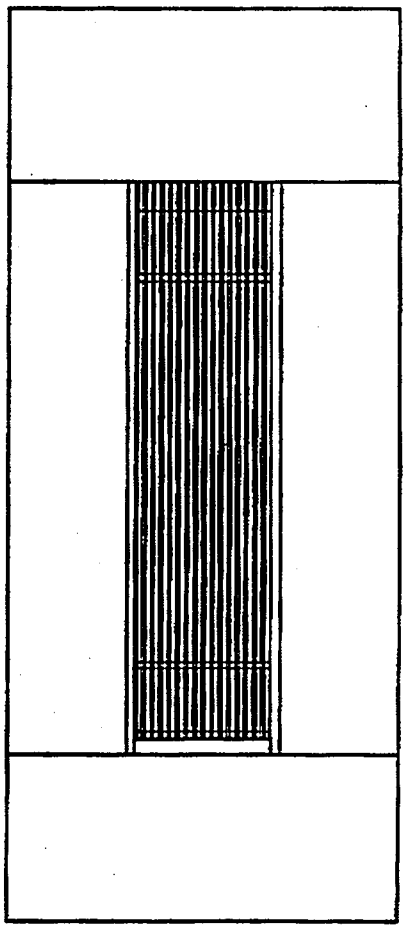


Figure 3.1.1-8 MCNP Plot: EXP2 y-z plane cross-section

INFORMATION ONLY

01/07/98 10:46:08
CRITICAL EXPERIMENT No. 3.
(p243tx24). 2.35w/o with
Aluminum Absorber Plates
probid = 01/07/98 10:45:57
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(.00, .00, 5.00)
extent = (100.00, 100.00)

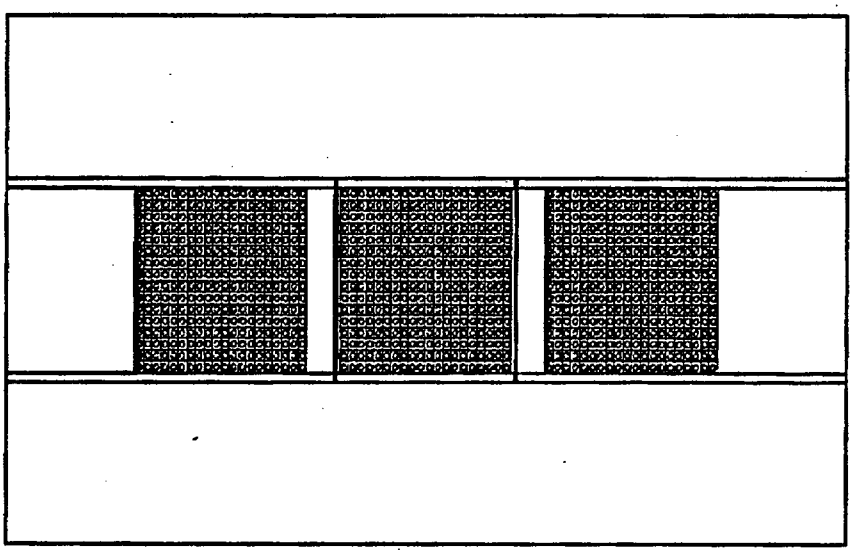


Figure 3.1.1-9 MCNP Plot: EXP3 x-y plane cross-section

01/07/98 10:46:27
CRITICAL EXPERIMENT No. 3.
(p4013x24). 2.35w/o with
Aluminum Absorber Plates
probid = 01/07/98 10:45:57
basis:
(1.000000, .000000, .000000)
(.000000, .000000, 1.000000)
origin:
(.00, 5.00, 5.00)
extent = (100.00, 100.00)

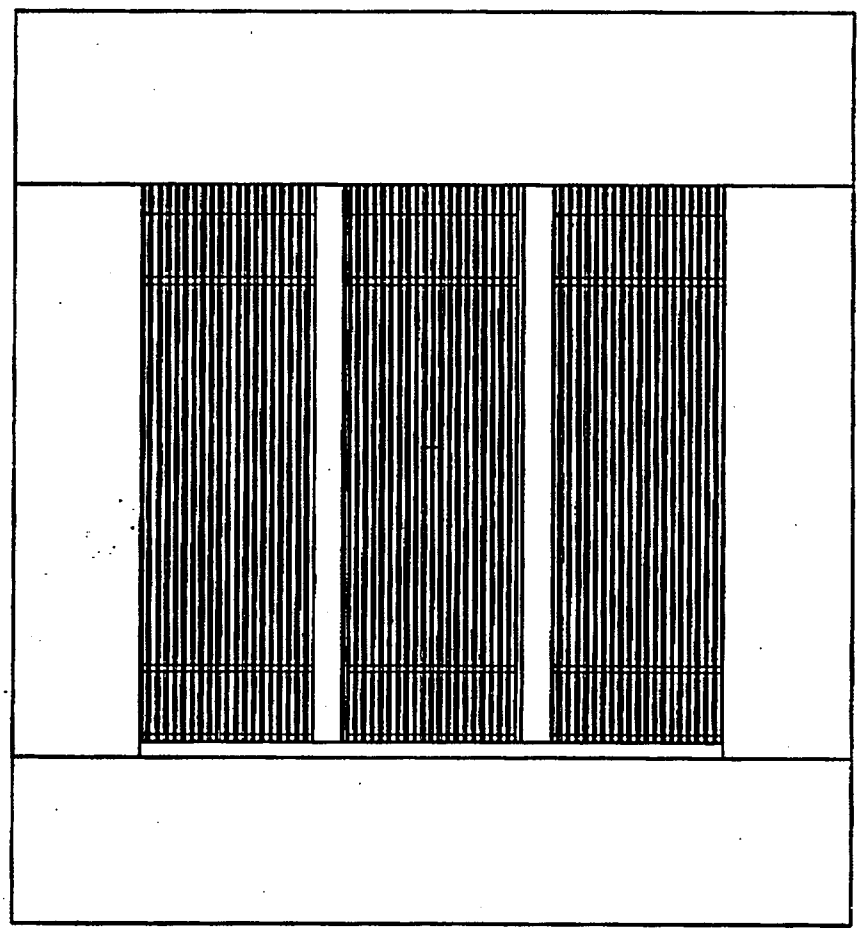


Figure 3.1.1-10 MCNP Plot: EXP3 x-z plane cross-section

INFORMATION ONLY

01/07/98 10:47:09
CRITICAL EXPERIMENT No. 3.
(p343x24). 2.35w/o with
Aluminum Absorber Plates
probid = 01/07/98 10:45:57
basis:
(.000000, 1.000000, .000000)
(.000000, .000000, 1.000000)
origin:
(5.00, 5.00, 5.00)
extent = (100.00, 100.00)

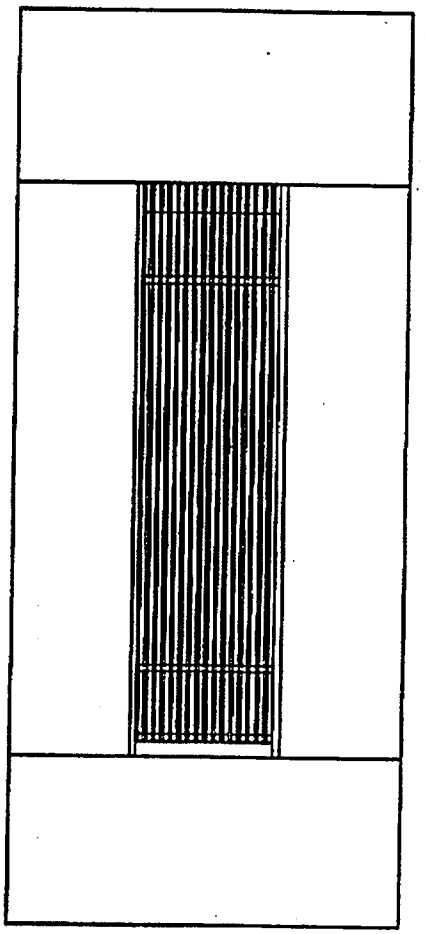


Figure 3.1.1-11 MCNP Plot: EXP3 y-z plane cross-section

01/07/98 10:48:02
CRITICAL EXPERIMENT No. 4.
(p3438x28). 2.35w/o with Steel
Absorber Plates
probid = 01/07/98 10:47:47
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(.00, .00, 5.00)
extent = (100.00, 100.00)

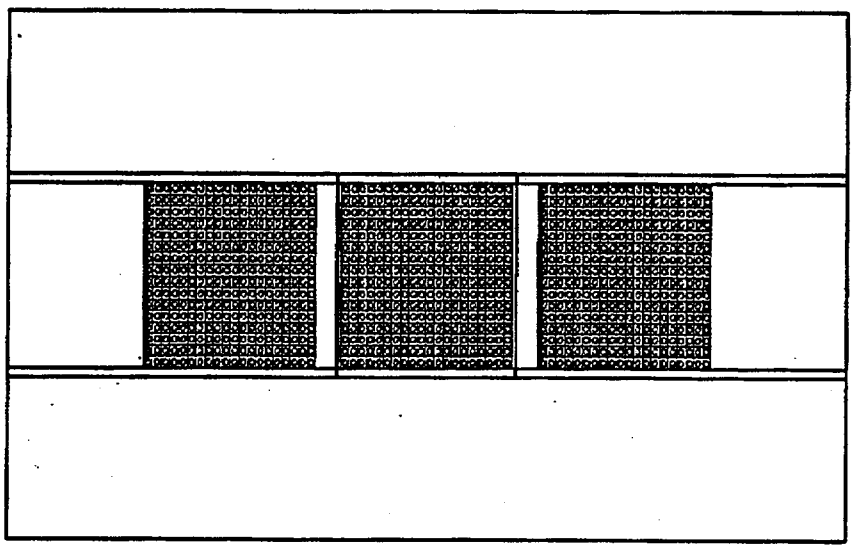


Figure 3.1.1-12 MCNP Plot: EXP4 x-y plane cross-section

01/07/98 10:48:20
CRITICAL EXPERIMENT No. 4.
(p24(6x28). 2.35w/o with Steel
Absorber Plates
probid = 01/07/98 10:47:47
basis:
(1.000000, .000000, .000000)
(.000000, .000000, 1.000000)
origin:
(.00, 5.00, 5.00)
extent = (100.00, 100.00)

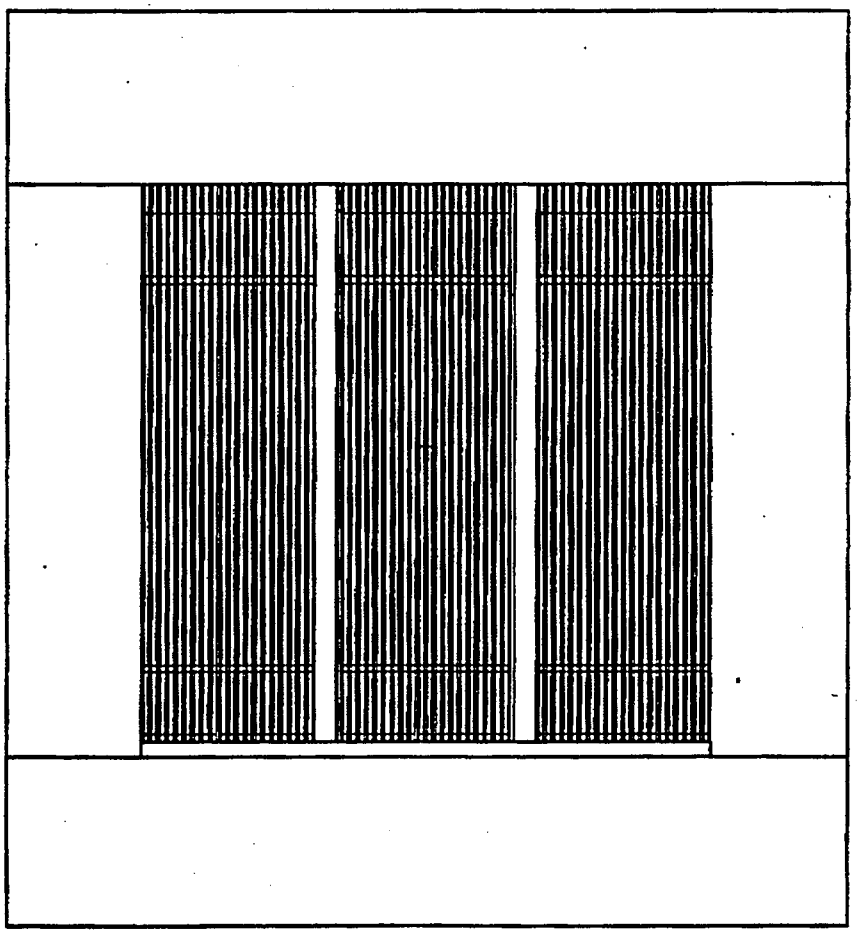


Figure 3.1.1-13 MCNP Plot: EXP4 x-z plane cross-section

3.1.2 Mixed Oxide Fuel

Electric Power Research Institute Mixed Oxide Critical Configurations

This section contains six critical experiment configurations (Ref. 5) composed of unborated and borated water moderated lattices of 2 wt% PuO_2 (8 wt% Pu-240)/98 wt% UO_2 (natural) fuel rods. The PuO_2/UO_2 fuel rod description is shown in Figure 3.1.2-1. The PuO_2/UO_2 composition used in the MCNP models in shown in Table 3.1.2-1. The fuel rods were supported in a core structure composed of "eggcrate" type lattice plates with an upper lead shield. The axial view of the general core configuration is shown in Figure 3.1.2-2. The eggcrate lattice description is shown in Figure 3.1.2-3. The aluminum compositions used in the MCNP models are shown in Table 3.1.2-2. A water reflector of at least 30 cm thickness was located below the aluminum base plate and around the fuel rod configuration in each experiment.

Table 3.1.2-1
2 Wt% PuO_2 (8 Wt% Pu-240)/98 Wt% UO_2 (natural) Fuel Composition (9.54 g/cc)

Element/Isotope	Atom Density (atoms/b-cm)
U-234	1.2462E-6
U-235	1.4891E-4
U-236	2.0943E-9
U-238	2.0619E-2
Pu-238	3.8850E-8
Pu-239	3.9477E-4
Pu-240	3.3218E-5
Pu-241	1.6023E-6
Pu-242	1.1887E-7
Am-241	1.5024E-6
Oxygen	4.3763E-2

Table 3.1.2-2
Type 6061 Aluminum Composition (2.6989 g/cc)

Element/Isotope	Weight Percent
Aluminum	96.93
Carbon	1.0
Silicon	0.6
Titanium	0.15
Chromium	0.195
Manganese	0.15
Iron	0.7
Copper	0.275

The first experiment, designated EXP22, is a 1.778 cm square pitch lattice composed of 469 fuel rods. The core loading diagram is shown in Figure 3.1.2-4. The water-to-fuel volume ratio is 1.195, and the water moderator is unborated. This critical experiment was analyzed with the WPO MCNP4B2 code system. This configuration's x-y plane, x-z plane, and y-z plane cross-sectional views obtained from the MCNP plotting sequence are presented in Figures 3.1.2-5, -6, -7, respectively.

The second experiment, designated EXP23, is a 1.778 cm square pitch lattice composed of 761 fuel rods. The core loading diagram is shown in Figure 3.1.2-8. The water-to-fuel volume ratio is 1.195, and the water moderator contains 680.9 ppm of boron. This configuration's x-y plane cross-sectional view obtained from the MCNP plotting sequence is presented in Figure 3.1.2-9.

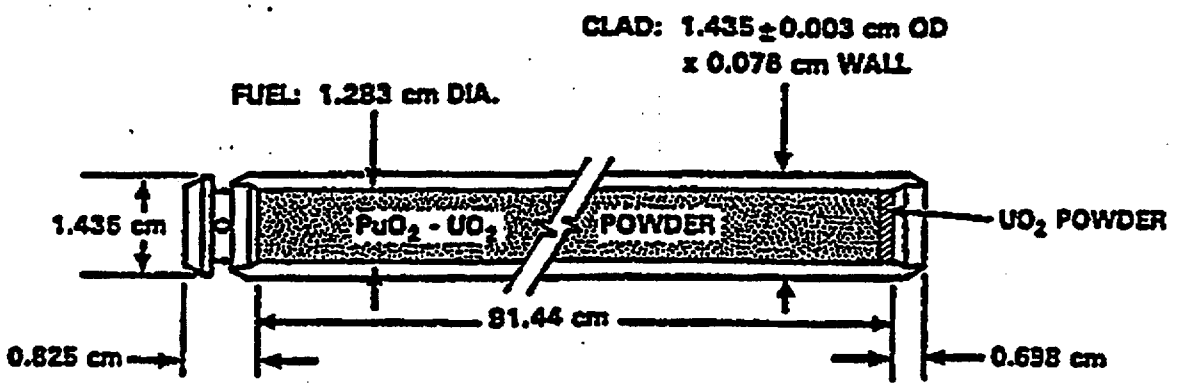
The third experiment, designated EXP24A, is a 2.210 cm square pitch lattice composed of 197 fuel rods. The core loading diagram is shown in Figure 3.1.2-10. The 1.562 cm pitch eggcrate lattice plate is used in this experiment. The fuel rods are loaded into every other lattice location to obtain the 2.210 cm pitch. The water-to-fuel volume ratio is 2.527, and the water moderator is unborated. This configuration's x-y plane cross-sectional view obtained from the MCNP plotting sequence is presented in Figure 3.1.2-11.

The fourth experiment, designated EXP25, is a 2.210 cm square pitch lattice composed of 761 fuel rods. The core loading diagram is shown in Figure 3.1.2-12. The 1.562 cm pitch eggcrate lattice plate is used in this experiment. The fuel rods are loaded into every other lattice location to obtain

the 2.210 cm pitch. The water-to-fuel volume ratio is 2.527, and the water moderator contains 1090.4 ppm of boron. This configuration's x-y plane cross-sectional view obtained from the MCNP plotting sequence is presented in Figure 3.1.2-13.

The fifth experiment, designated EXP26, is a 2.515 cm square pitch lattice composed of 160 fuel rods. The core loading diagram is shown in Figure 3.1.2-14. The 1.778 cm pitch eggcrate lattice plate is used in this experiment. The fuel rods are loaded into every other lattice location to obtain the 2.515 cm pitch. The water-to-fuel volume ratio is 3.641, and the water moderator is unborated. This configuration's x-y plane cross-sectional view obtained from the MCNP plotting sequence is presented in Figure 3.1.2-15.

The sixth experiment, designated EXP27, is a 2.515 cm square pitch lattice composed of 689 fuel rods. The core loading diagram is shown in Figure 3.1.2-16. The 1.778 cm pitch eggcrate lattice plate is used in this experiment. The fuel rods are loaded into every other lattice location to obtain the 2.515 cm pitch. The water-to-fuel volume ratio is 3.641, and the water moderator contains 767.2 ppm of boron. This configuration's x-y plane cross-sectional view obtained from the MCNP plotting sequence is presented in Figure 3.1.2-17.



CLADDING: ZIRCALOY-2 TUBING WITH PLUGS SEAL WELDED AT BOTH ENDS

LOADING:

ENRICHMENT - 2.00 WT% PuO_2 IN NATURAL UO_2
OXIDE DENSITY - 9.54 g/cm^3
PuO_2+UO_2 - 1128g/ROD
Pu - 20.169±0.004 g/ROD
U - 970.306±0.225 g/ROD
UO_2 POWDER - NATURAL URANIUM ABOUT 0.2 cm THICK

Figure 3.1.2-1 2 Wt% PuO_2 (8 Wt% Pu-240)/98 Wt% UO2 (natural) Fuel Rod

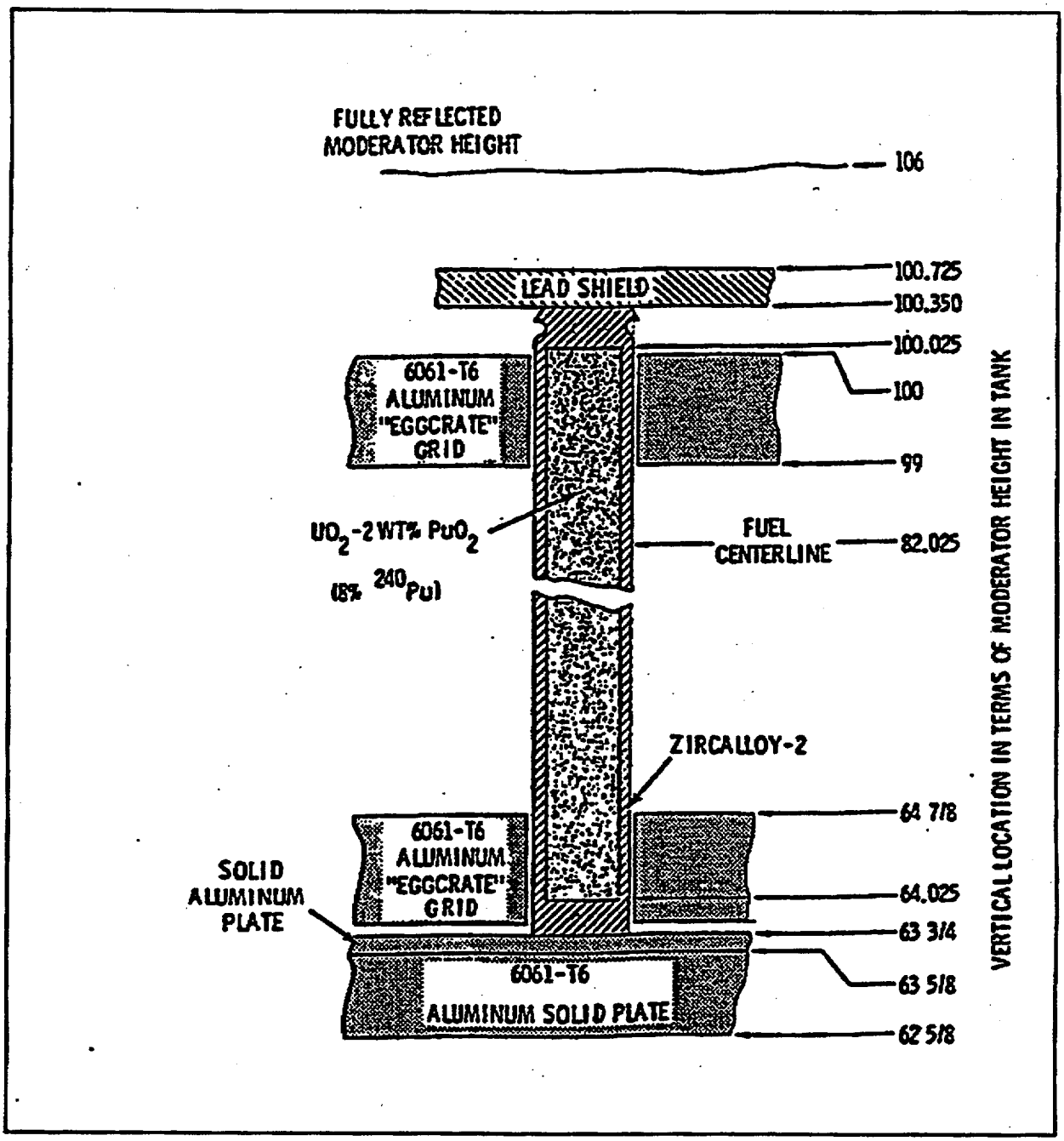
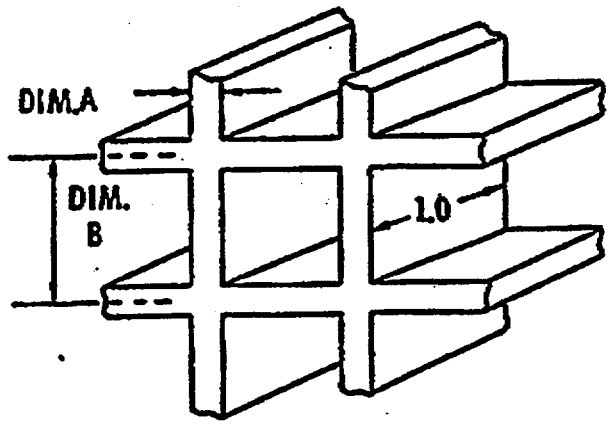


Figure 3.1.2-2 Axial View of the EPRI Mixed Oxide General Core Configuration



FUEL TYPE	PITCH	GRID	DIM.A	DIM B
UO_2-2.35% ^{235}U	0.615 0.87	UPPER LOWER	0.032 0.090	0.615
UO_2-2 WT% PuO_2 (8% ^{240}Pu)	0.87	UPPER LOWER	0.032 0.032	0.615
UO_2-2 WT% PuO_2 (8% ^{240}Pu)	0.70 0.99	UPPER LOWER	0.125 0.125	0.70

Figure 3.1.2-3 Mixed Oxide Experiment Eggcrate Lattice Plate Description

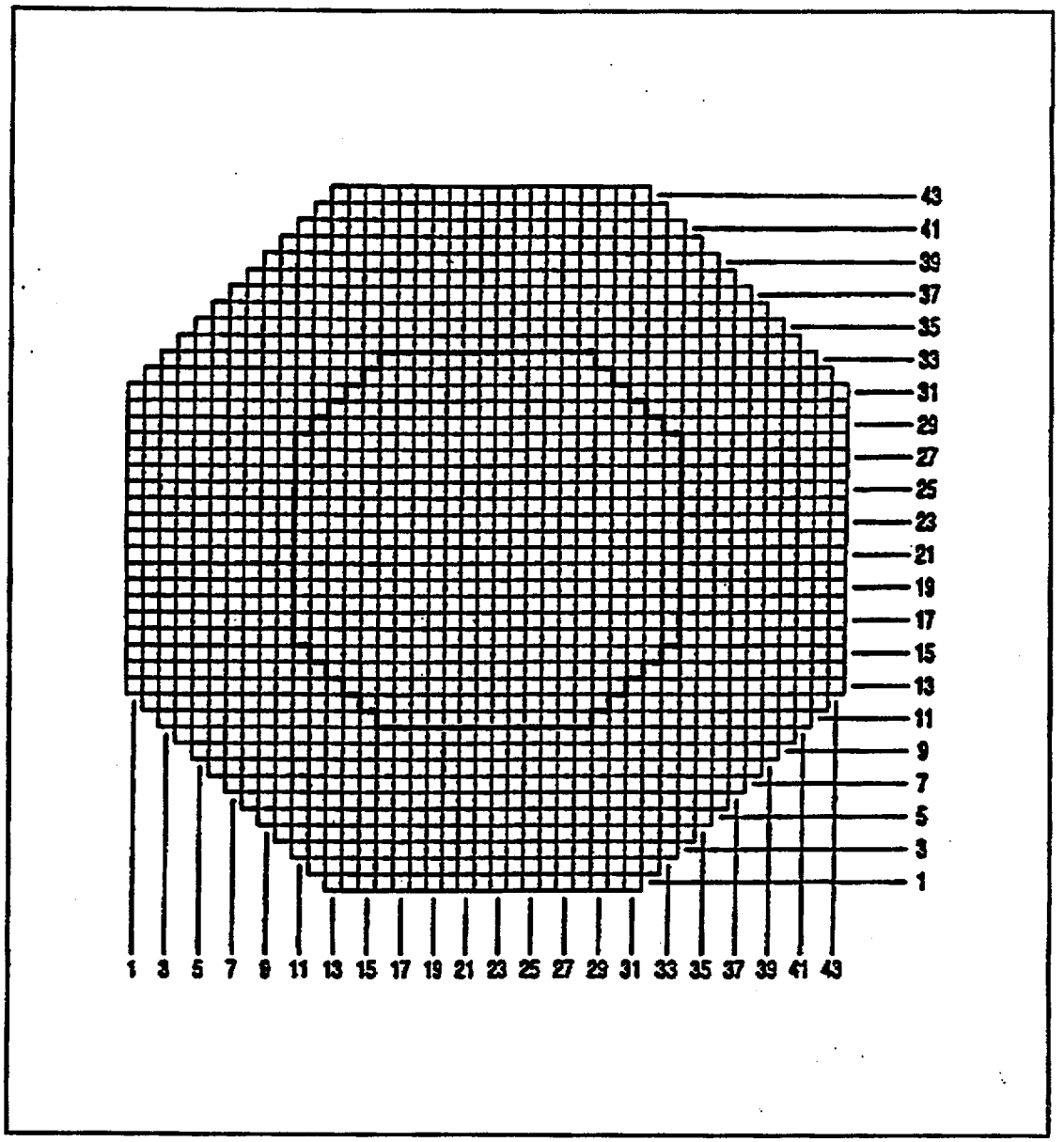


Figure 3.1.2-4 EXP22 Core Loading Description

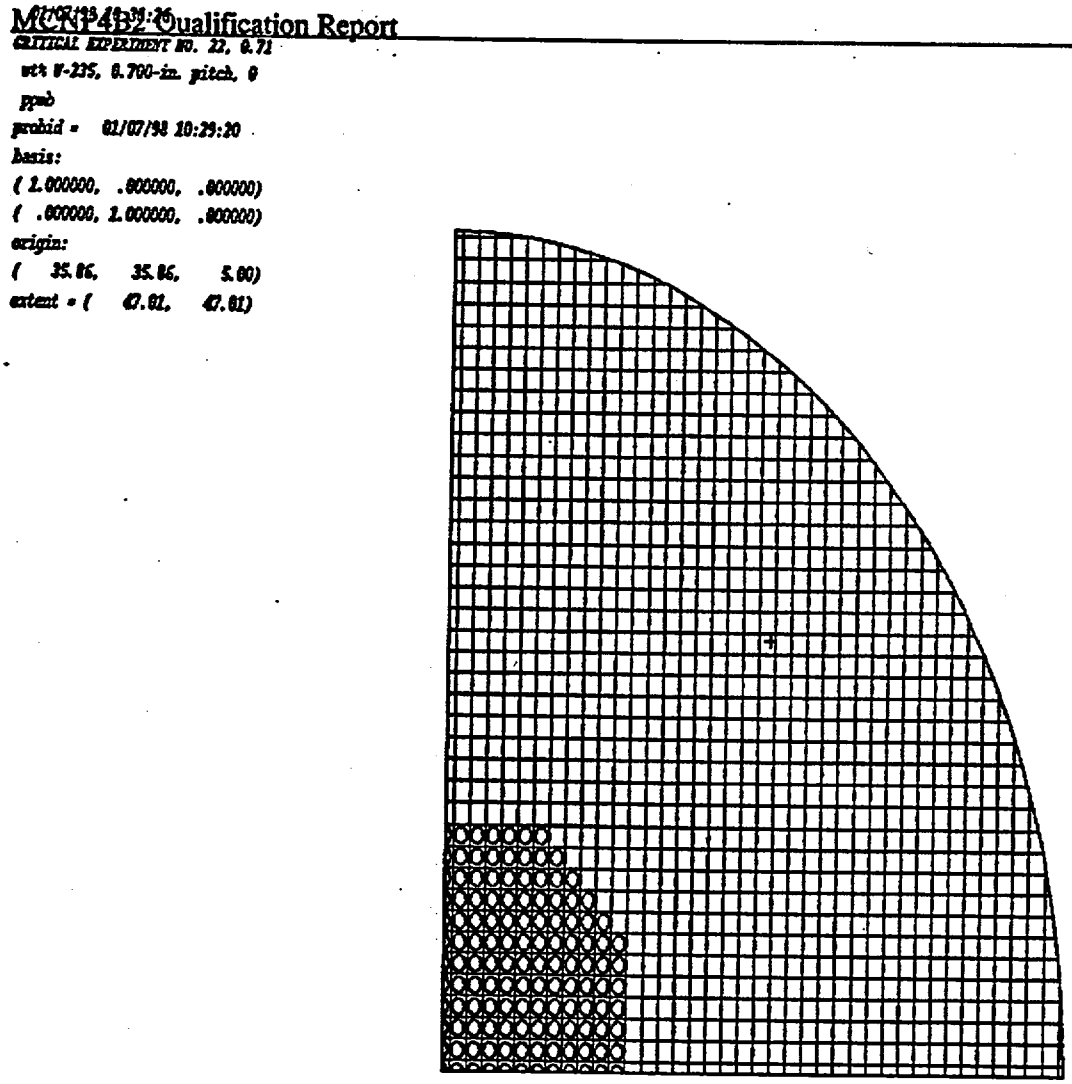


Figure 3.1.2-5 MCNP Plot: EXP22 x-y plane cross-section

01/07/98 10:36:11
CRITICAL EXPERIMENT NO. 22, 0.71
wt% U-235, 0.700-in. pitch, 0
ppmb
probid = 01/07/98 10:23:38
basis:
(1.000000, .000000, .000000)
(.000000, .000000, 1.000000)
origin:
(36.40, 5.00, 42.91)
extent = (43.25, 87.84)

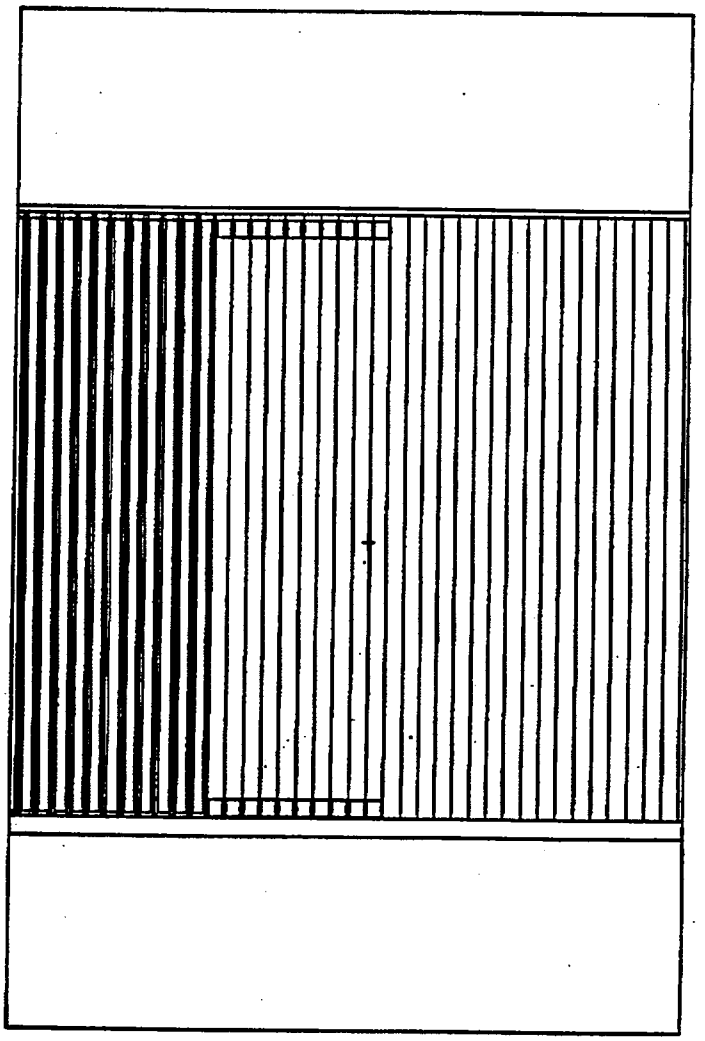


Figure 3.1.2-6 MCNP Plot: EXP22 x-z plane cross-section

01/07/98 10:37:38
CRITICAL EXPERIMENT NO. 22, 0.71
wt% U-235, 0.700-in. pitch, 0
ppmb
probid = 01/07/98 10:33:38
basis:
(.000000, 1.000000, .000000)
(.000000, .000000, 1.000000)
origin:
(5.00, 34.66, 46.01)
extent = (45.02, 88.05)

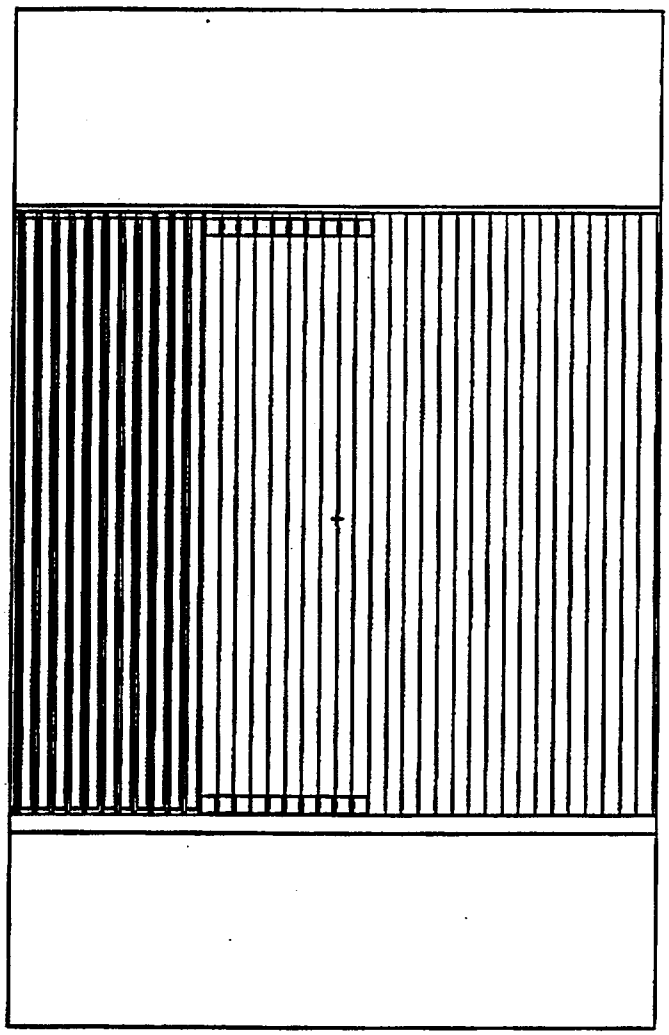


Figure 3.1.2-7 MCNP Plot: EXP22 y-z plane cross-section

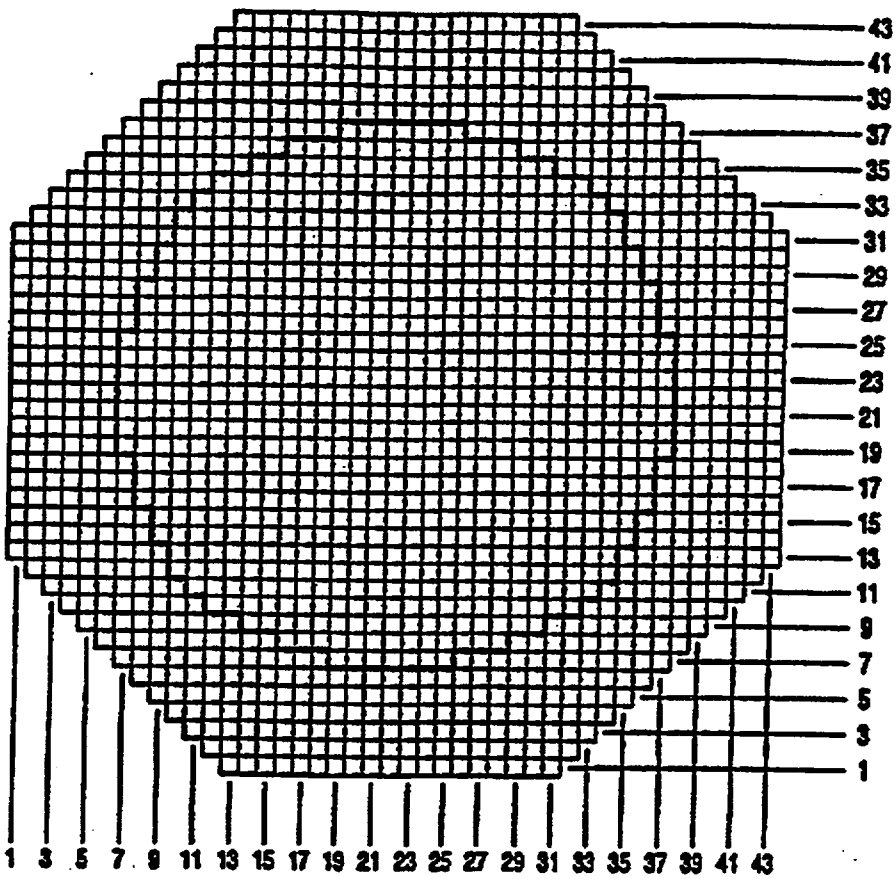


Fig. 31. EPRI 0.70-in. UO_2-2 wt % PuO_2 core, borated (from ref. 30).

Figure 3.1.2-8 EXP23 Core Loading Description

01/07/98 10:39:29
CRITICAL EXPERIMENT NO. 23, 0.71
wt% U-235, 0.700-in. pitch,
680.9 ppmb
probid = 01/07/98 10:38:53
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(35.19, 33.58, 5.00)
extent = (47.41, 47.41)

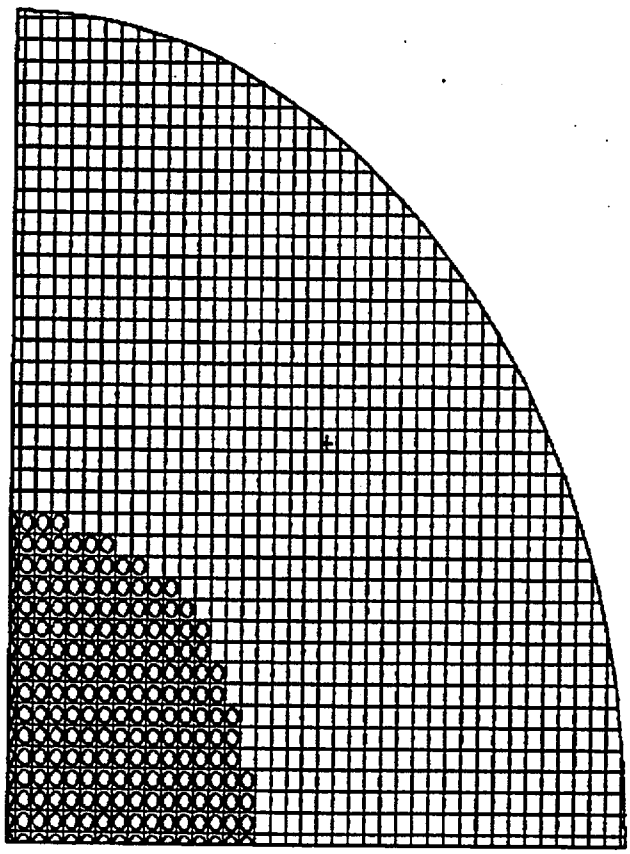


Figure 3.1.2-9 MCNP Plot: EXP23 x-y plane cross-section

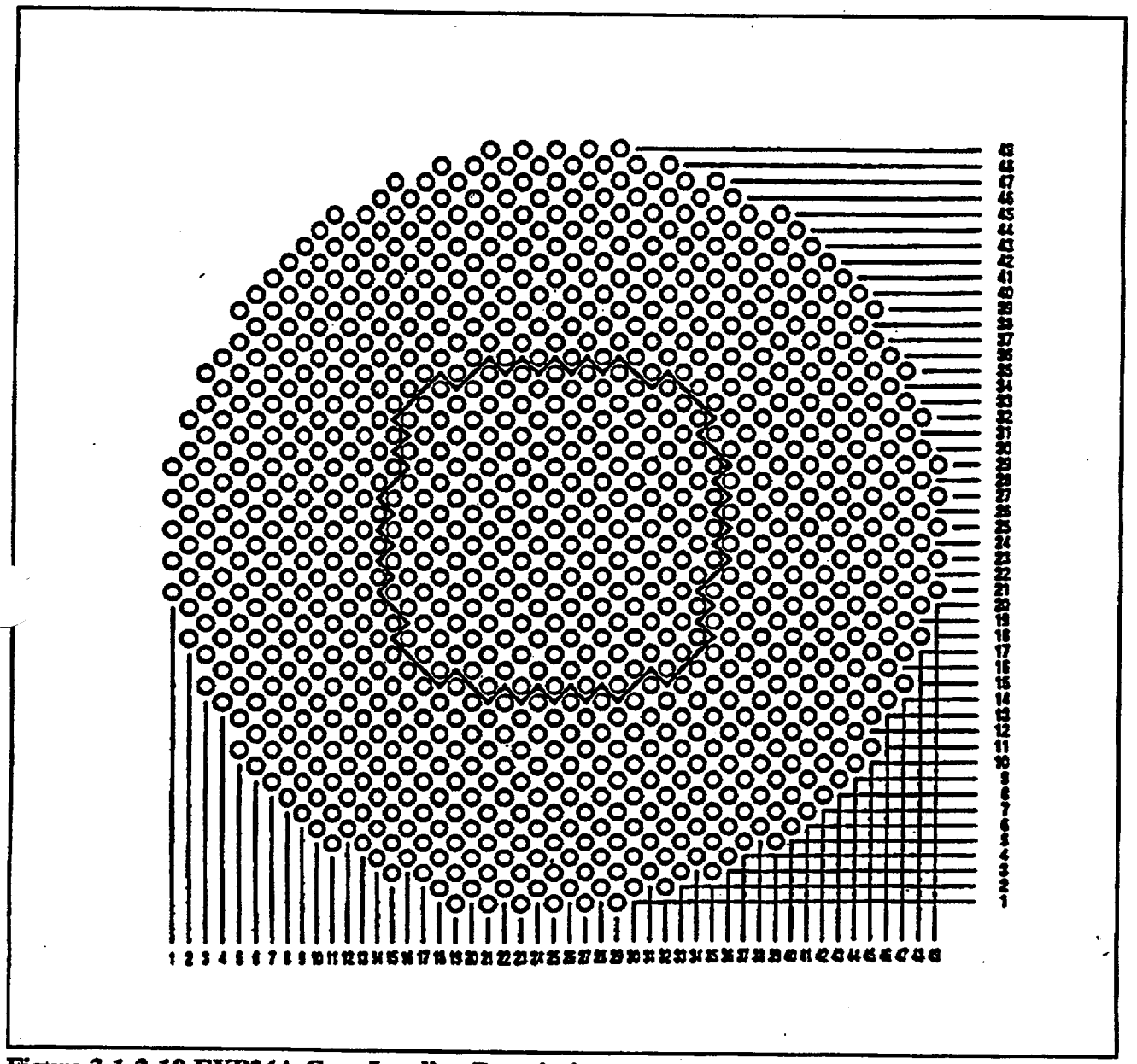


Figure 3.1.2-10 EXP24A Core Loading Description

01/07/98 10:39:55
CRITICAL EXPERIMENT NO. 24a,
8.72 wt% U-235, 0.870-in.
pitch, 0 ppmb
probid = 01/07/98 10:39:41
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(.00, .00, 5.00)
extent = (100.00, 100.00)

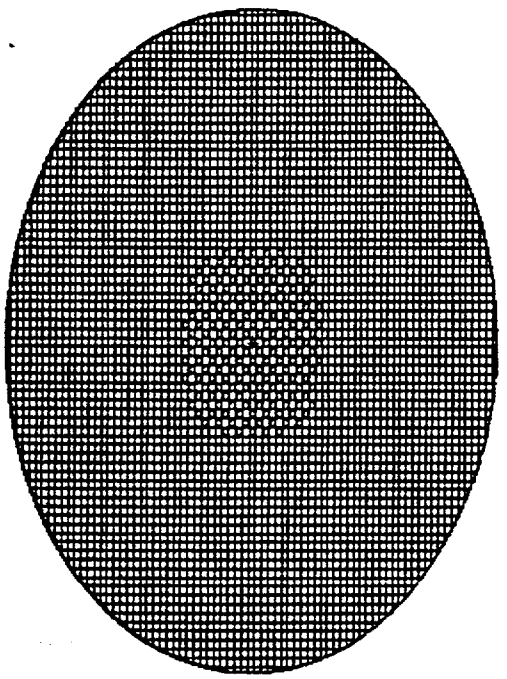


Figure 3.1.2-11 MCNP Plot: EXP24A x-y plane cross-section

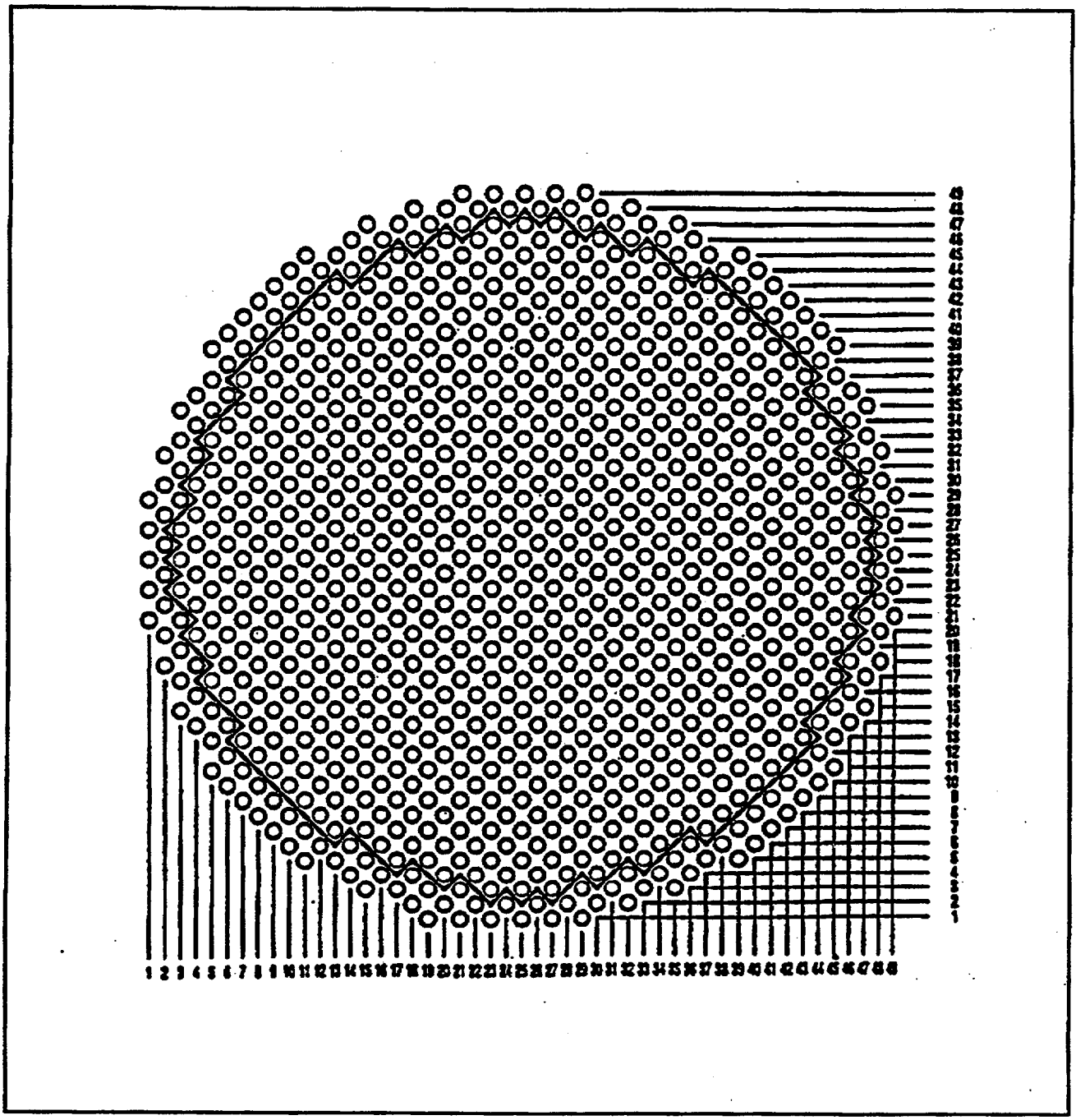


Figure 3.1.2-12 EXP25 Core Loading Description

01/07/98 10:41:00
CRITICAL EXPERIMENT NO. 25, 0.71
wt% U-235, 0.070-in. pitch,
1090.4 ppmb
probid = 01/07/98 10:40:34
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(29.95, 30.89, 5.00)
extent = (39.49, 39.49)

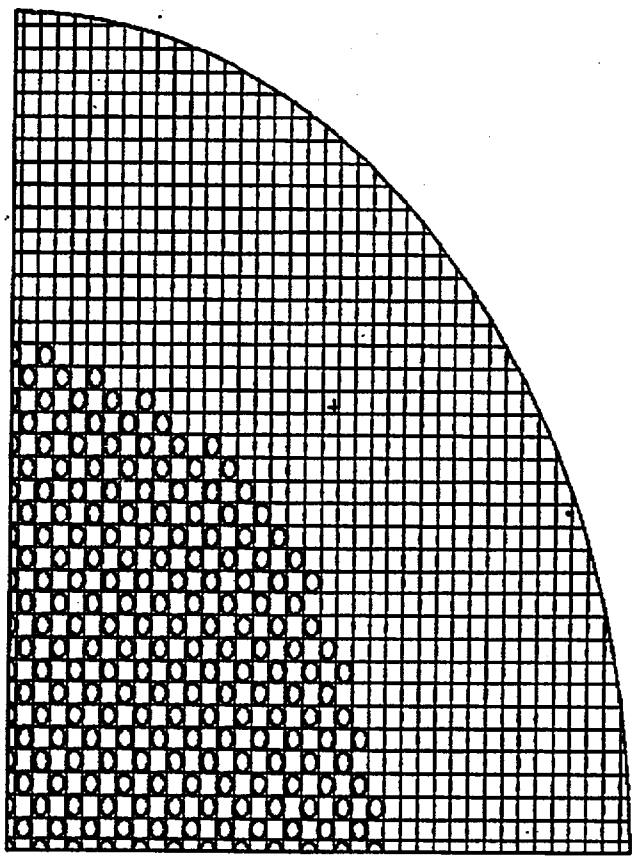


Figure 3.1.2-13 MCNP Plot: EXP25 x-y plane cross-section

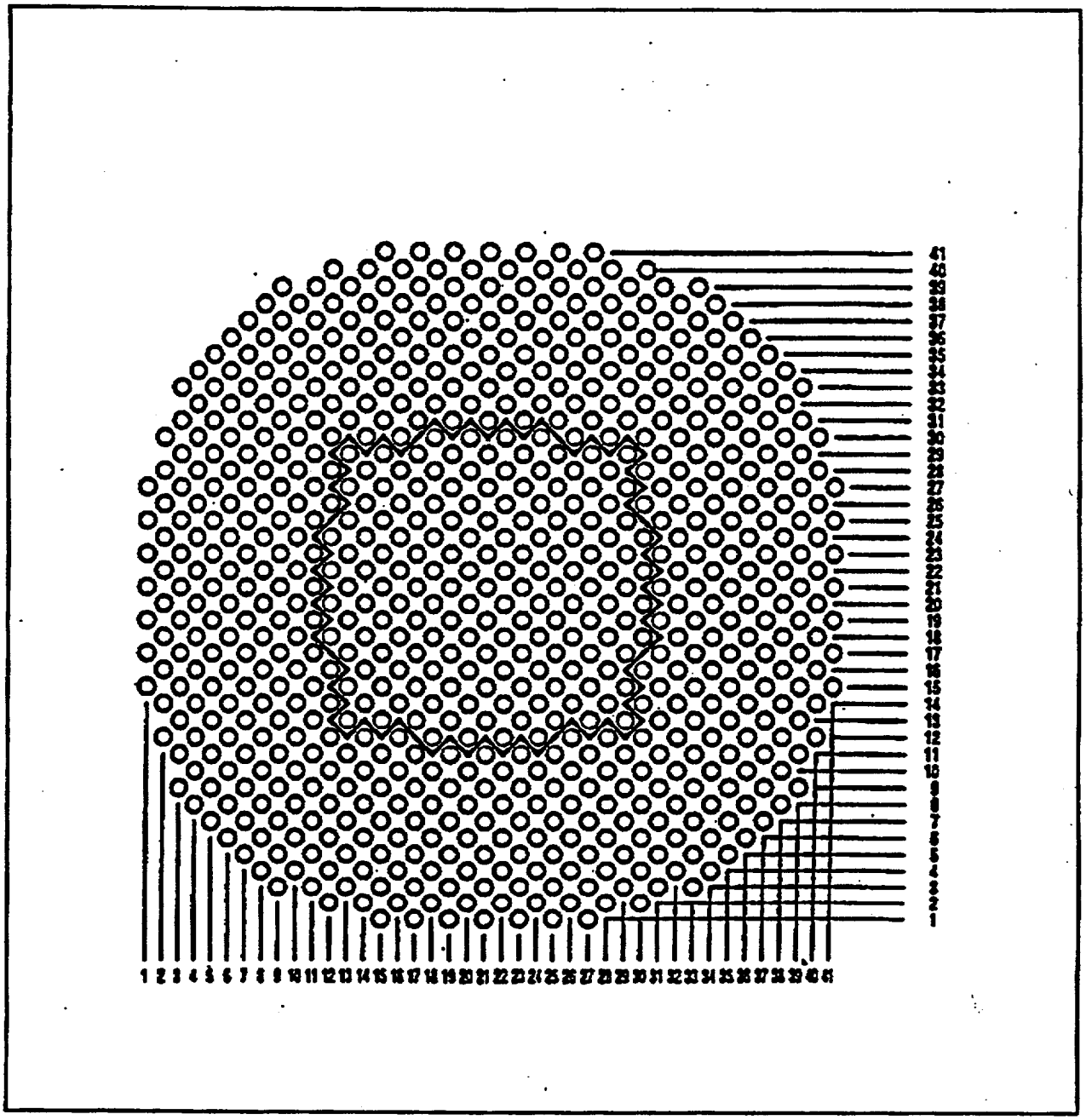


Figure 3.1.2-14 EXP26 Core Loading Description

01/07/98 10:41:42
CRITICAL EXPERIMENT NO. 26, 0.71
wt% U-235, 0.990-in. pitch, 0
ppmb
probid = 01/07/98 10:41:27
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(33.44, 36.00, 5.00)
extent = (45.69, 45.69)

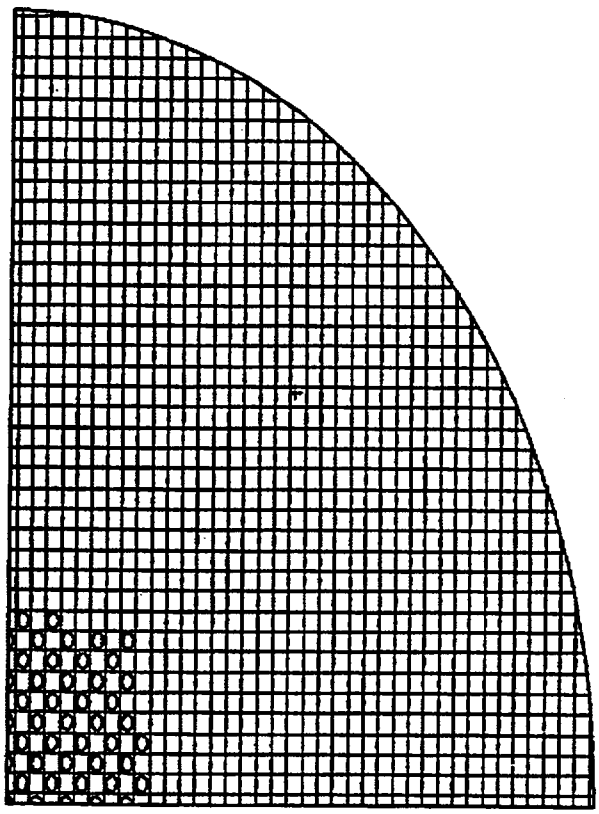


Figure 3.1.2-15 MCNP Plot: EXP26 x-y plane cross-section

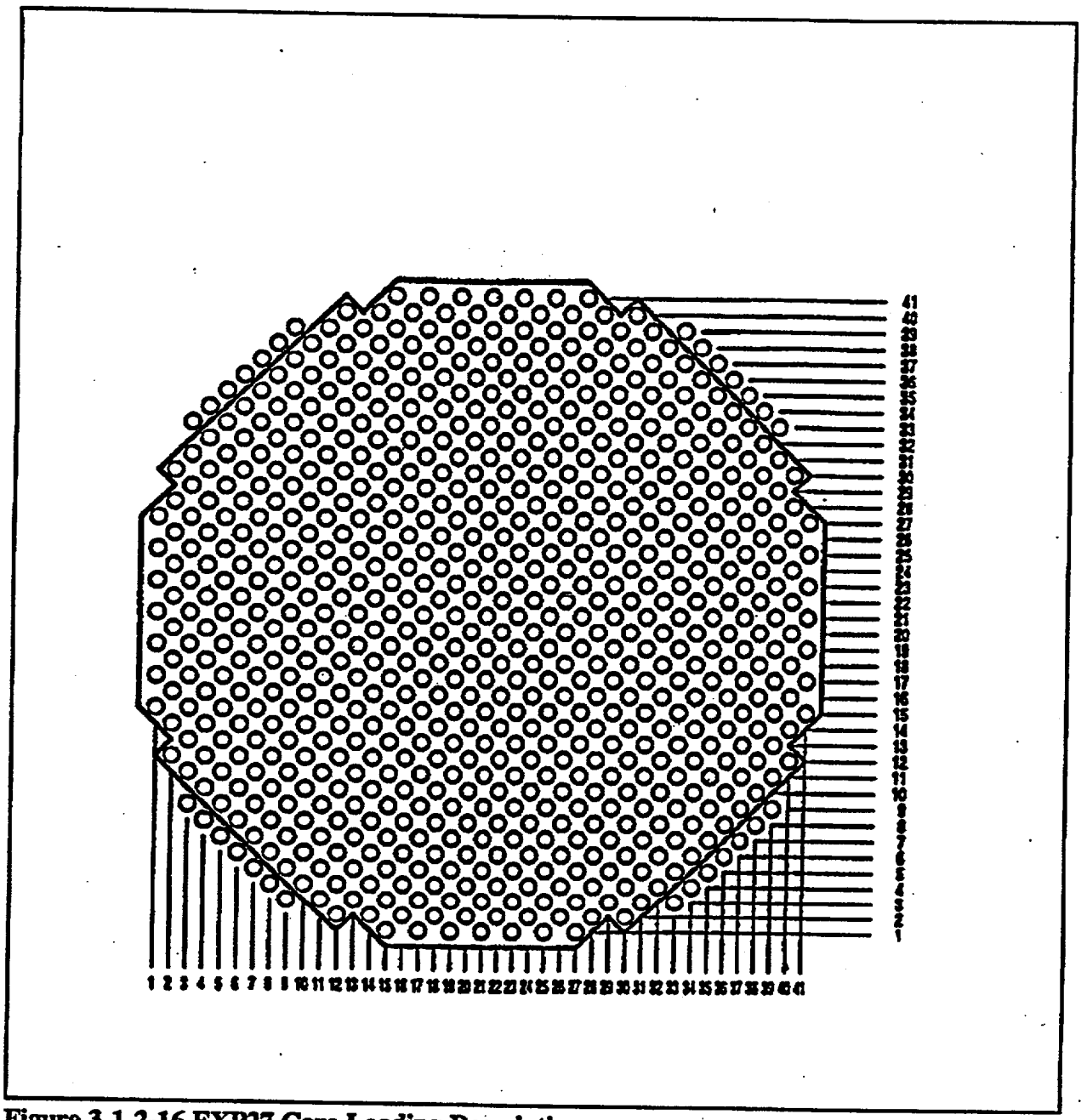


Figure 3.1.2-16 EXP27 Core Loading Description

01/07/98 10:42:32
CRITICAL EXPERIMENT NO. 27, 0.71
wt% U-235, 0.990-in. pitch,
767.2 ppmb
probid = 01/07/98 10:42:02
basis:
(1.000000, .000000, .000000)
(.000000, 1.000000, .000000)
origin:
(35.32, 35.73, 5.00)
extent = (51.31, 51.31)

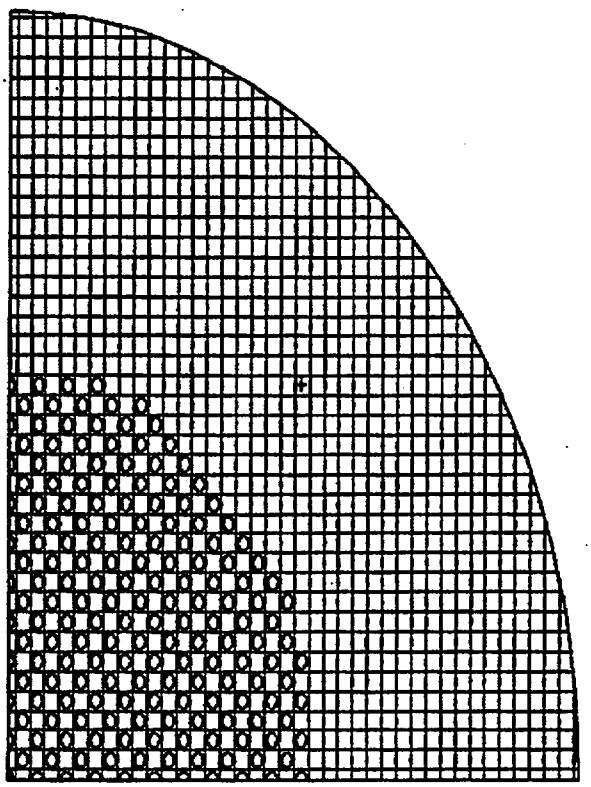


Figure 3.1.2-17 MCNP Plot: EXP27 x-y plane cross-section

3.1.3 Criticality Benchmarks

Seventeen additional criticality benchmark cases briefly described in Tables 12, 13, and 14 of Reference 14 were selected for the MCNP4B2 validation.. These test cases are a subset of those listed in References 6 and 7 with input decks and provide additional validation tests to demonstrate that the code package is performing correctly on the Unix workstations and PC desktop systems over the parameter range covered by these cases. The relevant output for the 17 test cases requires numerous printed pages and is too large to include in this SQR. This output is archived in corresponding electronic medias.

3.1.4 Results of Validation for the HP 9000 and SUN Ultra-2 Workstations

The results of the validation benchmark test cases on the OPUS HP 9000/735 workstation running HP-UX 9.07 are tabulated in Table 3.1.4-1 along with the results from HP 9000/C180 series workstation running HP-UX 10.20 designated "SPUDS". Results are also provided for the same benchmark test cases run on the SUN Ultra-2 workstation to confirm correct operation. The multiplication factor results from MCNP4B2 represent the combined average of three MCNP4B2 estimated multiplication factors: collision, absorption, and track length. Differences in multiplication factors between operating systems and CPUs (HP 9000/C180 vs. HP 9000/735) for the same experiments are within 3σ statistical uncertainty. Also, the differences in multiplication factors between different brand workstations (HP vs. SUN) for the same experiments are within 3σ statistical uncertainty. The ten benchmark test cases are well established critical experiments which all have a multiplication factor of 1.000. It must be noted that input files for the problems exp22, exp23, exp24a, exp25, exp26 and exp27 had to be modified to use corrected Zr cross sections as mentioned in the 'README' file (Attachment II).

The seventeen additional criticality benchmark test cases were run on the WPO workstations as part of the validation process.. The original results obtained by LANL and the results from the rerun of these cases on the OPUS HP 9000/735 workstation, the SPUDS HP 9000/C180 workstation, and OTIS SUN Ultra-2 workstation are listed in Table 3.1.4-2. In the latest release of MCNP (version 4B2), the repeated structure source description has been changed and is not compatible with version 4A. Therefore, the benchmark problem 3 input file had to be modified. The filename for the modified case is 'prob3n'.

In addition, a subset of the benchmark cases (exp1, exp27, prob1, prob20, LA1X, LA3, godiva, and jez4.5) were run on each HP 9000 workstation (HODGE: 700667, PORTNOY: 700669, MILO: 105062, OLIVER: 700314, DALLAS: 110689, QUICHE: 110431, BOBBI: 111503, MAJOR: 115288, ZORK: 115289 and ROSEBUD: 700315) in the WPO to verify correct network installation. The results of these cases show that all similar machines give identical results.

While most of the results fall within 2σ of the experiments, the maximum percent deviation from the experiment is observed to be approximately 3% which satisfies the acceptance criteria previously established. Based on the MCNP4B2 multiplication factor results for the benchmark test cases, the MCNP4B2 code package installed at the NFS mount point located on the QUICHE HP 9000/C160 workstation and run on any HP 9000 workstation in the WPO and the code package installed on SUN Ultra-2 workstation are determined to be operating correctly for applications involving criticality and shielding analyses supporting WPO activities.

TABLE 3.1.4-1
MCNP4B2 RESULTS (k_{eff}) FOR BENCHMARK CASES ON UNIX WORKSTATIONS

	HP9000/C180 (SPUDS)	HP9000/735 (OPUS)	SUN Ultra-2 (OTIS)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
Exp1	1.0001 (0.0013)	0.9990 (0.0013)	1.0000 (0.0013)
Exp2	0.9993 (0.0014)	0.9995 (0.0014)	1.0017 (0.0013)
Exp3	0.9984 (0.0013)	1.0028 (0.0013)	0.9927 (0.0013)
Exp4	1.0018 (0.0013)	1.0035 (0.0013)	1.0021 (0.0013)
Exp22	0.9946 (0.0015)	0.9946 (0.0015)	0.9946 (0.0015)
Exp23	0.9973 (0.0016)	0.9987 (0.0016)	0.9987 (0.0016)
Exp24a	1.0032 (0.0015)	1.0032 (0.0015)	1.0032 (0.0015)
Exp25	1.0053 (0.0014)	1.0053 (0.0014)	1.0053 (0.0014)
Exp26	1.0091 (0.0015)	1.0091 (0.0015)	1.0091 (0.0015)
Exp27	1.0069 (0.0014)	1.0069 (0.0014)	1.0069 (0.0014)

Table 3.1.4-2 MCNP4B2 RESULTS (k_{eff}) FOR ADDITIONAL BENCHMARK CASES

	LANL Results	HP9000/C180 (SPUDS)	HP9000/735 (OPUS)	SUN Ultra-2 (OTIS)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
LA1X	0.9998 (0.0005)	0.9997 (0.0005)	0.9997 (0.0005)	0.9997 (0.0005)
LA2X	0.9900 (0.0010)	0.9908 (0.0009)	0.9908 (0.0009)	0.9908 (0.0009)
LA3	0.9992 (0.0015)	0.9992 (0.0013)	0.9992 (0.0013)	0.9992 (0.0013)
LA1X5	0.9998 (0.0005)	1.0008 (0.0004)	1.0008 (0.0004)	1.0008 (0.0004)

	LANL Results	HP9000/C180 (SPUDS)	HP9000/735 (OPUS)	SUN Ultra-2 (OTIS)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
LA2X5	0.9900 (0.0010)	0.9885 (0.0011)	0.9885 (0.0011)	0.9885 (0.0011)
LA3X5	0.9992 (0.0015)	1.0060 (0.0014)	1.0060 (0.0014)	1.0060 (0.0014)
Godiva	0.9953 (0.0011)	0.9940 (0.0010)	0.9940 (0.0010)	0.9940 (0.0010)
Jez20	1.0097 (0.0012)	1.0073 (0.0012)	1.0073 (0.0012)	1.0073 (0.0012)
Jez4.5	1.0023 (0.0022)	1.0057 (0.0017)	1.0057 (0.0017)	1.0057 (0.0017)
Prob1	0.9936 (0.0009)	0.9951 (0.0008)	0.9951 (0.0008)	0.9951 (0.0008)
Prob3n	1.0002 (0.0011)	0.9988 (0.0011)	0.9997 (0.0010)	0.9988 (0.0011)
Prob6	0.7426 (0.0007)	0.7426 (0.0007)	0.7426 (0.0007)	0.7426 (0.0007)
Prob7	0.9954 (0.0008)	0.9951 (0.0008)	0.9951 (0.0008)	0.9951 (0.0008)
Prob12	0.9994 (0.0013)	0.9987 (0.0012)	0.9987 (0.0012)	0.9987 (0.0012)
Prob13	0.9914 (0.0008)	0.9924 (0.0008)	0.9924 (0.0008)	0.9924 (0.0008)
Prob14	0.9969 (0.0008)	0.9972 (0.0009)	0.9972 (0.0009)	0.9972 (0.0009)
Prob15	1.0003 (0.0011)	1.0005 (0.0011)	1.0005 (0.0011)	1.0005 (0.0011)
Prob16	0.9924 (0.0009)	0.9904 (0.0010)	0.9904 (0.0010)	0.9904 (0.0010)
Prob18	1.0308 (0.0013)	1.0274 (0.0013)	1.0306 (0.0013)	1.0285 (0.0013)
Prob20	0.9981 (0.0015)	0.9996 (0.0015)	0.9996 (0.0015)	0.9996 (0.0015)

3.1.5 Results of MCNP4B2 Criticality Validation Cases For PC

The validation cases for the standard sized desktop PC version of MCNP4B2 were run on the Dell PowerEdge 2000: 112110 and the validation cases for the large sized PC version on the Dell PowerEdge 2000: 112105. The results of the validation benchmark test cases on these WPO computers are tabulated in Table 3.1.5-1 together with HP 9000 workstation results for to confirm correct operation. The multiplication factor results from MCNP4B2 represent the combined average of three MCNP4B2 estimated multiplication factors: collision, absorption, and track length. Differences in multiplication factors between operating systems for the same experiments are within 3σ statistical uncertainty. The ten benchmark test cases are well established critical experiments which all have a multiplication factor of 1.000. In addition, a subset of the benchmark cases were run using the standard sized MCNP4B2 module on a set of additional PC desktop computers (Dell PowerEdge 2000: 112105, Dell Optiplx Gxi: 113132, GATEWAY2000 P5-166: 110942, GATEWAY2000 P5-166: 110831, Dell PowerEdge 2000: 112113, and GATEWAY2000 P5-166: 110837) in the WPO to verify correct installation. A subset of the benchmark cases using the large sized MCNP4B2 module were also run on the additional PC desktop computers with 64 Meg of RAM (Dell PowerEdge 2000: 112110, and Dell PowerEdge 2000: 112113) in the WPO to verify correct installation. The results of these cases show that all PC desktop machines give identical results.

The seventeen additional criticality benchmark test cases were run on the WPO workstations as part of the validation process.. The original results obtained by LANL and the results from the rerun of these cases on the PC desktop computers Dell PowerEdge 2000: 112105 (large version) and Dell PowerEdge 2000: 112110 (standard version) are listed in Table 3.1.5-2. In addition, a subset of the benchmark cases were run using the standard sized MCNP4B2 module on a set of additional PC desktop computers (Dell PowerEdge 2000: 112105, Dell Optiplx Gxi: 113132, GATEWAY2000 P5-166: 110942, GATEWAY2000 P5-166: 110831, Dell PowerEdge 2000: 112113, and GATEWAY2000 P5-166: 110837) in the WPO to verify correct installation. A subset of the benchmark cases using the large sized MCNP4B2 module were also run on the additional PC desktop computers with 64 Meg of RAM (Dell PowerEdge 2000: 112110, and Dell PowerEdge 2000: 112113) in the WPO to verify correct installation. The results of these cases show that all PC desktop machines give identical results.

In the latest release of MCNP (version 4B2), the repeated structure source description has been changed and is not compatible with version 4A. Therefore, the benchmark problem 3 input file from the additional criticality benchmark cases had to be modified. The filename for the modified case is 'prob3n'.

Based on the MCNP4B2 multiplication factor results for the ten benchmark test cases, the MCNP4B2 code package installed on the PC desktop computers located in the WPO is determined to be operating correctly for applications involving criticality and shielding analyses supporting WPO activities.

TABLE 3.1.5-1
MCNP4B2 RESULTS (k_{eff}) FOR CRITICALITY BENCHMARK CASES ON HP AND PC PLATFORMS

	HP9000/C180 (SPUDS)	HP9000/735 (OPUS)	PC desktop (Dell PowerEdge 2000: 112105)	PC desktop (Dell PowerEdge 2000: 112110)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
Exp1	1.0001 (0.0013)	0.9990 (0.0013)	0.99944 (0.00128)	0.99944 (0.00128)
Exp2	0.9993 (0.0014)	0.9995 (0.0014)	0.99982 (0.00135)	0.99982 (0.00135)
Exp3	0.9984 (0.0013)	1.0028 (0.0013)	1.00137 (0.00124)	1.00137 (0.00124)
Exp4	1.0018 (0.0013)	1.0035 (0.0013)	0.99988 (0.00129)	0.99988 (0.00129)
Exp22	0.9946 (0.0015)	0.9946 (0.0015)	0.99726 (0.00147)	0.99726 (0.00147)
Exp23	0.9973 (0.0016)	0.9987 (0.0016)	1.00062 (0.00152)	1.00062 (0.00152)
Exp24a	1.0032 (0.0015)	1.0032 (0.0015)	1.00554 (0.00150)	1.00554 (0.00150)
Exp25	1.0053 (0.0014)	1.0053 (0.0014)	1.00715 (0.00158)	1.00715 (0.00158)
Exp26	1.0091 (0.0015)	1.0091 (0.0015)	1.00821 (0.00139)	1.00821 (0.00139)
Exp27	1.0069 (0.0014)	1.0069 (0.0014)	1.01018 (0.00142)	1.01018 (0.00142)

Table 3.1.5-2 MCNP4B2 RESULTS (k_{eff}) FOR ADDITIONAL BENCHMARK CASES

	LANL Results	PC desktop (Dell PowerEdge 2000: 112105)	PC desktop (Dell PowerEdge 2000: 112110)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
LA1X	0.9998 (0.0005)	1.0000 (0.0004)	1.0000 (0.0004)
LA2X	0.9900 (0.0010)	0.9896 (0.0011)	0.9896 (0.0011)
LA3	0.9992 (0.0015)	0.9992 (0.0013)	0.9992 (0.0013)
LA1X5	0.9998 (0.0005)	1.0008 (0.0004)	1.0008 (0.0004)
LA2X5	0.9900 (0.0010)	0.9885 (0.0011)	0.9885 (0.0011)
LA3X5	0.9992 (0.0015)	1.0060 (0.0014)	1.0060 (0.0014)
Godiva	0.9953 (0.0011)	0.9953 (0.0011)	0.9953 (0.0011)

	LANL Results	PC desktop (Dell PowerEdge 2000: 112105)	PC desktop (Dell PowerEdge 2000: 112110)
Case ID	k_{eff} (σ)	k_{eff} (σ)	k_{eff} (σ)
Jez20	1.0097 (0.0012)	1.0073 (0.0012)	1.0073 (0.0012)
Jez4.5	1.0023 (0.0022)	1.0057 (0.0017)	1.0057 (0.0017)
Prob1	0.9936 (0.0009)	0.9937 (0.0009)	0.9937 (0.0009)
Prob3n	1.0002 (0.0011)	1.0004 (0.0010)	1.0004 (0.0010)
Prob6	0.7426 (0.0007)	0.7426 (0.0007)	0.7426 (0.0007)
Prob7	0.9954 (0.0008)	0.9954 (0.0008)	0.9954 (0.0008)
Prob12	0.9994 (0.0013)	0.9993 (0.0013)	0.9993 (0.0013)
Prob13	0.9914 (0.0008)	0.9914 (0.0008)	0.9914 (0.0008)
Prob14	0.9969 (0.0008)	0.9969 (0.0008)	0.9969 (0.0008)
Prob15	1.0003 (0.0011)	1.0007 (0.0011)	1.0007 (0.0011)
Prob16	0.9924 (0.0009)	0.9920 (0.0011)	0.9920 (0.0011)
Prob18	1.0308 (0.0013)	1.0300 (0.0013)	1.0300 (0.0013)
Prob20	0.9981 (0.0015)	0.9996 (0.0014)	0.9996 (0.0014)

3.2 Results Of Cross Section Installation Tests

During the original generation and testing of cross section library, results calculated using this library were compared with the results for a number of other data libraries for infinite medium simulations of all nuclides. In addition, a number of experimental benchmarks consisting of pulsed sphere experiments, iron benchmark experiments, and criticality experiments were run. The cases listed in References 6 and 7 are adequate for validating the cross section library for use with MCNP4B2. The benchmark test cases listed in Table 3.1.5-2 are a subset of those listed in References 6 and 7 and demonstrate that the validation can be extended to the HP 9000 series workstations, SUN Ultra-2 workstations and PC desktop computers. The output from these benchmark test cases (including mirrored input) is archived on electronic medias, MOY-980421-19 (MI: 30056-M03-001), MOY-980421-18 (MI: 30057-M03-001), and MOY-980421-20 (MI: 30055-M72-001).

Based on the result comparisons of these specific test cases, the operation of the MCNP4B2 code package on the SPUDS HP 9000/C180 workstation, the GATEWAY2000 P5-166 PC desktop computer, OTIS SUN Ultra-2 workstation and any other HP 9000 series workstation or DOS based PC desktop computer located at the WPO where MCNP4B2 is installed was determined to be satisfactory for criticality analysis. No limitations on the use of the cross section library with MCNP4B are noted.

3.3 MCNP4B2 Shielding Validation Tests

In order to investigate the applicability of MCNP Monte Carlo code to address waste package shielding concerns several experimental simple benchmark problems and an experimental benchmark cask problem are modeled by using the MCNP version 4B2 code installed on Waste Package Operations workstations and desktop PCs. Since it was already shown that HP workstations with same operating system version give identical results, the problems are run on machines that are representative of their class; namely, SPUDS, an HP Unix workstation running HP-UX V10.20 (CRWMS M&O #111504), opus, an HP Unix workstation running HP-UX V9.07 (CRWMS M&O #102878), otis, a SUN ULTRA-2 Unix workstation running SOLARIS 2.6 (CRWMS M&O #115491), and a PC desktop computer with Pentium processor (Dell OptiPlex Gxi, CRWMS M&O #113132). The acceptance criteria for shielding validation problems requires the ratio of calculated dose to measured dose to be greater than or equal to 0.95.

3.3.1 Simple Benchmark Problems

Several experimental benchmarks were performed by Ueki and Ohashi (Ref. 12) to help validate shielding computational tools. These experiments were used to validate several computer codes by Broadhead, et al. (Ref. 13). The experiments involved many different shield materials such as iron, graphite and polyethylene which are commonly used in the industry. The experimental set-up is shown in Figure 3.3.1-1. The neutron benchmarks used a Cf-252 neutron source whereas the photon benchmarks used a Co-60 gamma-ray source. Both types of measurements were performed with the same experimental configuration. The distance between the source and the back of the shield was 90 cm for neutron benchmark problems and 70 cm for photon benchmark problems. For photon benchmarks the detector was enclosed in a 5 cm lead sleeve. Also, the effect of shield thickness is examined by varying the thickness of the shield material.

The MCNP neutron calculations were performed with the cross sections in the RMCCS2 library and Cf-252 neutron spectrum as the source spectrum. The MCNP photon calculations were performed with MCPLIB2 cross sections and Co-60 source with gamma energies of 1.17 and 1.33 MeV. The results were renormalized to the total source strength to obtain the final dose rate. Note that percent standard deviation is defined as $(\sigma/R)*100$ where R is the dose rate per source particle per second. This can be interpreted as percent relative error.

3.3.2 Results of Simple Benchmark Problems

The source strengths of the neutron sources (Cf-252) used in the experiments were 1.62E+07, 1.50E+07, and 6.28E+07 neutrons per second for graphite, iron, and polyethylene, respectively. The

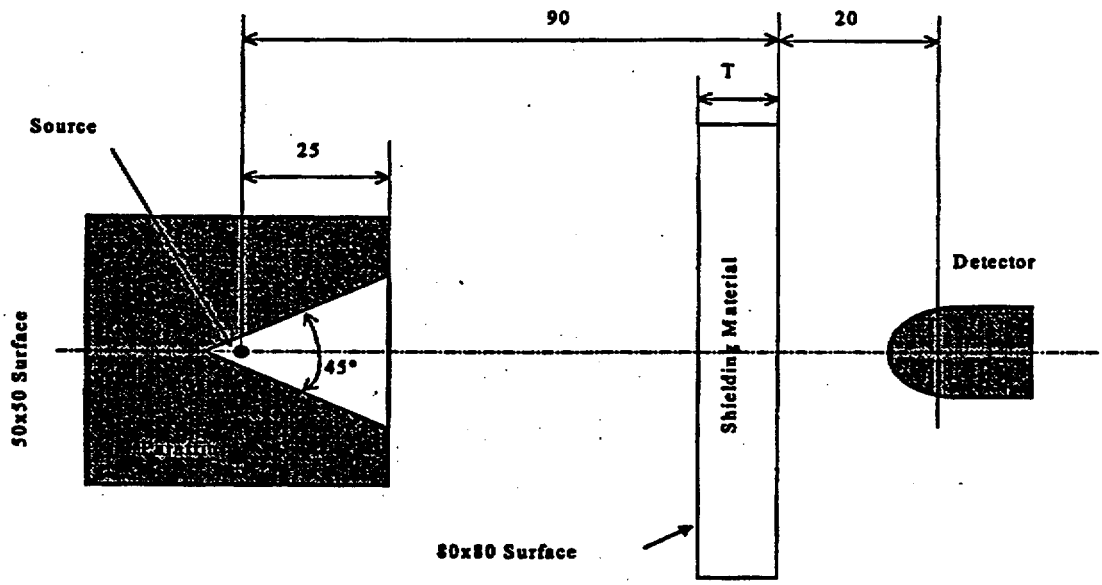


Figure 3.3.1-1 Schematic of Source, Shield and Detector ("T" is the thickness of the shield).

source strength for the gamma source was 40 mCi (Co-60). Since the results reported in the mcnp output are per source particle, the final result is obtained by multiplying the dose rate by the corresponding source strength.

The neutron results from the workstations spuds, opus and otis are all identical and given in Tables 3.3.1-1 through 3.3.1-3. The results from the PC are given in Tables 3.3.1-4 through 3.3.1-6. The results show good agreement between the experiments and mcnp calculations. For graphite and iron slabs, mcnp results are within 15%. For polyethylene, the differences between the experiments and calculations are as high as 50%.

Table 3.3.1-1. Comparison of Neutron Dose Rates from Workstations for Graphite Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.1	0	176.2	202.6	1	1.15
ueki.2	5	131.3	143.81	3	1.10
ueki.3	15	66.4	69.70	5	1.05
ueki.4	25	30.8	31.90	4	1.04
ueki.5	35	13.5	15.46	3	1.14

*Dose equivalent rate (μSv/h)

Table 3.3.1-2. Comparison of Neutron Dose Rates from Workstations for Iron Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.11	0	165.3	185.96	1	1.12
ueki.12	5	118.2	129.59	5	1.10
ueki.13	15	62.5	65.29	6	1.04
ueki.14	25	34.6	35.60	4	1.03
ueki.15	35	19.0	18.16	3	0.96

*Dose equivalent rate (μSv/h)

Table 3.3.1-3. Comparison of Neutron Dose Rates from Workstations for Polyethylene Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.31	0	683.0	774.50	1	1.13
ueki.32	5	288.0	370.18	7	1.29
ueki.33	15	42.6	57.77	9	1.36
ueki.34	25	8.3	12.25	11	1.48
ueki.35	35	2.25	3.28	10	1.46

*Dose equivalent rate (μSv/h)

Table 3.3.1-4. Comparison of Neutron Dose Rates from PC for Graphite Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.1	0	176.2	202.6	1	1.15
ueki.2	5	131.3	143.81	3	1.10
ueki.3	15	66.4	69.70	5	1.05
ueki.4	25	30.8	31.90	4	1.04
ueki.5	35	13.5	15.51	3	1.15

*Dose equivalent rate (μSv/h)

Table 3.3.1-5. Comparison of Neutron Dose Rates from PC for Iron Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.11	0	165.3	185.96	1	1.12
ueki.12	5	118.2	129.59	5	1.10
ueki.13	15	62.5	65.26	6	1.04
ueki.14	25	34.6	35.60	4	1.03
ueki.15	35	19.0	18.31	3	0.96

*Dose equivalent rate (μSv/h)

Table 3.3.1-6. Comparison of Neutron Dose Rates from PC for Polyethylene Slabs

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.31	0	683.0	774.50	1	1.13
ueki.32	5	288.0	370.18	7	1.29
ueki.33	15	42.6	57.77	9	1.36
ueki.34	25	8.3	12.25	11	1.48
ueki.35	35	2.25	3.25	10	1.44

*Dose equivalent rate (μSv/h)

The gamma dose rate results from the workstations spuds, opus and otis are all also identical and given in Table 3.3.1-7. The results from PC are given in Table 3.3.1-8. The results show very good agreement between the experiments and mcnp calculations for iron shield thicknesses up to 20 cm. For 25 and 30 cm thick iron shields, the attenuation of photons is approximately four orders of magnitude. It appears that the photon intensity is low enough for the floor and room scatter effects to be important. Therefore, in order to better assess the room scatter effects for thick iron shields, the 25 and 30 cm cases need to be reevaluated. However, due to insufficient information about the physical dimensions and properties of the detector and surrounding Pb sheath, the assessment of the roomscatter effects will not be performed.

Table 3.3.1-7. Comparison of Gamma Dose Rates for Iron Slabs from Workstations

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.21	0	1022.0	1022.85	1	1.00
ueki.22	5	255.0	275.36	2	1.08
ueki.24	15	9.62	10.33	3	1.07

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.25	20	1.67	1.71	3	1.02
ueki.26	25	0.34	0.28	3	0.83
ueki.27	30	0.12	0.05	4	0.42

*Dose equivalent rate (μSv/h)

Table 3.3.1-8. Comparison of Gamma Dose Rates for Iron Slabs from PC

Case Name	Shield Thickness (cm)	Experiment*	Calculated*	% Standard Deviation	Calculated/ Experiment
ueki.21	0	1022.0	1022.85	1	1.00
ueki.22	5	255.0	275.36	2	1.08
ueki.24	15	9.62	10.33	3	1.07
ueki.25	20	1.67	1.71	3	1.02
ueki.26	25	0.34	0.28	3	0.83
ueki.27	30	0.12	0.05	4	0.42

*Dose equivalent rate (μSv/h)

3.3.3 Multidimensional Cask Benchmark

The cask analyzed in this report is the Westinghouse MC-10 low-alloy, forged-steel storage cask with 24 PWR 15x15 spent fuel assemblies. The cask is 2.7 m in diameter and 4.8 m in height. It weighs approximately 110 tons after being loaded with PWR spent fuel assemblies. A layer of BISCO NS-3TM around the cask is used as the neutron shield. Vertical carbon steel fins pass through the neutron shield to increase cooling of the cask. The fuel basket inside the cask is made of aluminum, and each basket location contains a stainless steel enclosure and neutron poison for criticality control. The cask is closed with two lids and a seal cover which has elastomer and metallic O-rings. The horizontal and vertical cross sections of the cask are shown in Figures 3.3.3-1 and 3.3.3-2, respectively.

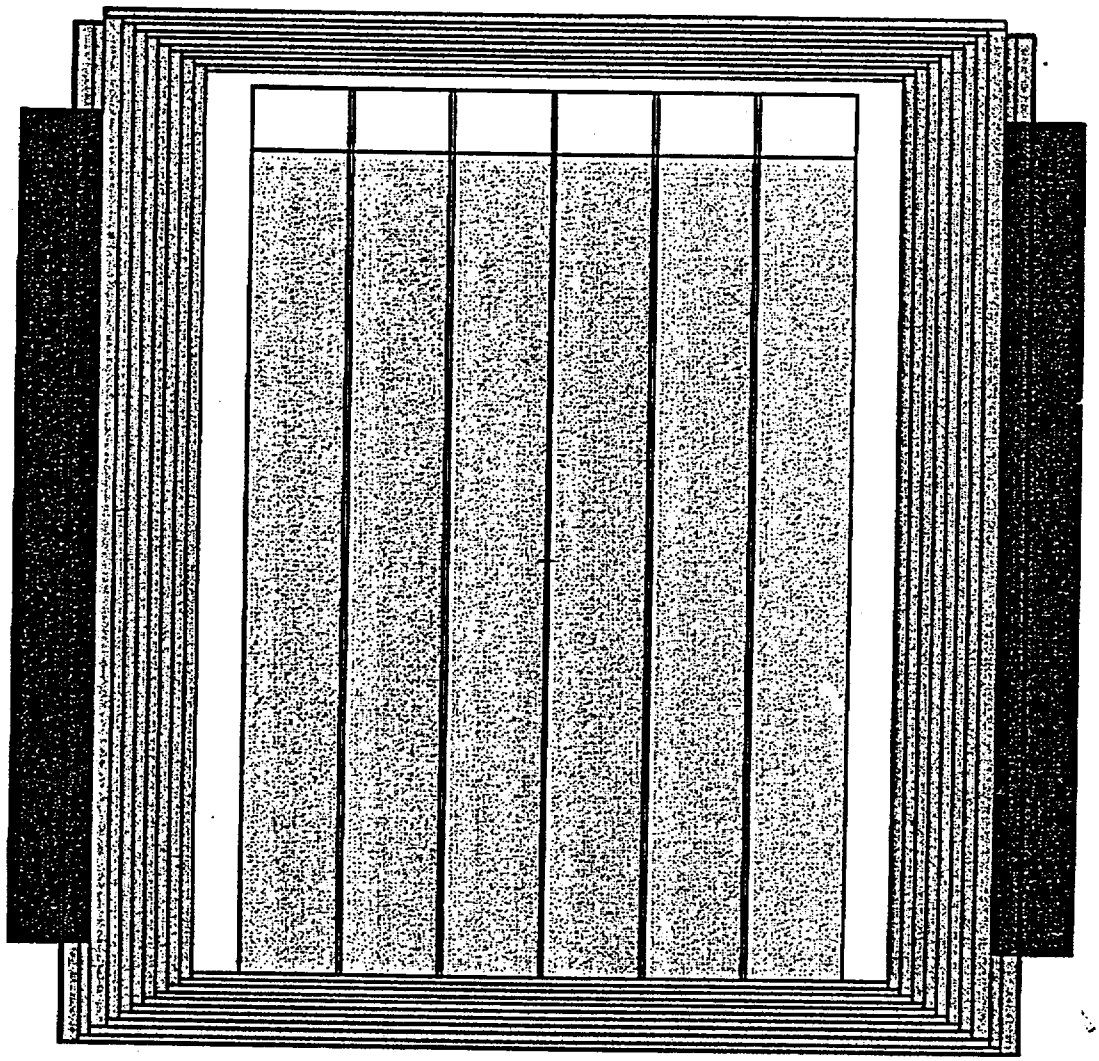


Figure 3.3.3-1 MC-10 Storage Cask Vertical Cross Section

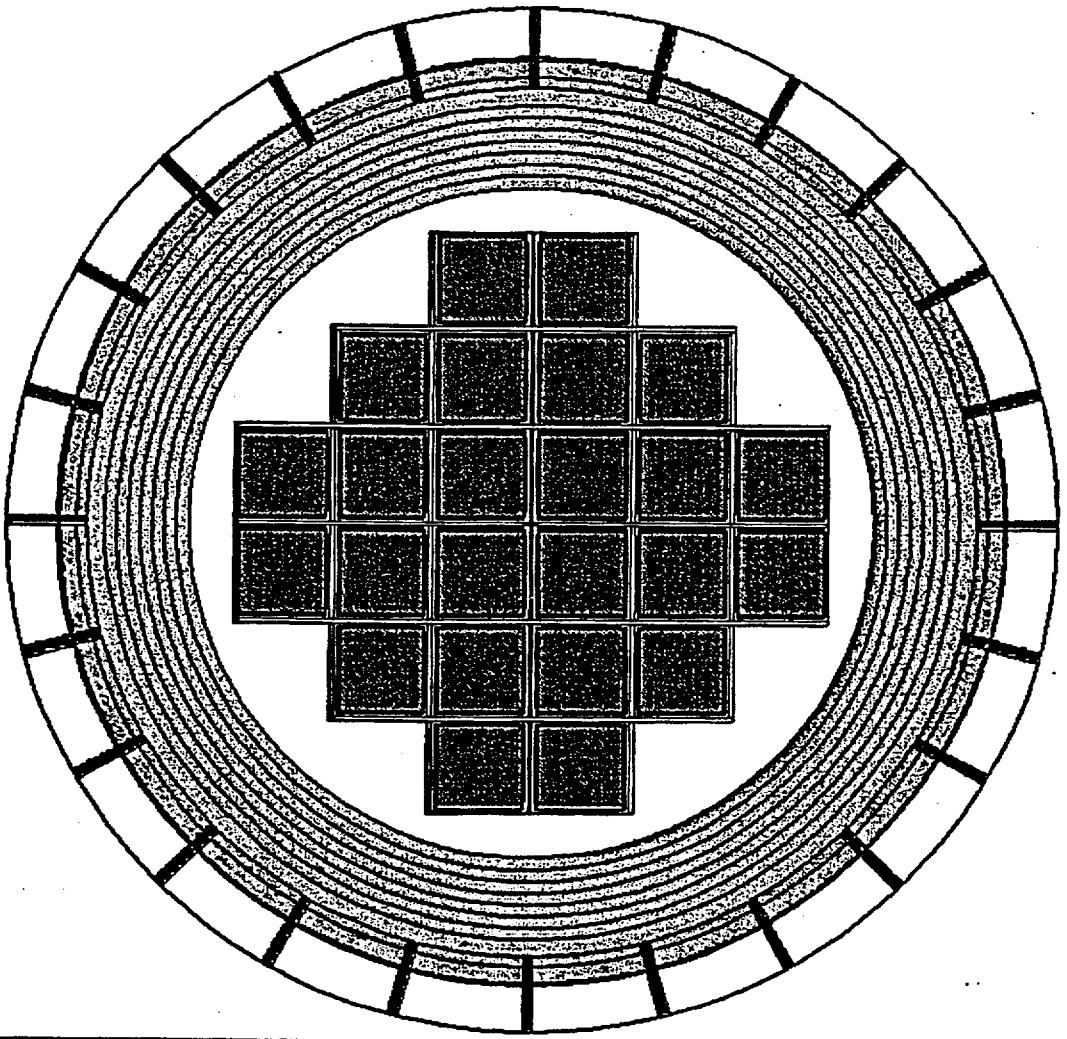


Figure 3.3.3-2 MC-10 Storage Cask Horizontal Cross Section

3.3.4 Multidimensional Cask Benchmark Results

The comparison of surface averaged dose rates for the MC-10 cask are given in Table 3.3.4-1. Note that all workstations calculated identical results. The results show that mcnp conservatively overestimates the average surface dose rate by 65%. The over prediction is mostly due to an overestimate of initial Co-59 impurity level. Therefore, with the limitation that initial impurity levels are known, these results substantiate confidence in the code.

Table 3.3.4-1. Comparison of Gamma Dose Rates for MC-10 Cask

Case Name	Machine	Experiment (mrem/h)	Calculated (mrem/h)	% Standard Deviation	Calculated/ Experiment
mc10new	workstations	21.4	35.40	3	1.65
mc10new	PC	21.4	35.32	3	1.65

3.4 Conclusions of MCNP4B2 Shielding Validation Tests

Since the simple benchmark experiments are very simple in nature they can be modeled with virtually all two or three dimensional shielding codes that are being used today. The simplicity also makes it possible to model the actual physical setting without any approximations for the geometry. These benchmarks serve as a valuable source for determination of attenuation effects of iron, graphite and polyethylene for neutral particle transport. Although the MC-10 storage cask is not simple in geometry, it can be modeled with mcnp. Since the storage cask is similar to the waste packages that are being designed by WPO, the benchmark proves to be a good source for validation efforts.

As a result of calculations performed with MCNP Version 4B2 which was installed on WPO workstations and PC's, it is concluded that the code can be used for shielding analyses of the waste packages and/or other configurations of radioactive materials that can be encountered during nuclear waste disposal. The results show that MCNP usually over predicts the dose rates by as much as 65%. All ratios of calculated dose to measured dose are greater than or equal to 0.95 which satisfies the acceptance criteria established in Section 3.3.

It is also concluded that the code should not be used for thick iron shields (25 cm or greater) with comparable source strength (40 mCi) for which roomscatter effects can be significant. Note that for higher source strengths (e.g., greater than 4 Ci) the roomscatter effects would be negligible even for 30 cm thick iron shield. Therefore, the code can still be used for thick iron shields (25 cm or greater) if the source strength is shown to be high enough for the roomscatter effects to be negligible.

4.0 RECOMMENDATIONS

The installation of the MCNP4B2 code package with associated cross section libraries was reviewed and found to have been accomplished according to the instructions provided by the developer. The test cases required for installation verification and code validation have been executed and found to satisfy the acceptance criterion for numerical results. Additional benchmark test cases have been successfully run to validate the proper operation of MCNP4B2. Thus, the MCNP4B2 code package installation was shown to be satisfactory and complete in all aspects. All elements of the software pertaining to the criticality due to neutrons and to the shielding due to neutrons and photons are included in the validation. Sections not included in the validation are the sections that involve charged particle transport.

Based upon the sufficient fulfillment of installation requirements as set forth by the developer, and the acceptance of the MCNP4B2 code by the NRC, it is recommended that the MCNP4B2 code be approved for use in criticality and shielding analyses of nuclear systems, including but not limited to spent nuclear fuel and other fissile material systems.

As noted above in Sections 3.1.3 and 3.4 for the Unix workstations, this validation document pertains to the HP 9000/735, HP 9000/C160, HP 9000/C180 workstations using the Unix operating systems V9.07 and V10.20, and SUN Ultra-2 workstation using the Unix operating system Solaris 2.6. The HP 9000 workstations (C180's, C160s and 735s) are connected to the QUICHE MCNP4B2 code package installation via a NFS mount. Numerous benchmark test cases have been run on all Unix workstations in this configuration at the WPO and results have been sufficiently similar for this validation document. For the PC version, this validation document pertains to the PC platforms using the MS-DOS running under WINDOWS 95 operating system. This validation document is valid for other PCs if they meet the platform requirements as listed in Section 1.3.3.

Also, the installation process can be repeated by following the instructions mentioned earlier in Chapter 2. However, if the user has a platform similar to one of the platforms used in this SQR, then the user may copy the executable and binary cross section libraries to a controlled location on the hard drive and run the full verification and validation test problems set. Upon calculating the same results reported in this SQR, the user may run the small set of problems to further install the software to all other identical machines. List of the files used in verification and validation are given in Attachment IV and archived on relevant electronic media based on platform type. Original Unix files are in the directory mcnp/exec. The files used during installation and verification and validation on WPO Unix machines are in the mcnp4b/exec and mcnp4b/ver-val directories. After restoring the files, the user will have the mcnp executable under mcnp4b/exec, cross section files under mcnp4b/xslib, verification files under mcnp4b/exec (mcnp4b/test for SUN), criticality validation problems under mcnp4b/ver-val/endf5 and

mcnp4b/ver-val/endf6, and shielding validation problems under mcnp4b/ver-val/shield. The coincident plane test problem is located under mcnp4b/ver-val/4b2fix. The small set that is used for regression testing is included in the directory mcnp4b/ver-val/smlset. Due to very large volume, all input and output files generated during verification, validation and regression testing of the MCNP Version 4B2 are archived in the electronic media MOY-980414-11 and listed in Attachment V.

A non-qualified PC executable version of the MCNP Version 4B2 is included with the installation which may be used only for graphical representation of models and not for analysis.

Finally, the instructions on how to use MCNP4B2 on WPO computers are given in Attachment VI. These instructions were originally distributed via interoffice correspondences LV.WP.SG.02/98-033, LV.WP.JAM.02/98-035 and LV.WP.JAM.02/98-039.

5.0 ATTACHMENTS

Attachment I: Software Acquisition Correspondence (I-1 thru I-2)

Attachment II: Installation Information/Notes (II-1 thru II-66)

Attachment III: MCNP4B2 Directory And File Listing (III-1 thru III-8)

Attachment IV: List of Verification and Validation Test Problems (IV-1 thru IV-34)

Attachment V: List of Output Files Archived on Electronic Media MOY-980414-11 (verification, validation, and regression testing files) (V-1 thru V-20)

Attachment VI: Execution Instructions (VI-1 thru VI-5)

Attachment VII: Regression Testing Correspondence (VII-1 thru VII-8)

Attachment I: Software Acquisition Correspondence

This attachment contains a copy of the correspondence showing means of acquisition of the MCNP4B2 package and associated libraries from LANL.

INFORMATION ONLY

To: Kenneth Wright
cc:
Subject: Request for verification of MCNP4B software distribution

Kenneth D. Wright and others,

Kenneth Wright attended an MCNP class at Los Alamos National Laboratory in 1997 and as part of his registration fee received 3 CD's provided by us, one with the MCNP source package, and two data library versions, one for a PC and one for a Unix based platform. I personally attest to these facts.

Judi Briesmeister
Group XCI, LANL

Attachment II: Installation Information/Notes

This attachment contains a copy of the installation instructions contained in the "READMAAG." and "README" files of the code package followed by a brief description of the cross section files. No difficulties were encountered with the installation by the installer. The "answer" file created during installation and the "install.fix" file used during installation are also included. A separate section is included in this Attachment on installation of the MCNP4B2 code with the ENDF/B-V and ENDF/B-VI cross section data files on the PC platform. This section follows the READMAAG and README sections for the Unix version.

...MATION ONLY

INSTALLATION OF MCNP4B2 ON Unix WORKSTATIONS

File 'READMAAG'

MCNP4B Notes 2/10/97

Copyright

MCNP was prepared by the Regents of the University of California at Los Alamos National Laboratory (the University) under contract number W-7405-ENG-36 with the U. S. Department of Energy (DOE). The University has certain rights in the program pursuant to the contract and the program should not be copied or distributed outside your organization. All rights in the program are reserved by the DOE and the University. Neither the U. S. government nor the University makes any warranty, express or implied, or assumes any liability or responsibility for the use of this software.

User Support

A LIMITED amount of free user support is available from John Hendricks, mcnp@lanl.gov, and Judi Briesmeister, 505-667-7277. Users are encouraged to communicate with other users via the two list servers, mcnp-l@psi.ch and mcnp-forum@lanl.gov. Our WWW Web site is:

http://www-xdiv.lanl.gov/XTM/mcnp

Contact mcnp@lanl.gov to be added to the MCNP e-mail list or to arrange additional support on a fee basis.

DISTRIBUTION FILES

The following files should be present with the MCNP 4B distribution:

FILE	DESCRIPTION
Readme	This file.
INSTALL	Installation controller. Named INSTALL.SYS for non-Unix systems (e.g., VMS and DOS).
INSTALL.FIX	Installation fix file.
MCSETUP.FOR	Setup FORTRAN code.
PRPR.ID	FORTRAN preprocessor code.
MAKXS.ID	Cross-section processor source code.
MCNPC.ID	MCNP C source code (used on Unix systems only).
MCNPF.ID	MCNP FORTRAN source code (named MCNP4B.ID).
RUNPROB	Script file for MCNP verification. Named RUNPROB.SYS for non-Unix systems.
TESTINP.TAR	Compressed input files for MCNP verification. Named TESTINP.SYS for non-Unix systems.
TESTMCTL.SYS	Compressed tally output files for MCNP verification.
TESTOUTP.SYS	Compressed MCNP output files for MCNP verification.
TESTDIR	Cross-section directory for MCNP verification.
TESTLIB1	Cross-section data for MCNP verification.

Substitute the appropriate system identifier from the following table for the "SYS" suffix.

SYSTEM	IDENTIFIER	SYSTEM	IDENTIFIER
Cray UNICOS	ucos	DEC ULTIRX	dec
Sun SunOS	sun	PC DOS	dos
IBM RS/6000 AIX	aix	Sun Solaris	sun
HP-9000 HPUX	hp	SGI IRIX	sgi
VAX VMS	vms		

The INSTALL.FIX file is used to implement corrections to either the MCNP source or the MAKEMCNP script. The latter is important for future changes/bugs in compilers and/or operating systems. The format of this file is provided within INSTALL.FIX, and more details can be found in Appendix C of the MCNP manual. The MCSETUP utility is a user friendly interface for creating system dependent files. The remaining files in the first group are MCNP related source code, and the second group of

files are used for MCNP verification (i.e. running the 29 MCNP test problems).

For DOS systems, two additional utilities have been included: the file compare utility FC.EXE and the archive utility PKXARC.COM.

SYSTEM REQUIREMENTS

Software Requirements:

(1) A FORTRAN 77 compiler. The supported compiler for each system is listed in the 1.1 MCSETUP menu (see below).

(2) On Unix systems, a C compiler is recommended and a Bourne-shell command interpreter is required to execute the installation scripts. If the X-Window graphics are to be used, an ANSI C library must be available.

Hardware Requirements:

	Minimum	Recommended
RAM	2 Mbytes	16 Mbytes
Disk Space	50 Mbytes	100 Mbytes

GETTING STARTED

Before proceeding, read the "KNOWN PROBLEMS AND AVAILABLE UPGRADES" section below. Your computer system may require modifications to the INSTALL.FIX file.

On VMS systems:

1. add the following line in your LOGIN.COM file to enable argument passing on the MCNP execution line:

   MCNP :== $MCNP_DISK:[MCNP_PATH]MCNP.EXE

   where MCNP_DISK and MCNP_PATH are the disk and directory path

to be used for the MCNP installation. To update this change, log back in or type @LOGIN.

2. The compilation process may be speedup up on VMS by increasing the system's paging file size. Otherwise, it may take an hour to compile.

3. VMS is not fully supported and will be dropped unless a funding source is found.

On all systems, initiate the installation controller with the following commands:

COMMANDS	COMMENT
chmod a+x install ./install SYS	Unix systems - SYS keyword given in the table above.
COPY INSTALL.VMS INSTALL.COM @INSTALL	VMS systems
COPY INSTALL.DOS INSTALL.BAT INSTALL	DOS systems

The MCSETUP utility is initiated first. Simply alter the main menu according to the MCNP options you desire. Note the following:

(1) Section 1.1 of the main menu SHOULD BE ALTERED FIRST. This sets the appropriate computer system which in turn selects suitable defaults for the remaining options.

(2) Default responses are included within barckets, [], (i.e., a <CR> will produce the default response) and additional options are included within parentheses.

(3) If the dynamic memory option is turned "off", an appropriate value for the MDAS parameter should be set (default is mdas=4000000). In general MDAS should be greater than 100000 and less than

(R-2)/4 * 1000000, where R is your available RAM in Mbytes.

(4) More information on the setup options is available in the MCNP manual. If you are unsure as to graphics libraries available on your system or their location, contact your system administrator. Default library names and directory paths are supplied by the MCSETUP utility; however these may not be applicable to your system. A FATAL error message is displayed if needed libraries could not be located. Included in this message is the expected library name and path.

When done altering the main menu, use the PROCESS command to continue the installation. The MCSETUP utility creates three system dependent files: the PRPR C patch file (PATCHC, for Unix systems only), the PRPR FORTRAN patch file (PATCHF), and the MAKEMCNP script. MCSETUP also creates an ANSWER file which contains the MCSETUP input for future installations. This file reflects all options chosen during the initial installation and can be used in future installations by

COMMAND(S)	COMMENT
./install SYS < answer	Unix systems
ASSIGN ANSWER.DAT SYS$COMMAND @INSTALL	VMS systems
INSTALL ANSWER	DOS systems

Next, the installation controller initiates the MAKEMCNP script which creates the MCNP executable. System differences can result in compilation errors (e.g., unsatisfied externals). If this occurs, contact MCNP@LANL.GOV regarding a fix. In most cases a two line fix can be added to your INSTALL.FIX file to rectify the situation (the INSTALL.FIX file included with the distribution contains examples of such fixes).

The last section of the installation controller performs MCNP verification by running the 29 MCNP test problems. If this step is to be omitted, rename the RUNPROB file with some other name (e.g.,

RUNPROB.ORG).

On most dedicated systems, compilation time is roughly 15-30 minutes and verification an additional 20-40 minutes.

UPON COMPLETION

A successful compilation generates an MCNP executable, called mcnp on Unix systems and MCNP.EXE on VMS and DOS sytems. The MCNP FORTRAN source will be placed in the flib directory on Unix systems or called MCNP.FOR on VMS and DOS systems. Likewise for the object code. A normal completion results in the following message:

Installation complete - see Readme file.

A log of the installation process is written to the INSTALL.LOG file. An abnormal completion results in one of the following messages:

SETUP ERROR OR USER ABORT.
COMPILATION ERROR - see INSTALL.LOG file.
VERIFICATION ERROR - see INSTALL.LOG file.

The cause of the error can be found in the INSTALL.LOG file.

Upon completion of MCNP verification, 29 difm?? files will exist containing the MCNP tally differences between your runs and the standard. Similarly, the 29 difo?? files will contain the MCNP output file differences between your runs and the standard. Exact tracking is required for MCNP verification, thus significant differences (i.e. other than round-off in the last digit) may prove to be serious (e.g. compiler bugs, etc.). In such cases the INSTALL.LOG file should be reviewed to ensure that the 29 test problems ran successfully.

KNOWN PROBLEMS AND AVAILABLE UPGRADES

(1) The following comments relate to PCs:
(a) Windows NT 4.0 is supported with Lahey graphics. Older versions

of NT result in fatal runtime erros related to opening files - the fix is to modify the FORTRAN and open all scratch files with file names.

(b) Windows 95 and DOS are also supported with Lahey graphics. On some DOS systems the INSTALL.BAT file echos all commands from the MAKEMCNP and RUNPROB batch files to the screen rather than to the INSTALL.LOG file, so error messages may appear only on the screen.

(c) On all PCs the CTRL-C interrupts are problematic. Usually executing the Lahey FORTRAN compiler will "magically" enable interrupts for subsequent MCNP runs. To test this, simply copy PRPR.ID to PRPR.FOR and execute "F77L3 PRPR.FOR", and run MCNP.

(d) Also on all PCs, the graphics plots can be saved to a postscript file using the FILE command at the PLOT or MCPLOT prompt. These postscript files can be sent to any postscript-ready printer for printing in color or black and white.

(e) The graphics for DOS systems has been upgraded to include support for X-windows. The INSTALL.FIX file has been modified to enable this. The following combination of software packages have proven to provide this capability:

Package	Version	Cost
F77L/EM-32 Lahey FORTRAN (702)831-2500	5.20	$795
MetaWare High C (408)429-6382	3.20 or 3.30	$795
DESQview/X by Quarterdeck (800)354-3222	2.00	$180
with the X11 OSF/Motif Toolkit for MetaWare		$250

Other combinations most likely also work (e.g., F77L/EM-32 5.01 with MetaWare C 3.02, etc.). DESQview/X is an X library based window manager. Theoretically any X based window manager can be used in this combination. MCNP executables created with this combination can be used on other DOS systems that only have DESQview/X (which reduces the cost to only $180, omitting the toolkit). RSICC will likely provide such executables in future releases. Contact GWM@LANL.GOV for further information.

(f) On both Pentium and Pentium Pro, using Lahey LF90 compiler, change
option break(lockl)
to

INFORMATION ONLY

call break(lockl)

If when lf90 compiles the code, you get "out of memory errors", split the source into two files and compiled each one separately.

(2) A bug has been found with IBM RS/6000 AIX XLF 3.01 linker. When X-windows is used with PVM multiprocessing the linker gives unsatisfied externals. Simply enter the link line manually and switch the order of the libraries (X11 last, PVM first):

```
xlf -o mcnp *.o -L/pvm_path -lfpvm3 -lpvm3 -L/usr/lib -lX11
mv *.o olib
```

We do not have the same problem on the XLF 3.0.2 linker.

(3) On all systems, EXACT tracking of ALL the test problems is required to verify proper code installation. If you do not track exactly or the code crashes running the test problems, recompile using a lower optimization and try again. If errors persist with even with NO optimization, try compiling without graphics. 99% of installation problems are due to compiler optimization bugs, compiler bugs, bad graphics libraries, or bad operating system environments.

File 'README'

README file for RSICC package DLC-189 1/97

This new package of data libraries contains all publically available data libraries supported by XTM for use with MCNP. The package contains the following neutron data libraries:

Continuous-energy
ENDF60 RMCCS RMCCSA ENDF5U ENDF5P
NEWXS ENDF5MT* MISC5XS** ENDL85 KIDMAN
100XS
Discrete
NEWXSD DRMCCS DRE5
Multigroup
MGXSNP
S(alpha,beta)
TMCCS THERXS
Dosimetry
531DOS 532DOS LLLDOS

the photon libraries: MCPLIB1 MCPLIB02

and the electron library: EL1

* The data library ENDF5MT contains data previously available in the library EPRIXS, along with the U600K data library.

** The data library MISC5XS contains corrected data for ENDF/B-V based Zr as described below, and the libraries IRNAT, MISCXS, ARKRC, TM169, GDT2GP, and T2DDC. None of these data libraries have been previously distributed through RSICC. The ENDF/B-V Zr data has been corrected for five ZAIDfs from the libraries RMCCS, DRMCCS, ENDF5P, DRE5, and EPRIXS. [Ref. 1-2] Below is a summary of the changes that have been made:

(Previous)		(Corrected)		
RMCCS	40000.51c -->	40000.57c	MISC5XS	300K
DRMCCS	40000.51d -->	40000.57d	MISC5XS	300K
ENDF5P	40000.50c -->	40000.56c	MISC5XS	300K
DRE5	40000.50d -->	40000.56d	MISC5XS	300K
EPRIXS	40000.53c -->	40000.58c	MISC5XS	600K

Additionally, the corresponding XSDIR file for all of these libraries is also distributed with this package. The file XSDIR1 will need to be renamed as XSDIR prior to running MCNP.

A SPECS file which preserves the default libraries is also provided for the MCNP user for producing Type 2 (Binary) versions of the data libraries to conserve disk space and speed up calculations.

The user must be aware of the limitations for some of these continuous-energy neutron data libraries.

ENDF60: This library is described in the accompanying file README_ENDF60, and other documentation in pdf format.

100XS: The 100XS library contains 9 data files nuclides each having an evaluation extending to 100 MeV. The 9 materials are Be-9, C-12, O-16, Al-27, Si, Ca- 40, Fe, W, and U-238. Modifications were made to the original evaluations and resulting data files to make them more compatable with MCNP, and version 4B of MCNP is needed to use these libraries. These files have been given the ZAID ending of ".21c". Heating numbers on this library are known to overestimate the energy deposition. The report "Summary Documentation for the 100XS Neutron Cross Section Library (Release 1)" LA-UR-96-24 [Ref. 3] describes the general characteristics of the library.

KIDMAN: This library contains data for a number of fission-product nuclides at 300K. There are no photon

INFORMATION ONLY

production available for nuclides on this library, and therefore the neutron heating numbers correspond to total heating (neutron + photon). Total charged particle production MT ƒs (MT=203-207) are available where appropriate. [Ref. 4]

MISC5XS: The data previously released as GDT2GP provide ENDF/B-V based Gd cross-section with photon production data from T-2 (LANL). The photon-production data are only valid up to 1 MeV. Since the photon production data were added to an existing set (ENDF5U), the neutron heating information is incorrect for this library and should not be used. [Ref. 5]

The data previously released as ARKRC are from both ENDF and ENDL sources. The neutron cross-section information for the Kr isotopes are from ENDF, while the cross-sections are from ENDL for Ar. Photon production data were added by T-2 (LANL). Photon production data were included to provide the user with rough estimates for quantities such as photon heating, not for detailed calculations. [Ref. 6]

The data previously released as T2DDC were provided by T-2 (LANL) for Br-79, Br-81, Rb-85, Rb-87, I-127 and Cs-133. All evaluations, with the exception of Cs-133, are incomplete having no photon production, heating numbers, or angular distribution information. [Ref. 7]

The thermal neutron libraries, TMCCS and THERXS, contain S(alpha,beta) data tables for MCNP. TMCCS is a library based on ENDF/B-V (which was unchanged from ENDF/B-III) and provides data for several materials at a number of temperatures. [Ref. 8] THERXS provides data for a few additional moderators based on later T-2 (LANL) evaluations.

The three dosimetry libraries, 531DOS, 532DOS, and LLLDOS, provide (energy, cross-section) pairs for a large number of reactions that are used in various

INFORMATION ONLY

dosimetry or activation applications. The ZAIDs on these libraries can only be used with the FM card option in MCNP, not for actual transport. [Ref. 9]

The latest tables for Appendix G may be downloaded from our WWW site at http://www-xdiv.lanl.gov/XTM/data/dataweb.html .

The photon data library MCPLIB02 is described in the pdf formatted document mcplib02.pdf.

REFERENCES

1. "Repairing ENDF/B-V Zirconium Cross Sections," R.E. Seamon, Los Alamos National Laboratory internal memorandum, X-6:RES-91-358 (1991).

2. "Revised ENDF/B-V Zirconium Cross Sections," R.E. Seamon, Los Alamos National Laboratory internal memorandum, X-6:RES-92-324 (1992).

3. "Summary Documentation for the 100XS Neutron Cross Section Library (Release 1)," Los Alamos National Laboratory internal memorandum, XTM:RCL-95-259 and LA-UR-96-24 (1995).

5. "ENDF/B-V Gd Cross Sections with Photon Production," R. C. Little and R. E. Seamon, Los Alamos National Laboratory internal memorandum, X-6:RCL:RES-86-30 (1986).

6. "Argon and Kyrpton Cross-section Files," R. C. Little, Los Alamos National Laboratory internal memorandum, June 30, 1982.

7. "Cross Sections in ACE Format for Various IP Target Materials," R. C. Little, Los Alamos National Laboratory internal memorandum, August 19, 1982.

INFORMATION ONLY

8. "New Thermal Library for MCNP (Update)," R. C. Little, Los Alamos National Laboratory internal memorandum, X-6:RCL-86-400 (1986).

9. "Dosimetry/Activation Cross Sections for MCNP," R. C. Little, Los Alamos National Laboratory internal memorandum, March 13, 1984.

INTERNAL USE ONLY

Brief Description of Some Cross Section Files

dre52	: 54 tables from ENDF/B-V (discrete data corresponding to ENDF5P2 plus ENDF5U2)
drmccs2	: 91 tables from ENDF/B-V, LANL and ENDL85 (discrete data corresponding to RMCCS2 plus RMCCSA2)
endf5p2	: 23 tables from ENDF/B-V continuous energy
endf5u2	: 31 tables from ENDF/B-V continuous energy neutron
mgxsnp2	: multigroup cross sections for neutrons and photons 4/19/91
newxs2	: newly processed evaluations 4/19/91
newxsd2	: discrete version of newxs2 4/19/91
rmccs2	: 64 tables from ENDF/B-V, LANL and ENDL85 (continuous energy neutron)
rmccsa2	: 27 tables from ENDF/B-V, LANL and ENDL85 (continuous energy neutron)
531dos2	: 18 tables from ENDF/B-V neutron dosimetry tape 531
531dos2	: 43 tables from ENDF/B-V neutron dosimetry activation tape 532
lldos2	: 374 tables from Livermore ACTL neutron dosimetry
tmccs2	: 42 tables from ENDF/B-V thermal neutrons (S(α,β) thermal cross sections)
therxs2	: thermal data for SMETH, LMETH, HORTHO, DPARA and DORTHO
100xs2	: 9 data files nuclides each having an evaluation extending to 100 MeV
kidman2	: data for a number of fission product nuclides at 300K
misc5xs2	: corrected data for ENDF/B-V based Zr, and data libraries IRNAT, MISCXS, ARKRC, TM169, GDT2GP, and T2DDC
endf5mt2	: data previously available in the library EPRIXS (evaluations at various temperatures including 300, 600 and 900 degrees for 7 isotopes), along with the U600K data library
endl852	: ENDL85 based continuous energy neutron cross sections
mcplib12	: 94 tables based on DLC-7E and Storm/Israel photons
mcplib022	: photon interaction library covering the energy range 1 keV - 100 GeV for elements Z = 1 to 94
el12	: electron library cross sections
endf602	:124 nuclides with an individual data file for each (processed with NJOY91 at room temperature (300K), using flat weighting, and thinned such that most nuclides had no more than 400,000 words)

File 'ANSWER'

```
1.1
4
2.1
1
2.2
1
2.3
1
3.1
1
3.2
1
3.3
1
/usr/lib/X11R5
libX11.a
/usr/include/X11R5
4.1
1
/opt/neut/MCNP4B/xslib
4.2
2
5.1
1
p
```

```
rw-rw-rw- 229/20 110017 Mar 31 08:16 1998 ./mcnp4b/ver-val/smlset/jez4.5o
rw-r----- 229/20  36661 Mar 31 08:16 1998 ./mcnp4b/ver-val/smlset/mc10new
rw-rw-rw- 229/20 430511 Mar 31 08:16 1998 ./mcnp4b/ver-val/smlset/mc10newo
rw-r----- 229/20   2117 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.14
rw-rw-rw- 229/20  26703 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.14o
rw-r----- 229/20   2412 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.24
rw-rw-rw- 229/20  28784 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.24o
rw-r----- 229/20   2021 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.34
rw-rw-rw- 229/20  33195 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.34o
rw-r----- 229/20   1999 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.4
rw-rw-rw- 229/20  25594 Mar 31 08:17 1998 ./mcnp4b/ver-val/smlset/ueki.4o
rw-rw-rw- 229/20   8851 Mar 31 08:24 1998 ./mcnp4b/ver-val/smlset/bug4b2
rw-rw-rw- 229/20 2072332 Mar 31 08:24 1998 ./mcnp4b/ver-val/smlset/bug4b2o
rwxrwxrwx 229/20      0 Mar 31 16:19 1998 ./mcnp4b/ver-val/4b2fix/
rw-rw-rw- 229/20   8851 Mar 27 15:55 1998 ./mcnp4b/ver-val/4b2fix/bug4b2
rw-rw-rw- 229/20 2072332 Mar 27 16:14 1998 ./mcnp4b/ver-val/4b2fix/bug4b2o
rwxr-xr-x 229/20      0 Mar  2 15:27 1998 ./mcnp4b/xslib/
rw-r--r-- 229/20 2680832 Dec 17 16:21 1997 ./mcnp4b/xslib/dre52
rw-r--r-- 229/20 305152 Dec 17 16:21 1997 ./mcnp4b/xslib/531dos2
rw-r--r-- 229/20 36685824 Dec 17 16:14 1997 ./mcnp4b/xslib/endf602
rw-r--r-- 229/20 1812480 Dec 17 16:14 1997 ./mcnp4b/xslib/newxs2
rw-r--r-- 229/20 8196096 Dec 17 16:15 1997 ./mcnp4b/xslib/rmccs2
rw-r--r-- 229/20 3532800 Dec 17 16:15 1997 ./mcnp4b/xslib/rmccsa2
rw-r--r-- 229/20 5736448 Dec 17 16:16 1997 ./mcnp4b/xslib/endf5p2
rw-r--r-- 229/20 5937152 Dec 17 16:17 1997 ./mcnp4b/xslib/endf5u2
rw-r--r-- 229/20 3840000 Dec 17 16:17 1997 ./mcnp4b/xslib/misc5xs2
rw-r--r-- 229/20 1259520 Dec 17 16:17 1997 ./mcnp4b/xslib/kidman2
rw-r--r-- 229/20 3590144 Dec 17 16:18 1997 ./mcnp4b/xslib/100xs2
rw-r--r-- 229/20 5859328 Dec 17 16:19 1997 ./mcnp4b/xslib/endl852
rw-r--r-- 229/20 2846720 Dec 17 16:19 1997 ./mcnp4b/xslib/endf5mt2
rw-r--r-- 229/20 716800 Dec 17 16:19 1997 ./mcnp4b/xslib/newxsd2
rw-r--r-- 229/20 5093376 Dec 17 16:20 1997 ./mcnp4b/xslib/drmccs2
rw-r--r-- 229/20 2416640 Dec 17 16:21 1997 ./mcnp4b/xslib/tmccs2
rw-r--r-- 229/20  90112 Dec 17 16:21 1997 ./mcnp4b/xslib/therxs2
rw-r--r-- 229/20 874496 Dec 17 16:21 1997 ./mcnp4b/xslib/532dos2
rw-r--r-- 229/20 1687552 Dec 17 16:21 1997 ./mcnp4b/xslib/111dos2
rw-r--r-- 229/20 1628160 Dec 17 16:21 1997 ./mcnp4b/xslib/mgxsnp2
rw-r--r-- 229/20 577536 Dec 17 16:21 1997 ./mcnp4b/xslib/mcplib022
rw-r--r-- 229/20 440320 Dec 17 16:21 1997 ./mcnp4b/xslib/mcplib2
rw-r--r-- 229/20 770048 Dec 17 16:21 1997 ./mcnp4b/xslib/el2
rw-r--r-- 229/20 146972 Dec 18 07:46 1997 ./mcnp4b/xslib/xsdir
```

Files from SPUDS on HP backup tape MOY-980421-19 (MI: 30056-M03-001)

Verification test problems are located in mcnp4b/exec. Criticality validation test problems are located in mcnp4b/ver-val/endf5. Criticality validation test problems are located in mcnp4b/ver-val/endf6. Shielding validation test problems are located in mcnp4b/ver-val/shield. Coincident planes verification test problem is located in mcnp4b/ver-val/4b2fix.

```
rwxrwxrwx 229/20      0 Jan 16 14:54 1998 ./mcnp4b/
rwxrwxrwx 229/20      0 Dec 18 08:40 1997 ./mcnp4b/xslib/
rw-rw-rw- 229/20 3590144 Dec 18 08:39 1997 ./mcnp4b/xslib/100xs2
rw-rw-rw- 229/20 305152 Dec 18 08:39 1997 ./mcnp4b/xslib/531dos2
rw-rw-rw- 229/20 874496 Dec 18 08:39 1997 ./mcnp4b/xslib/532dos2
rw-rw-rw- 229/20 2680832 Dec 18 08:39 1997 ./mcnp4b/xslib/dre52
rw-rw-rw- 229/20 5093376 Dec 18 08:39 1997 ./mcnp4b/xslib/drmccs2
rw-rw-rw- 229/20 770048 Dec 18 08:39 1997 ./mcnp4b/xslib/el2
rw-rw-rw- 229/20 2846720 Dec 18 08:39 1997 ./mcnp4b/xslib/endf5mt2
rw-rw-rw- 229/20 5736448 Dec 18 08:39 1997 ./mcnp4b/xslib/endf5p2
rw-rw-rw- 229/20 5937152 Dec 18 08:39 1997 ./mcnp4b/xslib/endf5u2
rw-rw-rw- 229/20 36685824 Dec 18 08:40 1997 ./mcnp4b/xslib/endf602
rw-rw-rw- 229/20 5859328 Dec 18 08:40 1997 ./mcnp4b/xslib/endl852
rw-rw-rw- 229/20 1259520 Dec 18 08:40 1997 ./mcnp4b/xslib/kidman2
rw-rw-rw- 229/20 1687552 Dec 18 08:40 1997 ./mcnp4b/xslib/111dos2
rw-rw-rw- 229/20 577536 Dec 18 08:40 1997 ./mcnp4b/xslib/mcplib022
rw-rw-rw- 229/20 440320 Dec 18 08:40 1997 ./mcnp4b/xslib/mcplib2
```

```
rw-rw-rw- 229/20 1628160 Dec 18 08:40 1997 ./mcnp4b/xslib/mgxsnp2
rw-rw-rw- 229/20 3840000 Dec 18 08:40 1997 ./mcnp4b/xslib/misc5xs2
rw-rw-rw- 229/20 1812480 Dec 18 08:40 1997 ./mcnp4b/xslib/newxs2
rw-rw-rw- 229/20 716800 Dec 18 08:40 1997 ./mcnp4b/xslib/newxsd2
rw-rw-rw- 229/20 8196096 Dec 18 08:40 1997 ./mcnp4b/xslib/rmccs2
rw-rw-rw- 229/20 3532800 Dec 18 08:40 1997 ./mcnp4b/xslib/rmccsa2
rw-rw-rw- 229/20  90112 Dec 18 08:40 1997 ./mcnp4b/xslib/therxs2
rw-rw-rw- 229/20 2416640 Dec 18 08:40 1997 ./mcnp4b/xslib/tmccs2
rw-rw-rw- 229/20 146971 Dec 18 08:41 1997 ./mcnp4b/xslib/xsdir
rwxrwxrwx 229/20      0 Apr  1 10:26 1998 ./mcnp4b/exec/
rw-rw-rw- 229/20   2918 Dec 18 08:31 1997 ./mcnp4b/exec/INSTALL.FIX.old
rw-rw-rw- 229/20   4523 Dec 18 08:31 1997 ./mcnp4b/exec/INSTALL.VMS
rw-rw-rw- 229/20   6070 Dec 18 08:31 1997 ./mcnp4b/exec/RUNPROB.VMS
rw-rw-rw- 229/20 193437 Dec 18 08:31 1997 ./mcnp4b/exec/TESTINP.VMS
rw-rw-rw- 229/20 235520 Dec 18 08:31 1997 ./mcnp4b/exec/TESTMCTL.AIX
rw-rw-rw- 229/20 227840 Dec 18 08:31 1997 ./mcnp4b/exec/TESTMCTL.SUN
rw-rw-rw- 229/20 290288 Dec 18 08:31 1997 ./mcnp4b/exec/TESTMCTL.VMS
rw-rw-rw- 229/20 2048000 Dec 18 08:31 1997 ./mcnp4b/exec/TESTOUTP.AIX
rw-rw-rw- 229/20 2040320 Dec 18 08:31 1997 ./mcnp4b/exec/TESTOUTP.SUN
rw-rw-rw- 229/20 2354588 Dec 18 08:31 1997 ./mcnp4b/exec/TESTOUTP.VMS
rw-rw-rw- 229/20    230 Dec 18 08:31 1997 ./mcnp4b/exec/answer
rwxrwxrwx 229/20   2241 Dec 18 09:12 1997 ./mcnp4b/exec/runtest
rwx------ 229/20   1396 Mar  1 13:23 1996 ./mcnp4b/exec/inp01
rwx------ 229/20   1963 Mar  2 12:09 1996 ./mcnp4b/exec/inp02
rwx------ 229/20   1911 Mar  1 13:26 1996 ./mcnp4b/exec/inp03
rwx------ 229/20   1052 Mar  1 13:31 1996 ./mcnp4b/exec/inp04
rwx------ 229/20   2164 Mar  1 13:31 1996 ./mcnp4b/exec/inp05
rwx------ 229/20   1599 Mar  1 13:32 1996 ./mcnp4b/exec/inp06
rwx------ 229/20   1539 Mar  1 13:32 1996 ./mcnp4b/exec/inp07
rwx------ 229/20   3287 Mar  4 08:53 1996 ./mcnp4b/exec/inp08
rwx------ 229/20   1261 Mar  1 15:56 1996 ./mcnp4b/exec/inp09
rwx------ 229/20   1004 Mar  1 13:34 1996 ./mcnp4b/exec/inp10
rwx------ 229/20   2023 Mar  2 12:21 1996 ./mcnp4b/exec/inp11
rwx------ 229/20  46304 Mar  4 09:00 1996 ./mcnp4b/exec/inp12
rwx------ 229/20   1172 Mar  1 11:10 1996 ./mcnp4b/exec/inp13
rwx------ 229/20   2459 Mar  1 13:52 1996 ./mcnp4b/exec/inp14
rwx------ 229/20   1104 Mar  1 13:53 1996 ./mcnp4b/exec/inp15
rwx------ 229/20   2220 Mar  1 13:54 1996 ./mcnp4b/exec/inp16
rwx------ 229/20    968 Mar  1 13:54 1996 ./mcnp4b/exec/inp17
rwx------ 229/20   4323 Mar  4 07:50 1996 ./mcnp4b/exec/inp18
rwx------ 229/20    567 Mar  1 13:55 1996 ./mcnp4b/exec/inp19
rwx------ 229/20   1171 Mar  1 13:56 1996 ./mcnp4b/exec/inp20
rwx------ 229/20   8134 Mar  2 12:03 1996 ./mcnp4b/exec/inp21
rwx------ 229/20   7496 Mar  1 15:25 1996 ./mcnp4b/exec/inp22
rwx------ 229/20   5496 Mar  1 15:26 1996 ./mcnp4b/exec/inp23
rwx------ 229/20   2096 Mar  1 13:13 1996 ./mcnp4b/exec/inp24
rwx------ 229/20     42 Feb 29 14:35 1996 ./mcnp4b/exec/inp25
rwx------ 229/20     42 Feb 29 14:35 1996 ./mcnp4b/exec/inp26
rwx------ 229/20    917 Mar  1 15:27 1996 ./mcnp4b/exec/inp27
rwx------ 229/20   5756 Feb 29 14:35 1996 ./mcnp4b/exec/inp28
rwx------ 229/20    839 Mar  4 08:00 1996 ./mcnp4b/exec/inp29
rw-r--r-- 229/20   6853 Jan  6 14:04 1997 ./mcnp4b/exec/mctl01
rw-r--r-- 229/20  15297 Jan  6 14:04 1997 ./mcnp4b/exec/mctl02
rw-r--r-- 229/20   1793 Jan  6 14:04 1997 ./mcnp4b/exec/mctl03
rw-r--r-- 229/20  11301 Jan  6 14:04 1997 ./mcnp4b/exec/mctl04
rw-r--r-- 229/20   2199 Jan  6 14:04 1997 ./mcnp4b/exec/mctl05
rw-r--r-- 229/20   4956 Jan  6 14:04 1997 ./mcnp4b/exec/mctl06
rw-r--r-- 229/20   1472 Jan  6 14:04 1997 ./mcnp4b/exec/mctl07
rw-r--r-- 229/20   3457 Jan  6 14:04 1997 ./mcnp4b/exec/mctl08
rw-r--r-- 229/20  17893 Jan  6 14:04 1997 ./mcnp4b/exec/mctl09
rw-r--r-- 229/20    748 Jan  6 14:04 1997 ./mcnp4b/exec/mctl10
rw-r--r-- 229/20   4562 Jan  6 14:04 1997 ./mcnp4b/exec/mctl11
rw-r--r-- 229/20   3600 Jan  6 14:04 1997 ./mcnp4b/exec/mctl12
rw-r--r-- 229/20   2889 Jan  6 14:04 1997 ./mcnp4b/exec/mctl13
rw-r--r-- 229/20   3212 Jan  6 14:04 1997 ./mcnp4b/exec/mctl14
rw-r--r-- 229/20    771 Jan  6 14:04 1997 ./mcnp4b/exec/mctl15
rw-r--r-- 229/20   1366 Jan  6 14:04 1997 ./mcnp4b/exec/mctl16
rw-r--r-- 229/20  11346 Jan  6 14:04 1997 ./mcnp4b/exec/mctl17
rw-r--r-- 229/20   8487 Jan  6 14:04 1997 ./mcnp4b/exec/mctl18
rw-r--r-- 229/20   2414 Jan  6 14:04 1997 ./mcnp4b/exec/mctl19
```

```
rw-r--r-- 229/20   9663 Jan  6 14:04 1997 ./mcnp4b/exec/mctl20
rw-r--r-- 229/20  23069 Jan  6 14:04 1997 ./mcnp4b/exec/mctl21
rw-r--r-- 229/20   1503 Jan  6 14:04 1997 ./mcnp4b/exec/mctl22
rw-r--r-- 229/20   2944 Jan  6 14:04 1997 ./mcnp4b/exec/mctl23
rw-r--r-- 229/20   1240 Jan  6 14:04 1997 ./mcnp4b/exec/mctl24
rw-r--r-- 229/20   1472 Jan  6 14:04 1997 ./mcnp4b/exec/mctl25
rw-r--r-- 229/20  18897 Jan  6 14:04 1997 ./mcnp4b/exec/mctl26
rw-r--r-- 229/20   3062 Jan  6 14:04 1997 ./mcnp4b/exec/mctl27
rw-rw-rw- 229/20    923 Dec 18 08:32 1997 ./mcnp4b/exec/getfiles
rw-r--r-- 229/20  37974 Jan  6 14:04 1997 ./mcnp4b/exec/mctl28
rw-r--r-- 229/20   1380 Jan  6 14:04 1997 ./mcnp4b/exec/mctl29
rw-r--r-- 229/20 109352 Jan  6 14:04 1997 ./mcnp4b/exec/outp01
rw-r--r-- 229/20 116665 Jan  6 14:04 1997 ./mcnp4b/exec/outp02
rw-r--r-- 229/20  19769 Jan  6 14:04 1997 ./mcnp4b/exec/outp03
rw-r--r-- 229/20 144259 Jan  6 14:04 1997 ./mcnp4b/exec/outp04
rw-r--r-- 229/20  22577 Jan  6 14:04 1997 ./mcnp4b/exec/outp05
rw-r--r-- 229/20  34544 Jan  6 14:04 1997 ./mcnp4b/exec/outp06
rw-r--r-- 229/20  75653 Jan  6 14:04 1997 ./mcnp4b/exec/outp07
rw-r--r-- 229/20 176554 Jan  6 14:04 1997 ./mcnp4b/exec/outp08
rw-r--r-- 229/20  57202 Jan  6 14:04 1997 ./mcnp4b/exec/outp09
rw-r--r-- 229/20  31787 Jan  6 14:04 1997 ./mcnp4b/exec/outp10
rw-r--r-- 229/20  56608 Jan  6 14:04 1997 ./mcnp4b/exec/outp11
rw-r--r-- 229/20 170494 Jan  6 14:04 1997 ./mcnp4b/exec/outp12
rw-r--r-- 229/20  89657 Jan  6 14:04 1997 ./mcnp4b/exec/outp13
rw-r--r-- 229/20  31715 Jan  6 14:04 1997 ./mcnp4b/exec/outp14
rw-r--r-- 229/20  44841 Jan  6 14:04 1997 ./mcnp4b/exec/outp15
rw-r--r-- 229/20  51524 Jan  6 14:04 1997 ./mcnp4b/exec/outp16
rw-r--r-- 229/20 107636 Jan  6 14:04 1997 ./mcnp4b/exec/outp17
rw-r--r-- 229/20  77712 Jan  6 14:04 1997 ./mcnp4b/exec/outp18
rw-r--r-- 229/20  14787 Jan  6 14:04 1997 ./mcnp4b/exec/outp19
rw-r--r-- 229/20  54656 Jan  6 14:04 1997 ./mcnp4b/exec/outp20
rw-r--r-- 229/20  81680 Jan  6 14:04 1997 ./mcnp4b/exec/outp21
rw-r--r-- 229/20  52192 Jan  6 14:04 1997 ./mcnp4b/exec/outp22
rw-r--r-- 229/20  91245 Jan  6 14:04 1997 ./mcnp4b/exec/outp23
rw-r--r-- 229/20  33164 Jan  6 14:04 1997 ./mcnp4b/exec/outp24
rw-r--r-- 229/20  17877 Jan  6 14:04 1997 ./mcnp4b/exec/outp25
rw-r--r-- 229/20  57594 Jan  6 14:04 1997 ./mcnp4b/exec/outp26
rw-r--r-- 229/20  17907 Jan  6 14:04 1997 ./mcnp4b/exec/outp27
rw-r--r-- 229/20 144379 Jan  6 14:04 1997 ./mcnp4b/exec/outp28
rw-r--r-- 229/20  36905 Jan  6 14:04 1997 ./mcnp4b/exec/outp29
rw-rw-rw- 229/20  53893 Dec 18 09:20 1997 ./mcnp4b/exec/runtest.log
rw-r--r-- 229/20 109352 Mar 27 16:32 1998 ./mcnp4b/exec/inp01o
rw-r--r-- 229/20  33468 Mar 27 16:32 1998 ./mcnp4b/exec/inp01p
rw-r--r-- 229/20 116665 Mar 27 16:32 1998 ./mcnp4b/exec/inp02o
rw-r--r-- 229/20   6853 Mar 27 16:32 1998 ./mcnp4b/exec/inp01m
rw-rw-rw- 229/20      0 Mar 27 16:32 1998 ./mcnp4b/exec/difm01
rw-rw-rw- 229/20    258 Mar 27 16:32 1998 ./mcnp4b/exec/difo01
rw-r--r-- 229/20  25038 Mar 27 16:32 1998 ./mcnp4b/exec/inp02p
rw-r--r-- 229/20  19769 Mar 27 16:33 1998 ./mcnp4b/exec/inp03o
rw-r--r-- 229/20  15297 Mar 27 16:32 1998 ./mcnp4b/exec/inp02m
rw-rw-rw- 229/20      0 Mar 27 16:32 1998 ./mcnp4b/exec/difm02
rw-rw-rw- 229/20      0 Mar 27 16:32 1998 ./mcnp4b/exec/difo02
rw-r--r-- 229/20 144259 Mar 27 16:33 1998 ./mcnp4b/exec/inp04o
rw-r--r-- 229/20   1793 Mar 27 16:33 1998 ./mcnp4b/exec/inp03m
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difm03
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difo03
rw-r--r-- 229/20  22577 Mar 27 16:33 1998 ./mcnp4b/exec/inp05o
rw-r--r-- 229/20  11301 Mar 27 16:33 1998 ./mcnp4b/exec/inp04m
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difm04
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difo04
rw-r--r-- 229/20  34544 Mar 27 16:33 1998 ./mcnp4b/exec/inp06o
rw-r--r-- 229/20   2199 Mar 27 16:33 1998 ./mcnp4b/exec/inp05m
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difm05
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difo05
rw-r--r-- 229/20  75653 Mar 27 16:34 1998 ./mcnp4b/exec/inp07o
rw-r--r-- 229/20   4956 Mar 27 16:33 1998 ./mcnp4b/exec/inp06m
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difm06
rw-rw-rw- 229/20      0 Mar 27 16:33 1998 ./mcnp4b/exec/difo06
rw-r--r-- 229/20   1472 Mar 27 16:34 1998 ./mcnp4b/exec/inp07m
rw-r--r-- 229/20 176554 Mar 27 16:34 1998 ./mcnp4b/exec/inp08o
```

```
rw-r--r-- 229/20 481295 Mar 27 16:34 1998 ./mcnp4b/exec/inp07w
rw-rw-rw- 229/20      0 Mar 27 16:34 1998 ./mcnp4b/exec/difm07
rw-rw-rw- 229/20      0 Mar 27 16:34 1998 ./mcnp4b/exec/difo07
rw-r--r-- 229/20    812 Mar 27 16:34 1998 ./mcnp4b/exec/inp08p
rw-r--r-- 229/20  57202 Mar 27 16:35 1998 ./mcnp4b/exec/inp09o
rw-r--r-- 229/20   3457 Mar 27 16:34 1998 ./mcnp4b/exec/inp08m
rw-rw-rw- 229/20      0 Mar 27 16:34 1998 ./mcnp4b/exec/difm08
rw-rw-rw- 229/20      0 Mar 27 16:34 1998 ./mcnp4b/exec/difo08
rw-r--r-- 229/20  17893 Mar 27 16:35 1998 ./mcnp4b/exec/inp09m
rw-r--r-- 229/20 180036 Mar 27 16:35 1998 ./mcnp4b/exec/inp09s
rw-r--r-- 229/20  17907 Mar 27 16:42 1998 ./mcnp4b/exec/inp27o
rw-r--r-- 229/20 180036 Mar 27 16:42 1998 ./mcnp4b/exec/inp26s
rw-rw-rw- 229/20      0 Mar 27 16:35 1998 ./mcnp4b/exec/difm09
rw-rw-rw- 229/20      0 Mar 27 16:35 1998 ./mcnp4b/exec/difo09
rw-r--r-- 229/20  31787 Mar 27 16:35 1998 ./mcnp4b/exec/inp10o
rw-r--r-- 229/20  56608 Mar 27 16:36 1998 ./mcnp4b/exec/inp11o
rw-r--r-- 229/20    748 Mar 27 16:35 1998 ./mcnp4b/exec/inp10m
rw-rw-rw- 229/20      0 Mar 27 16:35 1998 ./mcnp4b/exec/difm10
rw-rw-rw- 229/20      0 Mar 27 16:35 1998 ./mcnp4b/exec/difo10
rw-r--r-- 229/20 170494 Mar 27 16:37 1998 ./mcnp4b/exec/inp12o
rw-r--r-- 229/20   4562 Mar 27 16:36 1998 ./mcnp4b/exec/inp11m
rw-rw-rw- 229/20      0 Mar 27 16:36 1998 ./mcnp4b/exec/difm11
rw-rw-rw- 229/20      0 Mar 27 16:36 1998 ./mcnp4b/exec/difo11
rw-r--r-- 229/20  89657 Mar 27 16:37 1998 ./mcnp4b/exec/inp13o
rw-r--r-- 229/20   3600 Mar 27 16:37 1998 ./mcnp4b/exec/inp12m
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difm12
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difo12
rw-r--r-- 229/20  31715 Mar 27 16:37 1998 ./mcnp4b/exec/inp14o
rw-r--r-- 229/20   2889 Mar 27 16:37 1998 ./mcnp4b/exec/inp13m
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difm13
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difo13
rw-r--r-- 229/20  44841 Mar 27 16:37 1998 ./mcnp4b/exec/inp15o
rw-r--r-- 229/20   3212 Mar 27 16:37 1998 ./mcnp4b/exec/inp14m
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difm14
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difo14
rw-r--r-- 229/20  51524 Mar 27 16:37 1998 ./mcnp4b/exec/inp16o
rw-r--r-- 229/20    771 Mar 27 16:37 1998 ./mcnp4b/exec/inp15m
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difm15
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difo15
rw-rw-rw- 229/20   3971 Dec 18 08:32 1997 ./mcnp4b/exec/install
rw-rw-rw- 229/20   6603 Dec 18 08:32 1997 ./mcnp4b/exec/install.fix
rw-rw-rw- 229/20  74983 Dec 18 08:32 1997 ./mcnp4b/exec/install.log
rw-rw-rw- 229/20    632 Dec 18 08:32 1997 ./mcnp4b/exec/makemcnp
rw-rw-rw- 229/20 135165 Dec 18 08:32 1997 ./mcnp4b/exec/makxsf
rwxrwxrwx 229/20 1458176 Mar 27 16:29 1998 ./mcnp4b/exec/mcnp
rw-rw-rw- 229/20 188412 Dec 18 08:32 1997 ./mcnp4b/exec/mcsetup
rw-rw-rw- 229/20  38920 Dec 18 08:32 1997 ./mcnp4b/exec/mcsetup.for
rw-r--r-- 229/20  77712 Mar 27 16:38 1998 ./mcnp4b/exec/inp18o
rw-r--r-- 229/20   1366 Mar 27 16:37 1998 ./mcnp4b/exec/inp16m
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difm16
rw-rw-rw- 229/20      0 Mar 27 16:37 1998 ./mcnp4b/exec/difo16
rw-r--r-- 229/20 107636 Mar 27 16:38 1998 ./mcnp4b/exec/inp17o
rw-r--r-- 229/20 180036 Mar 27 16:38 1998 ./mcnp4b/exec/inp18s
rw-r--r-- 229/20  11346 Mar 27 16:38 1998 ./mcnp4b/exec/inp17m
rw-rw-rw- 229/20      0 Mar 27 16:38 1998 ./mcnp4b/exec/difm17
rw-rw-rw- 229/20      0 Mar 27 16:38 1998 ./mcnp4b/exec/difo17
rw-r--r-- 229/20   1443 Mar 27 16:38 1998 ./mcnp4b/exec/inp18p
rw-r--r-- 229/20  14787 Mar 27 16:39 1998 ./mcnp4b/exec/inp19o
rw-r--r-- 229/20   8487 Mar 27 16:38 1998 ./mcnp4b/exec/inp18m
rw-rw-rw- 229/20      0 Mar 27 16:38 1998 ./mcnp4b/exec/difm18
rw-rw-rw- 229/20      0 Mar 27 16:38 1998 ./mcnp4b/exec/difo18
rw-r--r-- 229/20  54656 Mar 27 16:39 1998 ./mcnp4b/exec/inp20o
rw-r--r-- 229/20   2414 Mar 27 16:39 1998 ./mcnp4b/exec/inp19m
rw-rw-rw- 229/20      0 Mar 27 16:39 1998 ./mcnp4b/exec/difm19
rw-rw-rw- 229/20      0 Mar 27 16:39 1998 ./mcnp4b/exec/difo19
rw-r--r-- 229/20  81680 Mar 27 16:40 1998 ./mcnp4b/exec/inp21o
rw-r--r-- 229/20   9663 Mar 27 16:39 1998 ./mcnp4b/exec/inp20m
rw-rw-rw- 229/20      0 Mar 27 16:39 1998 ./mcnp4b/exec/difm20
rw-rw-rw- 229/20    256 Mar 27 16:39 1998 ./mcnp4b/exec/difo20
rw-r--r-- 229/20  23069 Mar 27 16:40 1998 ./mcnp4b/exec/inp21m
```

```
rw-r--r-- 229/20  52192 Mar 27 16:40 1998 ./mcnp4b/exec/inp22o
rw-r--r-- 229/20 3420431 Mar 27 16:40 1998 ./mcnp4b/exec/inp21w
rw-rw-rw- 229/20      0 Mar 27 16:40 1998 ./mcnp4b/exec/difm21
rw-rw-rw- 229/20    468 Mar 27 16:40 1998 ./mcnp4b/exec/difo21
rw-r--r-- 229/20  91245 Mar 27 16:41 1998 ./mcnp4b/exec/inp23o
rw-r--r-- 229/20   1503 Mar 27 16:40 1998 ./mcnp4b/exec/inp22m
rw-rw-rw- 229/20      0 Mar 27 16:40 1998 ./mcnp4b/exec/difm22
rw-rw-rw- 229/20      0 Mar 27 16:40 1998 ./mcnp4b/exec/difo22
rw-r--r-- 229/20  31209 Mar 27 16:41 1998 ./mcnp4b/exec/inp23p
rw-r--r-- 229/20  33164 Mar 27 16:41 1998 ./mcnp4b/exec/inp24o
rw-r--r-- 229/20   2944 Mar 27 16:41 1998 ./mcnp4b/exec/inp23m
rw-rw-rw- 229/20      0 Mar 27 16:41 1998 ./mcnp4b/exec/difm23
rw-rw-rw- 229/20    388 Mar 27 16:41 1998 ./mcnp4b/exec/difo23
rw-r--r-- 229/20 180036 Mar 27 16:41 1998 ./mcnp4b/exec/inp24s
rw-r--r-- 229/20  57594 Mar 27 16:42 1998 ./mcnp4b/exec/inp26o
rw-r--r-- 229/20   1240 Mar 27 16:41 1998 ./mcnp4b/exec/inp24m
rw-rw-rw- 229/20      0 Mar 27 16:41 1998 ./mcnp4b/exec/difm24
rw-rw-rw- 229/20      0 Mar 27 16:41 1998 ./mcnp4b/exec/difo24
rw-r--r-- 229/20  17877 Mar 27 16:41 1998 ./mcnp4b/exec/inp25o
rw-r--r-- 229/20 180036 Mar 27 16:41 1998 ./mcnp4b/exec/inp25s
rw-r--r-- 229/20   1472 Mar 27 16:41 1998 ./mcnp4b/exec/inp25m
rw-rw-rw- 229/20      0 Mar 27 16:41 1998 ./mcnp4b/exec/difm25
rw-rw-rw- 229/20      0 Mar 27 16:41 1998 ./mcnp4b/exec/difo25
rw-r--r-- 229/20  18897 Mar 27 16:42 1998 ./mcnp4b/exec/inp26m
rw-r--r-- 229/20 644815 Mar 27 16:41 1998 ./mcnp4b/exec/inp09w
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difm26
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difo26
rw-r--r-- 229/20  37974 Mar 27 16:42 1998 ./mcnp4b/exec/inp28m
rw-r--r-- 229/20   3062 Mar 27 16:42 1998 ./mcnp4b/exec/inp27m
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difm27
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difo27
rw-r--r-- 229/20 144379 Mar 27 16:42 1998 ./mcnp4b/exec/inp28o
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difm28
rw-r--r-- 229/20  36905 Mar 27 16:43 1998 ./mcnp4b/exec/inp29o
rw-rw-rw- 229/20 258045 Dec 18 08:32 1997 ./mcnp4b/exec/prpr
rw-rw-rw- 229/20  13492 Dec 18 08:32 1997 ./mcnp4b/exec/readmaag
rw-rw-rw- 229/20   4871 Dec 18 08:32 1997 ./mcnp4b/exec/runpraad
rwxrwxrwx 229/20   3264 Dec 18 08:32 1997 ./mcnp4b/exec/runprob
rw-rw-rw- 229/20  22914 Dec 18 08:32 1997 ./mcnp4b/exec/testdir
rw-rw-rw- 229/20 196608 Dec 18 08:36 1997 ./mcnp4b/exec/testinp.tar
rw-rw-rw- 229/20 16038097 Dec 18 08:36 1997 ./mcnp4b/exec/testlib1
rw-rw-rw- 229/20 262144 Dec 18 08:33 1997 ./mcnp4b/exec/testmaae
rw-rw-rw- 229/20 235520 Dec 18 08:33 1997 ./mcnp4b/exec/testmctl.hp
rw-rw-rw- 229/20 2097152 Dec 18 08:33 1997 ./mcnp4b/exec/testoaaf
rw-rw-rw- 229/20 2048000 Dec 18 08:33 1997 ./mcnp4b/exec/testoutp.hp
rw-rw-rw- 229/20      0 Mar 27 16:42 1998 ./mcnp4b/exec/difo28
rw-r--r-- 229/20   1380 Mar 27 16:43 1998 ./mcnp4b/exec/inp29m
rw-rw-rw- 229/20      0 Mar 27 16:43 1998 ./mcnp4b/exec/difm29
rw-rw-rw- 229/20      0 Mar 27 16:43 1998 ./mcnp4b/exec/difo29
rwxrwxrwx 229/20      0 Apr  1 08:13 1998 ./mcnp4b/ver-val/
rwxrwxrwx 229/20      0 Mar 31 16:13 1998 ./mcnp4b/ver-val/endf5/
rw-rw-rw- 229/20   5723 Dec 18 09:27 1997 ./mcnp4b/ver-val/endf5/exp1
rw-rw-rw- 229/20   7650 Dec 18 09:27 1997 ./mcnp4b/ver-val/endf5/exp2
rw-rw-rw- 229/20   6813 Dec 18 09:27 1997 ./mcnp4b/ver-val/endf5/exp3
rw-rw-rw- 229/20   7127 Dec 18 09:27 1997 ./mcnp4b/ver-val/endf5/exp4
rw-rw-rw- 229/20   5160 Dec 18 14:18 1997 ./mcnp4b/ver-val/endf5/exp22
rw-rw-rw- 229/20   5259 Dec 18 14:18 1997 ./mcnp4b/ver-val/endf5/exp23
rw-rw-rw- 229/20   7117 Dec 18 14:18 1997 ./mcnp4b/ver-val/endf5/exp24a
rw-rw-rw- 229/20   6146 Dec 18 14:18 1997 ./mcnp4b/ver-val/endf5/exp25
rw-rw-rw- 229/20   5420 Dec 18 14:19 1997 ./mcnp4b/ver-val/endf5/exp26
rw-rw-rw- 229/20   6474 Dec 18 14:19 1997 ./mcnp4b/ver-val/endf5/exp27
rwxr-xr-x 229/20   1012 Mar 30 08:58 1998 ./mcnp4b/ver-val/endf5/runexp
rw-r--r-- 229/20 1849757 Mar 27 18:01 1998 ./mcnp4b/ver-val/endf5/exp1o
rw-r--r-- 229/20 1953283 Mar 27 19:30 1998 ./mcnp4b/ver-val/endf5/exp2o
rw-r--r-- 229/20 1868546 Mar 27 21:03 1998 ./mcnp4b/ver-val/endf5/exp3o
rwxr-xr-x 229/20      0 Mar 27 16:53 1998 ./mcnp4b/ver-val/endf5/mcnp symbolic link to
../../exec/mcnp
rwxrwxrwx 229/20      0 Dec 18 09:28 1997 ./mcnp4b/ver-val/endf5/xsdir symbolic link to
../../xslib/xsdir
rw-r--r-- 229/20 1871778 Mar 27 22:34 1998 ./mcnp4b/ver-val/endf5/exp4o
```


INFORMATION ONLY

```
rw-r--r-- 229/20 907025 Mar 28 00:22 1998 ./mcnp4b/ver-val/endf5/exp22o
rw-r--r-- 229/20 935259 Mar 28 01:44 1998 ./mcnp4b/ver-val/endf5/exp23o
rw-r--r-- 229/20   4283 Dec 19 10:19 1997 ./mcnp4b/ver-val/endf5/LA3X5
rw-r--r-- 229/20 4108230 Mar 28 03:28 1998 ./mcnp4b/ver-val/endf5/exp24ao
rw-r--r-- 229/20 943720 Mar 28 04:30 1998 ./mcnp4b/ver-val/endf5/exp25o
rw-r--r-- 229/20 853252 Mar 28 06:12 1998 ./mcnp4b/ver-val/endf5/exp26o
rw-r--r-- 229/20 903209 Mar 28 07:15 1998 ./mcnp4b/ver-val/endf5/exp27o
rw-r--r-- 229/20 240805 Mar 28 09:14 1998 ./mcnp4b/ver-val/endf5/LA1X5o
rw-r--r-- 229/20 209766 Mar 28 09:21 1998 ./mcnp4b/ver-val/endf5/LA2X5o
rw-r--r-- 229/20 271384 Mar 28 09:39 1998 ./mcnp4b/ver-val/endf5/LA3X5o
rw-r--r-- 229/20    418 Dec 19 08:41 1997 ./mcnp4b/ver-val/endf5/LA2X5
rw-r--r-- 229/20    325 Dec 19 08:35 1997 ./mcnp4b/ver-val/endf5/LA1X5
rwxrwxrwx 229/20      0 Mar 31 16:13 1998 ./mcnp4b/ver-val/endf6/
rw-r--r-- 229/20   3169 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob1
rwxr-xr-x 229/20      0 Mar 27 16:53 1998 ./mcnp4b/ver-val/endf6/mcnp symbolic link to
../../exec/mcnp
rw-r--r-- 229/20   4094 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob12
rw-r--r-- 229/20 325631 Mar 27 17:48 1998 ./mcnp4b/ver-val/endf6/prob1o
rw-r--r-- 229/20   1603 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob13
rw-r--r-- 229/20   2694 Mar 31 16:13 1998 ./mcnp4b/ver-val/endf6/gak
rw-r--r-- 229/20   2383 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob14
rw-r--r-- 229/20   1440 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob15
rw-r--r-- 229/20   1866 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob16
rw-r--r-- 229/20 369635 Mar 27 23:00 1998 ./mcnp4b/ver-val/endf6/prob3no
rw-r--r-- 229/20   4174 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob18
rw-r--r-- 229/20   3109 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob20
rw-r--r-- 229/20   4270 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob3
rw-r--r-- 229/20   1689 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob6
rw-r--r-- 229/20   1755 Dec 18 11:01 1997 ./mcnp4b/ver-val/endf6/prob7
rw-r--r-- 229/20 295003 Mar 27 23:07 1998 ./mcnp4b/ver-val/endf6/prob6o
rw-r--r-- 229/20    325 Dec 18 11:02 1997 ./mcnp4b/ver-val/endf6/LA1X
rw-r--r-- 229/20    475 Dec 18 11:02 1997 ./mcnp4b/ver-val/endf6/LA2X
rw-r--r-- 229/20   5050 Dec 18 11:02 1997 ./mcnp4b/ver-val/endf6/LA3
rwxr-x--x 229/20   1238 Mar 27 16:53 1998 ./mcnp4b/ver-val/endf6/rune6
rw-r--r-- 229/20 295226 Mar 27 23:17 1998 ./mcnp4b/ver-val/endf6/prob7o
rwxrwxrwx 229/20      0 Dec 18 18:08 1997 ./mcnp4b/ver-val/endf6/xsdir symbolic link to
../../xslib/xsdir
rw-r--r-- 229/20   4269 Dec 19 16:09 1997 ./mcnp4b/ver-val/endf6/prob3n
rw-r--r-- 229/20 317231 Mar 27 23:38 1998 ./mcnp4b/ver-val/endf6/prob12o
rw-r--r-- 229/20 305270 Mar 27 23:46 1998 ./mcnp4b/ver-val/endf6/prob13o
rw-r--r-- 229/20 308612 Mar 27 23:55 1998 ./mcnp4b/ver-val/endf6/prob14o
rw-r--r-- 229/20 276132 Mar 28 03:34 1998 ./mcnp4b/ver-val/endf6/prob15o
rw-r--r-- 229/20 310065 Mar 28 04:11 1998 ./mcnp4b/ver-val/endf6/prob16o
rw-r--r-- 229/20 312453 Mar 28 07:33 1998 ./mcnp4b/ver-val/endf6/prob18o
rw-r--r-- 229/20 325086 Mar 28 08:00 1998 ./mcnp4b/ver-val/endf6/prob20o
rw-r--r-- 229/20 240797 Mar 28 09:39 1998 ./mcnp4b/ver-val/endf6/LA1Xo
rw-r--r-- 229/20 210075 Mar 28 09:44 1998 ./mcnp4b/ver-val/endf6/LA2Xo
rw-r--r-- 229/20 287883 Mar 28 09:56 1998 ./mcnp4b/ver-val/endf6/LA3o
rw-r--r-- 229/20 175648 Mar 28 09:59 1998 ./mcnp4b/ver-val/endf6/godivao
rw-r--r-- 229/20 175420 Mar 28 10:01 1998 ./mcnp4b/ver-val/endf6/jez20o
rw-r--r-- 229/20 110017 Mar 28 10:02 1998 ./mcnp4b/ver-val/endf6/jez4.5o
rw-r--r-- 229/20    221 Dec 19 09:35 1997 ./mcnp4b/ver-val/endf6/jez20
rw-r--r-- 229/20    228 Dec 19 09:35 1997 ./mcnp4b/ver-val/endf6/jez4.5
rw-r--r-- 229/20    223 Dec 19 09:35 1997 ./mcnp4b/ver-val/endf6/godiva
rwxr-xr-x 229/20      0 Jan  7 10:59 1998 ./mcnp4b/ver-val/plots/
rw-r--r-- 229/20   5723 Jan  5 17:09 1998 ./mcnp4b/ver-val/plots/exp1
rwxr-xr-x 229/20      0 Jan  5 16:50 1998 ./mcnp4b/ver-val/plots/mcnp symbolic link to
/opt/neut/MCNP4B/mcnp
rwxr-xr-x 229/20      0 Jan  5 16:51 1998 ./mcnp4b/ver-val/plots/xsdir symbolic link to
/opt/neut/MCNP4B/xslib/xsdir
rw-r--r-- 229/20   5160 Jan  6 08:25 1998 ./mcnp4b/ver-val/plots/exp22
rw-r--r-- 229/20   5259 Jan  6 08:25 1998 ./mcnp4b/ver-val/plots/exp23
rw-r--r-- 229/20   6146 Jan  6 08:25 1998 ./mcnp4b/ver-val/plots/exp25
rw-r--r-- 229/20   7650 Jan  5 17:09 1998 ./mcnp4b/ver-val/plots/exp2
rw-r--r-- 229/20   6813 Jan  5 17:09 1998 ./mcnp4b/ver-val/plots/exp3
rw-r--r-- 229/20   7127 Jan  5 17:09 1998 ./mcnp4b/ver-val/plots/exp4
rw-r--r-- 229/20   5420 Jan  6 08:25 1998 ./mcnp4b/ver-val/plots/exp26
rw-r--r-- 229/20   6474 Jan  6 08:25 1998 ./mcnp4b/ver-val/plots/exp27
rw-r--r-- 229/20  30633 Jan  7 10:38 1998 ./mcnp4b/ver-val/plots/exp22o
rw-r--r-- 229/20      0 Jan  7 10:33 1998 ./mcnp4b/ver-val/plots/exp22s
```

```
rw-r--r-- 229/20   1377 Jan  7 10:38 1998 ./mcnp4b/ver-val/plots/exp22c
rw-r--r-- 229/20  29553 Jan  7 10:39 1998 ./mcnp4b/ver-val/plots/exp23o
rw-r--r-- 229/20      0 Jan  7 10:38 1998 ./mcnp4b/ver-val/plots/exp23s
rw-r--r-- 229/20    243 Jan  7 10:39 1998 ./mcnp4b/ver-val/plots/exp23c
rw-r--r-- 229/20  31403 Jan  7 10:40 1998 ./mcnp4b/ver-val/plots/exp24ao
rw-r--r-- 229/20 897537 Jan  5 17:01 1998 ./mcnp4b/ver-val/plots/exp1xy.xwd
rw-r--r-- 229/20 897537 Jan  5 17:06 1998 ./mcnp4b/ver-val/plots/exp1xz.xwd
rw-r--r-- 229/20 897537 Jan  5 17:07 1998 ./mcnp4b/ver-val/plots/exp1yz.xwd
rw-r--r-- 229/20 897537 Jan  5 17:11 1998 ./mcnp4b/ver-val/plots/exp2xy.xwd
rw-r--r-- 229/20 897537 Jan  5 17:16 1998 ./mcnp4b/ver-val/plots/exp2xz.xwd
rw-r--r-- 229/20 897537 Jan  5 17:18 1998 ./mcnp4b/ver-val/plots/exp2yz.xwd
rw-r--r-- 229/20 897537 Jan  6 08:01 1998 ./mcnp4b/ver-val/plots/exp3xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:07 1998 ./mcnp4b/ver-val/plots/exp3xz.xwd
rw-r--r-- 229/20 897537 Jan  6 08:08 1998 ./mcnp4b/ver-val/plots/exp3yz.xwd
rw-r--r-- 229/20 897537 Jan  6 08:15 1998 ./mcnp4b/ver-val/plots/exp4xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:19 1998 ./mcnp4b/ver-val/plots/exp4xz.xwd
rw-r--r-- 229/20      0 Jan  7 10:39 1998 ./mcnp4b/ver-val/plots/exp24as
rw-r--r-- 229/20    162 Jan  7 10:40 1998 ./mcnp4b/ver-val/plots/exp24ac
rw-r--r-- 229/20  29553 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/exp25o
rw-r--r-- 229/20      0 Jan  7 10:40 1998 ./mcnp4b/ver-val/plots/exp25s
rw-r--r-- 229/20    243 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/exp25c
rw-r--r-- 229/20  29173 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/exp26o
rw-r--r-- 229/20      0 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/exp26s
rw-r--r-- 229/20    243 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/exp26c
rw-r--r-- 229/20   7117 Jan  6 08:53 1998 ./mcnp4b/ver-val/plots/exp24a
rw-r--r-- 229/20  30211 Jan  7 10:42 1998 ./mcnp4b/ver-val/plots/exp27o
rw-r--r-- 229/20      0 Jan  7 10:42 1998 ./mcnp4b/ver-val/plots/exp27s
rw-r--r-- 229/20    243 Jan  7 10:42 1998 ./mcnp4b/ver-val/plots/exp27c
rw-r--r-- 229/20 897537 Jan  6 08:32 1998 ./mcnp4b/ver-val/plots/exp22xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:39 1998 ./mcnp4b/ver-val/plots/exp22xz.xwd
rw-r--r-- 229/20 897537 Jan  6 08:41 1998 ./mcnp4b/ver-val/plots/exp22yz.xwd
rw-r--r-- 229/20 897537 Jan  6 08:45 1998 ./mcnp4b/ver-val/plots/exp23xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:57 1998 ./mcnp4b/ver-val/plots/exp24xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:48 1998 ./mcnp4b/ver-val/plots/exp25xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:50 1998 ./mcnp4b/ver-val/plots/exp26xy.xwd
rw-r--r-- 229/20 897537 Jan  6 08:52 1998 ./mcnp4b/ver-val/plots/exp27xy.xwd
rw-r--r-- 229/20  54022 Jan  7 09:18 1998 ./mcnp4b/ver-val/plots/exp1xy.gif
rw-r--r-- 229/20  95512 Jan  7 09:19 1998 ./mcnp4b/ver-val/plots/exp1xz.gif
rw-r--r-- 229/20  51060 Jan  7 09:20 1998 ./mcnp4b/ver-val/plots/exp1yz.gif
rw-r--r-- 229/20  69669 Jan  7 09:20 1998 ./mcnp4b/ver-val/plots/exp22xy.gif
rw-r--r-- 229/20  79441 Jan  7 09:21 1998 ./mcnp4b/ver-val/plots/exp22xz.gif
rw-r--r-- 229/20  79631 Jan  7 09:21 1998 ./mcnp4b/ver-val/plots/exp22yz.gif
rw-r--r-- 229/20  85422 Jan  7 09:42 1998 ./mcnp4b/ver-val/plots/exp23xy.gif
rw-r--r-- 229/20  59898 Jan  7 09:26 1998 ./mcnp4b/ver-val/plots/exp24xy.gif
rw-r--r-- 229/20  91121 Jan  7 09:27 1998 ./mcnp4b/ver-val/plots/exp25xy.gif
rw-r--r-- 229/20  85639 Jan  7 09:27 1998 ./mcnp4b/ver-val/plots/exp26xy.gif
rw-r--r-- 229/20  86663 Jan  7 09:28 1998 ./mcnp4b/ver-val/plots/exp27xy.gif
rw-r--r-- 229/20  54055 Jan  7 09:28 1998 ./mcnp4b/ver-val/plots/exp2xy.gif
rw-r--r-- 229/20  97436 Jan  7 09:29 1998 ./mcnp4b/ver-val/plots/exp2xz.gif
rw-r--r-- 229/20  51536 Jan  7 09:29 1998 ./mcnp4b/ver-val/plots/exp2yz.gif
rw-r--r-- 229/20  54000 Jan  7 09:29 1998 ./mcnp4b/ver-val/plots/exp3xy.gif
rw-r--r-- 229/20  97078 Jan  7 09:30 1998 ./mcnp4b/ver-val/plots/exp3xz.gif
rw-r--r-- 229/20  51583 Jan  7 09:30 1998 ./mcnp4b/ver-val/plots/exp3yz.gif
rw-r--r-- 229/20  53775 Jan  7 09:31 1998 ./mcnp4b/ver-val/plots/exp4xy.gif
rw-r--r-- 229/20  96591 Jan  7 09:31 1998 ./mcnp4b/ver-val/plots/exp4xz.gif
rw-r--r-- 229/20  32011 Jan  7 10:44 1998 ./mcnp4b/ver-val/plots/exp1o
rw-r--r-- 229/20      0 Jan  7 10:43 1998 ./mcnp4b/ver-val/plots/exp1s
rw-r--r-- 229/20    324 Jan  7 10:44 1998 ./mcnp4b/ver-val/plots/exp1c
rw-r--r-- 229/20  44122 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/exp2o
rw-r--r-- 229/20      0 Jan  7 10:44 1998 ./mcnp4b/ver-val/plots/exp2s
rw-r--r-- 229/20    324 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/exp2c
rw-r--r-- 229/20  38806 Jan  7 10:47 1998 ./mcnp4b/ver-val/plots/exp3o
rw-r--r-- 229/20      0 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/exp3s
rw-r--r-- 229/20    324 Jan  7 10:47 1998 ./mcnp4b/ver-val/plots/exp3c
rw-r--r-- 229/20  40453 Jan  7 10:49 1998 ./mcnp4b/ver-val/plots/exp4o
rw-r--r-- 229/20      0 Jan  7 10:47 1998 ./mcnp4b/ver-val/plots/exp4s
rw-r--r-- 229/20    324 Jan  7 10:49 1998 ./mcnp4b/ver-val/plots/exp4c
rw-r--r-- 229/20 897537 Jan  7 10:43 1998 ./mcnp4b/ver-val/plots/xe1xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:44 1998 ./mcnp4b/ver-val/plots/xe1xz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:44 1998 ./mcnp4b/ver-val/plots/xe1yz.xwd
```

```
rw-r--r-- 229/20 897537 Jan  7 10:32 1998 ./mcnp4b/ver-val/plots/xe22xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:36 1998 ./mcnp4b/ver-val/plots/xe22xz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:37 1998 ./mcnp4b/ver-val/plots/xe22yz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:39 1998 ./mcnp4b/ver-val/plots/xe23xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:40 1998 ./mcnp4b/ver-val/plots/xe24axy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/xe25xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:41 1998 ./mcnp4b/ver-val/plots/xe26xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:42 1998 ./mcnp4b/ver-val/plots/xe27xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/xe2xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/xe2xz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:45 1998 ./mcnp4b/ver-val/plots/xe2yz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:46 1998 ./mcnp4b/ver-val/plots/xe3xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:47 1998 ./mcnp4b/ver-val/plots/xe3xz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:47 1998 ./mcnp4b/ver-val/plots/xe3yz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:48 1998 ./mcnp4b/ver-val/plots/xe4xy.xwd
rw-r--r-- 229/20 897537 Jan  7 10:48 1998 ./mcnp4b/ver-val/plots/xe4xz.xwd
rw-r--r-- 229/20 897537 Jan  7 10:48 1998 ./mcnp4b/ver-val/plots/xe4yz.xwd
rw-r--r-- 229/20  13688 Jan  7 10:50 1998 ./mcnp4b/ver-val/plots/xe1xy.gif
rw-r--r-- 229/20  19937 Jan  7 10:51 1998 ./mcnp4b/ver-val/plots/xe1xz.gif
rw-r--r-- 229/20  11054 Jan  7 10:52 1998 ./mcnp4b/ver-val/plots/xe1yz.gif
rw-r--r-- 229/20  16208 Jan  7 10:52 1998 ./mcnp4b/ver-val/plots/xe22xy.gif
rw-r--r-- 229/20  18808 Jan  7 10:53 1998 ./mcnp4b/ver-val/plots/xe22xz.gif
rw-r--r-- 229/20  18238 Jan  7 10:53 1998 ./mcnp4b/ver-val/plots/xe22yz.gif
rw-r--r-- 229/20  17034 Jan  7 10:53 1998 ./mcnp4b/ver-val/plots/xe23xy.gif
rw-r--r-- 229/20  13346 Jan  7 10:54 1998 ./mcnp4b/ver-val/plots/xe24axy.gif
rw-r--r-- 229/20  21022 Jan  7 10:54 1998 ./mcnp4b/ver-val/plots/xe25xy.gif
rw-r--r-- 229/20  15173 Jan  7 10:55 1998 ./mcnp4b/ver-val/plots/xe26xy.gif
rw-r--r-- 229/20  17581 Jan  7 10:55 1998 ./mcnp4b/ver-val/plots/xe27xy.gif
rw-r--r-- 229/20  14431 Jan  7 10:56 1998 ./mcnp4b/ver-val/plots/xe2xy.gif
rw-r--r-- 229/20  21050 Jan  7 10:56 1998 ./mcnp4b/ver-val/plots/xe2xz.gif
rw-r--r-- 229/20  11490 Jan  7 10:57 1998 ./mcnp4b/ver-val/plots/xe2yz.gif
rw-r--r-- 229/20  14098 Jan  7 10:57 1998 ./mcnp4b/ver-val/plots/xe3xy.gif
rw-r--r-- 229/20  20600 Jan  7 10:58 1998 ./mcnp4b/ver-val/plots/xe3xz.gif
rw-r--r-- 229/20  11382 Jan  7 10:58 1998 ./mcnp4b/ver-val/plots/xe3yz.gif
rw-r--r-- 229/20  14040 Jan  7 10:58 1998 ./mcnp4b/ver-val/plots/xe4xy.gif
rw-r--r-- 229/20  20612 Jan  7 10:59 1998 ./mcnp4b/ver-val/plots/xe4xz.gif
rw-r--r-- 229/20  11386 Jan  7 10:59 1998 ./mcnp4b/ver-val/plots/xe4yz.gif
rwxr-xr-x 229/20      0 Mar 31 16:22 1998 ./mcnp4b/ver-val/4b2fix/
rw-r--r-- 229/20   8851 Mar 30 14:49 1998 ./mcnp4b/ver-val/4b2fix/bug4b2
rw-r--r-- 229/20 2072332 Mar 30 15:02 1998 ./mcnp4b/ver-val/4b2fix/bug4b2o
rwxr-xr-x 229/20      0 Mar 30 14:49 1998 ./mcnp4b/ver-val/4b2fix/xsdir symbolic link to
/opt/neut/MCNP4B/xslib/xsdir
rwxr-x--- 229/20      0 Mar 31 16:19 1998 ./mcnp4b/ver-val/shield/
rw-r----- 229/20  36661 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/mc10new
rw-r----- 229/20   1457 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.1
rw-r----- 229/20   1575 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.11
rw-r----- 229/20   1639 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.12
rw-r----- 229/20   1898 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.13
rw-r----- 229/20   2117 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.14
rw-r----- 229/20   2361 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.15
rw-r----- 229/20   1521 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.2
rw-r----- 229/20   1857 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.21
rw-r----- 229/20   2123 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.22
rw-r----- 229/20   2412 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.24
rw-r----- 229/20   2598 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.25
rw-r----- 229/20   2855 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.26
rw-r----- 229/20   4103 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.27
rw-r----- 229/20   1780 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.3
rw-r----- 229/20   1479 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.31
rw-r----- 229/20   1543 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.32
rw-r----- 229/20   1802 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.33
rw-r----- 229/20   2021 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.34
rw-r----- 229/20   2265 Feb 20 13:38 1998 ./mcnp4b/ver-val/shield/ueki.35
rw-r----- 229/20   1999 Feb 13 14:37 1998 ./mcnp4b/ver-val/shield/ueki.4
rw-r----- 229/20   2248 Feb 20 14:31 1998 ./mcnp4b/ver-val/shield/ueki.5
rwxr-xr-x 229/20      0 Feb 24 09:39 1998 ./mcnp4b/ver-val/shield/plots/
rw-r----- 229/20  36661 Feb 13 15:00 1998 ./mcnp4b/ver-val/shield/plots/mc10new
rw-r----- 229/20  33048 Feb 13 14:40 1998 ./mcnp4b/ver-val/shield/plots/mc10rg2
rw-r----- 229/20  36380 Feb 13 14:40 1998 ./mcnp4b/ver-val/shield/plots/mc10rgd2
rw-r----- 229/20   1457 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.1
```

```
rwxr-xr-x 229/20      0 Feb 23 14:14 1998 ./mcnp4b/ver-val/shield/plots/mcnp symbolic link to
/opt/neut/MCNP4B/mcnp
rw-r----- 229/20   1575 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.11
rw-r----- 229/20   1639 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.12
rw-r--r-- 229/20 897537 Feb 13 15:06 1998 ./mcnp4b/ver-val/shield/plots/mc10newpz.xwd
rw-r--r-- 229/20 897537 Feb 13 15:07 1998 ./mcnp4b/ver-val/shield/plots/mc10newpx.xwd
rw-r--r-- 229/20 897537 Feb 13 14:49 1998 ./mcnp4b/ver-val/shield/plots/mc10rg2pz.xwd
rw-r--r-- 229/20 897537 Feb 13 14:59 1998 ./mcnp4b/ver-val/shield/plots/mc10rg2px.xwd
rw-r----- 229/20   1898 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.13
rw-r----- 229/20   2117 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.14
rw-r----- 229/20   2361 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.15
rw-r----- 229/20   1521 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.2
rw-r----- 229/20   1857 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.21
rw-r----- 229/20   2123 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.22
rw-r----- 229/20   2412 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.24
rw-r----- 229/20   2598 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.25
rw-r----- 229/20   2855 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.26
rw-r----- 229/20   4103 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.27
rw-r----- 229/20   1780 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.3
rw-r----- 229/20   1479 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.31
rw-r----- 229/20   1543 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.32
rw-r----- 229/20   1802 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.33
rw-r----- 229/20   2021 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.34
rw-r----- 229/20   2265 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.35
rw-r----- 229/20   1999 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.4
rw-r----- 229/20   2243 Feb 13 15:08 1998 ./mcnp4b/ver-val/shield/plots/ueki.5
rwxr-xr-x 229/20      0 Feb 18 11:48 1998 ./mcnp4b/ver-val/shield/plots/mc10rgd symbolic link to
mc10rgd2
rwxr-xr-x 229/20      0 Feb 23 14:14 1998 ./mcnp4b/ver-val/shield/plots/xsdir symbolic link to
/opt/neut/MCNP4B/xslib/xsdir
rw-r--r-- 229/20  12860 Feb 23 09:58 1998 ./mcnp4b/ver-val/shield/plots/ueki.26o
rw-r--r-- 229/20 897537 Feb 13 15:21 1998 ./mcnp4b/ver-val/shield/plots/ueki1.xwd
rw-r--r-- 229/20 115783 Feb 18 11:45 1998 ./mcnp4b/ver-val/shield/plots/mc10rg2o
rw-r--r-- 229/20 897537 Feb 13 15:21 1998 ./mcnp4b/ver-val/shield/plots/ueki2.xwd
rw-r--r-- 229/20    243 Feb 18 11:45 1998 ./mcnp4b/ver-val/shield/plots/mc10rg2c
rw-r--r-- 229/20 897537 Feb 13 15:22 1998 ./mcnp4b/ver-val/shield/plots/ueki3.xwd
rw-r--r-- 229/20 114545 Feb 23 14:30 1998 ./mcnp4b/ver-val/shield/plots/mc10newpx.gif
rw-r--r-- 229/20 897537 Feb 13 15:23 1998 ./mcnp4b/ver-val/shield/plots/ueki4.xwd
rw-r--r-- 229/20  94604 Feb 23 14:32 1998 ./mcnp4b/ver-val/shield/plots/mc10newpz.gif
rw-r--r-- 229/20 897537 Feb 13 15:24 1998 ./mcnp4b/ver-val/shield/plots/ueki5.xwd
rw-r--r-- 229/20    810 Feb 23 09:58 1998 ./mcnp4b/ver-val/shield/plots/ueki.26c
rw-r--r-- 229/20 139141 Feb 18 11:49 1998 ./mcnp4b/ver-val/shield/plots/mc10rgdo
rw-r--r-- 229/20    162 Feb 18 11:49 1998 ./mcnp4b/ver-val/shield/plots/mc10rgdc
rw-r--r-- 229/20 130761 Feb 18 11:47 1998 ./mcnp4b/ver-val/shield/plots/mc10newo
rw-r--r-- 229/20 897537 Feb 13 15:26 1998 ./mcnp4b/ver-val/shield/plots/ueki11.xwd
rw-r--r-- 229/20    162 Feb 18 11:47 1998 ./mcnp4b/ver-val/shield/plots/mc10newc
rwxr-xr-x 229/20      0 Feb 23 15:29 1998 ./mcnp4b/ver-val/shield/xsdir symbolic link to
/opt/neut/MCNP4B/xslib/xsdir
rwxr-xr-x 229/20      0 Mar 27 16:58 1998 ./mcnp4b/ver-val/shield/mcnp symbolic link to
../../exec/mcnp
rw-r--r-- 229/20  25500 Mar 30 08:34 1998 ./mcnp4b/ver-val/shield/ueki.1o
rw-r--r-- 229/20 429535 Mar 30 14:31 1998 ./mcnp4b/ver-val/shield/mc10newo
rwxr-xr-x 229/20    116 Mar 27 17:01 1998 ./mcnp4b/ver-val/shield/runshld2
rw-r--r-- 229/20  26811 Mar 30 08:36 1998 ./mcnp4b/ver-val/shield/ueki.11o
rwxr-xr-x 229/20    117 Mar 27 17:01 1998 ./mcnp4b/ver-val/shield/runshld1
rw-r--r-- 229/20  22074 Mar 30 08:38 1998 ./mcnp4b/ver-val/shield/ueki.12o
rw-r--r-- 229/20  30015 Mar 30 08:41 1998 ./mcnp4b/ver-val/shield/ueki.13o
rw-r--r-- 229/20  26703 Mar 30 08:46 1998 ./mcnp4b/ver-val/shield/ueki.14o
rw-r--r-- 229/20  29000 Mar 30 09:14 1998 ./mcnp4b/ver-val/shield/ueki.15o
rw-r--r-- 229/20  20896 Mar 30 09:16 1998 ./mcnp4b/ver-val/shield/ueki.2o
rw-r--r-- 229/20  28831 Mar 30 09:16 1998 ./mcnp4b/ver-val/shield/ueki.21o
rw-r--r-- 229/20  26284 Mar 30 09:23 1998 ./mcnp4b/ver-val/shield/ueki.22o
rw-r--r-- 229/20  28540 Mar 30 09:34 1998 ./mcnp4b/ver-val/shield/ueki.24o
rw-r--r-- 229/20  29776 Mar 30 09:48 1998 ./mcnp4b/ver-val/shield/ueki.25o
rw-r--r-- 229/20  32588 Mar 30 10:10 1998 ./mcnp4b/ver-val/shield/ueki.26o
rw-r--r-- 229/20  49473 Mar 30 10:29 1998 ./mcnp4b/ver-val/shield/ueki.27o
rw-r--r-- 229/20  23023 Mar 30 10:31 1998 ./mcnp4b/ver-val/shield/ueki.3o
rw-r--r-- 229/20  25727 Mar 30 10:33 1998 ./mcnp4b/ver-val/shield/ueki.31o
rw-r--r-- 229/20  26333 Mar 30 10:36 1998 ./mcnp4b/ver-val/shield/ueki.32o
rw-r--r-- 229/20  29570 Mar 30 10:39 1998 ./mcnp4b/ver-val/shield/ueki.33o
```

```
rw-r--r-- 229/20  32951 Mar 30 10:47 1998 ./mcnp4b/ver-val/shield/ueki.34o
rw-r--r-- 229/20  35495 Mar 30 11:23 1998 ./mcnp4b/ver-val/shield/ueki.35o
rw-r--r-- 229/20  25594 Mar 30 11:30 1998 ./mcnp4b/ver-val/shield/ueki.4o
rw-r--r-- 229/20  28554 Mar 30 12:34 1998 ./mcnp4b/ver-val/shield/ueki.5o
rwxr-xr-x 229/20      0 Mar 31 08:16 1998 ./mcnp4b/ver-val/smlset/
rw-r--r-- 229/20   8851 Mar 31 08:01 1998 ./mcnp4b/ver-val/smlset/bug4b2
rw-r--r-- 229/20   5723 Mar 31 08:03 1998 ./mcnp4b/ver-val/smlset/exp1
rw-r--r-- 229/20 2072332 Mar 31 08:01 1998 ./mcnp4b/ver-val/smlset/bug4b2o
rw-r--r-- 229/20 1849757 Mar 31 08:03 1998 ./mcnp4b/ver-val/smlset/exp1o
rw-r--r-- 229/20   6474 Mar 31 08:03 1998 ./mcnp4b/ver-val/smlset/exp27
rw-r--r-- 229/20 903209 Mar 31 08:03 1998 ./mcnp4b/ver-val/smlset/exp27o
rw-r--r-- 229/20   3169 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/prob1
rw-r--r-- 229/20 325631 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/prob1o
rw-r--r-- 229/20   3109 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/prob20
rw-r--r-- 229/20 325086 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/prob20o
rw-r--r-- 229/20    325 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/LA1X
rw-r--r-- 229/20 240797 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/LA1Xo
rw-r--r-- 229/20   5050 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/LA3
rw-r--r-- 229/20 287883 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/LA3o
rw-r--r-- 229/20    223 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/godiva
rw-r--r-- 229/20 175648 Mar 31 08:04 1998 ./mcnp4b/ver-val/smlset/godivao
rw-r--r-- 229/20    228 Mar 31 08:05 1998 ./mcnp4b/ver-val/smlset/jez4.5
rw-r--r-- 229/20 110017 Mar 31 08:05 1998 ./mcnp4b/ver-val/smlset/jez4.5o
rw-r----- 229/20   1999 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.4
rw-r--r-- 229/20  25594 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.4o
rw-r----- 229/20   2117 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.14
rw-r--r-- 229/20  26703 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.14o
rw-r----- 229/20   2412 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.24
rw-r--r-- 229/20  28540 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.24o
rw-r----- 229/20   2021 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.34
rw-r--r-- 229/20  32951 Mar 31 08:09 1998 ./mcnp4b/ver-val/smlset/ueki.34o
rwxr-xr-x 229/20    232 Mar 31 08:27 1998 ./mcnp4b/ver-val/smlset/runset
rw-r--r-- 229/20     93 Mar 31 08:11 1998 ./mcnp4b/ver-val/smlset/list
rw-r----- 229/20  36661 Mar 31 08:07 1998 ./mcnp4b/ver-val/smlset/mc10new
rw-r--r-- 229/20 429535 Mar 31 08:07 1998 ./mcnp4b/ver-val/smlset/mc10newo
rw-r--r-- 229/20 6942720 Mar 31 08:27 1998 ./mcnp4b/ver-val/smlset.spuds
```

Files from OTIS on HP backup tape MOY-980421-18 (MI: 30057-M03-001)

Verification test problems are located in mcnp4b/test. Criticality validation test problems are located in mcnp4b/ver-val/endf5. Criticality validation test problems are located in mcnp4b/ver-val/endf6. Shielding validation test problems are located in mcnp4b/ver-val/shield. Coincident planes verification test problem is located in mcnp4b/ver-val/4b2fix.

```
rwxr-xr-x 229/20      0 Apr  8 15:44 1998 ./mcnp4b/
rwxr-xr-x 229/20      0 Mar 30 15:56 1998 ./mcnp4b/ver-val/
rwxr-xr-x 229/20      0 Mar 31 16:29 1998 ./mcnp4b/ver-val/endf5/
rw-r--r-- 229/20    325 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/LA1X5
rwxrwxrwx 229/20      0 Feb 13 16:17 1998 ./mcnp4b/ver-val/endf5/mcnp symbolic link to
/usr2/mcnp4b/mcnp
rw-r--r-- 229/20    418 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/LA2X5
rwxrwxrwx 229/20      0 Feb 13 16:18 1998 ./mcnp4b/ver-val/endf5/xsdir symbolic link to
/usr2/mcnp4b/xslib/xsdir
rw-r--r-- 229/20   4283 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/LA3X5
rwxr-xr-x 229/20   1012 Mar 30 13:36 1998 ./mcnp4b/ver-val/endf5/runexp
rw-r--r-- 229/20   5723 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp1
rw-r--r-- 229/20 1849486 Mar 30 14:02 1998 ./mcnp4b/ver-val/endf5/exp1o
rw-r--r-- 229/20   7650 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp2
rw-r--r-- 229/20   5160 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp22
rw-r--r-- 229/20 1953218 Mar 30 14:28 1998 ./mcnp4b/ver-val/endf5/exp2o
rw-r--r-- 229/20   5259 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp23
rw-r--r-- 229/20 1868375 Mar 30 14:55 1998 ./mcnp4b/ver-val/endf5/exp3o
rw-r--r-- 229/20   7117 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp24a
rw-r--r-- 229/20   6146 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp25
rw-r--r-- 229/20 1871713 Mar 30 15:21 1998 ./mcnp4b/ver-val/endf5/exp4o
rw-r--r-- 229/20   5420 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp26
rw-r--r-- 229/20   6474 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp27
```

```
rw-r--r-- 229/20 903144 Mar 30 18:33 1998 ./mcnp4b/ver-val/endf5/exp27o
rw-r--r-- 229/20   6813 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp3
rw-r--r-- 229/20   7127 Feb  5 12:19 1998 ./mcnp4b/ver-val/endf5/exp4
rw-r--r-- 229/20 906960 Mar 30 16:01 1998 ./mcnp4b/ver-val/endf5/exp22o
rwxr-xr-x 229/20    231 Feb  5 12:27 1998 ./mcnp4b/ver-val/endf5/rune5
rw-r--r-- 229/20 935194 Mar 30 16:24 1998 ./mcnp4b/ver-val/endf5/exp23o
rw-r--r-- 229/20 4107853 Mar 30 16:54 1998 ./mcnp4b/ver-val/endf5/exp24ao
rw-r--r-- 229/20 943655 Mar 30 17:12 1998 ./mcnp4b/ver-val/endf5/exp25o
rw-r--r-- 229/20 853187 Mar 30 17:44 1998 ./mcnp4b/ver-val/endf5/exp26o
rw-r--r-- 229/20 240781 Mar 30 20:32 1998 ./mcnp4b/ver-val/endf5/LA1X5o
rw-r--r-- 229/20 209604 Mar 30 20:40 1998 ./mcnp4b/ver-val/endf5/LA2X5o
rw-r--r-- 229/20 271270 Mar 30 20:57 1998 ./mcnp4b/ver-val/endf5/LA3X5o
rwxr-xr-x 229/20      0 Mar 31 16:40 1998 ./mcnp4b/ver-val/4b2fix/
rw-r--r-- 229/20   8851 Mar 30 15:21 1998 ./mcnp4b/ver-val/4b2fix/bug4b2
rwxrwxrwx 229/20      0 Mar 30 15:21 1998 ./mcnp4b/ver-val/4b2fix/xsdir symbolic link to
/usr2/mcnp4b/xslib/xsdir
rw-r--r-- 229/20 2072371 Mar 30 15:38 1998 ./mcnp4b/ver-val/4b2fix/bug4b2o
rwxr-xr-x 229/20      0 Mar 31 16:31 1998 ./mcnp4b/ver-val/endf6/
rw-r--r-- 229/20    325 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/LA1X
rwxrwxrwx 229/20      0 Feb 13 16:19 1998 ./mcnp4b/ver-val/endf6/xsdir symbolic link to
/usr2/mcnp4b/xslib/xsdir
rwxrwxrwx 229/20      0 Feb 13 16:19 1998 ./mcnp4b/ver-val/endf6/mcnp symbolic link to
/usr2/mcnp4b/mcnp
rw-r--r-- 229/20    475 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/LA2X
rw-r--r-- 229/20 325372 Mar 30 17:57 1998 ./mcnp4b/ver-val/endf6/prob1o
rw-r--r-- 229/20   5050 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/LA3
rw-r--r-- 229/20    223 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/godiva
rw-r--r-- 229/20 369064 Mar 30 22:26 1998 ./mcnp4b/ver-val/endf6/prob3no
rw-r--r-- 229/20    221 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/jez20
rw-r--r-- 229/20    228 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/jez4.5
rw-r--r-- 229/20 294744 Mar 30 22:32 1998 ./mcnp4b/ver-val/endf6/prob6o
rw-r--r-- 229/20   3169 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob1
rw-r--r-- 229/20   4094 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob12
rw-r--r-- 229/20 294967 Mar 30 22:39 1998 ./mcnp4b/ver-val/endf6/prob7o
rw-r--r-- 229/20   1603 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob13
rw-r--r-- 229/20   2383 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob14
rw-r--r-- 229/20   1440 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob15
rw-r--r-- 229/20 316975 Mar 30 22:51 1998 ./mcnp4b/ver-val/endf6/prob12o
rw-r--r-- 229/20   1866 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob16
rw-r--r-- 229/20   4174 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob18
rw-r--r-- 229/20 305015 Mar 30 22:57 1998 ./mcnp4b/ver-val/endf6/prob13o
rw-r--r-- 229/20   3109 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob20
rw-r--r-- 229/20   4270 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob3
rw-r--r-- 229/20   4269 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob3n
rw-r--r-- 229/20   1689 Feb  5 12:20 1998 ./mcnp4b/ver-val/endf6/prob6
rw-r--r-- 229/20 308353 Mar 30 23:02 1998 ./mcnp4b/ver-val/endf6/prob14o
rw-r--r-- 229/20   1755 Feb  5 12:21 1998 ./mcnp4b/ver-val/endf6/prob7
rwxr-xr-x 229/20   1238 Mar 30 13:38 1998 ./mcnp4b/ver-val/endf6/rune6
rw-r--r-- 229/20 275642 Mar 31 01:33 1998 ./mcnp4b/ver-val/endf6/prob15o
rw-r--r-- 229/20 175535 Mar 31 05:03 1998 ./mcnp4b/ver-val/endf6/godivao
rw-r--r-- 229/20 309810 Mar 31 02:00 1998 ./mcnp4b/ver-val/endf6/prob16o
rw-r--r-- 229/20 311865 Mar 31 04:09 1998 ./mcnp4b/ver-val/endf6/prob18o
rw-r--r-- 229/20 324830 Mar 31 04:19 1998 ./mcnp4b/ver-val/endf6/prob20o
rw-r--r-- 229/20 240773 Mar 31 04:53 1998 ./mcnp4b/ver-val/endf6/LA1Xo
rw-r--r-- 229/20 209913 Mar 31 04:56 1998 ./mcnp4b/ver-val/endf6/LA2Xo
rw-r--r-- 229/20 287769 Mar 31 05:01 1998 ./mcnp4b/ver-val/endf6/LA3o
rw-r--r-- 229/20 175307 Mar 31 05:04 1998 ./mcnp4b/ver-val/endf6/jez20o
rw-r--r-- 229/20 109968 Mar 31 05:04 1998 ./mcnp4b/ver-val/endf6/jez4.5o
rwxr-xr-x 229/20      0 Mar 31 16:32 1998 ./mcnp4b/ver-val/shield/
rw-r--r-- 229/20  36661 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/mc10new
rw-r--r-- 229/20  25474 Mar 30 18:04 1998 ./mcnp4b/ver-val/shield/ueki.1o
rwxr-xr-x 229/20    142 Feb 13 16:36 1998 ./mcnp4b/ver-val/shield/runshld
rw-r--r-- 229/20   1457 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.1
rw-r--r-- 229/20   1575 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.11
rw-r--r-- 229/20   1639 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.12
rw-r--r-- 229/20   1898 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.13
rw-r--r-- 229/20   2117 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.14
rw-r--r-- 229/20   2361 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.15
rw-r--r-- 229/20   1521 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.2
rw-r--r-- 229/20   1857 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.21
```

```
rw-r--r-- 229/20   2123 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.22
rw-r--r-- 229/20   2412 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.24
rw-r--r-- 229/20   2598 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.25
rw-r--r-- 229/20   2855 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.26
rw-r--r-- 229/20   4103 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.27
rw-r--r-- 229/20   1780 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.3
rw-r--r-- 229/20   1479 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.31
rw-r--r-- 229/20   1543 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.32
rw-r--r-- 229/20   1802 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.33
rw-r--r-- 229/20   2021 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.34
rw-r--r-- 229/20   2268 Feb 20 13:53 1998 ./mcnp4b/ver-val/shield/ueki.35
rw-r--r-- 229/20   1999 Feb 13 16:33 1998 ./mcnp4b/ver-val/shield/ueki.4
rw-r--r-- 229/20   2248 Feb 20 14:38 1998 ./mcnp4b/ver-val/shield/ueki.5
rwxrwxrwx 229/20      0 Feb 14 13:00 1998 ./mcnp4b/ver-val/shield/xsdir symbolic link to
/usr2/mcnp4b/xslib/xsdir
rw-r--r-- 229/20  26785 Mar 30 18:09 1998 ./mcnp4b/ver-val/shield/ueki.11o
rw-r--r-- 229/20  22048 Mar 30 18:14 1998 ./mcnp4b/ver-val/shield/ueki.12o
rw-r--r-- 229/20  29989 Mar 30 18:20 1998 ./mcnp4b/ver-val/shield/ueki.13o
rw-r--r-- 229/20  26657 Mar 30 18:34 1998 ./mcnp4b/ver-val/shield/ueki.14o
rw-r--r-- 229/20  28954 Mar 30 19:40 1998 ./mcnp4b/ver-val/shield/ueki.15o
rw-r--r-- 229/20  20870 Mar 30 19:45 1998 ./mcnp4b/ver-val/shield/ueki.2o
rw-r--r-- 229/20  28805 Mar 30 19:46 1998 ./mcnp4b/ver-val/shield/ueki.21o
rw-r--r-- 229/20  26240 Mar 30 20:01 1998 ./mcnp4b/ver-val/shield/ueki.22o
rw-r--r-- 229/20  28496 Mar 30 20:25 1998 ./mcnp4b/ver-val/shield/ueki.24o
rw-r--r-- 229/20  29732 Mar 30 20:58 1998 ./mcnp4b/ver-val/shield/ueki.25o
rw-r--r-- 229/20  32544 Mar 30 21:31 1998 ./mcnp4b/ver-val/shield/ueki.26o
rw-r--r-- 229/20  49185 Mar 30 21:58 1998 ./mcnp4b/ver-val/shield/ueki.27o
rw-r--r-- 229/20  22997 Mar 30 22:02 1998 ./mcnp4b/ver-val/shield/ueki.3o
rw-r--r-- 229/20  25701 Mar 30 22:05 1998 ./mcnp4b/ver-val/shield/ueki.31o
rw-r--r-- 229/20  26307 Mar 30 22:09 1998 ./mcnp4b/ver-val/shield/ueki.32o
rw-r--r-- 229/20  29544 Mar 30 22:13 1998 ./mcnp4b/ver-val/shield/ueki.33o
rw-r--r-- 229/20  32905 Mar 30 22:28 1998 ./mcnp4b/ver-val/shield/ueki.34o
rw-r--r-- 229/20  35449 Mar 30 23:38 1998 ./mcnp4b/ver-val/shield/ueki.35o
rw-r--r-- 229/20  25548 Mar 30 23:49 1998 ./mcnp4b/ver-val/shield/ueki.4o
rw-r--r-- 229/20  28264 Mar 31 01:38 1998 ./mcnp4b/ver-val/shield/ueki.5o
rw-r--r-- 229/20 429369 Mar 31 04:09 1998 ./mcnp4b/ver-val/shield/mc10newo
rwxr-xr-x 229/20      0 Mar 30 13:14 1998 ./mcnp4b/exec/
r-xr-xr-x 229/20      0 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/
r--r--r-- 229/20 3590144 Jan 14 10:03 1998 ./mcnp4b/exec/xslib/100xs2
r--r--r-- 229/20 305152 Jan 14 10:03 1998 ./mcnp4b/exec/xslib/531dos2
r--r--r-- 229/20 874496 Jan 14 10:03 1998 ./mcnp4b/exec/xslib/532dos2
r--r--r-- 229/20   9265 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/README
r--r--r-- 229/20  20759 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/README_ENDF60
r--r--r-- 229/20 2680832 Jan 14 10:04 1998 ./mcnp4b/exec/xslib/dre52
r--r--r-- 229/20 5093376 Jan 14 10:05 1998 ./mcnp4b/exec/xslib/drmccs2
r--r--r-- 229/20 770048 Jan 14 10:05 1998 ./mcnp4b/exec/xslib/el2
r--r--r-- 229/20 2846720 Jan 14 10:06 1998 ./mcnp4b/exec/xslib/endf5mt2
r--r--r-- 229/20 5736448 Jan 14 10:07 1998 ./mcnp4b/exec/xslib/endf5p2
r--r--r-- 229/20 5937152 Jan 14 10:09 1998 ./mcnp4b/exec/xslib/endf5u2
r--r--r-- 229/20 36685824 Jan 14 10:22 1998 ./mcnp4b/exec/xslib/endf602
r--r--r-- 229/20 5859328 Jan 14 10:24 1998 ./mcnp4b/exec/xslib/endl852
r--r--r-- 229/20 1259520 Jan 14 10:24 1998 ./mcnp4b/exec/xslib/kidman2
r--r--r-- 229/20 1687552 Jan 14 10:25 1998 ./mcnp4b/exec/xslib/111dos2
r--r--r-- 229/20 577536 Jan 14 10:25 1998 ./mcnp4b/exec/xslib/mcplib022
r--r--r-- 229/20 440320 Jan 14 10:26 1998 ./mcnp4b/exec/xslib/mcplib2
r--r--r-- 229/20 1628160 Jan 14 10:26 1998 ./mcnp4b/exec/xslib/mgxsnp2
r--r--r-- 229/20 3840000 Jan 14 10:28 1998 ./mcnp4b/exec/xslib/misc5xs2
r--r--r-- 229/20 1812480 Jan 14 10:29 1998 ./mcnp4b/exec/xslib/newxs2
r--r--r-- 229/20 716800 Jan 14 10:29 1998 ./mcnp4b/exec/xslib/newxsd2
r--r--r-- 229/20 8196096 Jan 14 10:32 1998 ./mcnp4b/exec/xslib/rmccs2
r--r--r-- 229/20 3532800 Jan 14 10:33 1998 ./mcnp4b/exec/xslib/rmccsa2
r--r--r-- 229/20    523 Jan 14 10:33 1998 ./mcnp4b/exec/xslib/specs
r--r--r-- 229/20  90112 Jan 14 10:33 1998 ./mcnp4b/exec/xslib/therxs2
r--r--r-- 229/20 2416640 Jan 14 10:33 1998 ./mcnp4b/exec/xslib/tmccs2
r--r--r-- 229/20   5416 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/tprint
r--r--r-- 229/20 146976 Jan 14 10:36 1998 ./mcnp4b/exec/xslib/xsdir
r--r--r-- 229/20  98714 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/xsdir1.org
r--r--r-- 229/20 146934 Jan 14 10:34 1998 ./mcnp4b/exec/xslib/xsdir2
r--r--r-- 229/20 304084 Jan 16 11:45 1998 ./mcnp4b/exec/libF77.so.3
r-xr-xr-x 229/20 2104584 Mar 30 13:17 1998 ./mcnp4b/exec/mcnp4b2
```

```
r--r--r-- 229/20 637768 Mar 30 13:14 1998 ./mcnp4b/exec/libsunmath.so.1
rwxr-xr-x 229/20      0 Mar 31 16:25 1998 ./mcnp4b/test/
rw-r--r-- 229/20 2040320 Feb  5 11:37 1998 ./mcnp4b/test/testoutp.sun
rwx------ 229/20   1396 Mar  1 13:23 1996 ./mcnp4b/test/inp01
rw-r--r-- 229/20 196608 Feb  5 11:37 1998 ./mcnp4b/test/testinp.tar
rw-r--r-- 229/20 16038097 Feb  5 11:37 1998 ./mcnp4b/test/testlib1
rwxr-xr-x 229/20   3264 Feb  5 11:37 1998 ./mcnp4b/test/runprob
rwxr-xr-x 229/20      0 Feb  5 12:09 1998 ./mcnp4b/test/trns-set/
rw-r--r-- 229/20 227840 Feb  5 12:09 1998 ./mcnp4b/test/trns-set/testmctl.sun
rw-r--r-- 229/20 2040320 Feb  5 12:09 1998 ./mcnp4b/test/trns-set/testoutp.sun
rw-r--r-- 229/20   3264 Feb  5 11:39 1998 ./mcnp4b/test/trns-set/runprob
rw-r--r-- 229/20 196608 Feb  5 11:39 1998 ./mcnp4b/test/trns-set/testinp.tar
rw-r--r-- 229/20 16038097 Feb  5 11:39 1998 ./mcnp4b/test/trns-set/testlib1
rw-r--r-- 229/20  22914 Feb  5 11:44 1998 ./mcnp4b/test/trns-set/testdir
rwxr-xr-x 229/20   2241 Feb  5 12:09 1998 ./mcnp4b/test/trns-set/runtest
rw-r--r-- 229/20 227840 Feb  5 11:37 1998 ./mcnp4b/test/testmctl.sun
rwxr-xr-x 229/20   2241 Feb  5 11:58 1998 ./mcnp4b/test/runtest
rwx------ 229/20   1963 Mar  2 12:09 1996 ./mcnp4b/test/inp02
rwx------ 229/20   1911 Mar  1 13:26 1996 ./mcnp4b/test/inp03
rwx------ 229/20   1052 Mar  1 13:31 1996 ./mcnp4b/test/inp04
rwx------ 229/20   2164 Mar  1 13:31 1996 ./mcnp4b/test/inp05
rwx------ 229/20   1599 Mar  1 13:32 1996 ./mcnp4b/test/inp06
rwx------ 229/20   1539 Mar  1 13:32 1996 ./mcnp4b/test/inp07
rwx------ 229/20   3287 Mar  4 08:53 1996 ./mcnp4b/test/inp08
rwx------ 229/20   1261 Mar  1 15:56 1996 ./mcnp4b/test/inp09
rwx------ 229/20   1004 Mar  1 13:34 1996 ./mcnp4b/test/inp10
rwx------ 229/20   2023 Mar  2 12:21 1996 ./mcnp4b/test/inp11
rwx------ 229/20  46304 Mar  4 09:00 1996 ./mcnp4b/test/inp12
rwx------ 229/20   1172 Mar  1 11:10 1996 ./mcnp4b/test/inp13
rwx------ 229/20   2459 Mar  1 13:52 1996 ./mcnp4b/test/inp14
rwx------ 229/20   1104 Mar  1 13:53 1996 ./mcnp4b/test/inp15
rwx------ 229/20   2220 Mar  1 13:54 1996 ./mcnp4b/test/inp16
rwx------ 229/20    968 Mar  1 13:54 1996 ./mcnp4b/test/inp17
rwx------ 229/20   4323 Mar  4 07:50 1996 ./mcnp4b/test/inp18
rwx------ 229/20    567 Mar  1 13:55 1996 ./mcnp4b/test/inp19
rwx------ 229/20   1171 Mar  1 13:56 1996 ./mcnp4b/test/inp20
rwx------ 229/20   8134 Mar  2 12:03 1996 ./mcnp4b/test/inp21
rwx------ 229/20   7496 Mar  1 15:25 1996 ./mcnp4b/test/inp22
rwx------ 229/20   5496 Mar  1 15:26 1996 ./mcnp4b/test/inp23
rwx------ 229/20   2096 Mar  1 13:13 1996 ./mcnp4b/test/inp24
rwx------ 229/20     42 Feb 29 14:35 1996 ./mcnp4b/test/inp25
rwx------ 229/20     42 Feb 29 14:35 1996 ./mcnp4b/test/inp26
rwx------ 229/20    917 Mar  1 15:27 1996 ./mcnp4b/test/inp27
rwx------ 229/20   5756 Feb 29 14:35 1996 ./mcnp4b/test/inp28
rwx------ 229/20    839 Mar  4 08:00 1996 ./mcnp4b/test/inp29
rw------- 229/20   6853 Dec 24 07:33 1996 ./mcnp4b/test/mctl01
rw------- 229/20  15297 Dec 24 07:34 1996 ./mcnp4b/test/mctl02
rw------- 229/20   1793 Dec 24 07:35 1996 ./mcnp4b/test/mctl03
rw------- 229/20  11301 Dec 24 07:37 1996 ./mcnp4b/test/mctl04
rw------- 229/20   2199 Dec 24 07:37 1996 ./mcnp4b/test/mctl05
rw------- 229/20   4956 Dec 24 07:37 1996 ./mcnp4b/test/mctl06
rw------- 229/20   1472 Dec 24 07:39 1996 ./mcnp4b/test/mctl07
rw------- 229/20   3457 Dec 24 07:39 1996 ./mcnp4b/test/mctl08
rw------- 229/20  17893 Dec 24 07:40 1996 ./mcnp4b/test/mctl09
rw------- 229/20    748 Dec 24 07:41 1996 ./mcnp4b/test/mctl10
rw------- 229/20   4562 Dec 24 07:43 1996 ./mcnp4b/test/mctl11
rw------- 229/20   3600 Dec 24 07:45 1996 ./mcnp4b/test/mctl12
rw------- 229/20   2889 Dec 24 07:46 1996 ./mcnp4b/test/mctl13
rw------- 229/20   3212 Dec 24 07:46 1996 ./mcnp4b/test/mctl14
rw------- 229/20    771 Dec 24 07:46 1996 ./mcnp4b/test/mctl15
rw------- 229/20   1366 Dec 24 07:47 1996 ./mcnp4b/test/mctl16
rw------- 229/20  11346 Dec 24 07:48 1996 ./mcnp4b/test/mctl17
rw------- 229/20   8487 Dec 24 07:50 1996 ./mcnp4b/test/mctl18
rw------- 229/20   2414 Dec 24 07:51 1996 ./mcnp4b/test/mctl19
rw------- 229/20   9663 Dec 24 07:52 1996 ./mcnp4b/test/mctl20
rw------- 229/20  23069 Dec 24 07:54 1996 ./mcnp4b/test/mctl21
rw------- 229/20   1503 Dec 24 07:55 1996 ./mcnp4b/test/mctl22
rw------- 229/20   2944 Dec 24 07:56 1996 ./mcnp4b/test/mctl23
rw------- 229/20   1240 Dec 24 07:57 1996 ./mcnp4b/test/mctl24
rw------- 229/20   1472 Dec 24 07:58 1996 ./mcnp4b/test/mctl25
```

```
rw------- 229/20  18897 Dec 24 07:58 1996 ./mcnp4b/test/mctl26
rw------- 229/20   3062 Dec 24 07:58 1996 ./mcnp4b/test/mctl27
rw------- 229/20  37974 Dec 24 07:59 1996 ./mcnp4b/test/mctl28
rw------- 229/20   1380 Dec 24 08:01 1996 ./mcnp4b/test/mctl29
rw------- 229/20 109022 Dec 24 07:34 1996 ./mcnp4b/test/outp01
rw------- 229/20 116319 Dec 24 07:34 1996 ./mcnp4b/test/outp02
rw------- 229/20  19734 Dec 24 07:35 1996 ./mcnp4b/test/outp03
rw------- 229/20 144172 Dec 24 07:37 1996 ./mcnp4b/test/outp04
rw------- 229/20  22497 Dec 24 07:37 1996 ./mcnp4b/test/outp05
rw------- 229/20  34471 Dec 24 07:37 1996 ./mcnp4b/test/outp06
rw------- 229/20  75601 Dec 24 07:39 1996 ./mcnp4b/test/outp07
rw------- 229/20 176440 Dec 24 07:39 1996 ./mcnp4b/test/outp08
rw------- 229/20  57143 Dec 24 07:40 1996 ./mcnp4b/test/outp09
rw------- 229/20  31745 Dec 24 07:41 1996 ./mcnp4b/test/outp10
rw------- 229/20  56456 Dec 24 07:43 1996 ./mcnp4b/test/outp11
rw------- 229/20 170414 Dec 24 07:45 1996 ./mcnp4b/test/outp12
rw------- 229/20  89562 Dec 24 07:46 1996 ./mcnp4b/test/outp13
rw------- 229/20  31665 Dec 24 07:46 1996 ./mcnp4b/test/outp14
rw------- 229/20  44797 Dec 24 07:46 1996 ./mcnp4b/test/outp15
rw------- 229/20  51488 Dec 24 07:47 1996 ./mcnp4b/test/outp16
rw------- 229/20 107566 Dec 24 07:48 1996 ./mcnp4b/test/outp17
rw------- 229/20  77612 Dec 24 07:50 1996 ./mcnp4b/test/outp18
rw------- 229/20  14740 Dec 24 07:51 1996 ./mcnp4b/test/outp19
rw------- 229/20  54507 Dec 24 07:52 1996 ./mcnp4b/test/outp20
rw------- 229/20  81600 Dec 24 07:54 1996 ./mcnp4b/test/outp21
rw------- 229/20  52150 Dec 24 07:55 1996 ./mcnp4b/test/outp22
rw------- 229/20  91175 Dec 24 07:56 1996 ./mcnp4b/test/outp23
rw------- 229/20  33123 Dec 24 07:57 1996 ./mcnp4b/test/outp24
rw------- 229/20  17836 Dec 24 07:58 1996 ./mcnp4b/test/outp25
rw------- 229/20  57469 Dec 24 07:58 1996 ./mcnp4b/test/outp26
rw------- 229/20  17851 Dec 24 07:58 1996 ./mcnp4b/test/outp27
rw------- 229/20 144311 Dec 24 07:59 1996 ./mcnp4b/test/outp28
rwxrwxrwx 229/20      0 Mar 30 10:16 1998 ./mcnp4b/test/mcnp symbolic link to ../exec/mcnp4b2
rw------- 229/20  36857 Dec 24 08:01 1996 ./mcnp4b/test/outp29
rw-r--r-- 229/20 109022 Mar 30 13:22 1998 ./mcnp4b/test/inp01o
rw-r--r-- 229/20  53496 Feb  5 12:05 1998 ./mcnp4b/test/runtest.log
rw-r--r-- 229/20  22914 Feb  5 11:44 1998 ./mcnp4b/test/testdir
rwxrwxrwx 229/20      0 Mar 30 13:15 1998 ./mcnp4b/test/libsunmath.so.1 symbolic link to
../exec/libsunmath.so.1
rw-r--r-- 229/20 116319 Mar 30 13:22 1998 ./mcnp4b/test/inp02o
rw-r--r-- 229/20   6853 Mar 30 13:22 1998 ./mcnp4b/test/inp01m
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difm01
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difo01
rw-r--r-- 229/20  19734 Mar 30 13:22 1998 ./mcnp4b/test/inp03o
rw-r--r-- 229/20  15297 Mar 30 13:22 1998 ./mcnp4b/test/inp02m
rw-r--r-- 229/20  33468 Mar 30 13:22 1998 ./mcnp4b/test/inp01p
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difm02
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difo02
rw-r--r-- 229/20 144172 Mar 30 13:23 1998 ./mcnp4b/test/inp04o
rw-r--r-- 229/20   1793 Mar 30 13:22 1998 ./mcnp4b/test/inp03m
rw-r--r-- 229/20  25038 Mar 30 13:22 1998 ./mcnp4b/test/inp02p
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difm03
rw-r--r-- 229/20      0 Mar 30 13:22 1998 ./mcnp4b/test/difo03
rw-r--r-- 229/20  22497 Mar 30 13:23 1998 ./mcnp4b/test/inp05o
rw-r--r-- 229/20  11301 Mar 30 13:23 1998 ./mcnp4b/test/inp04m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm04
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo04
rw-r--r-- 229/20  34471 Mar 30 13:23 1998 ./mcnp4b/test/inp06o
rw-r--r-- 229/20   2199 Mar 30 13:23 1998 ./mcnp4b/test/inp05m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm05
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo05
rw-r--r-- 229/20  75601 Mar 30 13:23 1998 ./mcnp4b/test/inp07o
rw-r--r-- 229/20   4956 Mar 30 13:23 1998 ./mcnp4b/test/inp06m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm06
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo06
rw-r--r-- 229/20 176440 Mar 30 13:23 1998 ./mcnp4b/test/inp08o
rw-r--r-- 229/20 481295 Mar 30 13:23 1998 ./mcnp4b/test/inp07w
rw-r--r-- 229/20   1472 Mar 30 13:23 1998 ./mcnp4b/test/inp07m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm07
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo07
```

```
rw-r--r-- 229/20  57143 Mar 30 13:23 1998 ./mcnp4b/test/inp09o
rw-r--r-- 229/20   3457 Mar 30 13:23 1998 ./mcnp4b/test/inp08m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm08
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo08
rw-r--r-- 229/20  17851 Mar 30 13:26 1998 ./mcnp4b/test/inp27o
rw-r--r-- 229/20 180036 Mar 30 13:26 1998 ./mcnp4b/test/inp26s
rw-r--r-- 229/20    812 Mar 30 13:23 1998 ./mcnp4b/test/inp08p
rw-r--r-- 229/20  17893 Mar 30 13:23 1998 ./mcnp4b/test/inp09m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm09
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo09
rw-r--r-- 229/20  31745 Mar 30 13:23 1998 ./mcnp4b/test/inp10o
rw-r--r-- 229/20 180036 Mar 30 13:23 1998 ./mcnp4b/test/inp09s
rw-r--r-- 229/20  56456 Mar 30 13:24 1998 ./mcnp4b/test/inp11o
rw-r--r-- 229/20    748 Mar 30 13:23 1998 ./mcnp4b/test/inp10m
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difm10
rw-r--r-- 229/20      0 Mar 30 13:23 1998 ./mcnp4b/test/difo10
rw-r--r-- 229/20 170414 Mar 30 13:24 1998 ./mcnp4b/test/inp12o
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm11
rw-r--r-- 229/20   4562 Mar 30 13:24 1998 ./mcnp4b/test/inp11m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo11
rw-r--r-- 229/20  89562 Mar 30 13:24 1998 ./mcnp4b/test/inp13o
rw-r--r-- 229/20   3600 Mar 30 13:24 1998 ./mcnp4b/test/inp12m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm12
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo12
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difm20
rw-r--r-- 229/20  31665 Mar 30 13:24 1998 ./mcnp4b/test/inp14o
rw-r--r-- 229/20   2889 Mar 30 13:24 1998 ./mcnp4b/test/inp13m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm13
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo13
rw-r--r-- 229/20  44797 Mar 30 13:24 1998 ./mcnp4b/test/inp15o
rw-r--r-- 229/20   3212 Mar 30 13:24 1998 ./mcnp4b/test/inp14m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm14
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo14
rw-r--r-- 229/20  51488 Mar 30 13:24 1998 ./mcnp4b/test/inp16o
rw-r--r-- 229/20    771 Mar 30 13:24 1998 ./mcnp4b/test/inp15m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm15
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo15
rw-r--r-- 229/20  77612 Mar 30 13:25 1998 ./mcnp4b/test/inp18o
rw-r--r-- 229/20   1366 Mar 30 13:24 1998 ./mcnp4b/test/inp16m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm16
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo16
rw-r--r-- 229/20 107566 Mar 30 13:24 1998 ./mcnp4b/test/inp17o
rw-r--r-- 229/20 180036 Mar 30 13:25 1998 ./mcnp4b/test/inp18s
rw-r--r-- 229/20  11346 Mar 30 13:24 1998 ./mcnp4b/test/inp17m
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difm17
rw-r--r-- 229/20      0 Mar 30 13:24 1998 ./mcnp4b/test/difo17
rw-r--r-- 229/20  14740 Mar 30 13:25 1998 ./mcnp4b/test/inp19o
rw-r--r-- 229/20   8487 Mar 30 13:25 1998 ./mcnp4b/test/inp18m
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difm18
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difo18
rw-r--r-- 229/20  54507 Mar 30 13:25 1998 ./mcnp4b/test/inp20o
rw-r--r-- 229/20   2414 Mar 30 13:25 1998 ./mcnp4b/test/inp19m
rw-r--r-- 229/20   1443 Mar 30 13:25 1998 ./mcnp4b/test/inp18p
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difm19
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difo19
rw-r--r-- 229/20  81600 Mar 30 13:25 1998 ./mcnp4b/test/inp21o
rw-r--r-- 229/20   9663 Mar 30 13:25 1998 ./mcnp4b/test/inp20m
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difo20
rw-r--r-- 229/20  52150 Mar 30 13:26 1998 ./mcnp4b/test/inp22o
rw-r--r-- 229/20 3420431 Mar 30 13:25 1998 ./mcnp4b/test/inp21w
rw-r--r-- 229/20  23069 Mar 30 13:25 1998 ./mcnp4b/test/inp21m
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difm21
rw-r--r-- 229/20      0 Mar 30 13:25 1998 ./mcnp4b/test/difo21
rw-r--r-- 229/20  91175 Mar 30 13:26 1998 ./mcnp4b/test/inp23o
rw-r--r-- 229/20   1503 Mar 30 13:26 1998 ./mcnp4b/test/inp22m
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm22
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo22
rw-r--r-- 229/20  33123 Mar 30 13:26 1998 ./mcnp4b/test/inp24o
rw-r--r-- 229/20   2944 Mar 30 13:26 1998 ./mcnp4b/test/inp23m
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm23
```

INFORMATION ONLY

```
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo23
rw-r--r-- 229/20  57469 Mar 30 13:26 1998 ./mcnp4b/test/inp26o
rw-r--r-- 229/20   1240 Mar 30 13:26 1998 ./mcnp4b/test/inp24m
rw-r--r-- 229/20  31209 Mar 30 13:26 1998 ./mcnp4b/test/inp23p
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm24
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo24
rw-r--r-- 229/20  17836 Mar 30 13:26 1998 ./mcnp4b/test/inp25o
rw-r--r-- 229/20 180036 Mar 30 13:26 1998 ./mcnp4b/test/inp24s
rw-r--r-- 229/20   1472 Mar 30 13:26 1998 ./mcnp4b/test/inp25m
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm25
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo25
rw-r--r-- 229/20 644815 Mar 30 13:26 1998 ./mcnp4b/test/inp09w
rw-r--r-- 229/20 180036 Mar 30 13:26 1998 ./mcnp4b/test/inp25s
rw-r--r-- 229/20  18897 Mar 30 13:26 1998 ./mcnp4b/test/inp26m
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm26
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo26
rw-r--r-- 229/20  37974 Mar 30 13:26 1998 ./mcnp4b/test/inp28m
rw-r--r-- 229/20   3062 Mar 30 13:26 1998 ./mcnp4b/test/inp27m
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm27
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo27
rw-r--r-- 229/20  36857 Mar 30 13:27 1998 ./mcnp4b/test/inp29o
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difm28
rw-r--r-- 229/20 144311 Mar 30 13:26 1998 ./mcnp4b/test/inp28o
rw-r--r-- 229/20      0 Mar 30 13:26 1998 ./mcnp4b/test/difo28
rw-r--r-- 229/20      0 Mar 30 13:27 1998 ./mcnp4b/test/difm29
rw-r--r-- 229/20   1380 Mar 30 13:27 1998 ./mcnp4b/test/inp29m
rw-r--r-- 229/20      0 Mar 30 13:27 1998 ./mcnp4b/test/difo29
```

Files from GATEWAY2000 P5-166 PC on HP colorado backup tape MOY-980421-20 (MI: 30055-M72-001)

D:\mcnp4b.xc\100XS2
D:\mcnp4b.xc\531DOS2
D:\mcnp4b.xc\532DOS2
D:\mcnp4b.xc\DRMCCS2
D:\mcnp4b.xc\EL2
D:\mcnp4b.xc\ENDF5MT2
D:\mcnp4b.xc\ENDF5P2
D:\mcnp4b.xc\ENDF5U2
D:\mcnp4b.xc\ENDF602
D:\mcnp4b.xc\ENDL852
D:\mcnp4b.xc\KIDMAN2
D:\mcnp4b.xc\LLLDOS2
D:\mcnp4b.xc\MCPLIB2
D:\mcnp4b.xc\MCPLIB22
D:\mcnp4b.xc\MGXSNP2
D:\mcnp4b.xc\MISC5XS2
D:\mcnp4b.xc\NEWXS2
D:\mcnp4b.xc\NEWXSD2
D:\mcnp4b.xc\RMCCS2
D:\mcnp4b.xc\RMCCSA2
D:\mcnp4b.xc\THERXS2
D:\mcnp4b.xc\TMCCS2
D:\mcnp4b\README.TXT
D:\mcnp4b\RUNMCNP.BAT
D:\mcnp4b\RUNMCNPX.BAT
D:\mcnp4b\XSDIR
D:\mcnp4b\exe\MCNP4B2.EXE
D:\mcnp4b\exe\MCNP4B2X.EXE
D:\mcnp4b\exe\README.TXT
D:\mcnp4b\exe\SPECS
D:\mcnp4b\exe\XSDIR1
D:\MCNP4b\TEST\mcnp7.exe
D:\MCNP4B\Install\ANSWER
D:\MCNP4B\Install\FSPLIT.FOR

D:\MCNP4B\Install\FSPLIT.EXE
D:\MCNP4B\Install\GETFILES
D:\MCNP4B\Install\INSTALL.LOG
D:\MCNP4B\Install\INSTALL.FIX
D:\MCNP4B\Install\INSTALL.BAT
D:\MCNP4B\Install\MAKEMCNP.BAT
D:\MCNP4B\Install\MAKXS.ID
D:\MCNP4B\Install\MAKXSF.EXE
D:\MCNP4B\Install\MCNP4B.ID
D:\MCNP4B\Install\MCSETUP.FOR
D:\MCNP4B\Install\MCSETUP.EXE
D:\MCNP4B\Install\PATCHC
D:\MCNP4B\Install\PATCHF
D:\MCNP4B\Install\PLOT.FOR
D:\MCNP4B\Install\PRPR.ID
D:\MCNP4B\Install\PRPR.EXE
D:\MCNP4B\Install\READMAAG
D:\MCNP4B\Install\readme4b2.txt
D:\MCNP4B\Install\fix4b2.txt
D:\MCNP4B\Install\answer.std
D:\MCNP4B\Install\install.log.std
D:\MCNP4B\Install\install.fix.std
D:\MCNP4B\Install\install.log.std
D:\MCNP4B\Install\plot.obj

Attachment V: List of Output Files Archived on Electronic Media MOY-980414-11 (verification, validation, and regression testing files)

MCNP4B2 files from OPUS

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-opus\endf5

LA1X5O              244,021  04-01-98  8:16a LA1X5o
LA2X5O              212,043  04-01-98  8:16a LA2X5o
LA3X5O              274,520  04-01-98  8:16a LA3X5o
EXP1O             1,875,869  04-01-98  8:16a exp1o
EXP22O              918,566  04-01-98  8:16a exp22o
EXP23O              947,216  04-01-98  8:17a exp23o
EXP24AO           4,169,253  04-01-98  8:17a exp24ao
EXP25O              955,767  04-01-98  8:17a exp25o
EXP26O              863,930  04-01-98  8:17a exp26o
EXP27O              914,641  04-01-98  8:17a exp27o
EXP2O             1,981,256  04-01-98  8:17a exp2o
EXP3O             1,895,181  04-01-98  8:17a exp3o
EXP4O             1,898,335  04-01-98  8:17a exp4o
```

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-opus\endf6

LA1XO               244,009  04-01-98  8:18a LA1Xo
LA2XO               212,360  04-01-98  8:18a LA2Xo
LA3O                291,163  04-01-98  8:18a LA3o
GODIVAO             177,583  04-01-98  8:18a godivao
JEZ20O              177,352  04-01-98  8:18a jez20o
JEZ4      5O        111,316  04-01-98  8:18a jez4.5o
PROB12O             320,682  04-01-98  8:18a prob12o
PROB13O             308,504  04-01-98  8:18a prob13o
PROB14O             311,903  04-01-98  8:18a prob14o
PROB15O             280,344  04-01-98  8:18a prob15o
PROB16O             313,649  04-01-98  8:18a prob16o
PROB18O             317,083  04-01-98  8:18a prob18o
PROB1O              329,059  04-01-98  8:18a prob1o
PROB20O             328,878  04-01-98  8:18a prob20o
PROB3NO             375,667  04-01-98  8:18a prob3no
PROB6O              298,164  04-01-98  8:18a prob6o
PROB7O              298,387  04-01-98  8:18a prob7o
```

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-opus\shield

MC10NEWO            435,752  04-01-98  8:18a mc10newo
UEKI     110         27,151  04-01-98  8:18a ueki.11o
UEKI     120         22,380  04-01-98  8:18a ueki.12o
UEKI     130         30,387  04-01-98  8:18a ueki.13o
UEKI     140         27,063  04-01-98  8:18a ueki.14o
UEKI     150         29,882  04-01-98  8:18a ueki.15o
UEKI     10          25,826  04-01-98  8:18a ueki.1o
UEKI     210         29,191  04-01-98  8:18a ueki.21o
UEKI     220         26,638  04-01-98  8:18a ueki.22o
UEKI     240         29,164  04-01-98  8:18a ueki.24o
UEKI     250         30,412  04-01-98  8:18a ueki.25o
UEKI     260         33,255  04-01-98  8:18a ueki.26o
UEKI     270         50,087  04-01-98  8:19a ueki.27o
UEKI     20          21,189  04-01-98  8:19a ueki.2o
UEKI     310         26,055  04-01-98  8:19a ueki.31o
UEKI     320         26,667  04-01-98  8:19a ueki.32o
UEKI     330         29,935  04-01-98  8:19a ueki.33o
UEKI     340         33,602  04-01-98  8:19a ueki.34o
UEKI     350         36,423  04-01-98  8:19a ueki.35o
UEKI     30          23,340  04-01-98  8:19a ueki.3o
UEKI     40          25,943  04-01-98  8:19a ueki.4o
UEKI     50          29,683  04-01-98  8:19a ueki.5o

 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-opus\4b2fix

BUG4B2O           2,100,815  04-01-98  8:16a bug4b2o
```

MCNP4B2 files from SPUDS

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-spuds\endf5

LA1X5O              243,385  04-01-98  8:21a LA1X5o
LA2X5O              212,043  04-01-98  8:21a LA2X5o
LA3X5O              274,520  04-01-98  8:21a LA3X5o
EXP1O             1,875,551  04-01-98  8:21a exp1o
EXP22O              918,248  04-01-98  8:21a exp22o
EXP23O              946,898  04-01-98  8:21a exp23o
EXP24AO           4,168,935  04-01-98  8:21a exp24ao
EXP25O              955,449  04-01-98  8:21a exp25o
EXP26O              863,612  04-01-98  8:21a exp26o
EXP27O              914,323  04-01-98  8:21a exp27o
EXP2O             1,980,620  04-01-98  8:21a exp2o
EXP3O             1,894,545  04-01-98  8:21a exp3o
EXP4O             1,897,805  04-01-98  8:21a exp4o

 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-spuds\endf6

LA1XO               243,373  04-01-98  8:21a LA1Xo
LA2XO               212,360  04-01-98  8:21a LA2Xo
LA3O                291,163  04-01-98  8:21a LA3o
GODIVAO             177,583  04-01-98  8:21a godivao
JEZ20O              177,352  04-01-98  8:21a jez20o
JEZ4      5O        111,316  04-01-98  8:21a jez4.5o
PROB12O             320,682  04-01-98  8:21a prob12o
PROB13O             308,504  04-01-98  8:21a prob13o
PROB14O             311,903  04-01-98  8:21a prob14o
PROB15O             279,072  04-01-98  8:21a prob15o
PROB16O             313,331  04-01-98  8:21a prob16o
PROB18O             315,811  04-01-98  8:21a prob18o
PROB1O              329,059  04-01-98  8:21a prob1o
PROB20O             328,560  04-01-98  8:21a prob20o
PROB3NO             373,511  04-01-98  8:21a prob3no
PROB6O              298,164  04-01-98  8:21a prob6o
PROB7O              298,387  04-01-98  8:22a prob7o

 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-spuds\shield

MC10NEWO            434,760  04-01-98  8:22a mc10newo
```

```
UEKI     110        27,151  04-01-98  8:22a ueki.11o
UEKI     120        22,380  04-01-98  8:22a ueki.12o
UEKI     130        30,387  04-01-98  8:22a ueki.13o
UEKI     140        27,063  04-01-98  8:22a ueki.14o
UEKI     150        29,386  04-01-98  8:22a ueki.15o
UEKI     10         25,826  04-01-98  8:22a ueki.1o
UEKI     210        29,191  04-01-98  8:22a ueki.21o
UEKI     220        26,638  04-01-98  8:22a ueki.22o
UEKI     240        28,916  04-01-98  8:22a ueki.24o
UEKI     250        30,164  04-01-98  8:22a ueki.25o
UEKI     260        33,007  04-01-98  8:22a ueki.26o
UEKI     270        50,087  04-01-98  8:22a ueki.27o
UEKI     20         21,189  04-01-98  8:22a ueki.2o
UEKI     310        26,055  04-01-98  8:22a ueki.31o
UEKI     320        26,667  04-01-98  8:22a ueki.32o
UEKI     330        29,935  04-01-98  8:22a ueki.33o
UEKI     340        33,354  04-01-98  8:22a ueki.34o
UEKI     350        35,927  04-01-98  8:22a ueki.35o
UEKI     30         23,340  04-01-98  8:22a ueki.3o
UEKI     40         25,943  04-01-98  8:22a ueki.4o
UEKI     50         28,939  04-01-98  8:22a ueki.5o

 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-spuds\4b2fix

BUG4B2O          2,100,815  04-01-98  8:20a bug4b2o
```

MCNP4B2 files from OTIS

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-otis\endf5

LA1X5O              243,363  04-01-98  8:23a LA1X5o
LA2X5O              211,883  04-01-98  8:23a LA2X5o
LA3X5O              274,408  04-01-98  8:23a LA3X5o
EXP1O             1,875,276  04-01-98  8:23a exp1o
EXP22O              918,185  04-01-98  8:23a exp22o
EXP23O              946,835  04-01-98  8:23a exp23o
EXP24AO           4,168,554  04-01-98  8:24a exp24ao
EXP25O              955,386  04-01-98  8:24a exp25o
EXP26O              863,549  04-01-98  8:24a exp26o
EXP27O              914,260  04-01-98  8:24a exp27o
EXP2O             1,980,557  04-01-98  8:24a exp2o
EXP3O             1,894,376  04-01-98  8:24a exp3o
EXP4O             1,897,742  04-01-98  8:24a exp4o
```

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-otis\endf6

LA1XO               243,351  04-01-98  8:24a LA1Xo
LA2XO               212,200  04-01-98  8:24a LA2Xo
LA3O                291,051  04-01-98  8:24a LA3o
GODIVAO             177,472  04-01-98  8:24a godivao
JEZ20O              177,241  04-01-98  8:24a jez20o
JEZ4      5O        111,269  04-01-98  8:24a jez4.5o
PROB12O             320,428  04-01-98  8:24a prob12o
PROB13O             308,251  04-01-98  8:24a prob13o
PROB14O             311,646  04-01-98  8:24a prob14o
PROB15O             278,578  04-01-98  8:24a prob15o
PROB16O             313,078  04-01-98  8:24a prob16o
PROB18O             315,219  04-01-98  8:24a prob18o
PROB1O              328,802  04-01-98  8:24a prob1o
PROB20O             328,306  04-01-98  8:24a prob20o
PROB3NO             372,936  04-01-98  8:24a prob3no
PROB6O              297,907  04-01-98  8:24a prob6o
PROB7O              298,130  04-01-98  8:24a prob7o
```

```
 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-otis\shield

MC10NEWO            434,593  04-01-98  8:24a mc10newo
```

```
UEKI     110        27,127  04-01-98  8:24a ueki.11o
UEKI     120        22,356  04-01-98  8:24a ueki.12o
UEKI     130        30,363  04-01-98  8:24a ueki.13o
UEKI     140        27,019  04-01-98  8:24a ueki.14o
UEKI     150        29,342  04-01-98  8:24a ueki.15o
UEKI     10         25,802  04-01-98  8:24a ueki.1o
UEKI     210        29,167  04-01-98  8:24a ueki.21o
UEKI     220        26,596  04-01-98  8:24a ueki.22o
UEKI     240        28,874  04-01-98  8:24a ueki.24o
UEKI     250        30,122  04-01-98  8:24a ueki.25o
UEKI     260        32,965  04-01-98  8:24a ueki.26o
UEKI     270        49,797  04-01-98  8:24a ueki.27o
UEKI     20         21,165  04-01-98  8:24a ueki.2o
UEKI     310        26,031  04-01-98  8:24a ueki.31o
UEKI     320        26,643  04-01-98  8:24a ueki.32o
UEKI     330        29,911  04-01-98  8:24a ueki.33o
UEKI     340        33,310  04-01-98  8:24a ueki.34o
UEKI     350        35,883  04-01-98  8:24a ueki.35o
UEKI     30         23,316  04-01-98  8:24a ueki.3o
UEKI     40         25,899  04-01-98  8:24a ueki.4o
UEKI     50         28,647  04-01-98  8:24a ueki.5o

 Volume in drive C is DELLWIN95
 Volume Serial Number is 205C-13FB
 Directory of C:\Work\mcnp4b2\ver-val-otis\4b2fix

BUG4B2O          2,100,857  04-01-98  8:23a bug4b2o
```

MCNP4B2X files from PC #112105

```
 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\MCNP4B\TEST\install

INP01                1,446  01-08-97  2:18p INP01
INP02                2,037  01-08-97  2:18p INP02
INP03                1,996  01-08-97  2:18p INP03
INP04                1,106  01-08-97  2:18p INP04
INP05                2,236  01-08-97  2:18p INP05
INP06                1,667  01-08-97  2:18p INP06
INP07                1,611  01-08-97  2:18p INP07
INP08                3,406  01-08-97  2:18p INP08
INP09                1,315  01-08-97  2:18p INP09
INP10                1,060  01-08-97  2:19p INP10
INP11                2,097  01-08-97  2:19p INP11
INP12               47,060  01-08-97  2:19p INP12
INP13                1,223  01-08-97  2:19p INP13
INP14                2,541  01-08-97  2:19p INP14
INP15                1,150  01-08-97  2:19p INP15
INP16                2,319  01-08-97  2:19p INP16
INP17                1,013  01-08-97  2:19p INP17
INP18                4,436  01-08-97  2:19p INP18
INP19                  598  01-08-97  2:19p INP19
INP20                1,232  01-08-97  2:19p INP20
INP21                8,405  01-08-97  2:19p INP21
INP22                7,757  01-08-97  2:20p INP22
INP23                5,659  01-08-97  2:20p INP23
INP24                2,174  01-08-97  2:20p INP24
INP25                   45  01-08-97  2:20p INP25
INP26                   45  01-08-97  2:20p INP26
INP27                  957  01-08-97  2:20p INP27
INP28                5,898  01-08-97  2:20p INP28
INP29                  873  01-08-97  2:20p INP29
TESTLIB1        16,236,204  02-12-97  9:07a TESTLIB1
TESTDIR             23,199  02-12-97  9:07a TESTDIR
OUTP               110,633  04-03-98  4:49p OUTP
RUNTPE             101,512  04-03-98  4:49p RUNTPE
MCTAL                6,989  04-03-98  4:49p MCTAL
RUNPROB  BAT         3,641  04-03-98  5:14p runprob.bat
PTRAC               31,025  04-03-98  4:49p PTRAC
RUNPROB  DOS         3,177  02-12-97  9:07a RUNPROB.DOS
TESTIAAI DOS        46,586  02-12-97  9:07a TESTIAAI.DOS
TESTMAAJ DOS        58,271  02-12-97  9:07a TESTMAAJ.DOS
INSTALL  BAT         2,332  04-03-98  5:00p INSTALL.BAT
TESTOAAK DOS       540,472  02-12-97  9:07a TESTOAAK.DOS
PKARCAAM COM        19,573  02-19-97  3:10p PKARCAAM.COM
PKXARAAL COM        12,242  02-19-97  3:10p PKXARAAL.COM
```

MCTL01	6,989	02-04-97	12:00p	MCTL01
MCTL02	15,554	02-04-97	12:00p	MCTL02
MCTL03	1,855	02-04-97	12:00p	MCTL03
MCTL04	11,483	02-04-97	12:01p	MCTL04
MCTL05	2,269	02-04-97	12:01p	MCTL05
MCTL06	5,098	02-04-97	12:02p	MCTL06
MCTL07	1,516	02-04-97	12:02p	MCTL07
MCTL08	3,589	02-04-97	12:03p	MCTL08
MCTL09	18,204	02-04-97	12:03p	MCTL09
MCTL10	780	02-04-97	12:04p	MCTL10
MCTL11	4,704	02-04-97	12:05p	MCTL11
MCTL12	3,694	02-04-97	12:06p	MCTL12
MCTL13	2,989	02-04-97	12:06p	MCTL13
MCTL14	3,278	02-04-97	12:06p	MCTL14
MCTL15	805	02-04-97	12:06p	MCTL15
MCTL16	1,417	02-04-97	12:07p	MCTL16
MCTL17	11,601	02-04-97	12:07p	MCTL17
MCTL18	8,618	02-04-97	12:09p	MCTL18
MCTL19	2,468	02-04-97	12:09p	MCTL19
MCTL20	9,890	02-04-97	12:10p	MCTL20
MCTL21	23,397	02-04-97	12:11p	MCTL21
MCTL22	1,545	02-04-97	12:11p	MCTL22
MCTL23	3,050	02-04-97	12:12p	MCTL23
MCTL24	1,272	02-04-97	12:12p	MCTL24
MCTL25	1,508	02-04-97	12:13p	MCTL25
MCTL26	19,226	02-04-97	12:13p	MCTL26
MCTL27	3,116	02-04-97	12:13p	MCTL27
MCTL28	38,462	02-04-97	12:13p	MCTL28
MCTL29	1,424	02-04-97	12:14p	MCTL29
OUTP01	110,633	02-04-97	12:00p	OUTP01
OUTP02	118,116	02-04-97	12:00p	OUTP02
OUTP03	20,004	02-04-97	12:00p	OUTP03
OUTP04	145,829	02-04-97	12:01p	OUTP04
OUTP05	22,776	02-04-97	12:01p	OUTP05
OUTP06	34,972	02-04-97	12:02p	OUTP06
OUTP07	76,680	02-04-97	12:02p	OUTP07
OUTP08	178,891	02-04-97	12:03p	OUTP08
OUTP09	57,775	02-04-97	12:03p	OUTP09
OUTP10	32,142	02-04-97	12:04p	OUTP10
OUTP11	57,334	02-04-97	12:05p	OUTP11
OUTP12	172,386	02-04-97	12:06p	OUTP12
OUTP13	90,499	02-04-97	12:06p	OUTP13
OUTP14	32,147	02-04-97	12:06p	OUTP14
OUTP15	45,291	02-04-97	12:06p	OUTP15
OUTP16	52,465	02-04-97	12:07p	OUTP16
OUTP17	109,124	02-04-97	12:07p	OUTP17
OUTP18	78,459	02-04-97	12:09p	OUTP18
OUTP19	14,953	02-04-97	12:09p	OUTP19
OUTP20	55,232	02-04-97	12:10p	OUTP20

OUTP21	82,479	02-04-97	12:11p	OUTP21
OUTP22	52,731	02-04-97	12:11p	OUTP22
OUTP23	92,255	02-04-97	12:12p	OUTP23
OUTP24	33,532	02-04-97	12:12p	OUTP24
OUTP25	18,086	02-04-97	12:13p	OUTP25
OUTP26	58,087	02-04-97	12:13p	OUTP26
OUTP27	18,131	02-04-97	12:13p	OUTP27
OUTP28	146,123	02-04-97	12:13p	OUTP28
OUTP29	37,339	02-04-97	12:14p	OUTP29
DIFM01	69	04-03-98	5:15p	difm01
DIFO01	69	04-03-98	5:15p	difo01
DIFM02	69	04-03-98	5:15p	difm02
DIFO02	541	04-03-98	5:15p	difo02
DIFM03	69	04-03-98	5:15p	difm03
DIFO03	69	04-03-98	5:15p	difo03
DIFM04	69	04-03-98	5:15p	difm04
DIFO04	3,745	04-03-98	5:15p	difo04
DIFM05	69	04-03-98	5:16p	difm05
DIFO05	69	04-03-98	5:16p	difo05
DIFM06	69	04-03-98	5:16p	difm06
DIFO06	69	04-03-98	5:16p	difo06
DIFM07	69	04-03-98	5:16p	difm07
DIFO07	69	04-03-98	5:16p	difo07
DIFM08	69	04-03-98	5:16p	difm08
DIFO08	681	04-03-98	5:16p	difo08
DIFM09	69	04-03-98	5:17p	difm09
DIFO09	1,065	04-03-98	5:17p	difo09
DIFM10	69	04-03-98	5:17p	difm10
DIFO10	69	04-03-98	5:17p	difo10
DIFM11	69	04-03-98	5:18p	difm11
DIFO11	69	04-03-98	5:18p	difo11
DIFM12	69	04-03-98	5:18p	difm12
DIFO12	785	04-03-98	5:18p	difo12
DIFM13	69	04-03-98	5:18p	difm13
DIFO13	3,257	04-03-98	5:18p	difo13
DIFM14	69	04-03-98	5:18p	difm14
DIFO14	69	04-03-98	5:18p	difo14
DIFM15	69	04-03-98	5:18p	difm15
DIFO15	681	04-03-98	5:18p	difo15
DIFM16	69	04-03-98	5:18p	difm16
DIFO16	69	04-03-98	5:18p	difo16
DIFM17	69	04-03-98	5:19p	difm17
DIFO17	69	04-03-98	5:19p	difo17
DIFM18	69	04-03-98	5:19p	difm18
DIFO18	359	04-03-98	5:19p	difo18
DIFM19	69	04-03-98	5:19p	difm19
DIFO19	69	04-03-98	5:19p	difo19
DIFM20	69	04-03-98	5:20p	difm20
DIFO20	69	04-03-98	5:20p	difo20

DIFM21	69	04-03-98	5:20p	difm21
DIFO21	763	04-03-98	5:20p	difo21
DIFM22	69	04-03-98	5:21p	difm22
DIFO22	69	04-03-98	5:21p	difo22
DIFM23	69	04-03-98	5:21p	difm23
DIFO23	811	04-03-98	5:21p	difo23
DIFM24	69	04-03-98	5:21p	difm24
DIFO24	363	04-03-98	5:21p	difo24
DIFM25	69	04-03-98	5:21p	difm25
DIFO25	69	04-03-98	5:21p	difo25
DIFM26	69	04-03-98	5:21p	difm26
DIFO26	1,065	04-03-98	5:21p	difo26
DIFM27	69	04-03-98	5:22p	difm27
DIFO27	551	04-03-98	5:22p	difo27
DIFM28	69	04-03-98	5:22p	difm28
DIFO28	1,003	04-03-98	5:22p	difo28
DIFM29	69	04-03-98	5:22p	difm29
DIFO29	69	04-03-98	5:22p	difo29
INP01O	110,633	04-03-98	5:15p	INP01O
INP02O	118,116	04-03-98	5:15p	INP02O
INP01M	6,989	04-03-98	5:15p	INP01M
INP03O	20,004	04-03-98	5:15p	INP03O
INP02M	15,554	04-03-98	5:15p	INP02M
INP01P	31,025	04-03-98	5:15p	INP01P
INP04O	145,829	04-03-98	5:15p	INP04O
INP03M	1,855	04-03-98	5:15p	INP03M
INP02P	25,629	04-03-98	5:15p	INP02P
INP05O	22,776	04-03-98	5:16p	INP05O
INP04M	11,483	04-03-98	5:15p	INP04M
INP06O	34,972	04-03-98	5:16p	INP06O
INP05M	2,269	04-03-98	5:16p	INP05M
INP07O	76,680	04-03-98	5:16p	INP07O
INP06M	5,098	04-03-98	5:16p	INP06M
INP08O	178,891	04-03-98	5:16p	INP08O
INP07W	429,749	04-03-98	5:16p	INP07W
INP07M	1,516	04-03-98	5:16p	INP07M
INP09O	57,775	04-03-98	5:17p	INP09O
INP08M	3,589	04-03-98	5:16p	INP08M
INP27O	18,131	04-03-98	5:22p	INP27O
INP26S	180,030	04-03-98	5:22p	INP26S
INP08P	821	04-03-98	5:16p	INP08P
INP09M	18,204	04-03-98	5:17p	INP09M
INP10O	32,142	04-03-98	5:17p	INP10O
INP09S	180,030	04-03-98	5:17p	INP09S
INP11O	57,334	04-03-98	5:18p	INP11O
INP10M	780	04-03-98	5:17p	INP10M
INP12O	172,386	04-03-98	5:18p	INP12O
INP13O	90,499	04-03-98	5:18p	INP13O
INP11M	4,704	04-03-98	5:18p	INP11M

```
INP12M          3,694  04-03-98  5:18p INP12M
INP14O         32,147  04-03-98  5:18p INP14O
INP13M          2,989  04-03-98  5:18p INP13M
INP15O         45,291  04-03-98  5:18p INP15O
INP14M          3,278  04-03-98  5:18p INP14M
INP16O         52,465  04-03-98  5:18p INP16O
INP15M            805  04-03-98  5:18p INP15M
INP17O        109,124  04-03-98  5:19p INP17O
INP16M          1,417  04-03-98  5:18p INP16M
INP18O         78,459  04-03-98  5:19p INP18O
INP19O         14,953  04-03-98  5:19p INP19O
INP18M          8,618  04-03-98  5:19p INP18M
INP17M         11,601  04-03-98  5:19p INP17M
INP20O         55,232  04-03-98  5:20p INP20O
INP18S        180,030  04-03-98  5:19p INP18S
INP19M          2,468  04-03-98  5:19p INP19M
INP18P          1,461  04-03-98  5:19p INP18P
INP21O         82,479  04-03-98  5:20p INP21O
INP20M          9,890  04-03-98  5:20p INP20M
INP22O         52,731  04-03-98  5:21p INP22O
INP21W      3,277,913  04-03-98  5:20p INP21W
INP21M         23,397  04-03-98  5:20p INP21M
INP23O         92,255  04-03-98  5:21p INP23O
INP22M          1,545  04-03-98  5:21p INP22M
INP24O         33,532  04-03-98  5:21p INP24O
INP23M          3,050  04-03-98  5:21p INP23M
INP26O         58,087  04-03-98  5:22p INP26O
INP24M          1,272  04-03-98  5:21p INP24M
INP23P         20,920  04-03-98  5:21p INP23P
INP25O         18,086  04-03-98  5:21p INP25O
INP24S        180,030  04-03-98  5:21p INP24S
INP25M          1,508  04-03-98  5:21p INP25M
INP09W        617,942  04-03-98  5:22p INP09W
INP26M         19,226  04-03-98  5:22p INP26M
INP25S        180,030  04-03-98  5:21p INP25S
INP29O         37,339  04-03-98  5:22p INP29O
INP27M          3,116  04-03-98  5:22p INP27M
INP28M         38,462  04-03-98  5:22p INP28M
INP28O        146,123  04-03-98  5:22p inp28o
INP29M          1,424  04-03-98  5:22p INP29M


 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\MCNP4B\TEST\endf5

EXP1      OUT      1,875,904  04-02-98  2:25p exp1.out
```

```
EXP2      OUT     1,980,968  04-02-98  3:08p exp2.out
EXP22     OUT       918,671  04-02-98  4:04p exp22.out
EXP23     OUT       947,145  04-02-98  4:39p exp23.out
EXP24A    OUT     4,169,283  04-02-98  5:28p exp24a.out
EXP25     OUT       955,484  04-02-98  5:57p exp25.out
EXP26     OUT       863,953  04-02-98  6:46p exp26.out
EXP27     OUT       914,459  04-02-98  7:14p exp27.out
EXP3      OUT     1,894,792  04-02-98  7:58p exp3.out
EXP4      OUT     1,898,052  04-02-98  8:42p exp4.out
LA1X5     OUT       243,858  04-02-98  9:38p la1x5.out
LA2X5     OUT       212,065  04-02-98  9:42p la2x5.out
LA3X5     OUT       274,473  04-02-98  9:50p la3x5.out


 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\MCNP4B\TEST\endf6

PROB3     OUT        41,062  04-07-98 11:11a prob3.out
PROB1     OUT       318,243  04-07-98 11:11a prob1.out
PROB3N    OUT       373,746  04-08-98  6:02p prob3n.out
PROB6     OUT       298,699  04-07-98 11:16a prob6.out
PROB20    OUT       327,914  04-07-98 11:34a prob20.out
PROB7     OUT       307,817  04-07-98 11:40a prob7.out
PROB16    OUT       314,858  04-07-98 12:02p prob16.out
PROB18    OUT       316,263  04-07-98  1:55p prob18.out
PROB15    OUT       279,622  04-07-98  3:59p prob15.out
PROB14    OUT       300,925  04-07-98  4:05p prob14.out
PROB13    OUT       299,941  04-07-98  4:10p prob13.out
PROB12    OUT       321,011  04-07-98  4:22p prob12.out
GODIVA    OUT       177,624  04-07-98  4:25p godiva.out
LA3       OUT       291,130  04-07-98  4:34p la3.out
LA2X      OUT       213,185  04-07-98  4:38p la2x.out
LA1X      OUT       243,874  04-07-98  5:37p la1x.out
JEZ45~1   OUT       111,261  04-07-98  5:38p jez4.5.out
JEZ20     OUT       177,233  04-07-98  5:40p jez20.out


 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\MCNP4B\TEST\shielding

UEKI1~1   OUT        25,802  04-01-98  4:43p ueki.1.out
UEKI2~1   OUT        21,165  04-01-98  4:46p ueki.2.out
UEKI3~1   OUT        23,316  04-01-98  4:50p ueki.3.out
UEKI4~1   OUT        25,899  04-01-98  5:01p ueki.4.out
UEKI5~1   OUT        29,391  04-01-98  6:41p ueki.5.out
```

```
UEKI11~2 OUT        27,127  04-01-98  6:45p ueki.11.out
UEKI12~2 OUT        22,356  04-01-98  6:48p ueki.12.out
UEKI13~2 OUT        30,363  04-01-98  6:52p ueki.13.out
UEKI14~2 OUT        27,019  04-01-98  7:01p ueki.14.out
UEKI15~2 OUT        29,590  04-01-98  7:42p ueki.15.out
MC10NEW  OUT       435,246  04-01-98  9:57p mc10new.out
UEKI21~2 OUT        29,167  04-01-98  9:57p ueki.21.out
UEKI22~2 OUT        26,596  04-01-98 10:06p ueki.22.out
UEKI24~2 OUT        28,874  04-01-98 10:20p ueki.24.out
UEKI25~2 OUT        30,358  04-01-98 10:39p ueki.25.out
UEKI26~2 OUT        33,213  04-02-98  7:37a ueki.26.out
UEKI27~2 OUT        57,748  04-02-98  8:04a ueki.27.out
UEKI31~2 OUT        26,031  04-02-98  8:07a ueki.31.out
UEKI32~2 OUT        26,643  04-02-98  8:11a ueki.32.out
UEKI33~2 OUT        29,911  04-02-98  8:15a ueki.33.out
UEKI34~2 OUT        33,310  04-02-98  8:29a ueki.34.out
UEKI35~2 OUT        36,131  04-02-98  9:24a ueki.35.out
```

MCNP4B2 files from PC #112110

```
 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\mcnp4b\TEST\install

RUNMCNP  BAT          802  04-01-98  5:49p runmcnp.bat
INP01               1,446  01-08-97  2:18p INP01
INP02               2,037  01-08-97  2:18p INP02
INP03               1,996  01-08-97  2:18p INP03
INP04               1,106  01-08-97  2:18p INP04
INP05               2,236  01-08-97  2:18p INP05
INP06               1,667  01-08-97  2:18p INP06
INP07               1,611  01-08-97  2:18p INP07
INP08               3,406  01-08-97  2:18p INP08
INP09               1,315  01-08-97  2:18p INP09
INP10               1,060  01-08-97  2:19p INP10
INP11               2,097  01-08-97  2:19p INP11
INP12              47,060  01-08-97  2:19p INP12
INP13               1,223  01-08-97  2:19p INP13
INP14               2,541  01-08-97  2:19p INP14
INP15               1,150  01-08-97  2:19p INP15
INP16               2,319  01-08-97  2:19p INP16
INP17               1,013  01-08-97  2:19p INP17
INP18               4,436  01-08-97  2:19p INP18
INP19                 598  01-08-97  2:19p INP19
INP20               1,232  01-08-97  2:19p INP20
INP21               8,405  01-08-97  2:19p INP21
INP22               7,757  01-08-97  2:20p INP22
INP23               5,659  01-08-97  2:20p INP23
INP24               2,174  01-08-97  2:20p INP24
INP25                  45  01-08-97  2:20p INP25
INP26                  45  01-08-97  2:20p INP26
INP27                 957  01-08-97  2:20p INP27
INP28               5,898  01-08-97  2:20p INP28
INP29                 873  01-08-97  2:20p INP29
RUNPROB  BAT        3,612  04-03-98  5:19p runprob.bat
TESTDIR            23,199  02-12-97  9:07a TESTDIR
TESTLIB1       16,236,204  02-12-97  9:07a TESTLIB1
MCTL01              6,989  02-04-97 12:00p MCTL01
MCTL02             15,554  02-04-97 12:00p MCTL02
MCTL03              1,855  02-04-97 12:00p MCTL03
MCTL04             11,483  02-04-97 12:01p MCTL04
MCTL05              2,269  02-04-97 12:01p MCTL05
MCTL06              5,098  02-04-97 12:02p MCTL06
MCTL07              1,516  02-04-97 12:02p MCTL07
MCTL08              3,589  02-04-97 12:03p MCTL08
MCTL09             18,204  02-04-97 12:03p MCTL09
```

MCTL10	780	02-04-97	12:04p	MCTL10
MCTL11	4,704	02-04-97	12:05p	MCTL11
MCTL12	3,694	02-04-97	12:06p	MCTL12
MCTL13	2,989	02-04-97	12:06p	MCTL13
MCTL14	3,278	02-04-97	12:06p	MCTL14
MCTL15	805	02-04-97	12:06p	MCTL15
MCTL16	1,417	02-04-97	12:07p	MCTL16
MCTL17	11,601	02-04-97	12:07p	MCTL17
MCTL18	8,618	02-04-97	12:09p	MCTL18
MCTL19	2,468	02-04-97	12:09p	MCTL19
MCTL20	9,890	02-04-97	12:10p	MCTL20
MCTL21	23,397	02-04-97	12:11p	MCTL21
MCTL22	1,545	02-04-97	12:11p	MCTL22
MCTL23	3,050	02-04-97	12:12p	MCTL23
MCTL24	1,272	02-04-97	12:12p	MCTL24
MCTL25	1,508	02-04-97	12:13p	MCTL25
MCTL26	19,226	02-04-97	12:13p	MCTL26
MCTL27	3,116	02-04-97	12:13p	MCTL27
MCTL28	38,462	02-04-97	12:13p	MCTL28
MCTL29	1,424	02-04-97	12:14p	MCTL29
OUTP01	110,633	02-04-97	12:00p	OUTP01
OUTP02	118,116	02-04-97	12:00p	OUTP02
OUTP03	20,004	02-04-97	12:00p	OUTP03
OUTP04	145,829	02-04-97	12:01p	OUTP04
OUTP05	22,776	02-04-97	12:01p	OUTP05
OUTP06	34,972	02-04-97	12:02p	OUTP06
OUTP07	76,680	02-04-97	12:02p	OUTP07
OUTP08	178,891	02-04-97	12:03p	OUTP08
OUTP09	57,775	02-04-97	12:03p	OUTP09
OUTP10	32,142	02-04-97	12:04p	OUTP10
OUTP11	57,334	02-04-97	12:05p	OUTP11
OUTP12	172,386	02-04-97	12:06p	OUTP12
OUTP13	90,499	02-04-97	12:06p	OUTP13
OUTP14	32,147	02-04-97	12:06p	OUTP14
OUTP15	45,291	02-04-97	12:06p	OUTP15
OUTP16	52,465	02-04-97	12:07p	OUTP16
OUTP17	109,124	02-04-97	12:07p	OUTP17
OUTP18	78,459	02-04-97	12:09p	OUTP18
OUTP19	14,953	02-04-97	12:09p	OUTP19
OUTP20	55,232	02-04-97	12:10p	OUTP20
OUTP21	82,479	02-04-97	12:11p	OUTP21
OUTP22	52,731	02-04-97	12:11p	OUTP22
OUTP23	92,255	02-04-97	12:12p	OUTP23
OUTP24	33,532	02-04-97	12:12p	OUTP24
OUTP25	18,086	02-04-97	12:13p	OUTP25
OUTP26	58,087	02-04-97	12:13p	OUTP26
OUTP27	18,131	02-04-97	12:13p	OUTP27
OUTP28	146,123	02-04-97	12:13p	OUTP28
OUTP29	37,339	02-04-97	12:14p	OUTP29

INP01O	110,633	04-03-98	5:19p	INP01O
INP02O	118,116	04-03-98	5:20p	INP02O
INP01M	6,989	04-03-98	5:19p	INP01M
DIFM01	69	04-03-98	5:19p	difm01
INP01P	31,025	04-03-98	5:19p	INP01P
DIFO01	69	04-03-98	5:19p	difo01
INP03O	20,004	04-03-98	5:20p	INP03O
INP02M	15,554	04-03-98	5:20p	INP02M
DIFM02	69	04-03-98	5:20p	difm02
INP02P	25,629	04-03-98	5:20p	INP02P
DIFO02	541	04-03-98	5:20p	difo02
INP04O	145,829	04-03-98	5:20p	INP04O
INP03M	1,855	04-03-98	5:20p	INP03M
INP05O	22,776	04-03-98	5:20p	INP05O
DIFM03	69	04-03-98	5:20p	difm03
DIFO03	69	04-03-98	5:20p	difo03
INP04M	11,483	04-03-98	5:20p	INP04M
INP06O	34,972	04-03-98	5:20p	INP06O
DIFM04	69	04-03-98	5:20p	difm04
DIFO04	3,745	04-03-98	5:20p	difo04
INP05M	2,269	04-03-98	5:20p	INP05M
INP07O	76,680	04-03-98	5:21p	INP07O
DIFM05	69	04-03-98	5:20p	difm05
DIFO05	69	04-03-98	5:20p	difo05
INP06M	5,098	04-03-98	5:20p	INP06M
INP08O	178,891	04-03-98	5:21p	INP08O
DIFM06	69	04-03-98	5:20p	difm06
DIFO06	69	04-03-98	5:20p	difo06
INP07W	429,749	04-03-98	5:21p	INP07W
INP07M	1,516	04-03-98	5:21p	INP07M
INP09O	57,775	04-03-98	5:21p	INP09O
DIFM07	69	04-03-98	5:21p	difm07
DIFO07	69	04-03-98	5:21p	difo07
INP08M	3,589	04-03-98	5:21p	INP08M
DIFM08	69	04-03-98	5:21p	difm08
INP08P	821	04-03-98	5:21p	INP08P
DIFO08	681	04-03-98	5:21p	difo08
INP27O	18,131	04-06-98	11:21a	INP27O
INP26S	180,030	04-06-98	11:21a	INP26S
INP09M	18,204	04-03-98	5:21p	INP09M
INP10O	32,142	04-03-98	5:21p	INP10O
INP09S	180,030	04-03-98	5:21p	INP09S
DIFM09	69	04-03-98	5:21p	difm09
DIFO09	1,065	04-03-98	5:21p	difo09
INP11O	57,334	04-03-98	5:22p	INP11O
INP10M	780	04-03-98	5:21p	INP10M
INP12O	172,386	04-03-98	5:22p	INP12O
DIFM10	69	04-03-98	5:21p	difm10
DIFO10	69	04-03-98	5:21p	difo10

INP13O	90,499	04-03-98	5:23p	INP13O
INP11M	4,704	04-03-98	5:22p	INP11M
DIFM11	69	04-03-98	5:22p	difm11
DIFO11	69	04-03-98	5:22p	difo11
INP12M	3,694	04-03-98	5:23p	INP12M
INP14O	32,147	04-03-98	5:23p	INP14O
DIFM12	69	04-03-98	5:23p	difm12
DIFO12	785	04-03-98	5:23p	difo12
INP13M	2,989	04-03-98	5:23p	INP13M
INP15O	45,291	04-03-98	5:23p	INP15O
DIFM13	69	04-03-98	5:23p	difm13
DIFO13	3,257	04-03-98	5:23p	difo13
INP14M	3,278	04-03-98	5:23p	INP14M
INP16O	52,465	04-03-98	5:23p	INP16O
DIFM14	69	04-03-98	5:23p	difm14
DIFO14	69	04-03-98	5:23p	difo14
INP15M	805	04-03-98	5:23p	INP15M
INP17O	109,124	04-03-98	5:23p	INP17O
DIFM15	69	04-03-98	5:23p	difm15
DIFO15	681	04-03-98	5:23p	difo15
INP16M	1,417	04-03-98	5:23p	INP16M
INP18O	78,459	04-06-98	11:16a	INP18O
DIFM16	69	04-03-98	5:23p	difm16
DIFO16	69	04-03-98	5:23p	difo16
INP19O	14,953	04-06-98	11:17a	INP19O
INP18M	8,618	04-06-98	11:16a	INP18M
INP17M	11,601	04-03-98	5:23p	INP17M
INP20O	55,232	04-06-98	11:18a	INP20O
DIFM17	69	04-03-98	5:23p	difm17
DIFO17	69	04-03-98	5:23p	difo17
INP18S	180,030	04-06-98	11:16a	INP18S
INP19M	2,468	04-06-98	11:17a	INP19M
INP18P	1,461	04-06-98	11:16a	INP18P
DIFM18	377	04-06-98	11:16a	difm18
DIFO18	359	04-06-98	11:16a	difo18
INP21O	82,479	04-06-98	11:19a	INP21O
DIFM19	69	04-06-98	11:17a	difm19
DIFO19	69	04-06-98	11:17a	difo19
INP20M	9,890	04-06-98	11:18a	INP20M
INP22O	52,731	04-06-98	11:19a	INP22O
DIFM20	69	04-06-98	11:18a	difm20
DIFO20	69	04-06-98	11:18a	difo20
INP21W	3,277,913	04-06-98	11:19a	INP21W
INP21M	23,397	04-06-98	11:19a	INP21M
INP23O	92,255	04-06-98	11:20a	INP23O
DIFM21	69	04-06-98	11:19a	difm21
DIFO21	763	04-06-98	11:19a	difo21
INP22M	1,545	04-06-98	11:19a	INP22M
INP24O	33,532	04-06-98	11:21a	INP24O

```
DIFM22                69  04-06-98 11:19a difm22
DIFO22                69  04-06-98 11:19a difo22
INP23M             3,050  04-06-98 11:20a INP23M
DIFM23                69  04-06-98 11:20a difm23
INP23P            20,920  04-06-98 11:20a INP23P
DIFO23               811  04-06-98 11:20a difo23
INP26O            58,087  04-06-98 11:21a INP26O
INP24M             1,272  04-06-98 11:21a INP24M
INP25O            18,086  04-06-98 11:21a INP25O
INP24S           180,030  04-06-98 11:21a INP24S
DIFM24                69  04-06-98 11:21a difm24
DIFO24               363  04-06-98 11:21a difo24
INP25M             1,508  04-06-98 11:21a INP25M
DIFM25                69  04-06-98 11:21a difm25
INP25S           180,030  04-06-98 11:21a INP25S
DIFO25                69  04-06-98 11:21a difo25
INP09W           617,942  04-06-98 11:21a INP09W
INP26M            19,226  04-06-98 11:21a INP26M
DIFM26                69  04-06-98 11:21a difm26
DIFO26             1,065  04-06-98 11:21a difo26
INP29O            37,339  04-06-98 11:23a INP29O
INP27M             3,116  04-06-98 11:21a INP27M
DIFM27                69  04-06-98 11:21a difm27
DIFO27               551  04-06-98 11:21a difo27
INP28M            38,462  04-06-98 11:22a INP28M
INP28O           146,123  04-06-98 11:21a inp28o
INP29M             1,424  04-06-98 11:23a INP29M
DIFM28                69  04-06-98 11:22a difm28
DIFO28             1,003  04-06-98 11:22a difo28
DIFM29                69  04-06-98 11:23a difm29
DIFO29                69  04-06-98 11:23a difo29


 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\mcnp4b\TEST\endf5

EXP2     OUT     1,981,604  04-08-98  9:49a exp2.out
EXP22    OUT       919,943  04-08-98 11:48a exp22.out
EXP23    OUT       947,145  04-08-98 12:31p exp23.out
EXP27    OUT       916,049  04-02-98 11:09p exp27.out
EXP24A   OUT     4,169,919  04-08-98  1:59p exp24a.out
EXP1     OUT     1,877,812  04-03-98  1:32a exp1.out
EXP25    OUT       956,438  04-08-98  3:12p exp25.out
EXP26    OUT       864,907  04-08-98  4:56p exp26.out
EXP3     OUT     1,896,382  04-08-98  6:58p exp3.out
EXP4     OUT     1,899,642  04-08-98  8:52p exp4.out
LA1X5    OUT       246,332  04-08-98 11:50p la1x5.out
LA2X5    OUT       212,065  04-09-98 12:01a la2x5.out
```

```
LA3X5     OUT        274,791  04-09-98 12:27a la3x5.out

 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\mcnp4b\TEST\endf6

PROB3     OUT         41,062  04-03-98 12:57p prob3.out
GODIVA    OUT        177,624  04-03-98 11:06p godiva.out
PROB6     OUT        298,699  04-03-98 12:57p prob6.out
PROB18    OUT        317,465  04-09-98 11:06a prob18.out
PROB3N    OUT        378,184  04-09-98  6:23p prob3n.out
LA3       OUT        291,130  04-03-98 11:19p la3.out
PROB20    OUT        327,970  04-03-98  1:36p prob20.out
PROB7     OUT        307,873  04-03-98  1:52p prob7.out
PROB16    OUT        314,858  04-03-98  2:18p prob16.out
PROB15    OUT        280,824  04-03-98 10:29p prob15.out
PROB14    OUT        300,925  04-03-98 10:37p prob14.out
PROB13    OUT        299,941  04-03-98 10:44p prob13.out
PROB12    OUT        321,329  04-03-98 11:02p prob12.out
LA2X      OUT        213,185  04-03-98 11:25p la2x.out
LA1X      OUT        244,192  04-07-98 12:40p la1x.out
JEZ45~1   OUT        111,261  04-07-98 12:42p jez4.5.out
JEZ20     OUT        177,233  04-07-98 12:44p jez20.out

 Volume in drive D is DELLWIN95-2
 Volume Serial Number is 1BE3-2E60
 Directory of D:\mcnp4b\TEST\shield

UEKI1~1   OUT         25,802  04-01-98  5:57p ueki.1.out
UEKI2~1   OUT         21,165  04-01-98  6:01p ueki.2.out
UEKI15~2  OUT         36,245  04-09-98  7:12p ueki.15.out
UEKI3~1   OUT         23,316  04-01-98  6:04p ueki.3.out
UEKI4~1   OUT         25,899  04-01-98  6:15p ueki.4.out
UEKI5~1   OUT         29,887  04-01-98  8:17p ueki.5.out
UEKI11~2  OUT         27,127  04-01-98  8:22p ueki.11.out
UEKI12~2  OUT         22,356  04-01-98  8:27p ueki.12.out
UEKI13~2  OUT         30,363  04-01-98  8:32p ueki.13.out
UEKI14~2  OUT         27,019  04-01-98  8:45p ueki.14.out
UEKI21~2  OUT         29,167  04-01-98  9:46p ueki.21.out
UEKI22~2  OUT         26,596  04-01-98  9:59p ueki.22.out
UEKI24~2  OUT         29,122  04-01-98 10:19p ueki.24.out
UEKI25~2  OUT         30,358  04-01-98 10:47p ueki.25.out
UEKI26~2  OUT         33,213  04-01-98 11:29p ueki.26.out
UEKI27~2  OUT         57,748  04-02-98  8:57a ueki.27.out
UEKI31~2  OUT         26,031  04-02-98  9:00a ueki.31.out
UEKI32~2  OUT         26,643  04-02-98  9:04a ueki.32.out
UEKI33~2  OUT         29,911  04-02-98  9:08a ueki.33.out
```

```
UEKI34~2 OUT        33,310  04-02-98  9:21a ueki.34.out
UEKI35~2 OUT        36,379  04-02-98 10:30a ueki.35.out
MC10NEW  OUT       435,494  04-02-98  2:00p mc10new.out
```

Attachment VI: Execution Instructions

From IOC LV.WP.SG.02/98-033: Execution of MCNP4B2 on WPO HP workstations

In order to perform analyses using MCNP4B2 on Waste Package Operations HP Unix workstations, the user may either enter:

/opt/neut/MCNP4B/mcnp *options*

where *options* is the command line options which also includes the input filename, e.g.,

/opt/neut/MCNP4B/mcnp name=input1

or

create a link to the executable by typing:

ln -s /opt/neut/MCNP4B/mcnp mcnp

and enter:

./mcnp *options*

where *options* is again the command line options which also includes the input filename.

Once mcnp is started it will look for a file called *xsdir* which has the cross section file information for all elements in all cross section libraries. In order to make sure correct cross sections are used, the user may set the ***DATAPATH*** environment variable by including the statement:

setenv DATAPATH /opt/neut/MCNP4B/xslib

in their login shell script. Earlier users of mcnp who have set this environment variable for MCNP4A need to change the variable in order to use the correct cross section sets. This can also be accomplished by creating a link to the *xsdir* file before running mcnp by entering:

ln -s /opt/neut/MCNP4B/xslib/xsdir xsdir

These steps will ensure that the most recent version of mcnp (Version 4B2) is used with the most recent cross section libraries. For other ways of setting up the environment to run mcnp, the user is referred to mcnp4b manual and HP Unix operating system manual.

FROM IOC LV.WP.JAM.02/98-035 : Execution of MCNP4B2 on WPO PC Systems

This IOC is superseded by IOC LV.WP.JAM.02/98-039, and therefore not included explicitly. IOC LV.WP.JAM.02/98-039 contains all of the information contained in LV.WP.JAM.02/98-035.

FROM IOC LV.WP.JAM.02/98-039 : Execution of MCNP4B2 on WPO PC Systems: Update for Systems Without D Drive

In order to perform analyses using MCNP4B2 on Waste Package Operations PC computers, the user may access the lf90 executable module using a DOS command line (with the requisite path) or by executing a DOS script. Once started, MCNP looks for a file named *xsdir* in the directory D:\mcnp4b containing pointers to the qualified cross section information. The MCNP cross section library datapath is specified in the first line of the *xsdir* file from the MCNP4B2 code package. If a different hard drive is specified during installation, place the *xsdir* file and the MCNP Version 4B2 executable module in the same relative directories and make the appropriate change to the cross section library datapath in the *xsdir* file. If running from a DOS command line, the *xsdir* file must be in the **local** directory if using the X drive where "X" is a valid hard drive other than the "D" drive. The DOS script below will use either the D or "X" drive where "X" is assumed to be the "C" drive creating a local *xsdir* file as necessary.

Command line execution:

>X:\mcnp4b\exe\mcnp4b2 *options*

where

> X identifies the PC hard drive where the program is installed (usually C or D), and *options* include execution path designators and file name definitions.

Example: >D:\mcnp4b\exe\mcnp4b2 ixr inp=*input filename* out=*output filename*.

Continuation cases can only be run from a command line.

DOS script execution:

The following script (named RUNMCNP.BAT) will run multiple cases where the input file for each case is respectively specified as an argument for the batch command. File names must correspond to DOS name conventions, not Extended DOS conventions. Files created by MCNP are renamed using the input file name with postfixes. The script may be run from any drive or directory. Running cases from the same directory as used by the MCNP installation is not

recommended but the script will preserve the installation *xsdir* file. The local *xsdir* file is deleted after running all cases except where the local directory is the one containing the installation *xsdir* file.

```
echo off
echo *
echo ************************************************
echo *                                  *
echo *  Run the MCNP lf90 Program...          *
echo *  graphics pkg not activated            *
echo *                                  *
echo ************************************************
set xdir="no"
set ddir="no"
:start
if "%1" == "" goto end
rem
if exist %1.rtp  del %1.rtp
if exist %1.out  del %1.out
if exist %1.mct  del %1.mct
copy %1 inp
rem  XSDIR COPIED TO LOCAL DIRECTORY IF NOT ON D DRIVE
if  exist d:\mcnp4b\xsdir goto dual
rem NO COPY IF XSDIR LOCAL
if exist xsdir goto dual
if not exist c:\mcnp4b\xsdir goto errx
copy c:\mcnp4b\xsdir xsdir
set ddir="yes"
:dual
if not exist d:\mcnp4b\exe\mcnp4b2.exe goto cdrv
rem USING D DRIVE
d:\mcnp4b\exe\mcnp4b2 ixr inp=inp
goto cont
:cdrv
rem USING C DRIVE
c:\mcnp4b\exe\mcnp4b2 ixr inp=inp
:cont
copy outp  %1.out
copy mctal  %1.mct
if exist srctp copy srctp %1.stp
copy runtpe %1.run
```

```
rem
echo ************************
echo   delete temp files   *
echo ************************
del inp
del outp
if exist srctp del srctp
del mctal
del runtpe
shift
goto start
:end
if "%ddir%"=="%xdir%" goto fend
del xsdir
goto fend
:errx
echo ***************************
echo XSDIR FILE NOT FOUND
echo   TASK TERMINATED
echo ***************************
:fend
```

Example: >runmcnp case1 case2

The cross section library includes both ENDF/B-V and ENDF/B-VI data. The ENDF/B-V Zr data has been corrected for five ZAID's from the libraries RMCCS, DRMCCS, ENDFP5, DRES, and EPRIXS. These changes are summarized as follows:

Previous		Corrected
RMCCS	40000.51c	40000.57c
DRMCCS	40000.51d	40000.57d
ENDF5P	40000.50c	40000.56c
DRE5	40000.50d	40000.56d
EPRIXS	40000.53c	40000.58c.

The lf90 executable module for MCNP Version 4B2 does not include plotting capability as no graphics interface package between MCNP and the lf90 library is distributed with the code package. A non-qualified f77 MCNP Version 4B executable module is included with the installation which may be used only for graphical representation of models and not for analysis. Use of this module for graphical representation of models has no effect on results from the qualified version 4B2. This module may be accessed by the DOS command

>X:\mcnp4b\test\mcnp7 *options*.

where

X identifies the PC hard drive where the program is installed (usually C or D), and *options* include execution path designators (*ip* only for this version) and file name definitions.

(Note: replace the MCNP executable name "mcnp4b2" with "mcnp4b2x" to run the large version)

Attachment VII: Regression Testing Correspondence

To: J.Wesley Davis@CRWMS
cc: Sedat Goluoglu@CRWMS
Subject: Benchmarking of Corrected Version of MCNP4B2 on PC

MJA.98032

I have finished running the suite of MCNP4B2 validation test cases on my PC (CRWMS M&O ID #: 110831) and the purpose of this communication is to convey the results of that testing. The KCODE cases produced the following eigenvalues:

bug4b2	1.02033 ± 0.00338
exp1	0.99944 ± 0.00128
exp27	1.01018 ± 0.00142
godiva	0.99525 ± 0.00109
jez4.5	1.00568 ± 0.00174
la1x	1.00003 ± 0.00042
la3	0.99916 ± 0.00131
prob1	0.99365 ± 0.00087
prob20	0.99957 ± 0.00138

The tally results for the shielding test problems are:

mc10new	4.88537E-19 ± 0.0309 [a]
ueki.4	1.96888E-10 ± 0.0418
ueki.14	2.37314E-10 ± 0.0398
ueki.24	3.49114E-13 ± 0.0258
ueki.34	1.95087E-11 ± 0.1087

[a]. This tally is over the whole surface.

Regards,

Mike Anderson

To: Sedat Goluoglu@CRWMS
cc:
Subject: MCNP VALID

Sedat,

I have finished running the suite of MCNP4B2 validation test cases on my PC (CRWMS M&O ID #: 112113) and the purpose of this communication is to convey the results of that testing. The KCODE cases produced the following eigenvalues:

MCNP4B2 Executable

bug4b2	1.02033 ± 0.00338
exp1	0.99944 ± 0.00128
exp27	1.01018 ± 0.00142
godiva	0.99525 ± 0.00108
jez4.5	1.00568 ± 0.00174
la1x	1.00003 ± 0.00042
la3	0.99916 ± 0.00131
prob1	0.99365 ± 0.00087
prob20	0.99957 ± 0.00138

The tally results for the shielding test problems are:

mc10new	4.88537E-19 ± 0.0309 [a]
ueki.4	1.96888E-10 ± 0.0418
ueki.14	2.37314E-10 ± 0.0398
ueki.24	3.49114E-13 ± 0.0258
ueki.34	1.95087E-11 ± 0.1087

MCNP4B2x Executable

bug4b2	1.02033 ± 0.00338
exp1	0.99944 ± 0.00128
exp27	1.01018 ± 0.00142
godiva	0.99525 ± 0.00109
jez4.5	1.00568 ± 0.00174
la1x	1.00003 ± 0.00042
la3	0.99916 ± 0.00131
prob1	0.99365 ± 0.00087
prob20	0.99957 ± 0.00138

The tally results for the shielding test problems are:

mc10new	4.88537E-19 ± 0.0309 [a]
ueki.4	1.96888E-10 ± 0.0418
ueki.14	2.37314E-10 ± 0.0398
ueki.24	3.49114E-13 ± 0.0258
ueki.34	1.95087E-11 ± 0.1087

[a]. This tally is over the whole surface.

Thanks.

David Henderson
5-4485

To: J.Wesley Davis@CRWMS
cc: Sedat Goluoglu@CRWMS
Subject: MCNP4B2 Test Results

The suite of MCNP4B2 test cases have finished running on the PC, CRWMS M&O Tag No.:110942. The results of the test cases are shown below.

CRITICALITY:

bug4b2	keff = 1.02033 with an estimated standard deviation of 0.00338
exp1	keff = 0.99944 with an estimated standard deviation of 0.00128
exp27	keff = 1.01018 with an estimated standard deviation of 0.00142
godiva	keff = 0.99525 with an estimated standard deviation of 0.00108
jez4.5	keff = 1.00568 with an estimated standard deviation of 0.00174
la1x	keff = 1.00003 with an estimated standard deviation of 0.00042
la3	keff = 0.99916 with an estimated standard deviation of 0.00131
prob1	keff = 0.99365 with an estimated standard deviation of 0.00087
prob20	keff = 0.99957 with an estimated standard deviation of 0.00138

SHIELDING:

mc10new	4.88537E-19 0.0309
ueki4	1.96888E-10 0.0418
ueki14	2.37314E-10 0.0398
ueki24	3.49114E-13 0.0258
ueki34	1.95087E-11 0.1087

To: Sedat Goluoglu@CRWMS
cc: J.Wesley Davis@CRWMS
Subject: mcnp validation

MCNP4B2 validation test cases on my PC (CRWMS M&O ID #: 113132). The KCODE cases produced the following eigenvalues:

MCNP4B2 Executable

bug4b2	1.02033 ± 0.00338
exp1	0.99944 ± 0.00128
exp27	1.01018 ± 0.00142
godiva	0.99525 ± 0.00108
jez4.5	1.00568 ± 0.00174
la1x	1.00003 ± 0.00042
la3	0.99916 ± 0.00131
prob1	0.99365 ± 0.00087
prob20	0.99957 ± 0.00138

The tally results for the shielding test problems are:

mc10new	4.88537E-19 ± 0.0309 [a]
ueki.4	1.96888E-10 ± 0.0418
ueki.14	2.37314E-10 ± 0.0398
ueki.24	3.49114E-13 ± 0.0258
ueki.34	1.95087E-11 ± 0.1087

MCNP4B2x Executable

bug4b2	1.02033 ± 0.00338
exp1	0.99944 ± 0.00128
exp27	1.01018 ± 0.00142
godiva	0.99525 ± 0.00109
jez4.5	1.00568 ± 0.00174
la1x	1.00003 ± 0.00042
la3	0.99916 ± 0.00131
prob1	0.99365 ± 0.00087
prob20	0.99957 ± 0.00138

The tally results for the shielding test problems are:

mc10new	4.88537E-19 ± 0.0309 [a]
ueki.4	1.96888E-10 ± 0.0418
ueki.14	2.37314E-10 ± 0.0398
ueki.24	3.49114E-13 ± 0.0258
ueki.34	1.95087E-11 ± 0.1087

[a]. This tally is over the whole surface.

INFORMATION ONLY

To: Sedat Goluoglu@CRWMS
cc:
Subject: MCNP4B2 verification

The suite of MCNP4B2 test cases have finished running on the PC, CRWMS M&O Tag No.:112105. The results of the test cases are shown below.

CRITICALITY:

bug4b2	keff = 1.02033 with an estimated standard deviation of 0.00338
exp1	keff = 0.99944 with an estimated standard deviation of 0.00128
exp27	keff = 1.01018 with an estimated standard deviation of 0.00142
godiva	keff = 0.99525 with an estimated standard deviation of 0.00108
jez4.5	keff = 1.00568 with an estimated standard deviation of 0.00174
la1x	keff = 1.00003 with an estimated standard deviation of 0.00042
la3	keff = 0.99916 with an estimated standard deviation of 0.00131
prob1	keff = 0.99365 with an estimated standard deviation of 0.00087
prob20	keff = 0.99957 with an estimated standard deviation of 0.00138

SHIELDING:

mc10new	4.88537E-19 0.0309
ueki4	1.96888E-10 0.0418
ueki14	2.37314E-10 0.0398
ueki24	3.49114E-13 0.0258
ueki34	1.95087E-11 0.1087

To: Sedat Goluoglu@CRWMS
cc:
Subject: MCNP cases

The suite of MCNP4B2 test cases have finished running on the PC, CRWMS M&O Tag No.:112110. The results of the test cases are shown below.

CRITICALITY:

bug4b2	keff = 1.02033 with an estimated standard deviation of 0.00338
exp1	keff = 0.99944 with an estimated standard deviation of 0.00128
exp27	keff = 1.01018 with an estimated standard deviation of 0.00142
godiva	keff = 0.99525 with an estimated standard deviation of 0.00108
jez4.5	keff = 1.00568 with an estimated standard deviation of 0.00174
la1x	keff = 1.00003 with an estimated standard deviation of 0.00042
la3	keff = 0.99916 with an estimated standard deviation of 0.00131
prob1	keff = 0.99365 with an estimated standard deviation of 0.00087
prob20	keff = 0.99957 with an estimated standard deviation of 0.00138

SHIELDING:

mc10new	4.88537E-19 0.0309
ueki4	1.96888E-10 0.0418
ueki14	2.37314E-10 0.0398
ueki24	3.49114E-13 0.0258
ueki34	1.95087E-11 0.1087

INFORMATION ONLY

To: Sedat Goluoglu@CRWMS
cc:
Subject: Re: MCNP4B2 Test Results

The suite of MCNP4B2 test cases have finished running on the PC, CRWMS M&O Tag No.:110837. The results of the test cases are shown below.

CRITICALITY:

bug4b2	keff = 1.02033 with an estimated standard deviation of 0.00338
exp1	keff = 0.99944 with an estimated standard deviation of 0.00128
exp27	keff = 1.01018 with an estimated standard deviation of 0.00142
godiva	keff = 0.99525 with an estimated standard deviation of 0.00108
jez4.5	keff = 1.00568 with an estimated standard deviation of 0.00174
la1x	keff = 1.00003 with an estimated standard deviation of 0.00042
la3	keff = 0.99916 with an estimated standard deviation of 0.00131
prob1	keff = 0.99365 with an estimated standard deviation of 0.00087
prob20	keff = 0.99957 with an estimated standard deviation of 0.00138

SHIELDING:

mc10new	4.88537E-19 0.0309
ueki4	1.96888E-10 0.0418
ueki14	2.37314E-10 0.0398
ueki24	3.49114E-13 0.0258
ueki34	1.95087E-11 0.1087