OAK RIDGE
NATIONAL LABORATORY
MANAGED BY UT-BATTELLE
FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2011/367

Development of a SCALE Model for High Flux Isotope Reactor Cycle 400

February 2012

Prepared by
Dan Ilas

UT-BATTELLE
ORNL-27 (4-00)

ORNL/TM-2011/367

Reactor and Nuclear Systems Division

DEVELOPMENT OF A SCALE MODEL FOR HIGH FLUX ISOTOPE REACTOR CYCLE 400

Dan Ilas

Date Published: February 2012

Prepared by
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725

CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

Table **Page**

ACRONYMS AND ABBREVIATIONS

2-D	two dimensional
3-D	three dimensional
BOC	beginning of cycle
CE	continuous energy
C/E	calculated to experimental
CR	control element region
DOE	U.S. Department of Energy
EOC	end of cycle
FTT	flux trap target region
HEU	high-enriched uranium
HFIR	High Flux Isotope Reactor
HT	hydraulic tube
ICE	inner control element
IFE	inner fuel element
IRSN	Institut de Radioprotection et de Sûreté Nucléaire (Institute for Radiological Protection and Nuclear Safety)
k_{eff}	effective multiplication constant
LANL	Los Alamos Nuclear Laboratory
LEU	low-enriched uranium
OCE	outer control element
OFE	outer fuel element
ORNL	Oak Ridge National Laboratory
pcm	per cent millirho
PB	permanent beryllium reflector region
PTP	peripheral target position
RB	removable beryllium reflector region
RNSD	Reactor and Nuclear Systems Division

ACKNOWLEDGMENTS

The author would like to acknowledge the support provided for this project by the Nuclear Science and Engineering Directorate and by the Reactor and Nuclear Systems Division (RNSD). Review of the manuscript by Germina Ilas and Josh Peterson (RNSD), formatting of the document by Hannah Turpin (RNSD), and editing by Amy Harkey (Publishing Services Group) are very much appreciated.

ABSTRACT

The development of a comprehensive SCALE computational model for the High Flux Isotope Reactor (HFIR) is documented and discussed in this report. The SCALE model has equivalent features and functionality as the reference MCNP model for Cycle 400 that has been used extensively for HFIR safety analyses and for HFIR experiment design and analyses. Numerical comparisons of the SCALE and MCNP models for the multiplication constant, power density distribution in the fuel, and neutron fluxes at several locations in HFIR indicate excellent agreement between the results predicted with the two models. The SCALE HFIR model is presented in sufficient detail to provide the users of the model with a tool that can be easily customized for various safety analysis or experiment design requirements.

1. INTRODUCTION

Comprehensive computational neutronic models for the High Flux Isotope Reactor (HFIR) have been developed for the past 10–20 years with numerous developers contributing to this effort. The endeavor culminated with a full HFIR model for the beginning of cycle (BOC) 400, which was developed and documented by Xoubi and Primm in 2004[1] and became known as the "Cycle 400 reference model." The Cycle 400 reference model relied on the older model HFIR-V.2, originally developed by J. C. Gehin, L. A. Smith, and J. A. Bucholz.[1]

The HFIR Cycle 400 reference model is an MCNP[2] Monte Carlo model of HFIR that, based on existing documentation and expert opinion, fully describes (most often in terms very close to the physical reality) the central target region, the fueled region, the control elements, and the beryllium reflector, and includes out-of-core components such as irradiation tubes, horizontal tubes, engineering tubes, and the reactor shielding and biological protection, up to an outer radius of 7.20 m and a total height of 3.00 m. Because of their complexity, the fuel elements required the largest amount of simplification in the model. Homogenization methods were applied in this case to reduce the intricacies of the fuel element's model.

More recently, the Cycle 400 reference model constituted the basis for neutronic and thermal-hydraulic computations for the HEU to LEU fuel conversion study for HFIR.[3] For this latter purpose, the Cycle 400 reference MCNP model was further enhanced by refining the meshing in the fueled region, and then was embedded in a depletion model for use with VESTA[4] to perform full-core depletion for the duration of the cycle length and analyses at discrete points in time during the fuel cycle. Revisions of the Cycle 400 reference model were made in 2008 and 2010. The 2008 revision corrected a material data card in the beryllium removable reflector.[5] The 2010 revision added more axial layers (19 instead of 7) in both the inner and the outer fuel elements for depletion purposes and changed the material composition for the control elements to account for the actual irradiation history of the control elements prior to Cycle 400.[6] This revised MCNP model will be referred to as the "MCNP Cycle 400 revised model."

Over the past several years, the SCALE computational package[7], developed and maintained by Oak Ridge National Laboratory (ORNL), has undergone significant development and enhancements in its capabilities. Among these, we can enumerate the following capabilities in the latest release, SCALE 6.1: full, realistic geometry description of complex problems; extension to continuous energy treatment for criticality problems; enhancements in multigroup treatment; full-core depletion capabilities (with multigroup energy treatment); sensitivity and uncertainty analysis capabilities (multigroup); and new or improved nuclear data based primarily on ENDF/B-VII. These capabilities make the SCALE package unique in solving problems that necessitate the coupling of different phenomena in a critical system. With the upcoming enhancements for continuous energy Monte Carlo depletion, shielding, and sensitivity/uncertainty analyses the SCALE package has the potential to become the state of the art in terms of its analysis capabilities for neutronic modeling.

A SCALE model of HFIR with capabilities similar to those of the MCNP Cycle 400 reference model is both possible and desirable. The use of this SCALE model will have a reciprocal advantage for the SCALE developers and the potential users of the model: it allows the current capabilities in SCALE to be benchmarked on a realistic reactor problem of importance to ORNL, and it provides users of the model with a tool that can be easily customized to their needs.

The purpose of the work documented in this report was to develop a SCALE model for HFIR Cycle 400 as an alternative reference that is equivalent to the MCNP model for this same

configuration. The SCALE model was built, to the extent possible, using the same framework (i.e., no changes) as the MCNP model. Though the similarity of the MCNP and SCALE models was the primary criterion when developing the SCALE model, a secondary criterion focused on developing the SCALE model in a manner that will facilitate future additions, changes, or improvements to the model, such as employing a more modular representation of the configuration.

The MCNP model has been used extensively at HFIR for safety analyses and by HFIR customers for experiment design and analyses. Its performance has been validated against experimental data available from power distributions and destructive isotopic assay measurements.[8,9] A SCALE model with equivalent features as the reference MCNP model would facilitate the acceptance of and transition to this new model for HFIR users who are familiar with the MCNP model.

The SCALE model that has been developed for the HFIR is described in this report, and its accuracy is assessed by comparisons with results obtained for the MCNP Cycle 400 revised model. Being based on the MCNP Cycle 400 revised model, the SCALE HFIR model inherits its capability for further use in depletion simulations.

This report is organized as follows. Section 2 contains a brief description of the HFIR. Section 3 describes the SCALE model for HFIR, with a focus on the geometry. Section 4 compares results obtained with the SCALE and the MCNP models. Finally, Section 5 presents a few conclusions. The SCALE input file for the HFIR model is listed as Appendix A.

2. DESCRIPTION OF HFIR

HFIR is a research reactor at ORNL that supports isotope production, material irradiation research, and neutron scattering experiments. It currently operates at 85 MW(t) power. The central flux trap in HFIR provides one of the highest steady-state thermal neutron fluxes among research reactors in the world.[10]

The reactor core consists of a series of concentric regions: the central target region (flux trap), two fuel elements separated by a thin water region, the control elements region, the beryllium reflector, and a water region to the edge of the pressure vessel. The reactor is located in a pool of water. Details of the reactor configuration and operation can be found elsewhere[11] and also are outlined in the following sections in relation to the SCALE model of the reactor.

There are two fuel elements in HFIR, identified as an inner fuel element (IFE) and an outer fuel element (OFE). They are made up of 171 and 369 involute-shaped thin fuel plates, respectively, and are fuelled with 93.1 wt % enriched uranium. The fuel plates are separated by water channels. Because of their particular shape and the fact that the fuel zone in a fuel plate is radially graded, they are most challenging from a modelling point of view. Fig. 1 presents a schematic of HFIR at core midplane, which illustrates the complexity of the reactor geometry. The drawing was made before the removal of two engineering facilities to allow the enlargement of the HB-2 horizontal tube (prior to Cycle 400).

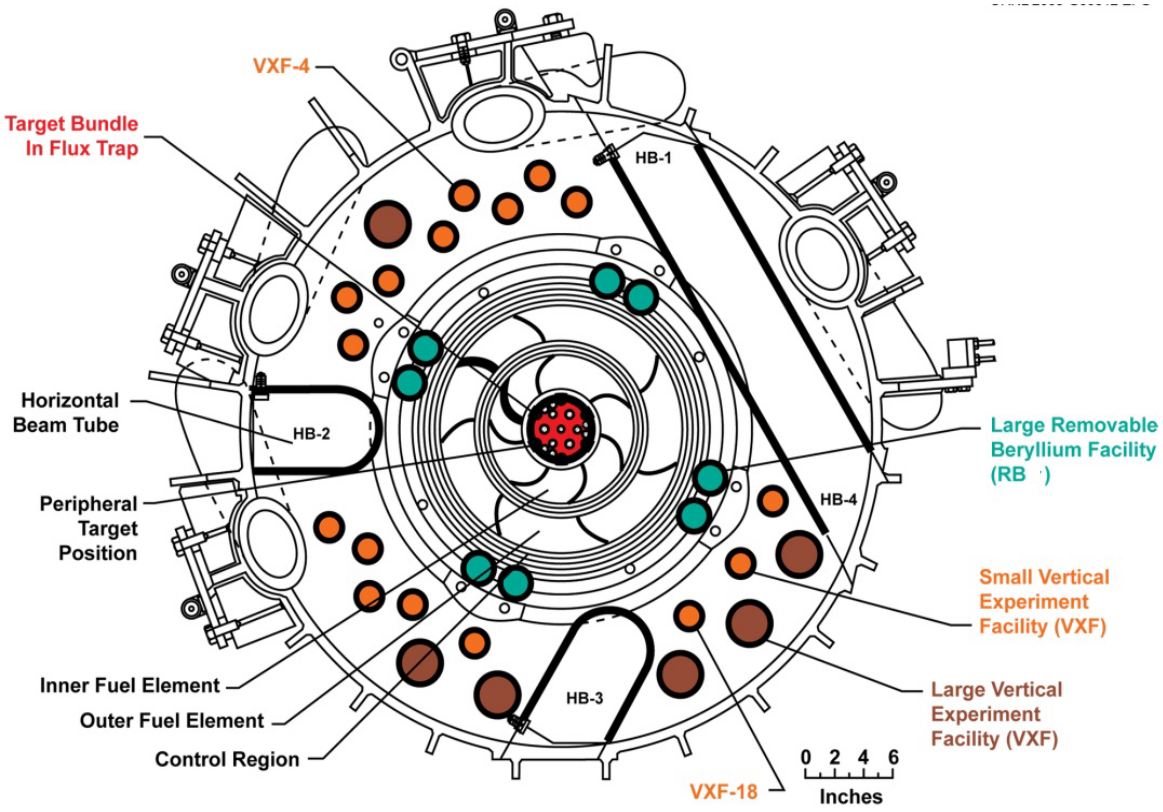


Fig. 1. HFIR schematic at core midplane (before removal of two engineering facilities).

3. DESCRIPTION OF THE SCALE HFIR MODEL

3.1 COMPUTATIONAL METHODS AND CODES

The SCALE model for HFIR was developed using the latest release, SCALE 6.1. The SCALE code system uses automated sequences to provide problem-dependent cross-section processing, reactor lattice physics, criticality safety, radiation shielding, and spent fuel characterization analysis capabilities. For this report, the CSAS26/KENO-VI sequence of SCALE with the continuous energy option for neutron transport was used.

The SCALE HFIR model is a large model containing over 10,000 lines of input. Of these, ~7,000 are material input lines and ~3,000 lines contain the geometry model. The input file is heavily commented, containing ~1,500 comment lines for easier navigation and identification of the different components of the model to enable user changes or additions to the model, such as may be necessary when a particular target or experiment is inserted into the reactor.

The SCALE model uses the KENO-VI geometry capability, which uses the SCALE generalized geometry package and therefore enables the use of the model as a basis for studies with any other module or sequence in SCALE. The KENO-VI code, a Monte Carlo transport code based on combinational geometry, can accept a wide range of geometry shapes to construct practically any geometric configuration of interest. Because of the particularities of this geometry capability in KENO-VI, there are significant differences between the geometry specifications in the SCALE HFIR model and the MCNP Cycle 400 revised model.

At every step during the development of the SCALE HFIR model, comparisons and checks were performed against the MCNP Cycle 400 revised model. The 5.1.51 version of the MCNP code, developed by Los Alamos National Laboratory, was used for this purpose. MCNP is a general-purpose Monte Carlo transport code that can simulate the transport of neutrons, photons, and electrons and calculate various quantities of interest for criticality, shielding, and energy deposition studies.

3.2 GEOMETRY MODEL

The following sub-sections discuss the geometry of the SCALE HFIR model starting from the center of the HFIR core and moving towards the periphery. A flowchart of the whole model is presented in the last sub-section. The flowchart is intended to facilitate navigation through the geometry of the model and later revisions of the input file.

3.2.1 Central Target Region

The central target region (also called the flux trap region) is the central section of the HFIR and includes 37 cylindrical experimental sites arranged in a hexagonal lattice. The arrangement of the target and the labeling scheme is shown in Fig. 2, which illustrates the actual flux trap region in the SCALE HFIR model. Of the 37 experimental sites in the flux trap, 31 are located inside a basket, and 6 are located at the vertices of the hexagonal lattice outside the basket. The experimental sites located outside the basket are identified as peripheral target positions (PTPs), shown as PTP-1 to PTP-6 at locations A-4, D-1, A-1, D-7, G-7, and G-4 in Fig. 2.

The experimental site at location B-3 is occupied by a hydraulic tube (HT) that allows for insertion of experimental specimens during reactor operation. The HT geometry unit, identified as Unit 750 in the SCALE HFIR model, is modeled explicitly to accommodate axially nine specimens, also known as “rabbits”. Also shown in Fig. 2 are two stainless steel targets labeled JP-26 and JP-27,

at locations C-6 and E-2, respectively. The seven dark cylinders at the center of the basket, at locations C-2, D-3, D-4, C-5, E-5, F-5, and E-6, are solid aluminum dummy targets. The other 21 cylindrical units in Fig. 2 are shrouded aluminum dummy targets.

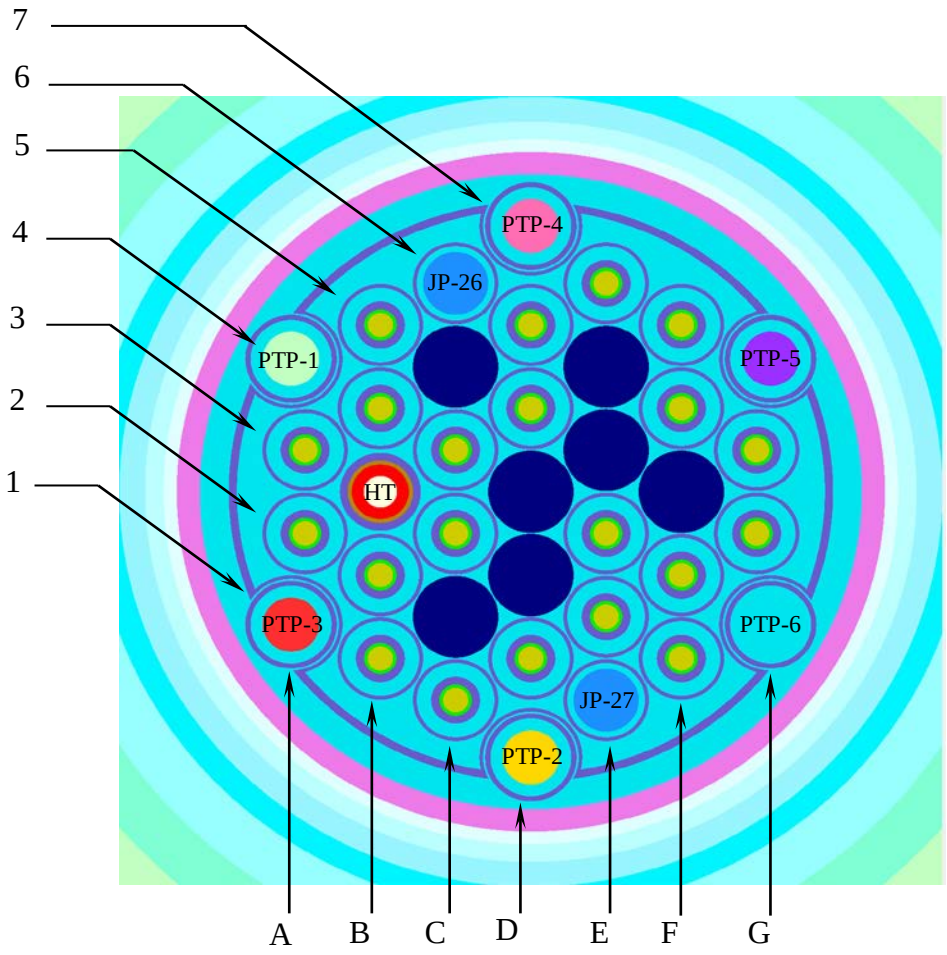


Fig. 2. Numbering scheme for the central target region (radial view) in the SCALE HFIR model.

3.2.2 Fuel and Control Elements Regions

As mentioned previously, two fuel elements in HFIR surround the central flux trap region. The IFE consists of 171 fuel plates, each containing[1] 15.18 ± 1% grams of ^{235}U. The OFE consists of 369 fuel plates, each containing 18.44 ± 1% grams of ^{235}U. For modeling purposes, the fuel plates are homogenized in the MCNP Cycle 400 revised model and the same simplification is used in the SCALE HFIR model. The IFE region is modeled by using (19 axial) × (8 radial) homogenized regions, with the ^{235}U concentration varying radially (peaks toward the outer boundary of the IFE) to account for the radial variation of the fuel meat thickness in each fuel plate. The OFE is modeled by using (19 axial) × (9 radial) homogenized regions, which also have the ^{235}U concentration varying radially (peaks close to the middle of the radius of the OFE). The dimensions for the radial and axial regions in the two fuel elements are shown in Table 1 and Table 2, respectively.

The control element region consists of two concentric annular regions that surround the OFE. They are identified as the inner control element (ICE) and the outer control element (OCE), each

0.635 cm (¼ in.) thick. The ICE is a full cylinder whose main function is to regulate the reactor power; for this reason, it is also called the control or regulating element. The OCE is made up of four quadrants or safety plates. The OCE is also called the safety element. More details on the control elements, including their lifetimes and material compositions, can be found elsewhere.[6] There are three axial material regions in each of the two control elements; these regions, known by the names "black," "gray," and "white" because of their different neutron-absorption properties, are modeled in the SCALE HFIR model with the same level of detail as in the MCNP Cycle 400 revised model.

Table 1. Radial fuel regions in the SCALE HFIR model

IFE		OFE	
Region #	**Outer radius (cm)**	**Region #**	**Outer radius (cm)**
0[a]	7.14	0[a]	15.12951
1	7.50	1	15.50
2	8.00	2	16.00
3	8.50	3	16.50
4	9.50	4	17.50
5	10.50	5	18.50
6	11.50	6	19.50
7	12.00	7	20.00
8	12.60	8	20.50
		9	20.978

[a]Region 0 gives the inner radius for IFE and OFE.

Table 2. Axial fuel layers in the SCALE HFIR model

Layer #	Top boundary (cm)[a]	Layer #	Top boundary (cm)[a]
1	25.4	11	-1.0
2	25.0	12	-4.0
3	23.0	13	-7.0
4	19.0	14	-10.0
5	16.0	15	-13.0
6	13.0	16	-16.0
7	10.0	17	-19.0
8	7.0	18	-23.0
9	4.0	19	-25.0
10	1.0	20[b]	-25.4

[a] Location is with respect to the core midline (at axial location 0.0 cm).
[b] Layer 20 gives the lower boundary of the fuel regions.

An axial cross section of the SCALE HFIR model with details of the fuel region and the control region is shown in Fig. 3. As seen, each of the two fuel elements is bordered radially by sidewalls, and there is a water gap between their adjacent sidewalls. The fueled regions of the fuel elements extend axially for a total height of 50.8 cm and have unfueled regions above and below them. The geometry unit numbers in the SCALE HFIR model are 2000 and 2300 for the IFE and OFE respectively, and 3000 and 3300 for the ICE and OCE, respectively.

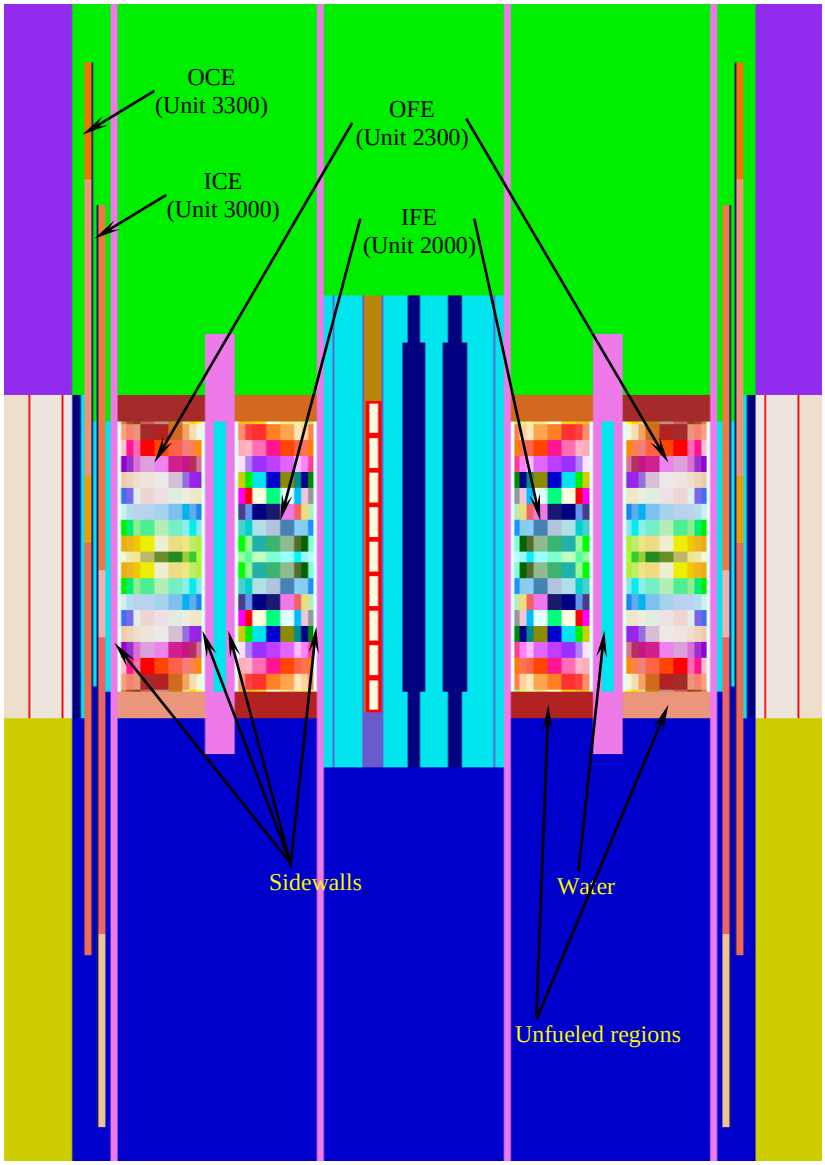


Fig. 3. Fuel and control regions (axial view) in the SCALE HFIR model.

3.2.3 Beryllium Reflector Regions

The beryllium reflector that surrounds the HFIR core contains three annular regions, as shown in Fig. 4, which is a cross section of the SCALE HFIR model at the core midplane. The removable reflector, the innermost region in the reflector, is replaced with fresh beryllium every 40 cycles.[1] It contains four pairs of large experiment facilities (labeled RB-nX, with n = 1,3,5,7 and X = A,B) and four small experiment facilities (labeled RB-n, with n = 2,4,6,8). The removable reflector region is surrounded by the semipermanent beryllium reflector region, which is replaced every 80 cycles and contains eight control rod access plug facilities (labeled CR-n, with n = 1 to 8). The outermost reflector region is the permanent beryllium reflector, which is replaced every 135 cycles and contains 22 vertical experimental facilities (labeled VXF-n, with n = 1 to 22). Six of the VXF tubes have a

larger diameter than the other VXF tubes. The permanent reflector also contains the tips of the four horizontal beam tubes and is indented at two places on its outer edge by engineering facility tubes, EF-1 and EF-2.

The beryllium reflector extends vertically for 60.96 cm, symmetrically above and below the horizontal midplane.

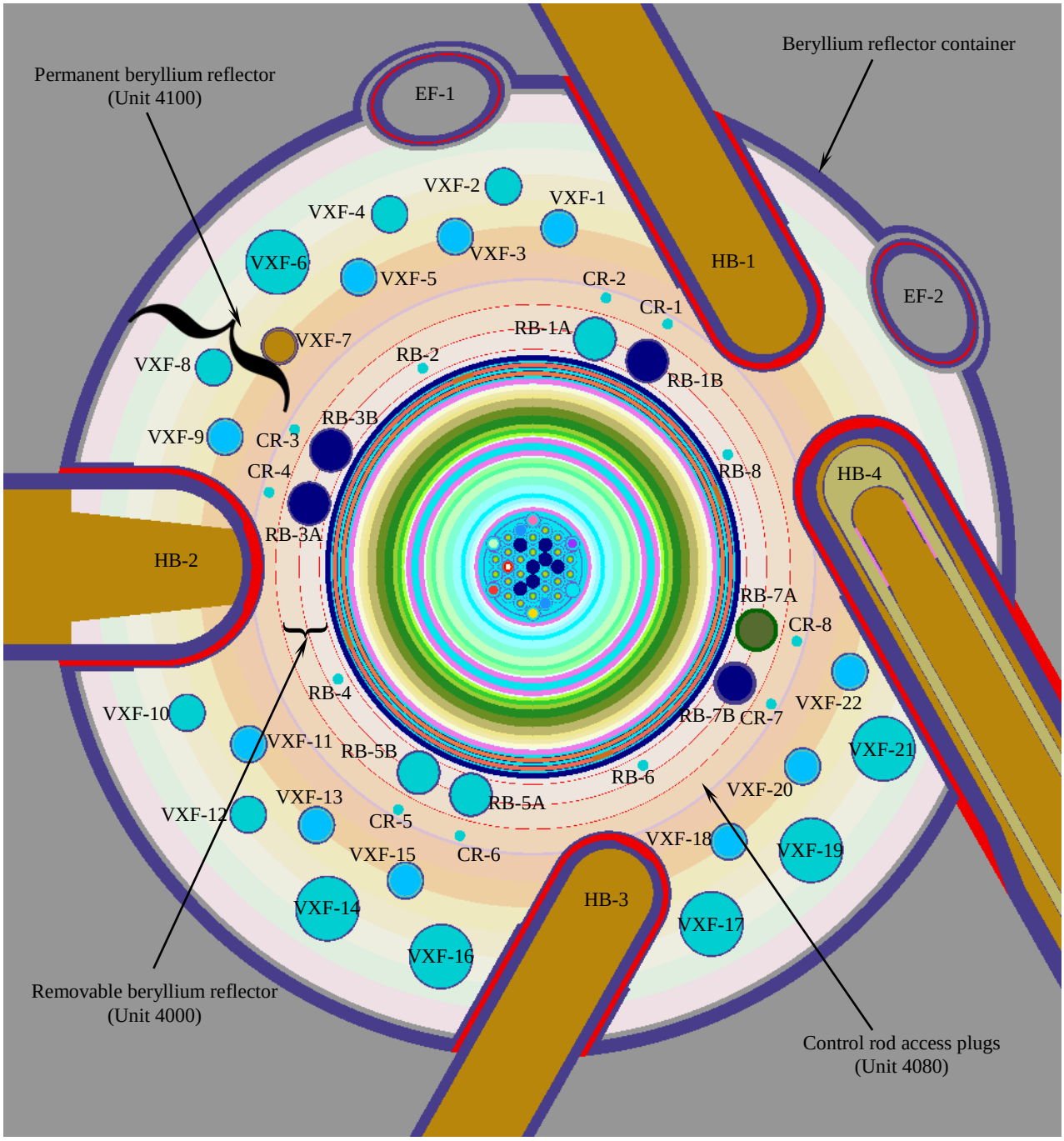


Fig. 4. Beryllium reflector at the horizontal midplane in the Scale HFIR model.

3.2.4 Outer Regions

The main regions outside the beryllium reflector as modeled in the SCALE HFIR model are shown in Fig. 5. The thick biological shielding (Unit 9997 in the geometry model) is made of concrete and is modeled to an outer radius of 720 cm. The water pool (Unit 4170 in the geometry model) is the next major region; it contains the reactor pressure vessel. Inside the pressure vessel and outside the beryllium reflector, there is another region filled with water that provides additional reflection for the reactor core and shielding for the pressure vessel. Cutouts through these regions are filled by the four horizontal beam tubes HB-1 to HB-4.

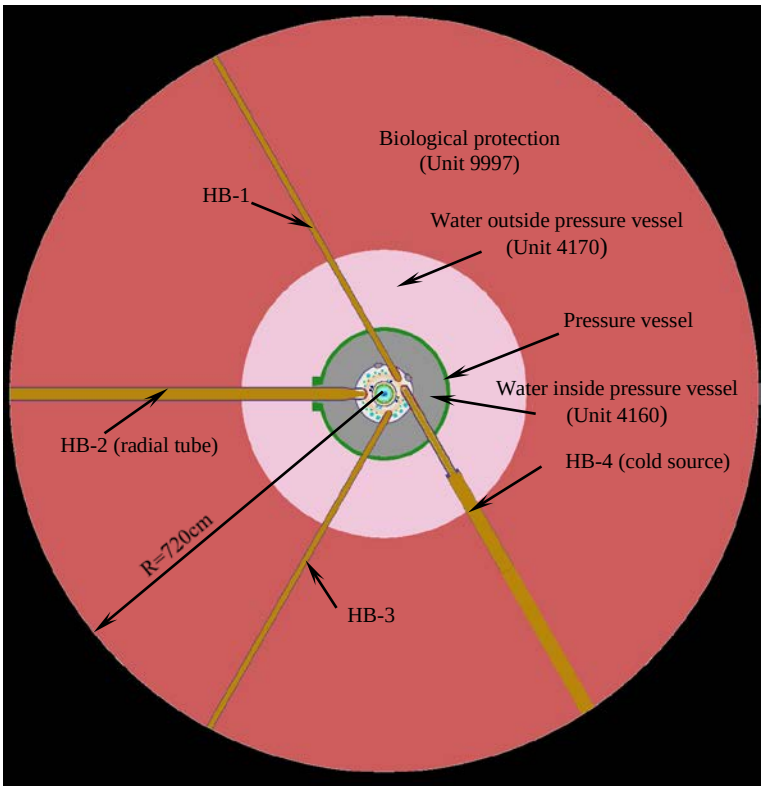


Fig. 5. Main outer core components of the SCALE HFIR model.

3.2.5 Flowchart of the SCALE HFIR Geometry Model

The general flowcharts describing the SCALE HFIR geometry model and the corresponding geometry units are shown in Fig. 6 for the HFIR regions that extend radially from the center to the outer edge of the OFE and in Fig. 7 for the HFIR regions that are radially outside the fuel regions. These flowcharts may be used by the expert users of the SCALE HFIR model to model their particular experimental configurations and to facilitate changes to the model.

Similar to the MCNP Cycle 400 revised model, the SCALE HFIR model has a cylindrical overall shape, with a height of 300 cm (from -150 cm to +150 cm around the core midplane) and an outer diameter of 1,440 cm (720 cm radius).

The general structure of the SCALE HFIR geometry model is based on concentric cylindrical shells. There are 10 such shells corresponding to the major *units* (*italicized* terms correspond strictly to ones used in the SCALE/KENO-VI geometry), as described in Fig. 6 and Fig. 7. Each shell has a

corresponding *unit* number that uniquely identifies it in the SCALE HFIR model. The outermost *unit* corresponds to the *global unit*, and the innermost *unit* comprises the central target region. Many of the major *units* include minor *units* that are embedded in the major ones by using the *hole* feature of the KENO-VI geometry. In all cases, the minor *units* are vertical cylinders with their axis parallel to the *z* axis of the reactor model.

The fuel materials are made up of radial regions, with each group of radial regions embedded in an axial layer region for both the inner and outer fuel elements, as shown in Fig. 6.

The horizontal tubes, labeled HB-1 to HB-4, span five major geometry *units* (blue-colored items in Fig. 7), numbered 4080, 4100, 4160, 4170, and 9997. The two engineering facility slant tubes span two major geometry units, numbered 4100 and 4160 (see Fig. 7).

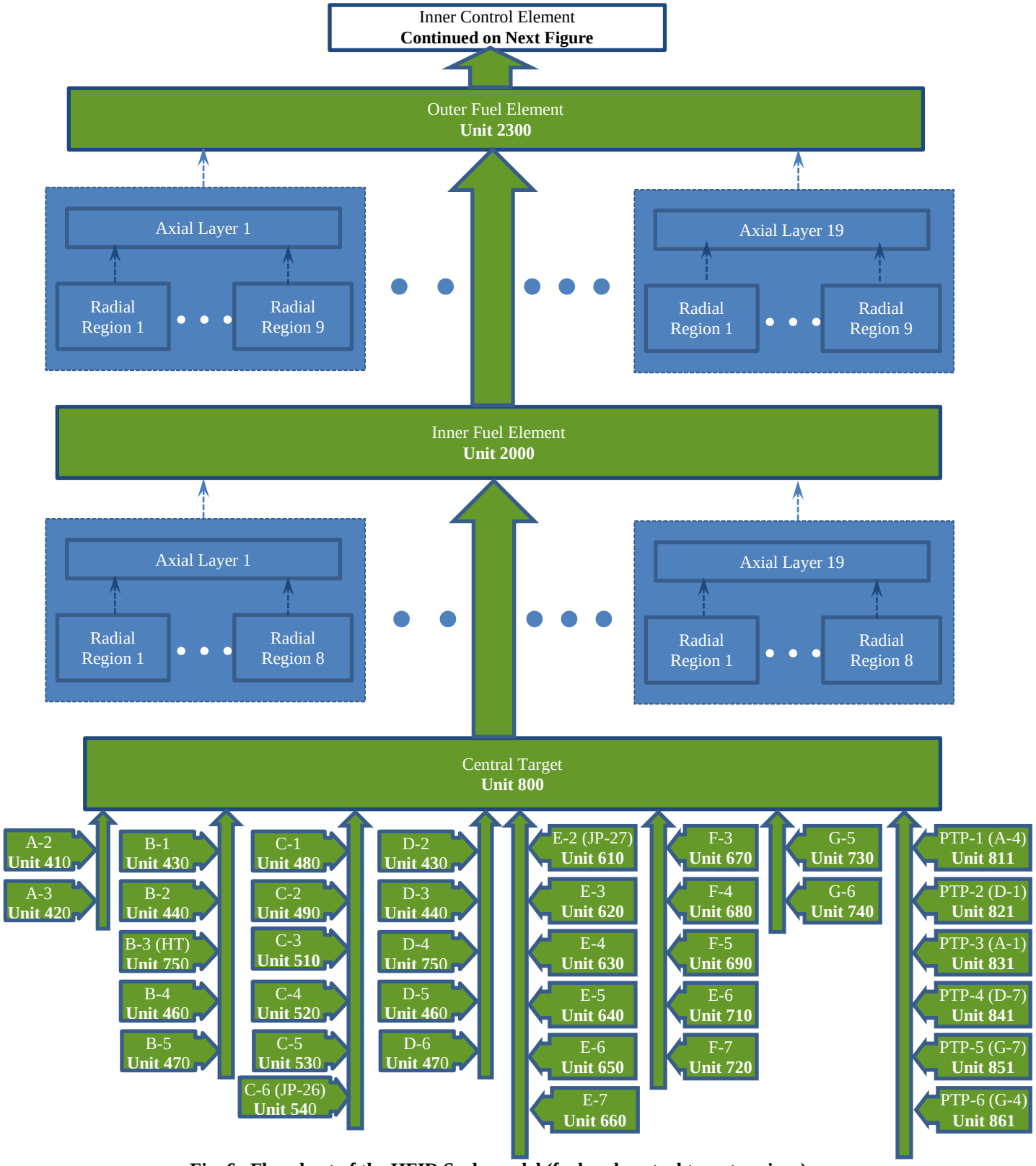


Fig. 6. Flowchart of the HFIR Scale model (fuel and central target regions).

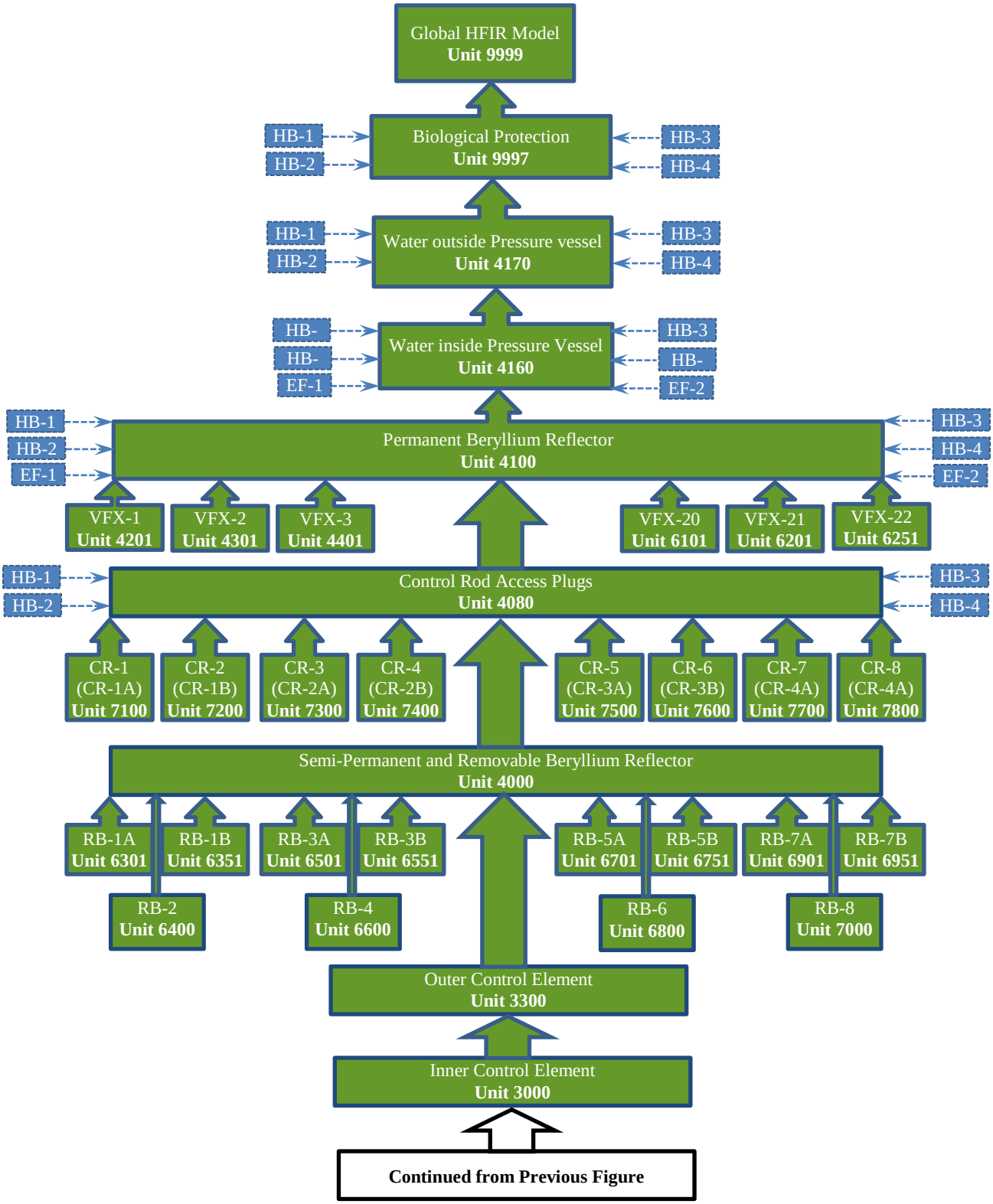


Fig. 7. Flowchart of the HFIR Scale model (outside the fuel region).

3.3 NUCLEAR CROSS-SECTION DATA

Throughout the development of the SCALE HFIR model, the ENDF/B-VII.0 version of the SCALE continuous energy (CE) cross-section library was used; CE ENDF/B-VII.0 data were also used with the MCNP Cycle 400 revised model. The CE library can easily be changed in the SCALE model by simply changing the name of the library. To convert the SCALE HFIR continuous energy model to a multigroup (MG) model, a "*celldata*" block must be added to the existing input to correctly process the cross sections for the problem. The cross sections in both the SCALE model and the MCNP Cycle 400 revised model are considered at 293.6 K temperature.

3.4 MATERIALS

The SCALE HFIR model contains a total of 264 materials defined by their number densities. Several of the features of the material description in the SCALE HFIR model are illustrated in Fig. 8.

The material numbering scheme in the SCALE model is the same as in the MCNP Cycle 400 revised model with the exception of the SCALE material 100, which was added to account for a different density of the same composition as material 1 (water). Similar MCNP structural materials that had a difference in density of less than 0.1% have been modeled as the same material. The fuel materials are labeled according to the scheme 2*ar* or 3*ar* for the IFE and OFE, respectively, where *a* is the axial layer number (varying from 0 to 9, with midplane symmetry considered and with *a*=0 being the central layer and *a*=9 the top layer) and *r* is the radial region within the axial layer (varying from 1 to 8 [moving from the center to the outside of HFIR] for the IFE and from 1 to 9 for the OFE). The material numbering for the nine axial layers located in the bottom half of the axial fuel region is based on the same scheme as used for the top-half axial layers, with core midline symmetry considered. For example, the same material number is used for the topmost and bottommost axial layers in a fuel element. The total number of materials used in the fuel region is 170, with 80 in the IFE and 90 in the OFE. As a note, the HFIR core is not axially symmetric, but using axially symmetric material distributions is an approximation that is usually considered to hold well.

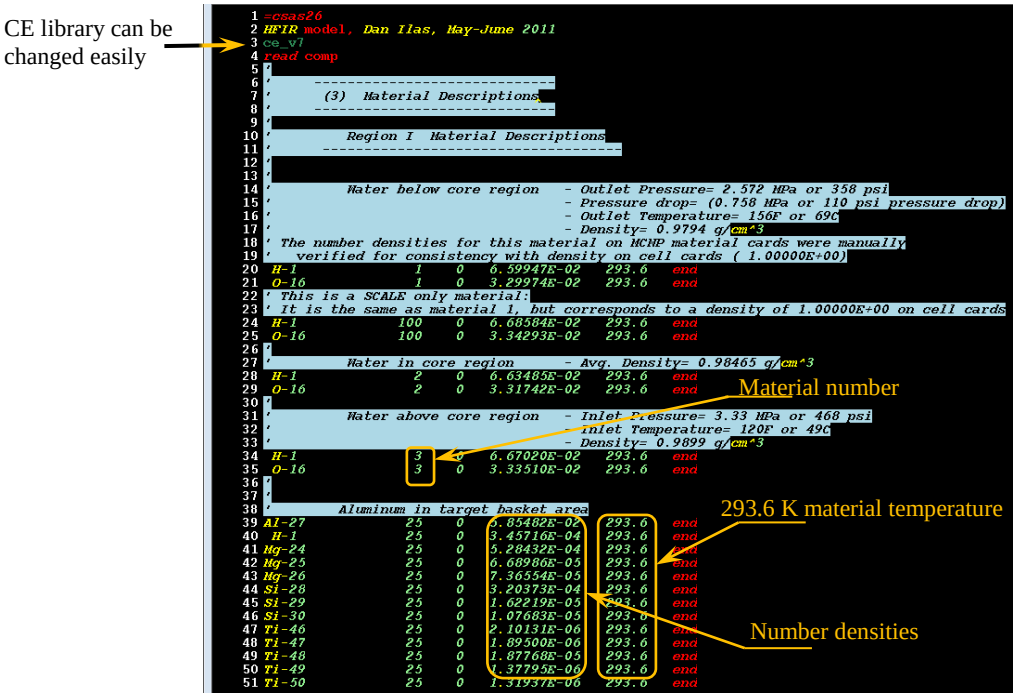


Fig. 8. A screenshot of the material block showing several features of the material description.

4. SCALE HFIR MODEL VERIFICATION

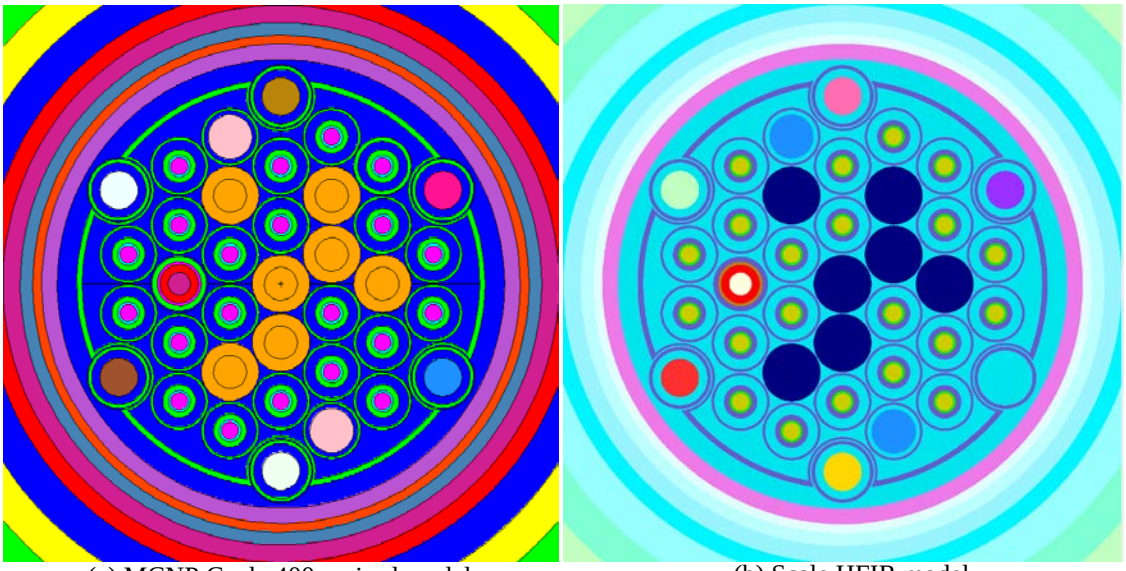
The SCALE HFIR model for Cycle 400 was verified by both visual inspection and numerical comparisons against the MCNP Cycle 400 revised model. The combination of these two approaches gives confidence in the similarity of the two models.

4.1 VISUAL COMPARISONS

Visual comparisons were performed for the more complicated geometry regions to confirm the consistency of the geometry modeling in the SCALE and MCNP models. In comparing the plots in the following sub-sections, it should be noted that the MCNP plots include the surface lines while the SCALE plots strictly represent the material regions.

4.1.1 Target Region

A comparison between the representation of the central target region in the SCALE HFIR model and the corresponding representation in the MCNP Cycle 400 revised model is shown in Fig. 9 for the horizontal midplane (z=0). Note that, apart from the different colors used by the plotting capabilities of the two software packages, the SCALE HFIR model reproduces with fidelity the MCNP Cycle 400 revised model representation of the central target region. The actual dimensions were compared by direct inspection of the input files for the two models.



(a) MCNP Cycle 400 revised model (b) Scale HFIR model

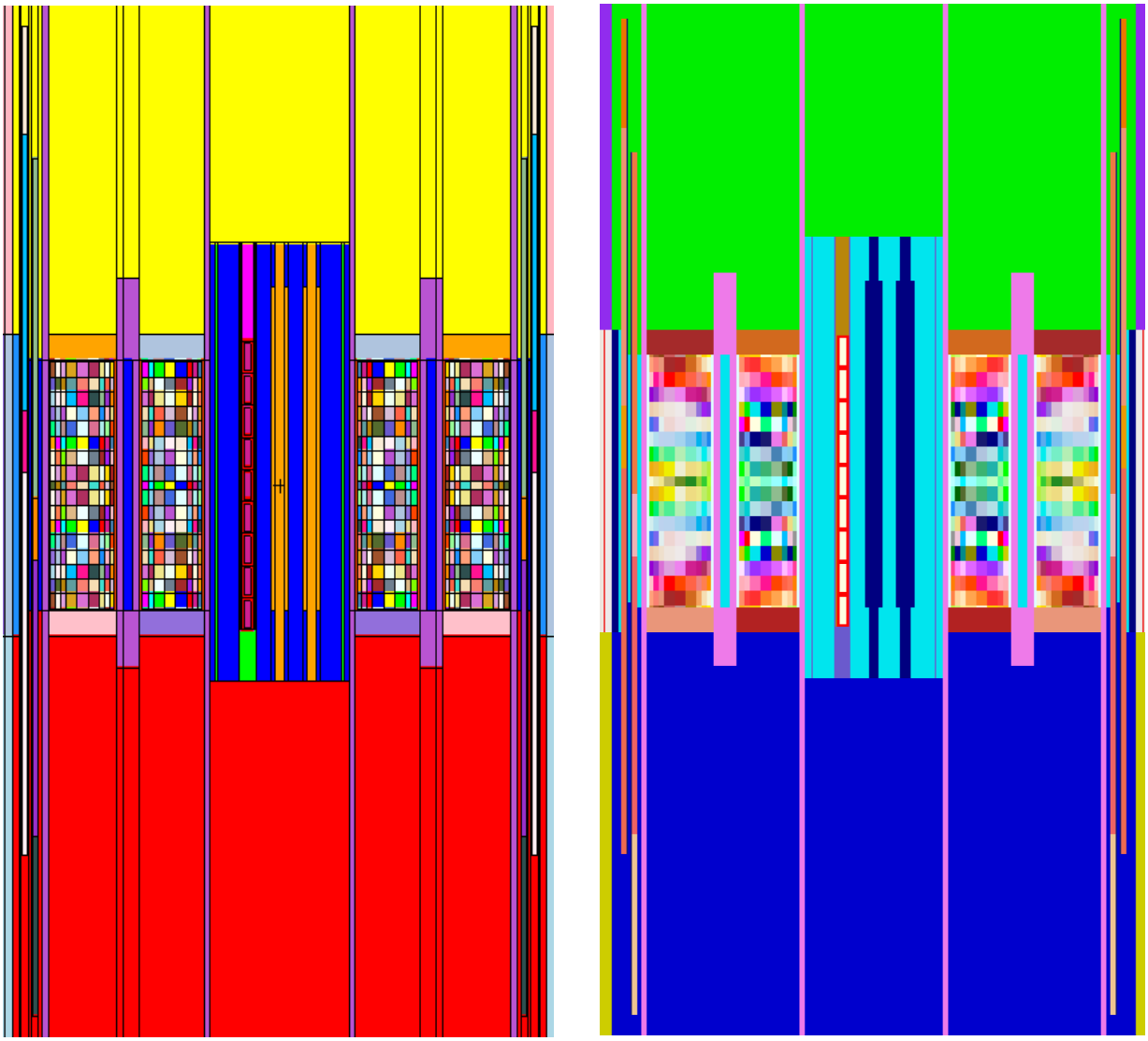
Fig. 9. Comparison of the central target region layouts.

4.1.2 Fuel and Control Regions

The fuel region models are compared in Fig. 10 (see Fig. 3 for region identification), where vertical sections of the HFIR are shown for the SCALE HFIR model and the MCNP Cycle 400 revised model in the plane *y*=0 (note that the plots are enlarged in the radial direction to show details).

Also note the symmetric distribution of the fuel materials with respect to the midplane z=0 and the slight axial asymmetry of the region that separates the two fuel elements.

Also apparent in Fig. 10 is the similar material distribution in the two control regions of the two HFIR models, as well as the axial model of the HT facility and two solid aluminum target facilities in the central flux trap region.

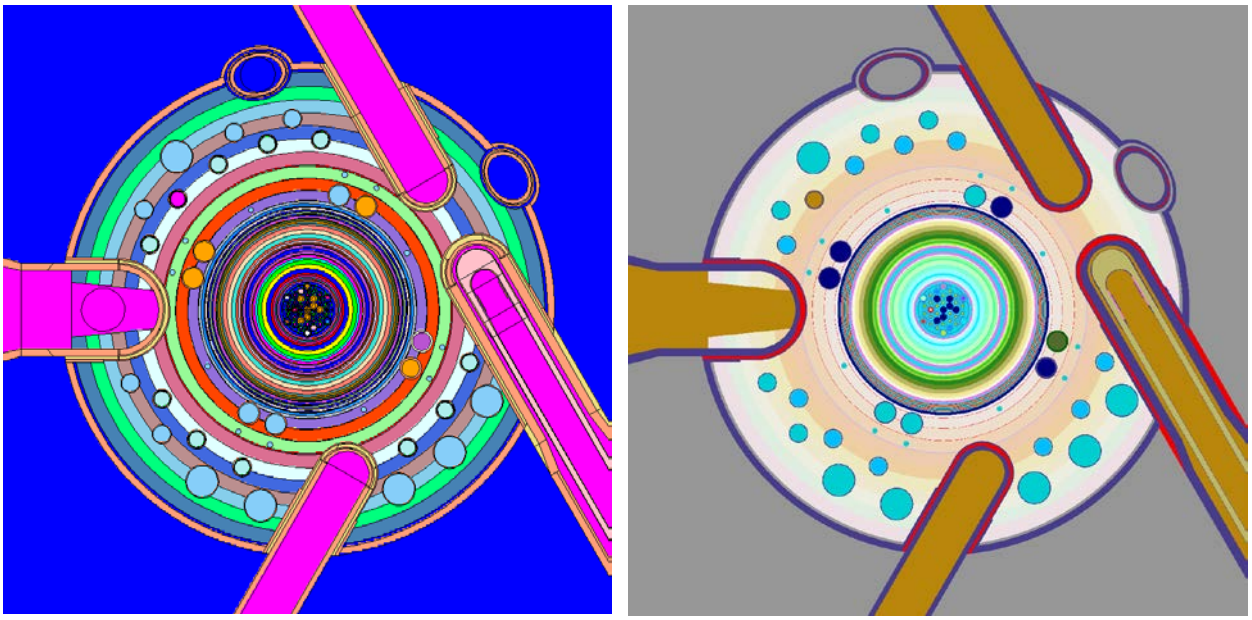


(a) MCNP Cycle 400 revised model (b) Scale HFIR model

Fig. 10. Comparison of the fuel and control regions.

4.1.3 Beryllium Reflector Regions

The similarity between the SCALE HFIR model and the MCNP Cycle 400 revised model, with respect to the distribution of the irradiation facilities that are embedded in the beryllium reflector, is visible in Fig. 11 where a core midplane (z=0) cross section is shown for the two models. The similar positioning of each of the facilities, including the horizontal tubes and the engineering facilities, can be seen.

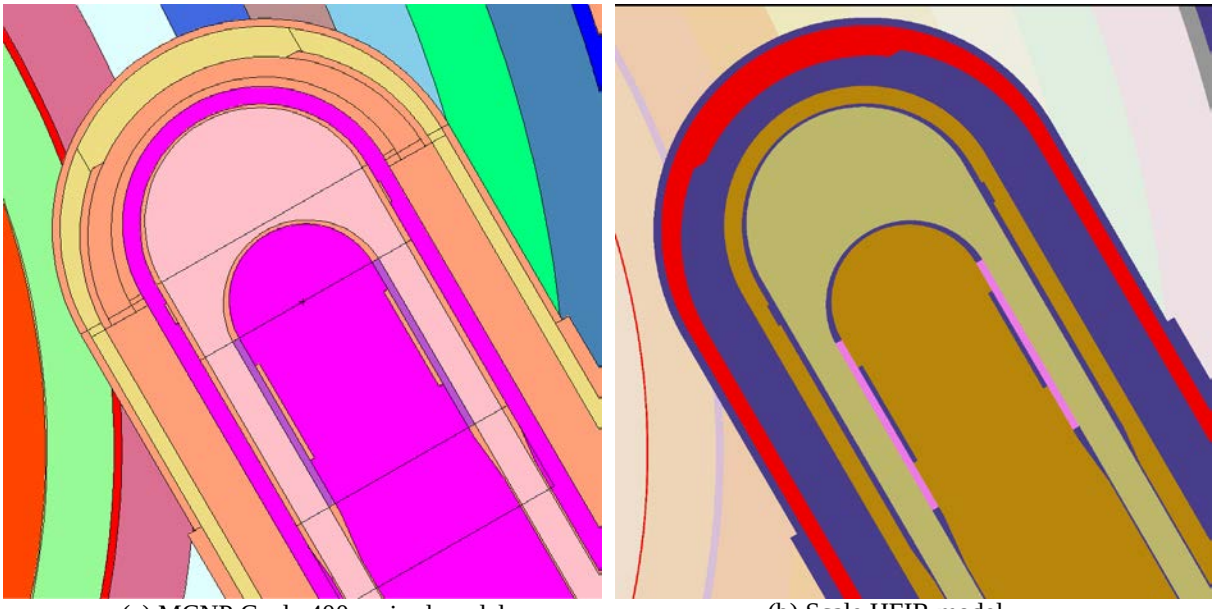


(a) MCNP Cycle 400 revised model (b) Scale HFIR model

Fig. 11. Beryllium reflector regions with irradiation facilities, horizontal tubes, and engineering facilities.

4.1.4 Horizontal Tube Regions

Correct modeling of the horizontal tubes is important to adequately characterize the neutron fluxes along each of the tubes and is especially important for the cold source tube, HB-4. Fig. 12 compares the details of the tip of the HB-4 tube at z=0 in the beryllium reflector, where the similarity of the hydrogen-filled region (light pink for the MCNP model and light yellow for the SCALE model) is apparent.

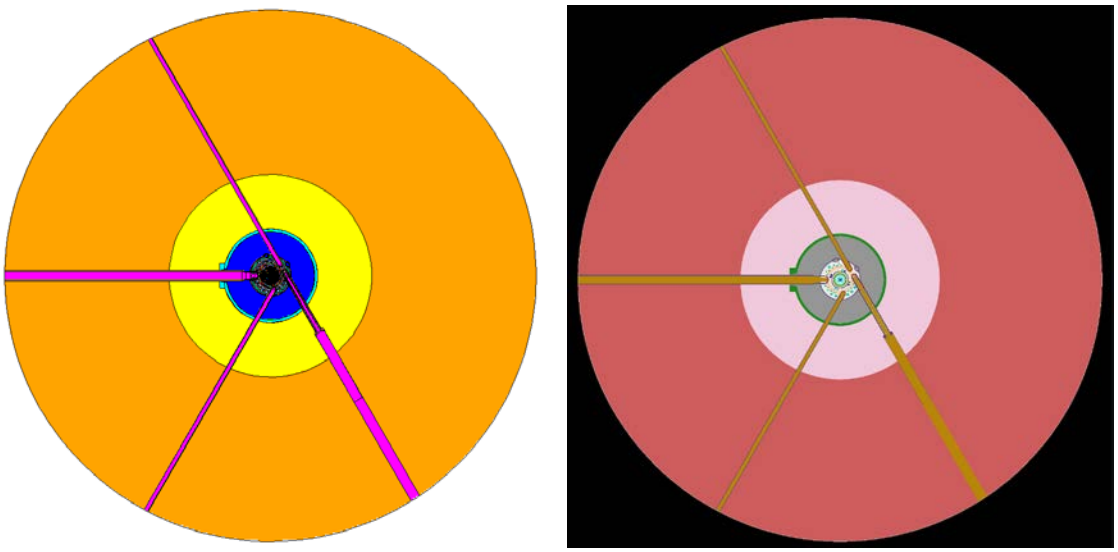


(a) MCNP Cycle 400 revised model (b) Scale HFIR model

Fig. 12. Comparison of the HT-4 tip (cold source tube) models.

4.1.5 Outer Regions

Layouts of the outer regions of HFIR (outside the pressure vessel), as obtained with the SCALE and MCNP Cycle 400 revised models, are shown in Fig. 13 for a core midplane cross section. The layouts of the four horizontal tubes are identical all the way to the periphery of the model.



(a) MCNP Cycle 400 revised model (b) Scale HFIR model

Fig. 13. Comparison of the HFIR outer regions.

4.2 CALCULATIONAL COMPARISONS

4.2.1 Multiplication Constant and Other System Parameters

The multiplication constants (k_{eff}) predicted by the SCALE HFIR model and the MCNP Cycle 400 revised model and the corresponding standard deviations are shown in Table 3. In each case, 2000 neutron active generations (cycles) were used in the Monte Carlo simulation, with each generation tracking 100,000 particles. A number of 200 generations were initially skipped to achieve a better convergence of the neutron source. As seen, there is excellent agreement between the k_{eff} values predicted by the two models, with a difference of 124 pcm.

Table 3. Comparison of multiplication constants

Model	k_{eff}	σ
SCALE HFIR	0.99630	0.00007
MCNP Cycle 400 revised	0.99754	0.00006

Other parameters of interest that globally characterize the HFIR as a critical system are the energy corresponding to the average neutron lethargy causing fission, $\bar{\epsilon}$, and the average number of neutrons produced per fission, $\bar{\nu}$. Table 4 summarizes the results obtained with the two models. The number of neutrons produced per fission is identical for the two models up to four significant digits. The energy corresponding to the average neutron lethargy causing fission differs slightly (by ~2%) between the SCALE and MCNP models.

Table 4. Comparison of HFIR system parameters

Model	$\bar{\epsilon}$ (eV)	$\bar{\nu}$
SCALE HFIR	0.174	2.439
MCNP Cycle 400 revised	0.170	2.439

4.2.2 Core Power Distribution

It is customary to approximate the relative power distribution in the reactor core with the relative fission reaction rate distribution. In MCNP, the fission reaction rate can be calculated for each cell where fuel is present. This capability is currently lacking in SCALE when used with a continuous energy cross-section library. The $\nu\Sigma_f$ reaction rate, however, can be extracted directly from the output file for the continuous energy SCALE model for HFIR, for each of the regions that contain fissile material. The relative $\nu\Sigma_f$ reaction rate density distribution obtained from the SCALE HFIR model output file was normalized to the neutron source in a manner similar to the MCNP results. The relative neutron production rate densities calculated with SCALE are displayed in Fig. 14 both as 3-D surfaces and 2-D contours (at the bottom of the plot), and the corresponding numerical values are given in Table 5. The $\nu\Sigma_f$ reaction rate peaks at the core midplane in the regions adjacent to the sidewall between the two fuel elements and also near the central flux trap.

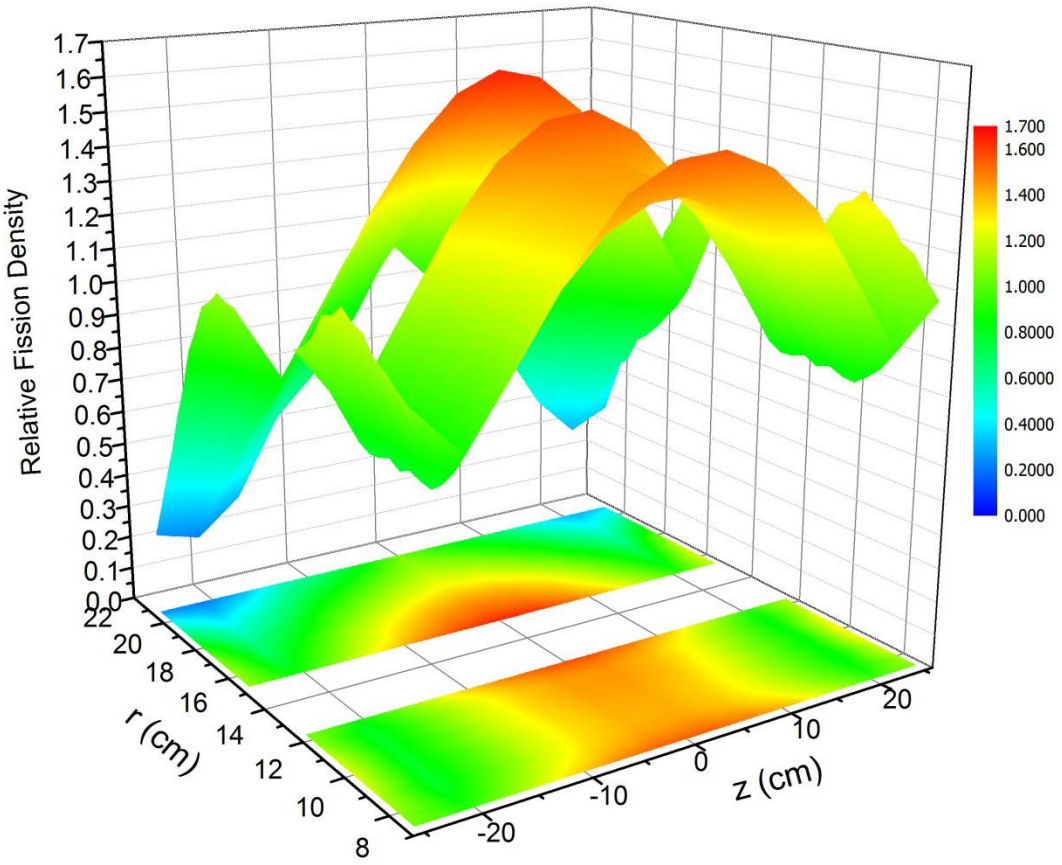


Fig. 14. Relative $\nu\Sigma_f$ reaction rate density distributions in IFE and OFE of HFIR.

To verify that the relative $\nu\Sigma_f$ reaction rate density distribution calculated with the SCALE HFIR

model is consistent with the relative fission density distribution predicted by the MCNP Cycle 400 revised model, a mesh-wise comparison of the two datasets was performed, and is illustrated in Fig. 15. Theoretically, the two distributions are the same when the number of neutrons emitted per fission is independent of energy over the energy range of the incident neutrons where most of the fissions occur. The data illustrated in Fig. 15 was calculated for each mesh as

$$100\% \times \frac{SCALE - MCNP}{MCNP}$$

where *SCALE* is the relative $\nu\Sigma_f$ reaction rate density calculated with the SCALE model, and *MCNP* is the relative fission density calculated with the MCNP model.[6] The data in Fig. 15 is displayed both as 3–D surfaces and 2–D contours (at the bottom of the plot). The difference per mesh between the two models is typically below 0.5% and increases slightly in the smaller meshes located at the top and bottom of the OFE, most likely due to the poorer statistics in these regions. The arithmetic average of the mesh difference between the two models is +0.00% for IFE and -0.01% for OFE with maxima of 0.93% for IFE and 0.99% for OFE and minima of -1.44% for IFE and -1.19% for OFE.

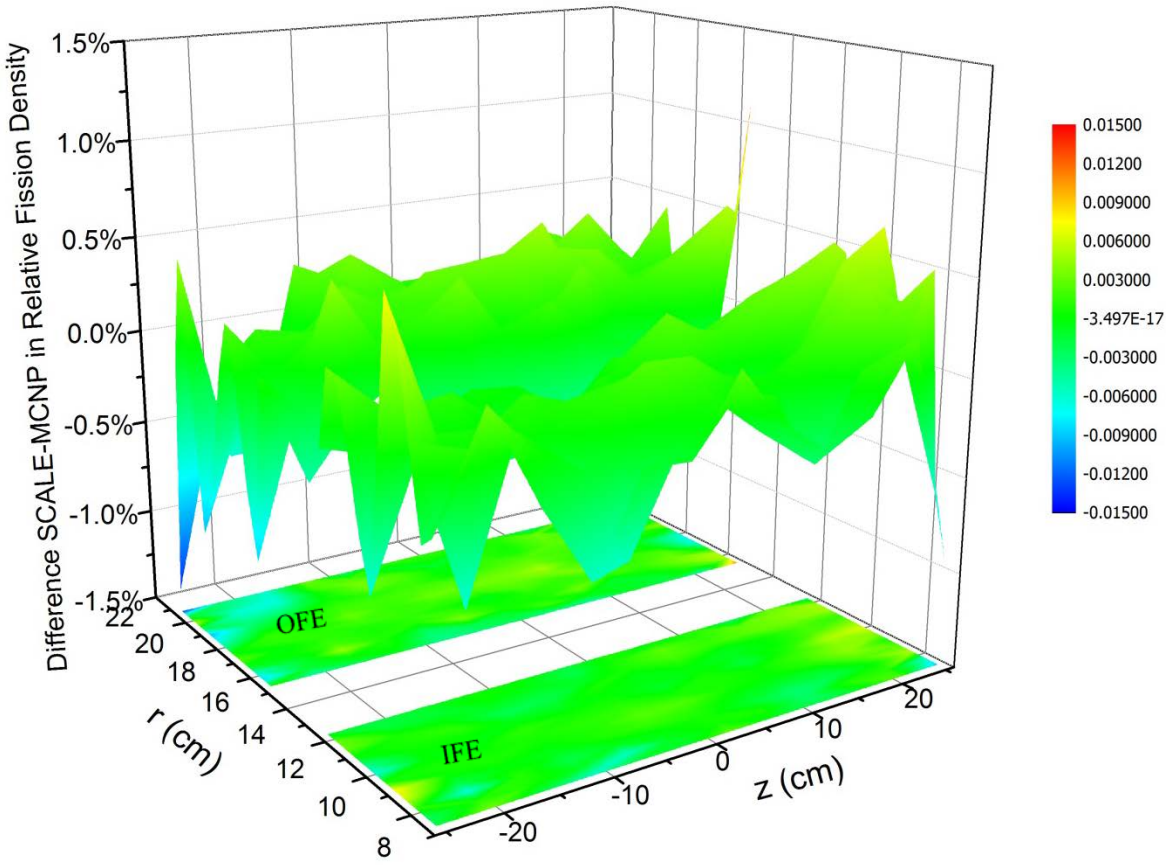


Fig. 15. Comparison of relative $\nu\Sigma_f$ reaction rate density distribution predicted by the SCALE HFIR model and relative fission density distribution predicted by the MCNP Cycle 400 revised model.

Table 5. Relative $\nu\Sigma_f$ reaction rate densities predicted by the SCALE HFIR model

Axial[a] layer #	IFE								OFE								
	r=1[b]	r=2	r=3	r=4	r=5	r=6	r=7	r=8	r=1	r=2	r=3	r=4	r=5	r=6	r=7	r=8	r=9
1	1.087	1.129	1.176	1.254	1.305	1.266	1.182	1.146	1.182	1.201	1.230	1.209	1.043	0.801	0.602	0.472	0.367
2	0.907	0.869	0.844	0.840	0.843	0.838	0.845	0.897	0.933	0.875	0.829	0.759	0.646	0.523	0.424	0.357	0.294
3	0.952	0.896	0.857	0.834	0.832	0.845	0.863	0.925	0.953	0.896	0.850	0.776	0.662	0.542	0.444	0.379	0.313
4	1.088	1.033	0.992	0.971	0.974	0.986	1.007	1.070	1.103	1.047	0.995	0.922	0.793	0.657	0.545	0.471	0.397
5	1.237	1.175	1.128	1.105	1.113	1.127	1.145	1.219	1.262	1.197	1.147	1.067	0.934	0.796	0.686	0.614	0.541
6	1.363	1.301	1.245	1.226	1.232	1.248	1.270	1.353	1.400	1.335	1.275	1.195	1.054	0.920	0.815	0.744	0.676
7	1.460	1.387	1.336	1.315	1.323	1.343	1.372	1.451	1.515	1.443	1.383	1.298	1.152	1.015	0.907	0.836	0.762
8	1.513	1.435	1.393	1.376	1.392	1.410	1.443	1.531	1.595	1.519	1.461	1.372	1.228	1.093	0.990	0.922	0.848
9	1.546	1.473	1.424	1.404	1.424	1.447	1.477	1.571	1.638	1.564	1.507	1.420	1.284	1.163	1.081	1.029	0.973
10	1.552	1.482	1.425	1.408	1.430	1.450	1.488	1.578	1.642	1.572	1.513	1.429	1.295	1.187	1.121	1.073	1.033
11	1.543	1.467	1.416	1.397	1.413	1.435	1.467	1.557	1.620	1.545	1.484	1.400	1.261	1.135	1.040	0.978	0.916
12	1.502	1.429	1.370	1.352	1.366	1.386	1.413	1.503	1.557	1.482	1.423	1.336	1.185	1.038	0.920	0.840	0.748
13	1.427	1.358	1.307	1.280	1.291	1.304	1.331	1.413	1.462	1.395	1.335	1.248	1.098	0.950	0.832	0.753	0.670
14	1.309	1.252	1.205	1.177	1.189	1.199	1.225	1.293	1.343	1.274	1.219	1.135	0.994	0.851	0.742	0.664	0.588
15	1.184	1.119	1.080	1.057	1.064	1.073	1.094	1.157	1.195	1.134	1.083	0.999	0.860	0.717	0.605	0.526	0.447
16	1.040	0.989	0.948	0.925	0.929	0.937	0.952	1.007	1.041	0.981	0.929	0.849	0.715	0.568	0.447	0.364	0.282
17	0.912	0.857	0.815	0.793	0.789	0.793	0.812	0.862	0.889	0.831	0.783	0.710	0.589	0.460	0.355	0.284	0.217
18	0.865	0.827	0.798	0.788	0.787	0.781	0.786	0.830	0.858	0.799	0.753	0.682	0.566	0.438	0.334	0.264	0.200
19	1.014	1.052	1.109	1.180	1.223	1.176	1.094	1.054	1.076	1.085	1.111	1.070	0.898	0.665	0.473	0.360	0.251

[a] The axial layer number increases from the top to the bottom of the fuel elements.

[b] r=n denotes the radial region number; n varies from 1 to 8 for the IFE and from 1 to 9 for the OFE, with r=1 corresponding to the smallest radius in the fuel element.

4.2.3 Neutron Flux

The neutron flux level is one of the key parameters for characterizing core performance. A comparison was made of three-group flux data estimated with the SCALE HFIR model and the MCNP Cycle 400 revised model for the HFIR core at 85 MW power for three relevant locations in the HFIR geometry. The flux data comparison is presented in Table 6. The statistical relative standard deviation for the tallied flux is less than 1% in all cases. The energy group definition for the three-group data is thermal, <0.625 eV; epithermal, 0.625 eV–100 keV; and fast, 100 keV–20 MeV. As the flux results provided by SCALE or MCNP are normalized to the fission source, the values for the flux in n/cm^{2}s were obtained by multiplying the flux tally values by the total source. The total source *S* was approximated as

$$S = \frac{\bar{\nu}P}{Eek_{eff}} \tag{5.1}$$

where $\bar{\nu}$ is the average number of neutrons per fission, *P* is the reactor power in MW, *E* is the average energy per fission in MeV, and *e* is a unit conversion factor (1.602×10^{-19} MJ/MeV). An approximate value of 200 MeV was used for *E*, whereas the value for k_{eff} and $\bar{\nu}$ were taken from Table 3 and Table 4, respectively. The value of the total source is 6.47×10^{18} n/s for the MCNP Cycle 400 revised model[6] and 6.49×10^{18} n/s for the SCALE HFIR model.

The flux data in Table 6 is shown for the following three locations: the central target in the flux trap, the edge of the cold source (hydrogen spherical region at the tip of the cold source), and the VXF-6 location in the beryllium reflector. As observed, the flux values agree well in the SCALE and MCNP models for the central target region and the VXF-6 location in reflector, with differences typically below 2%. The differences between the two models increase slightly to ~5% in the thermal and epithermal components, as well as for the total flux, at the cold source tip.

Table 6. Neutron flux comparison between the SCALE and MCNP models

Location	Model	Thermal flux (n/cm^{2}s)	Epithermal flux (n/cm^{2}s)	Fast flux (n/cm^{2}s)	Total flux (n/cm^{2}s)
Central target r,z = 0 cm	SCALE	2.25×10^{15}	1.33×10^{15}	1.12×10^{15}	4.71×10^{15}
	MCNP	2.24×10^{15}	1.30×10^{15}	1.13×10^{15}	4.67×10^{15}
Reflector VXF-6	SCALE	2.72×10^{14}	3.64×10^{13}	9.50×10^{12}	3.18×10^{14}
	MCNP	2.67×10^{14}	3.58×10^{13}	9.76×10^{12}	3.13×10^{14}
Cold source tip Unit 4100	SCALE	4.23×10^{14}	9.40×10^{13}	3.81×10^{13}	5.55×10^{14}
	MCNP	4.02×10^{14}	9.02×10^{13}	3.80×10^{13}	5.30×10^{14}

5. CONCLUSIONS

The development of a comprehensive SCALE computational model for HFIR is documented and discussed in this report. This SCALE model has equivalent features as the reference MCNP model for Cycle 400, which has been used extensively at HFIR for safety analyses and by HFIR users for experiment design and analyses.

Numerical and visual comparisons are employed to assess the performance of the SCALE HFIR model relative to the MCNP Cycle 400 revised model that is currently used to evaluate relevant reactor performance parameters for the HFIR. Visual comparisons of the two models show excellent geometry matching. Numerical comparisons for the global parameters of the system, power density distribution in the fuel, and neutron fluxes at several locations in the HFIR indicate excellent agreement between the results predicted with the SCALE model and those given by the MCNP model. The difference in k_{eff} values calculated with the two models is 124 pcm.

The SCALE HFIR model is presented in sufficient detail to provide the users of the model with a tool that can be easily customized for various safety analysis or experiment design requirements. To aid the users of the SCALE HFIR model, a flowchart of the model is included that shows in detail the geometry units describing various sections in the configuration. The input file for the SCALE HFIR model is heavily commented, containing ~1,500 comment lines, for easier navigation and identification of the different components of the model, to enable the user to make changes or to add to the model, such as for the case when a particular target or experiment is inserted in the reactor.

The SCALE HFIR model is based on the SCALE generalized geometry package, and therefore can be used as a basis for studies with other modules or sequences in SCALE, such as for depletion simulations or shielding analyses. Given the diverse capabilities existent or under development in SCALE, there is a potential for more analysis options with SCALE than those provided by MCNP. The SCALE HFIR model provides the modeling basis for future integrated reactor analyses for HFIR and also provides an alternative and a verification tool for the currently used HFIR MCNP model.

6. REFERENCES

1. N. Xoubi and R. T. Primm III, *Modelling of the High Flux Isotope Reactor Cycle 400,* ORNL/TM2004-251 (2005).

2. X-5 Monte Carlo Team, *MCNP—A General Monte Carlo N-Particle Transport Code, Version 5,* LA-CP-03-0245, Los Alamos National Laboratory (2003).

3. R. T. Primm III, R. J. Ellis, J. C. Gehin, D. L. Moses, J. L. Binder, and N. Xoubi, *Assumptions and Criteria for Performing a Feasibility Study of the Conversion of the High Flux Isotope Reactor Core to Use Low-Enriched Uranium Fuel,* ORNL/TM-2005/269, Oak Ridge National Laboratory (2006).

4. W. Haeck, *VESTA User's Manual—Version 2.0.0,* IRSN Report DSU/SEC/T/2008-331 Indice A, France (2009).

5. R. T. Primm III, D. Chandler, G. Ilas, B. C. Jolly, J. H. Miller, and J. D. Sease, *Design Study for a Low-Enriched Uranium Core for the High Flux Isotope Reactor, Annual Report for FY 2008,* ORNL/TM-2009/87, Oak Ridge National Laboratory (2009).

6. G. Ilas and R. T. Primm III, *Low-Enriched Uranium Fuel Design with Two-Dimensional Grading for the High Flux Isotope Reactor,* ORNL/TM-2010/318, Oak Ridge National Laboratory (2011).

7. SCALE*: A Comprehensive Modeling and Simulation Suite for Nuclear Safety Analysis and Design*, ORNL/TM-2005/39, Version 6.1, June 2011 (Available from Radiation Safety Information Computational Center at Oak Ridge National Laboratory as CCC-785.)

8. D. Chandler, R. T. Primm III, and G. I. Maldonado, *Validating MCNP for LEU Fuel Design via Power Distribution Comparisons*, ORNL/TM-2008/126, Oak Ridge National Laboratory (2008).

9. D. Chandler, R. T. Primm III, and G. I. Maldonado, *Validation of a Monte Carlo Based Depletion Methodology with HFIR Post-Irradiation Examination Data*, ORNL/TM-2009/123, Oak Ridge National Laboratory (2009).

10. *High Flux Isotope Reactor (HFIR) User Guide: A guide to in-vessel irradiations and experiments*. NSUF Revision 1. Oak Ridge National Laboratory (May 2011).

11. R. D. Cheverton and T. M. Sims, *HFIR Core Nuclear Design,* ORNL-4621, Oak Ridge National Laboratory (1971).

Appendix A

INPUT FILE FOR THE SCALE HFIR MODEL

Appendix A. Input File for the SCALE HFIR Model

```
=csas26
HFIR model, Dan Ilas, May-June 2011
ce_v7
read comp
'
'     ----------------------------
'      (3)  Material Descriptions
'     ----------------------------
'
'         Region I  Material Descriptions
'      ------------------------------------
'
'
'         Water below core region   - Outlet Pressure= 2.572 MPa or 358 psi
'                                   - Pressure drop= (0.758 MPa or 110 psi pressure drop)
'                                   - Outlet Temperature= 156F or 69C
'                                   - Density= 0.9794 g/cm^3
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 1.00000E+00)
 H-1              1    0   6.59947E-02   293.6   end
 O-16             1    0   3.29974E-02   293.6   end
' This is a SCALE only material:
' It is the same as material 1, but corresponds to a density of 1.00000E+00 on cell cards
 H-1            100    0   6.68584E-02   293.6   end
 O-16           100    0   3.34293E-02   293.6   end
'
'         Water in core region      - Avg. Density= 0.98465 g/cm^3
 H-1              2    0   6.63485E-02   293.6   end
 O-16             2    0   3.31742E-02   293.6   end
'
'         Water above core region   - Inlet Pressure= 3.33 MPa or 468 psi
'                                   - Inlet Temperature= 120F or 49C
'                                   - Density= 0.9899 g/cm^3
 H-1              3    0   6.67020E-02   293.6   end
 O-16             3    0   3.33510E-02   293.6   end
'
'
'        Aluminum in target basket area
Al-27            25    0   5.85482E-02   293.6   end
 H-1             25    0   3.45716E-04   293.6   end
Mg-24            25    0   5.28432E-04   293.6   end
Mg-25            25    0   6.68986E-05   293.6   end
Mg-26            25    0   7.36554E-05   293.6   end
Si-28            25    0   3.20373E-04   293.6   end
Si-29            25    0   1.62219E-05   293.6   end
Si-30            25    0   1.07683E-05   293.6   end
Ti-46            25    0   2.10131E-06   293.6   end
Ti-47            25    0   1.89500E-06   293.6   end
Ti-48            25    0   1.87768E-05   293.6   end
Ti-49            25    0   1.37795E-06   293.6   end
Ti-50            25    0   1.31937E-06   293.6   end
Cr-50            25    0   2.65258E-06   293.6   end
Cr-52            25    0   5.10942E-05   293.6   end
Cr-53            25    0   5.79300E-06   293.6   end
Cr-54            25    0   1.43910E-06   293.6   end
Mn-55            25    0   2.21974E-05   293.6   end
Fe-54            25    0   5.96144E-06   293.6   end
Fe-56            25    0   9.34978E-05   293.6   end
Fe-57            25    0   2.16039E-06   293.6   end
Fe-58            25    0   2.85334E-07   293.6   end
Cu-63            25    0   6.04931E-05   293.6   end
Cu-65            25    0   2.69626E-05   293.6   end
'
'        Al-1100 clad of target pellets       Total =   6.03240E-02
Al-27           511    0   6.00625E-02   293.6   end
Si-28           511    0   1.33983E-04   293.6   end
Si-29           511    0   6.78416E-06   293.6   end
Si-30           511    0   4.50340E-06   293.6   end
Mn-55           511    0   7.42655E-06   293.6   end
Fe-54           511    0   4.27394E-06   293.6   end
Fe-56           511    0   6.70314E-05   293.6   end
Fe-57           511    0   1.54885E-06   293.6   end
Fe-58           511    0   2.04565E-07   293.6   end
Cu-63           511    0   2.47400E-05   293.6   end
Cu-65           511    0   1.10270E-05   293.6   end
'
'        Al for shrouded targets              Total =   6.03240E-02
```

```
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 4.82102E-02)
Al-27           512    0   4.80012E-02   293.6   end
Si-28           512    0   1.07078E-04   293.6   end
Si-29           512    0   5.42182E-06   293.6   end
Si-30           512    0   3.59906E-06   293.6   end
Mn-55           512    0   5.93521E-06   293.6   end
Fe-54           512    0   3.41568E-06   293.6   end
Fe-56           512    0   5.35707E-05   293.6   end
Fe-57           512    0   1.23782E-06   293.6   end
Fe-58           512    0   1.63486E-07   293.6   end
Cu-63           512    0   1.97719E-05   293.6   end
Cu-65           512    0   8.81264E-06   293.6   end
'
'       Dummy solid Al targets  ( change to Al-1100) Total =   6.03240E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 6.02423E-02)
Al-27           530    0   5.99811E-02   293.6   end
Si-28           530    0   1.33801E-04   293.6   end
Si-29           530    0   6.77497E-06   293.6   end
Si-30           530    0   4.49730E-06   293.6   end
Mn-55           530    0   7.41649E-06   293.6   end
Fe-54           530    0   4.26815E-06   293.6   end
Fe-56           530    0   6.69406E-05   293.6   end
Fe-57           530    0   1.54675E-06   293.6   end
Fe-58           530    0   2.04288E-07   293.6   end
Cu-63           530    0   2.47065E-05   293.6   end
Cu-65           530    0   1.10121E-05   293.6   end
'
'
'    material for Jp-26 & Jp-27 solid SSt targets in Al holders  Total =  5.97E-02 (communication w/ Randy Hobbs 8/9/2004)
' The total number density on MCNP material cards ( 5.96631E-02)
'   is not the same as on cell cards ( 5.97000E-02)
Al-27           535    0   3.22199E-02   293.6   end
Fe-54           535    0   1.10633E-03   293.6   end
Fe-56           535    0   1.73515E-02   293.6   end
Fe-57           535    0   4.00928E-04   293.6   end
Fe-58           535    0   5.29528E-05   293.6   end
Cr-50           535    0   2.41574E-04   293.6   end
Cr-52           535    0   4.65323E-03   293.6   end
Cr-53           535    0   5.27576E-04   293.6   end
Cr-54           535    0   1.31061E-04   293.6   end
Ni-58           535    0   1.67581E-03   293.6   end
Ni-60           535    0   6.45411E-04   293.6   end
Ni-61           535    0   2.80614E-05   293.6   end
Ni-62           535    0   8.93533E-05   293.6   end
Ni-64           535    0   2.28922E-05   293.6   end
Mn-55           535    0   5.53342E-04   293.6   end
'
'
'
'
'   Material of PTP Experiments Loading
'   -----------------------------------
'
'
'   PTP-1 experiments
'
'   #1    (bottom) experiment material  (s1)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           711    0   5.91171E-02   293.6   end
Si-28           711    0   1.31874E-04   293.6   end
Si-29           711    0   6.67737E-06   293.6   end
Si-30           711    0   4.43251E-06   293.6   end
Mn-55           711    0   7.30965E-06   293.6   end
Fe-54           711    0   4.20667E-06   293.6   end
Fe-56           711    0   6.59763E-05   293.6   end
Fe-57           711    0   1.52447E-06   293.6   end
Fe-58           711    0   2.01345E-07   293.6   end
Cu-63           711    0   2.43506E-05   293.6   end
Cu-65           711    0   1.08534E-05   293.6   end
'
'   # 2  experiment material  (SO3E-003) sst/Al   Total =   4.47398E-02
' PTP1  experiment material
Al-27           712    0   3.56263E-02   293.6   end
 C              712    0   4.06300E-04   293.6   end
Si-28           712    0   2.81486E-04   293.6   end
Si-29           712    0   1.42528E-05   293.6   end
Si-30           712    0   9.46120E-06   293.6   end
Fe-54           712    0   4.81391E-04   293.6   end
```

```
Fe-56           712    0   7.55002E-03   293.6   end
Fe-57           712    0   1.74453E-04   293.6   end
Fe-58           712    0   2.30409E-05   293.6   end
Mo-92           712    0   2.56880E-05   293.6   end
Mo-94           712    0   1.60118E-05   293.6   end
Mo-95           712    0   2.75575E-05   293.6   end
Mo-96           712    0   2.88731E-05   293.6   end
Mo-97           712    0   1.65311E-05   293.6   end
Mo-98           712    0   4.17690E-05   293.6   end
Mo-100          712    0   1.66695E-05   293.6   end
'
'
'   # 3  experiment material  (NM-634)  W   Total =   3.38204E-02
 W-186          713    0   1.02360E-03   293.6   end
 O-16           713    0   2.09630E-03   293.6   end
Al-27           713    0   3.07005E-02   293.6   end
'
'   # 4  experiment material  (NM-627)  W   Total =   3.36267E-02
 W-186          714    0   9.54300E-04   293.6   end
 O-16           714    0   1.97190E-03   293.6   end
Al-27           714    0   3.07005E-02   293.6   end
'
'   # 5  experiment material  (S2)  Mo/V  Total =   2.32122E-02
 V              715    0   1.72431E-02   293.6   end
Mo-92           715    0   8.85814E-04   293.6   end
Mo-94           715    0   5.52142E-04   293.6   end
Mo-95           715    0   9.50281E-04   293.6   end
Mo-96           715    0   9.95646E-04   293.6   end
Mo-97           715    0   5.70049E-04   293.6   end
Mo-98           715    0   1.44034E-03   293.6   end
Mo-100          715    0   5.74824E-04   293.6   end
'
'   # 6  experiment material  (NM-659)  Ra   Total =   3.50519E-02
' No radon cross section
 O-16           716    0   1.00001E-07   293.6   end
Al-27           716    0   3.50518E-02   293.6   end
'
'   # 7  experiment material  top  (T031)  SST Tensile   Total =   6.4716E-03
Fe-54           717    0   3.91600E-04   293.6   end
Fe-56           717    0   5.92790E-03   293.6   end
Fe-57           717    0   1.34500E-04   293.6   end
Fe-58           717    0   1.76000E-05   293.6   end
'
'
'
'   PTP-2 experiments
'
'   #1  (bottom) experiment material   Gr/Al     Total=5.65355-2
Al-27           721    0   2.85703E-02   293.6   end
Si-28           721    0   4.25273E-04   293.6   end
Si-29           721    0   2.15334E-05   293.6   end
Si-30           721    0   1.42941E-05   293.6   end
Fe-54           721    0   5.17316E-05   293.6   end
Fe-56           721    0   8.11345E-04   293.6   end
Fe-57           721    0   1.87472E-05   293.6   end
Fe-58           721    0   2.47604E-06   293.6   end
 C-graphite     721    0   2.62709E-02   293.6   end
Mo-92           721    0   5.17768E-05   293.6   end
Mo-94           721    0   3.22733E-05   293.6   end
Mo-95           721    0   5.55449E-05   293.6   end
Mo-96           721    0   5.81965E-05   293.6   end
Mo-97           721    0   3.33200E-05   293.6   end
Mo-98           721    0   8.41896E-05   293.6   end
Mo-100          721    0   3.35991E-05   293.6   end
'
'
'   #2  experiment material   SiC/V     Total= 4.34300-2
' The total number density on MCNP material cards ( 5.48665E-02)
'   is not the same as on cell cards ( 6.00000E-02)
Al-27           722    0   1.90817E-02   293.6   end
Si-28           722    0   1.15348E-02   293.6   end
Si-29           722    0   5.84056E-04   293.6   end
Si-30           722    0   3.87703E-04   293.6   end
 C-graphite     722    0   1.25065E-02   293.6   end
Fe-54           722    0   5.14027E-05   293.6   end
Fe-56           722    0   8.06187E-04   293.6   end
Fe-57           722    0   1.86280E-05   293.6   end
Fe-58           722    0   2.46030E-06   293.6   end
 V              722    0   1.48368E-02   293.6   end
Mo-92           722    0   2.81564E-05   293.6   end
Mo-94           722    0   1.75504E-05   293.6   end
```

```
Mo-95           722    0   3.02055E-05   293.6   end
Mo-96           722    0   3.16475E-05   293.6   end
Mo-97           722    0   1.81196E-05   293.6   end
Mo-98           722    0   4.57827E-05   293.6   end
Mo-100          722    0   1.82714E-05   293.6   end
'
'
'
'   #3  experiment material  (s1)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           723    0   5.91171E-02   293.6   end
Si-28           723    0   1.31874E-04   293.6   end
Si-29           723    0   6.67737E-06   293.6   end
Si-30           723    0   4.43251E-06   293.6   end
Mn-55           723    0   7.30965E-06   293.6   end
Fe-54           723    0   4.20667E-06   293.6   end
Fe-56           723    0   6.59763E-05   293.6   end
Fe-57           723    0   1.52447E-06   293.6   end
Fe-58           723    0   2.01345E-07   293.6   end
Cu-63           723    0   2.43506E-05   293.6   end
Cu-65           723    0   1.08534E-05   293.6   end
'
'
'   #4  experiment material   Gr/V     Total=5.89491-2
Al-27           724    0   1.75354E-02   293.6   end
Si-28           724    0   4.33941E-04   293.6   end
Si-29           724    0   2.19724E-05   293.6   end
Si-30           724    0   1.45855E-05   293.6   end
Fe-54           724    0   5.14741E-05   293.6   end
Fe-56           724    0   8.07307E-04   293.6   end
Fe-57           724    0   1.86539E-05   293.6   end
Fe-58           724    0   2.46372E-06   293.6   end
 C-graphite     724    0   2.62254E-02   293.6   end
 V              724    0   1.35332E-02   293.6   end
Mo-92           724    0   4.52322E-05   293.6   end
Mo-94           724    0   2.81940E-05   293.6   end
Mo-95           724    0   4.85241E-05   293.6   end
Mo-96           724    0   5.08405E-05   293.6   end
Mo-97           724    0   2.91084E-05   293.6   end
Mo-98           724    0   7.35481E-05   293.6   end
Mo-100          724    0   2.93522E-05   293.6   end
'
'
'   #5  experiment material   Gr/V     Total=5.89252-2
Al-27           725    0   1.74621E-02   293.6   end
Si-28           725    0   4.32374E-04   293.6   end
Si-29           725    0   2.18930E-05   293.6   end
Si-30           725    0   1.45328E-05   293.6   end
Fe-54           725    0   5.13221E-05   293.6   end
Fe-56           725    0   8.04923E-04   293.6   end
Fe-57           725    0   1.85988E-05   293.6   end
Fe-58           725    0   2.45644E-06   293.6   end
 C-graphite     725    0   2.62644E-02   293.6   end
 V              725    0   1.34952E-02   293.6   end
Mo-92           725    0   5.30382E-05   293.6   end
Mo-94           725    0   3.30595E-05   293.6   end
Mo-95           725    0   5.68981E-05   293.6   end
Mo-96           725    0   5.96143E-05   293.6   end
Mo-97           725    0   3.41317E-05   293.6   end
Mo-98           725    0   8.62406E-05   293.6   end
Mo-100          725    0   3.44176E-05   293.6   end
'
'
'   #6  experiment material  (s1)   Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           726    0   5.91171E-02   293.6   end
Si-28           726    0   1.31874E-04   293.6   end
Si-29           726    0   6.67737E-06   293.6   end
Si-30           726    0   4.43251E-06   293.6   end
Mn-55           726    0   7.30965E-06   293.6   end
Fe-54           726    0   4.20667E-06   293.6   end
Fe-56           726    0   6.59763E-05   293.6   end
Fe-57           726    0   1.52447E-06   293.6   end
Fe-58           726    0   2.01345E-07   293.6   end
Cu-63           726    0   2.43506E-05   293.6   end
Cu-65           726    0   1.08534E-05   293.6   end
'
'
'   #7  experiment material   Gr/V     Total=6.03159-2
```

```
Al-27           727    0   1.74755E-02   293.6   end
Si-28           727    0   4.32650E-04   293.6   end
Si-29           727    0   2.19070E-05   293.6   end
Si-30           727    0   1.45421E-05   293.6   end
Fe-54           727    0   5.20649E-05   293.6   end
Fe-56           727    0   8.16574E-04   293.6   end
Fe-57           727    0   1.88680E-05   293.6   end
Fe-58           727    0   2.49200E-06   293.6   end
 C-graphite     727    0   2.63554E-02   293.6   end
 V              727    0   1.47856E-02   293.6   end
Mo-92           727    0   5.05153E-05   293.6   end
Mo-94           727    0   3.14869E-05   293.6   end
Mo-95           727    0   5.41916E-05   293.6   end
Mo-96           727    0   5.67786E-05   293.6   end
Mo-97           727    0   3.25081E-05   293.6   end
Mo-98           727    0   8.21384E-05   293.6   end
Mo-100          727    0   3.27804E-05   293.6   end
'
'
'
'   PTP-3 experiments
'
'   #1  (bottom) experiment material   Gr/Al     Total=5.64033-2
Al-27           731    0   2.85243E-02   293.6   end
Si-28           731    0   4.32373E-04   293.6   end
Si-29           731    0   2.18930E-05   293.6   end
Si-30           731    0   1.45328E-05   293.6   end
Fe-54           731    0   5.22931E-05   293.6   end
Fe-56           731    0   8.20152E-04   293.6   end
Fe-57           731    0   1.89507E-05   293.6   end
Fe-58           731    0   2.50292E-06   293.6   end
 C-graphite     731    0   2.61596E-02   293.6   end
Mo-92           731    0   5.29342E-05   293.6   end
Mo-94           731    0   3.29947E-05   293.6   end
Mo-95           731    0   5.67865E-05   293.6   end
Mo-96           731    0   5.94975E-05   293.6   end
Mo-97           731    0   3.40648E-05   293.6   end
Mo-98           731    0   8.60715E-05   293.6   end
Mo-100          731    0   3.43501E-05   293.6   end
'
'
'   #2  experiment material   SiC/V     Total= 4.31828-2
' The total number density on MCNP material cards ( 5.43818E-02)
'   is not the same as on cell cards ( 6.00000E-02)
Al-27           732    0   1.92518E-02   293.6   end
Si-28           732    0   1.13958E-02   293.6   end
Si-29           732    0   5.77020E-04   293.6   end
Si-30           732    0   3.83032E-04   293.6   end
 C-graphite     732    0   1.23559E-02   293.6   end
Fe-54           732    0   5.18609E-05   293.6   end
Fe-56           732    0   8.13373E-04   293.6   end
Fe-57           732    0   1.87940E-05   293.6   end
Fe-58           732    0   2.48223E-06   293.6   end
 V              732    0   1.49586E-02   293.6   end
Mo-92           732    0   2.84074E-05   293.6   end
Mo-94           732    0   1.77068E-05   293.6   end
Mo-95           732    0   3.04748E-05   293.6   end
Mo-96           732    0   3.19296E-05   293.6   end
Mo-97           732    0   1.82811E-05   293.6   end
Mo-98           732    0   4.61908E-05   293.6   end
Mo-100          732    0   1.84342E-05   293.6   end
'
'   #3 experiment material  (s1)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           733    0   5.91171E-02   293.6   end
Si-28           733    0   1.31874E-04   293.6   end
Si-29           733    0   6.67737E-06   293.6   end
Si-30           733    0   4.43251E-06   293.6   end
Mn-55           733    0   7.30965E-06   293.6   end
Fe-54           733    0   4.20667E-06   293.6   end
Fe-56           733    0   6.59763E-05   293.6   end
Fe-57           733    0   1.52447E-06   293.6   end
Fe-58           733    0   2.01345E-07   293.6   end
Cu-63           733    0   2.43506E-05   293.6   end
Cu-65           733    0   1.08534E-05   293.6   end
'
'  #4  experiment material  (S4)  Mo/V  Total =   2.59550E-02
 V              734    0   1.99828E-02   293.6   end
Mo-92           734    0   8.86274E-04   293.6   end
Mo-94           734    0   5.52429E-04   293.6   end
```

```
Mo-95           734    0   9.50774E-04   293.6   end
Mo-96           734    0   9.96163E-04   293.6   end
Mo-97           734    0   5.70345E-04   293.6   end
Mo-98           734    0   1.44109E-03   293.6   end
Mo-100          734    0   5.75123E-04   293.6   end
'
'
'  #5  experiment material  (S4)  Mo/V  Total =   2.32314E-02
 V              735    0   1.72623E-02   293.6   end
Mo-92           735    0   8.85814E-04   293.6   end
Mo-94           735    0   5.52142E-04   293.6   end
Mo-95           735    0   9.50281E-04   293.6   end
Mo-96           735    0   9.95646E-04   293.6   end
Mo-97           735    0   5.70049E-04   293.6   end
Mo-98           735    0   1.44034E-03   293.6   end
Mo-100          735    0   5.74824E-04   293.6   end
'
'
'   #6  experiment material  (s1)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           736    0   5.91171E-02   293.6   end
Si-28           736    0   1.31874E-04   293.6   end
Si-29           736    0   6.67737E-06   293.6   end
Si-30           736    0   4.43251E-06   293.6   end
Mn-55           736    0   7.30965E-06   293.6   end
Fe-54           736    0   4.20667E-06   293.6   end
Fe-56           736    0   6.59763E-05   293.6   end
Fe-57           736    0   1.52447E-06   293.6   end
Fe-58           736    0   2.01345E-07   293.6   end
Cu-63           736    0   2.43506E-05   293.6   end
Cu-65           736    0   1.08534E-05   293.6   end
'
'   #7  experiment material   Gr/V     Total=5.98973-2
Al-27           737    0   1.74177E-02   293.6   end
Si-28           737    0   4.25640E-04   293.6   end
Si-29           737    0   2.15521E-05   293.6   end
Si-30           737    0   1.43065E-05   293.6   end
Fe-54           737    0   5.18953E-05   293.6   end
Fe-56           737    0   8.13913E-04   293.6   end
Fe-57           737    0   1.88065E-05   293.6   end
Fe-58           737    0   2.48388E-06   293.6   end
 C-graphite     737    0   2.60117E-02   293.6   end
 V              737    0   1.47777E-02   293.6   end
Mo-92           737    0   5.07082E-05   293.6   end
Mo-94           737    0   3.16072E-05   293.6   end
Mo-95           737    0   5.43985E-05   293.6   end
Mo-96           737    0   5.69955E-05   293.6   end
Mo-97           737    0   3.26323E-05   293.6   end
Mo-98           737    0   8.24521E-05   293.6   end
Mo-100          737    0   3.29056E-05   293.6   end
'
'
'   PTP-4 experiments
'
'
'   #1  (bottom) experiment material   Gr/Al     Total=8.16415-2
'
 C-graphite     741    0   4.30656E-02   293.6   end
Al-27           741    0   3.61430E-02   293.6   end
Si-28           741    0   2.24386E-03   293.6   end
Si-29           741    0   1.13616E-04   293.6   end
Si-30           741    0   7.54199E-05   293.6   end
'
'
'   #2  experiment material   SiC/V     Total= 4.31234-2
' The total number density on MCNP material cards ( 5.42013E-02)
'   is not the same as on cell cards ( 6.00000E-02)
Al-27           742    0   1.93159E-02   293.6   end
Si-28           742    0   1.13102E-02   293.6   end
Si-29           742    0   5.72679E-04   293.6   end
Si-30           742    0   3.80151E-04   293.6   end
 C-graphite     742    0   1.22629E-02   293.6   end
Fe-54           742    0   5.20335E-05   293.6   end
Fe-56           742    0   8.16080E-04   293.6   end
Fe-57           742    0   1.88566E-05   293.6   end
Fe-58           742    0   2.49049E-06   293.6   end
 V              742    0   1.50767E-02   293.6   end
Mo-92           742    0   2.85019E-05   293.6   end
Mo-94           742    0   1.77658E-05   293.6   end
Mo-95           742    0   3.05762E-05   293.6   end
```

```
Mo-96           742    0   3.20359E-05   293.6   end
Mo-97           742    0   1.83419E-05   293.6   end
Mo-98           742    0   4.63445E-05   293.6   end
Mo-100          742    0   1.84956E-05   293.6   end
'
'
'  #3  experiment material  (s1)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           743    0   5.91171E-02   293.6   end
Si-28           743    0   1.31874E-04   293.6   end
Si-29           743    0   6.67737E-06   293.6   end
Si-30           743    0   4.43251E-06   293.6   end
Mn-55           743    0   7.30965E-06   293.6   end
Fe-54           743    0   4.20667E-06   293.6   end
Fe-56           743    0   6.59763E-05   293.6   end
Fe-57           743    0   1.52447E-06   293.6   end
Fe-58           743    0   2.01345E-07   293.6   end
Cu-63           743    0   2.43506E-05   293.6   end
Cu-65           743    0   1.08534E-05   293.6   end
'
'
'  #4  experiment material  (S4)  Mo/Al  Total =   4.89927E-02
' The total number density on MCNP material cards ( 4.37744E-02)
'   is not the same as on cell cards ( 4.89927E-02)
Al-27           744    0   4.83627E-02   293.6   end
Fe-54           744    0   1.44828E-05   293.6   end
Fe-56           744    0   2.27145E-04   293.6   end
Fe-57           744    0   5.24846E-06   293.6   end
Fe-58           744    0   6.93193E-07   293.6   end
Mo-92           744    0   5.67532E-05   293.6   end
Mo-94           744    0   3.53752E-05   293.6   end
Mo-95           744    0   6.08834E-05   293.6   end
Mo-96           744    0   6.37900E-05   293.6   end
Mo-97           744    0   3.65225E-05   293.6   end
Mo-98           744    0   9.22812E-05   293.6   end
Mo-100          744    0   3.68284E-05   293.6   end
'
'
'  #5  experiment material  (S4)  Mo/Al  Total =   4.90794E-02
' The total number density on MCNP material cards ( 4.38951E-02)
'   is not the same as on cell cards ( 4.90794E-02)
Al-27           745    0   4.84500E-02   293.6   end
Fe-54           745    0   1.44685E-05   293.6   end
Fe-56           745    0   2.26921E-04   293.6   end
Fe-57           745    0   5.24329E-06   293.6   end
Fe-58           745    0   6.92510E-07   293.6   end
Mo-92           745    0   5.66973E-05   293.6   end
Mo-94           745    0   3.53403E-05   293.6   end
Mo-95           745    0   6.08234E-05   293.6   end
Mo-96           745    0   6.37272E-05   293.6   end
Mo-97           745    0   3.64865E-05   293.6   end
Mo-98           745    0   9.21903E-05   293.6   end
Mo-100          745    0   3.67921E-05   293.6   end
'
'
'  #6  experiment material  (s-23)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           746    0   5.91171E-02   293.6   end
Si-28           746    0   1.31874E-04   293.6   end
Si-29           746    0   6.67737E-06   293.6   end
Si-30           746    0   4.43251E-06   293.6   end
Mn-55           746    0   7.30965E-06   293.6   end
Fe-54           746    0   4.20667E-06   293.6   end
Fe-56           746    0   6.59763E-05   293.6   end
Fe-57           746    0   1.52447E-06   293.6   end
Fe-58           746    0   2.01345E-07   293.6   end
Cu-63           746    0   2.43506E-05   293.6   end
Cu-65           746    0   1.08534E-05   293.6   end
'
'   #7  experiment material   Gr/V     Total=5.98063-2
' The total number density on MCNP material cards ( 5.97922E-02)
'   is not the same as on cell cards ( 5.98063E-02)
Al-27           747    0   1.75063E-02   293.6   end
Si-28           747    0   4.25373E-04   293.6   end
Si-29           747    0   2.15385E-05   293.6   end
Si-30           747    0   1.42975E-05   293.6   end
Fe-54           747    0   5.17321E-05   293.6   end
Fe-56           747    0   8.11353E-04   293.6   end
Fe-57           747    0   1.87473E-05   293.6   end
```

```
Fe-58           747    0   2.47606E-06   293.6   end
 C-graphite     747    0   2.58227E-02   293.6   end
 V              747    0   1.47900E-02   293.6   end
Mo-92           747    0   5.07203E-05   293.6   end
Mo-94           747    0   3.16148E-05   293.6   end
Mo-95           747    0   5.44114E-05   293.6   end
Mo-96           747    0   5.70090E-05   293.6   end
Mo-97           747    0   3.26401E-05   293.6   end
Mo-98           747    0   8.24716E-05   293.6   end
Mo-100          747    0   3.29135E-05   293.6   end
'
'
'
'   PTP-5 experiments
'
'
'   #1  (bottom)  experiment material  (s-4)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           751    0   5.91171E-02   293.6   end
Si-28           751    0   1.31874E-04   293.6   end
Si-29           751    0   6.67737E-06   293.6   end
Si-30           751    0   4.43251E-06   293.6   end
Mn-55           751    0   7.30965E-06   293.6   end
Fe-54           751    0   4.20667E-06   293.6   end
Fe-56           751    0   6.59763E-05   293.6   end
Fe-57           751    0   1.52447E-06   293.6   end
Fe-58           751    0   2.01345E-07   293.6   end
Cu-63           751    0   2.43506E-05   293.6   end
Cu-65           751    0   1.08534E-05   293.6   end
'
'   #2  experiment material   SiC/V     Total= 4.32788-2
' The total number density on MCNP material cards ( 5.45761E-02)
'   is not the same as on cell cards ( 6.00000E-02)
Al-27           752    0   1.91832E-02   293.6   end
Si-28           752    0   1.14549E-02   293.6   end
Si-29           752    0   5.80011E-04   293.6   end
Si-30           752    0   3.85018E-04   293.6   end
 C-graphite     752    0   1.24199E-02   293.6   end
Fe-54           752    0   5.16763E-05   293.6   end
Fe-56           752    0   8.10477E-04   293.6   end
Fe-57           752    0   1.87271E-05   293.6   end
Fe-58           752    0   2.47339E-06   293.6   end
 V              752    0   1.49028E-02   293.6   end
Mo-92           752    0   2.83062E-05   293.6   end
Mo-94           752    0   1.76438E-05   293.6   end
Mo-95           752    0   3.03663E-05   293.6   end
Mo-96           752    0   3.18159E-05   293.6   end
Mo-97           752    0   1.82160E-05   293.6   end
Mo-98           752    0   4.60263E-05   293.6   end
Mo-100          752    0   1.83686E-05   293.6   end
'
'
'   #3  experiment material   Lo3-106 assume equale to LO3-F7, -106)      Total= 4.74972-2
' The total number density on MCNP material cards ( 4.74971E-02)
'   is not the same as on cell cards ( 6.00000E-02)
Al-27           753    0   5.26979E-02   293.6   end
Fe-54           753    0   1.63022E-05   293.6   end
Fe-56           753    0   2.55680E-04   293.6   end
Fe-57           753    0   5.90780E-06   293.6   end
Fe-58           753    0   7.80275E-07   293.6   end
Mo-92           753    0   1.04228E-03   293.6   end
Mo-94           753    0   6.49670E-04   293.6   end
Mo-95           753    0   1.11813E-03   293.6   end
Mo-96           753    0   1.17151E-03   293.6   end
Mo-97           753    0   6.70740E-04   293.6   end
Mo-98           753    0   1.69476E-03   293.6   end
Mo-100          753    0   6.76359E-04   293.6   end
'
'
'   #4  experiment material  (Lo3-100)     Total =   7.00373E-02
Si-28           754    0   1.34632E-02   293.6   end
Si-29           754    0   6.81699E-04   293.6   end
Si-30           754    0   4.52519E-04   293.6   end
 C              754    0   1.45951E-02   293.6   end
Al-27           754    0   2.16858E-02   293.6   end
 V              754    0   1.91590E-02   293.6   end
'
'
'   #5  experiment material  (Lo3-101)     Total =   7.00373E-02
Si-28           755    0   1.34632E-02   293.6   end
```

```
Si-29           755    0   6.81699E-04   293.6   end
Si-30           755    0   4.52519E-04   293.6   end
 C              755    0   1.45951E-02   293.6   end
Al-27           755    0   2.16858E-02   293.6   end
 V              755    0   1.91590E-02   293.6   end
'
'
'   #6  experiment material  (s-9)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           756    0   5.91171E-02   293.6   end
Si-28           756    0   1.31874E-04   293.6   end
Si-29           756    0   6.67737E-06   293.6   end
Si-30           756    0   4.43251E-06   293.6   end
Mn-55           756    0   7.30965E-06   293.6   end
Fe-54           756    0   4.20667E-06   293.6   end
Fe-56           756    0   6.59763E-05   293.6   end
Fe-57           756    0   1.52447E-06   293.6   end
Fe-58           756    0   2.01345E-07   293.6   end
Cu-63           756    0   2.43506E-05   293.6   end
Cu-65           756    0   1.08534E-05   293.6   end
'
'   #7  experiment material   Gr/V     Total=6.00335-2
Al-27           757    0   1.74852E-02   293.6   end
Si-28           757    0   4.32929E-04   293.6   end
Si-29           757    0   2.19210E-05   293.6   end
Si-30           757    0   1.45514E-05   293.6   end
Fe-54           757    0   5.21880E-05   293.6   end
Fe-56           757    0   8.18503E-04   293.6   end
Fe-57           757    0   1.89125E-05   293.6   end
Fe-58           757    0   2.49788E-06   293.6   end
 C-graphite     757    0   2.60474E-02   293.6   end
 V              757    0   1.48011E-02   293.6   end
Mo-92           757    0   5.01890E-05   293.6   end
Mo-94           757    0   3.12836E-05   293.6   end
Mo-95           757    0   5.38415E-05   293.6   end
Mo-96           757    0   5.64119E-05   293.6   end
Mo-97           757    0   3.22982E-05   293.6   end
Mo-98           757    0   8.16078E-05   293.6   end
Mo-100          757    0   3.25688E-05   293.6   end
'
'
'   PTP-6 experiments
'
'   #1  (bottom) experiment material   Gr/Al     Total=5.63347-2
Al-27           761    0   2.84792E-02   293.6   end
Si-28           761    0   4.32005E-04   293.6   end
Si-29           761    0   2.18743E-05   293.6   end
Si-30           761    0   1.45204E-05   293.6   end
Fe-54           761    0   5.14157E-05   293.6   end
Fe-56           761    0   8.06391E-04   293.6   end
Fe-57           761    0   1.86327E-05   293.6   end
Fe-58           761    0   2.46092E-06   293.6   end
 C-graphite     761    0   2.62091E-02   293.6   end
Mo-92           761    0   4.43864E-05   293.6   end
Mo-94           761    0   2.76668E-05   293.6   end
Mo-95           761    0   4.76167E-05   293.6   end
Mo-96           761    0   4.98899E-05   293.6   end
Mo-97           761    0   2.85641E-05   293.6   end
Mo-98           761    0   7.21728E-05   293.6   end
Mo-100          761    0   2.88033E-05   293.6   end
'
'
'   # 2  experiment material  (SO3E-001) sst/Al   Total =  4.49341E-02
' PTP1  experiment material
Al-27           762    0   3.58373E-02   293.6   end
 C              762    0   4.06300E-04   293.6   end
Si-28           762    0   2.81486E-04   293.6   end
Si-29           762    0   1.42528E-05   293.6   end
Si-30           762    0   9.46120E-06   293.6   end
Fe-54           762    0   4.80004E-04   293.6   end
Fe-56           762    0   7.52827E-03   293.6   end
Fe-57           762    0   1.73950E-04   293.6   end
Fe-58           762    0   2.29746E-05   293.6   end
Mo-92           762    0   2.67268E-05   293.6   end
Mo-94           762    0   1.66593E-05   293.6   end
Mo-95           762    0   2.86719E-05   293.6   end
Mo-96           762    0   3.00407E-05   293.6   end
Mo-97           762    0   1.71996E-05   293.6   end
Mo-98           762    0   4.34581E-05   293.6   end
Mo-100          762    0   1.73436E-05   293.6   end
```

```
'
'
'   # 3  experiment material  (SO3E-001) sst/Al   Total =  3.98252E-02
' PTP1  experiment material
Al-27           763    0   3.53814E-02   293.6   end
 C              763    0   4.06300E-04   293.6   end
Si-28           763    0   2.81486E-04   293.6   end
Si-29           763    0   1.42528E-05   293.6   end
Si-30           763    0   9.46120E-06   293.6   end
Fe-54           763    0   2.08219E-04   293.6   end
Fe-56           763    0   3.26566E-03   293.6   end
Fe-57           763    0   7.54572E-05   293.6   end
Fe-58           763    0   9.96604E-06   293.6   end
Mo-92           763    0   2.56732E-05   293.6   end
Mo-94           763    0   1.60025E-05   293.6   end
Mo-95           763    0   2.75416E-05   293.6   end
Mo-96           763    0   2.88564E-05   293.6   end
Mo-97           763    0   1.65215E-05   293.6   end
Mo-98           763    0   4.17449E-05   293.6   end
Mo-100          763    0   1.66599E-05   293.6   end
'
'
'
'
'   #4  experiment material   Gr/V     Total=8.80417-2
Si-28           764    0   2.24386E-03   293.6   end
Si-29           764    0   1.13616E-04   293.6   end
Si-30           764    0   7.54199E-05   293.6   end
 C-graphite     764    0   4.30656E-02   293.6   end
Al-27           764    0   2.53001E-02   293.6   end
 V              764    0   1.72431E-02   293.6   end
'
'
'   #5  experiment material   Gr/V     Total=8.80417
Si-28           765    0   2.24386E-03   293.6   end
Si-29           765    0   1.13616E-04   293.6   end
Si-30           765    0   7.54199E-05   293.6   end
 C-graphite     765    0   4.30656E-02   293.6   end
Al-27           765    0   2.53001E-02   293.6   end
 V              765    0   1.72431E-02   293.6   end
'
'
'   #6 experiment material  (s-20)  Al spacer  Al-1100   Total =   5.93745E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 5.93745E-02)
Al-27           766    0   5.91171E-02   293.6   end
Si-28           766    0   1.31874E-04   293.6   end
Si-29           766    0   6.67737E-06   293.6   end
Si-30           766    0   4.43251E-06   293.6   end
Mn-55           766    0   7.30965E-06   293.6   end
Fe-54           766    0   4.20667E-06   293.6   end
Fe-56           766    0   6.59763E-05   293.6   end
Fe-57           766    0   1.52447E-06   293.6   end
Fe-58           766    0   2.01345E-07   293.6   end
Cu-63           766    0   2.43506E-05   293.6   end
Cu-65           766    0   1.08534E-05   293.6   end
'
'   #7  experiment material   Lo3-106 assume equale to LO3-F7, -106)      Total= 4.74972-2
' The total number density on MCNP material cards ( 4.74971E-02)
'   is not the same as on cell cards ( 6.02427E-02)
Al-27           767    0   5.29110E-02   293.6   end
Fe-54           767    0   1.63681E-05   293.6   end
Fe-56           767    0   2.56714E-04   293.6   end
Fe-57           767    0   5.93169E-06   293.6   end
Fe-58           767    0   7.83431E-07   293.6   end
Mo-92           767    0   1.04650E-03   293.6   end
Mo-94           767    0   6.52298E-04   293.6   end
Mo-95           767    0   1.12266E-03   293.6   end
Mo-96           767    0   1.17625E-03   293.6   end
Mo-97           767    0   6.73453E-04   293.6   end
Mo-98           767    0   1.70161E-03   293.6   end
Mo-100          767    0   6.79095E-04   293.6   end
'
'
'
'
'
'       Region II ( IFE) Material Descriptions
'      ----------------------------------------
'
```

```
'     Aluminum Sidewalls
'        Aluminum fuel element sidewalls
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 2.70000E+00)
Al-27            20    0   5.86577E-02   293.6   end
 H-1             20    0   3.46363E-04   293.6   end
Mg-24            20    0   5.29421E-04   293.6   end
Mg-25            20    0   6.70238E-05   293.6   end
Mg-26            20    0   7.37932E-05   293.6   end
Si-28            20    0   3.20972E-04   293.6   end
Si-29            20    0   1.62522E-05   293.6   end
Si-30            20    0   1.07884E-05   293.6   end
Ti-46            20    0   2.10524E-06   293.6   end
Ti-47            20    0   1.89855E-06   293.6   end
Ti-48            20    0   1.88119E-05   293.6   end
Ti-49            20    0   1.38053E-06   293.6   end
Ti-50            20    0   1.32184E-06   293.6   end
Cr-50            20    0   2.65754E-06   293.6   end
Cr-52            20    0   5.11898E-05   293.6   end
Cr-53            20    0   5.80384E-06   293.6   end
Cr-54            20    0   1.44179E-06   293.6   end
Mn-55            20    0   2.22389E-05   293.6   end
Fe-54            20    0   5.97259E-06   293.6   end
Fe-56            20    0   9.36727E-05   293.6   end
Fe-57            20    0   2.16443E-06   293.6   end
Fe-58            20    0   2.85868E-07   293.6   end
Cu-63            20    0   6.06063E-05   293.6   end
Cu-65            20    0   2.70130E-05   293.6   end
'
'      Upper and lower Unfuelled Core Regions (50% H2O-50% Al-6061) *
'         Inner fuel element--lower uncontrolled region
 H-1             70    0   3.35240E-02   293.6   end
 O-16            70    0   1.66756E-02   293.6   end
Al-27            70    0   2.92741E-02   293.6   end
Si-28            70    0   1.60187E-04   293.6   end
Si-29            70    0   8.11094E-06   293.6   end
Si-30            70    0   5.38413E-06   293.6   end
Ti-46            70    0   1.05065E-06   293.6   end
Ti-47            70    0   9.47498E-07   293.6   end
Ti-48            70    0   9.38838E-06   293.6   end
Ti-49            70    0   6.88973E-07   293.6   end
Ti-50            70    0   6.59682E-07   293.6   end
Cr-50            70    0   1.32629E-06   293.6   end
Cr-52            70    0   2.55471E-05   293.6   end
Cr-53            70    0   2.89649E-06   293.6   end
Cr-54            70    0   7.19549E-07   293.6   end
Mn-55            70    0   1.10987E-05   293.6   end
Fe-54            70    0   2.98072E-06   293.6   end
Fe-56            70    0   4.67489E-05   293.6   end
Fe-57            70    0   1.08019E-06   293.6   end
Fe-58            70    0   1.42667E-07   293.6   end
Cu-63            70    0   3.02466E-05   293.6   end
Cu-65            70    0   1.34813E-05   293.6   end
Mg-24            70    0   2.64216E-04   293.6   end
Mg-25            70    0   3.34493E-05   293.6   end
Mg-26            70    0   3.68277E-05   293.6   end
'         Inner fuel element--upper uncontrolled region
 H-1             71    0   3.31702E-02   293.6   end
 O-16            71    0   1.64987E-02   293.6   end
Al-27            71    0   2.92741E-02   293.6   end
Si-28            71    0   1.60187E-04   293.6   end
Si-29            71    0   8.11095E-06   293.6   end
Si-30            71    0   5.38414E-06   293.6   end
Ti-46            71    0   1.05065E-06   293.6   end
Ti-47            71    0   9.47499E-07   293.6   end
Ti-48            71    0   9.38839E-06   293.6   end
Ti-49            71    0   6.88974E-07   293.6   end
Ti-50            71    0   6.59683E-07   293.6   end
Cr-50            71    0   1.32629E-06   293.6   end
Cr-52            71    0   2.55471E-05   293.6   end
Cr-53            71    0   2.89649E-06   293.6   end
Cr-54            71    0   7.19550E-07   293.6   end
Mn-55            71    0   1.10987E-05   293.6   end
Fe-54            71    0   2.98072E-06   293.6   end
Fe-56            71    0   4.67489E-05   293.6   end
Fe-57            71    0   1.08019E-06   293.6   end
Fe-58            71    0   1.42667E-07   293.6   end
Cu-63            71    0   3.02466E-05   293.6   end
Cu-65            71    0   1.34813E-05   293.6   end
Mg-24            71    0   2.64216E-04   293.6   end
Mg-25            71    0   3.34493E-05   293.6   end
```

```
Mg-26            71    0   3.68277E-05   293.6   end
'
'       Inner Fuel Element
'         unheated region material (al+h2o)/2.   6/9/95     total nd = 7.98825-2
'         used in all unfuelled regions
 H-1            200    0   3.35240E-02   293.6   end
 O-16           200    0   1.66756E-02   293.6   end
Al-27           200    0   2.92741E-02   293.6   end
Si-28           200    0   1.60187E-04   293.6   end
Si-29           200    0   8.11095E-06   293.6   end
Si-30           200    0   5.38414E-06   293.6   end
Ti-46           200    0   1.05065E-06   293.6   end
Ti-47           200    0   9.47499E-07   293.6   end
Ti-48           200    0   9.38839E-06   293.6   end
Ti-49           200    0   6.88974E-07   293.6   end
Ti-50           200    0   6.59683E-07   293.6   end
Cr-50           200    0   1.32629E-06   293.6   end
Cr-52           200    0   2.55471E-05   293.6   end
Cr-53           200    0   2.89649E-06   293.6   end
Cr-54           200    0   7.19550E-07   293.6   end
Mn-55           200    0   1.10987E-05   293.6   end
Fe-54           200    0   2.98072E-06   293.6   end
Fe-56           200    0   4.67489E-05   293.6   end
Fe-57           200    0   1.08019E-06   293.6   end
Fe-58           200    0   1.42667E-07   293.6   end
Cu-63           200    0   3.02466E-05   293.6   end
Cu-65           200    0   1.34813E-05   293.6   end
Mg-24           200    0   2.64216E-04   293.6   end
Mg-25           200    0   3.34493E-05   293.6   end
Mg-26           200    0   3.68277E-05   293.6   end
'
'         Inner fuel element--fueled Axial region 1
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            211    0   3.32434E-02   293.6   end
 B-10           211    0   2.04121E-05   293.6   end
 B-11           211    0   8.26896E-05   293.6   end
 O-16           211    0   1.71757E-02   293.6   end
Mg-24           211    0   1.05686E-04   293.6   end
Mg-25           211    0   1.33797E-05   293.6   end
Mg-26           211    0   1.47310E-05   293.6   end
Al-27           211    0   2.89993E-02   293.6   end
Si-28           211    0   1.02644E-04   293.6   end
Si-29           211    0   5.19729E-06   293.6   end
Si-30           211    0   3.45002E-06   293.6   end
Ti-46           211    0   4.20262E-07   293.6   end
Ti-47           211    0   3.79000E-07   293.6   end
Ti-48           211    0   3.75536E-06   293.6   end
Ti-49           211    0   2.75590E-07   293.6   end
Ti-50           211    0   2.63873E-07   293.6   end
Cr-50           211    0   5.30517E-07   293.6   end
Cr-52           211    0   1.02189E-05   293.6   end
Cr-53           211    0   1.15860E-06   293.6   end
Cr-54           211    0   2.87821E-07   293.6   end
Mn-55           211    0   6.57731E-06   293.6   end
Fe-54           211    0   2.42259E-06   293.6   end
Fe-56           211    0   3.79953E-05   293.6   end
Fe-57           211    0   8.77930E-07   293.6   end
Fe-58           211    0   1.15953E-07   293.6   end
Cu-63           211    0   1.92203E-05   293.6   end
Cu-65           211    0   8.56676E-06   293.6   end
 U-234          211    0   2.20708E-06   293.6   end
 U-235          211    0   2.05700E-04   293.6   end
 U-236          211    0   8.82838E-07   293.6   end
 U-238          211    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            212    0   3.32434E-02   293.6   end
 B-10           212    0   1.77513E-05   293.6   end
 B-11           212    0   7.19107E-05   293.6   end
 O-16           212    0   1.73053E-02   293.6   end
Mg-24           212    0   1.05686E-04   293.6   end
Mg-25           212    0   1.33797E-05   293.6   end
Mg-26           212    0   1.47310E-05   293.6   end
Al-27           212    0   2.88388E-02   293.6   end
Si-28           212    0   1.02285E-04   293.6   end
Si-29           212    0   5.17912E-06   293.6   end
Si-30           212    0   3.43796E-06   293.6   end
Ti-46           212    0   4.20262E-07   293.6   end
Ti-47           212    0   3.79000E-07   293.6   end
Ti-48           212    0   3.75536E-06   293.6   end
```

```
Ti-49           212    0   2.75590E-07   293.6   end
Ti-50           212    0   2.63873E-07   293.6   end
Cr-50           212    0   5.30517E-07   293.6   end
Cr-52           212    0   1.02189E-05   293.6   end
Cr-53           212    0   1.15860E-06   293.6   end
Cr-54           212    0   2.87821E-07   293.6   end
Mn-55           212    0   6.55746E-06   293.6   end
Fe-54           212    0   2.41117E-06   293.6   end
Fe-56           212    0   3.78162E-05   293.6   end
Fe-57           212    0   8.73792E-07   293.6   end
Fe-58           212    0   1.15406E-07   293.6   end
Cu-63           212    0   1.91542E-05   293.6   end
Cu-65           212    0   8.53729E-06   293.6   end
 U-234          212    0   2.69313E-06   293.6   end
 U-235          212    0   2.51000E-04   293.6   end
 U-236          212    0   1.07726E-06   293.6   end
 U-238          212    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            213    0   3.32435E-02   293.6   end
 B-10           213    0   1.46911E-05   293.6   end
 B-11           213    0   5.95139E-05   293.6   end
 O-16           213    0   1.74543E-02   293.6   end
Mg-24           213    0   1.05686E-04   293.6   end
Mg-25           213    0   1.33797E-05   293.6   end
Mg-26           213    0   1.47310E-05   293.6   end
Al-27           213    0   2.86541E-02   293.6   end
Si-28           213    0   1.01874E-04   293.6   end
Si-29           213    0   5.15831E-06   293.6   end
Si-30           213    0   3.42415E-06   293.6   end
Ti-46           213    0   4.20263E-07   293.6   end
Ti-47           213    0   3.79001E-07   293.6   end
Ti-48           213    0   3.75537E-06   293.6   end
Ti-49           213    0   2.75590E-07   293.6   end
Ti-50           213    0   2.63873E-07   293.6   end
Cr-50           213    0   5.30518E-07   293.6   end
Cr-52           213    0   1.02189E-05   293.6   end
Cr-53           213    0   1.15860E-06   293.6   end
Cr-54           213    0   2.87821E-07   293.6   end
Mn-55           213    0   6.53464E-06   293.6   end
Fe-54           213    0   2.39803E-06   293.6   end
Fe-56           213    0   3.76103E-05   293.6   end
Fe-57           213    0   8.69031E-07   293.6   end
Fe-58           213    0   1.14778E-07   293.6   end
Cu-63           213    0   1.90782E-05   293.6   end
Cu-65           213    0   8.50342E-06   293.6   end
 U-234          213    0   3.25215E-06   293.6   end
 U-235          213    0   3.03100E-04   293.6   end
 U-236          213    0   1.30087E-06   293.6   end
 U-238          213    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'    8.009370E-02
 H-1            214    0   3.32434E-02   293.6   end
 B-10           214    0   1.03798E-05   293.6   end
 B-11           214    0   4.20486E-05   293.6   end
 O-16           214    0   1.76644E-02   293.6   end
Mg-24           214    0   1.05686E-04   293.6   end
Mg-25           214    0   1.33797E-05   293.6   end
Mg-26           214    0   1.47310E-05   293.6   end
Al-27           214    0   2.83940E-02   293.6   end
Si-28           214    0   1.01293E-04   293.6   end
Si-29           214    0   5.12887E-06   293.6   end
Si-30           214    0   3.40461E-06   293.6   end
Ti-46           214    0   4.20262E-07   293.6   end
Ti-47           214    0   3.79000E-07   293.6   end
Ti-48           214    0   3.75536E-06   293.6   end
Ti-49           214    0   2.75590E-07   293.6   end
Ti-50           214    0   2.63873E-07   293.6   end
Cr-50           214    0   5.30517E-07   293.6   end
Cr-52           214    0   1.02189E-05   293.6   end
Cr-53           214    0   1.15860E-06   293.6   end
Cr-54           214    0   2.87821E-07   293.6   end
Mn-55           214    0   6.50246E-06   293.6   end
Fe-54           214    0   2.37952E-06   293.6   end
Fe-56           214    0   3.73198E-05   293.6   end
Fe-57           214    0   8.62321E-07   293.6   end
Fe-58           214    0   1.13891E-07   293.6   end
Cu-63           214    0   1.89710E-05   293.6   end
Cu-65           214    0   8.45562E-06   293.6   end
 U-234          214    0   4.03970E-06   293.6   end
 U-235          214    0   3.76500E-04   293.6   end
```

```
 U-236          214    0   1.61589E-06   293.6   end
 U-238          214    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            215    0   3.32434E-02   293.6   end
 B-10           215    0   6.18010E-06   293.6   end
 B-11           215    0   2.50356E-05   293.6   end
 O-16           215    0   1.78689E-02   293.6   end
Mg-24           215    0   1.05686E-04   293.6   end
Mg-25           215    0   1.33797E-05   293.6   end
Mg-26           215    0   1.47310E-05   293.6   end
Al-27           215    0   2.81406E-02   293.6   end
Si-28           215    0   1.00727E-04   293.6   end
Si-29           215    0   5.10026E-06   293.6   end
Si-30           215    0   3.38560E-06   293.6   end
Ti-46           215    0   4.20262E-07   293.6   end
Ti-47           215    0   3.79000E-07   293.6   end
Ti-48           215    0   3.75536E-06   293.6   end
Ti-49           215    0   2.75590E-07   293.6   end
Ti-50           215    0   2.63873E-07   293.6   end
Cr-50           215    0   5.30518E-07   293.6   end
Cr-52           215    0   1.02189E-05   293.6   end
Cr-53           215    0   1.15860E-06   293.6   end
Cr-54           215    0   2.87821E-07   293.6   end
Mn-55           215    0   6.47114E-06   293.6   end
Fe-54           215    0   2.36149E-06   293.6   end
Fe-56           215    0   3.70370E-05   293.6   end
Fe-57           215    0   8.55788E-07   293.6   end
Fe-58           215    0   1.13028E-07   293.6   end
Cu-63           215    0   1.88666E-05   293.6   end
Cu-65           215    0   8.40911E-06   293.6   end
 U-234          215    0   4.80687E-06   293.6   end
 U-235          215    0   4.48000E-04   293.6   end
 U-236          215    0   1.92276E-06   293.6   end
 U-238          215    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            216    0   3.32434E-02   293.6   end
 B-10           216    0   5.79830E-06   293.6   end
 B-11           216    0   2.34889E-05   293.6   end
 O-16           216    0   1.78875E-02   293.6   end
Mg-24           216    0   1.05686E-04   293.6   end
Mg-25           216    0   1.33797E-05   293.6   end
Mg-26           216    0   1.47310E-05   293.6   end
Al-27           216    0   2.81176E-02   293.6   end
Si-28           216    0   1.00676E-04   293.6   end
Si-29           216    0   5.09768E-06   293.6   end
Si-30           216    0   3.38390E-06   293.6   end
Ti-46           216    0   4.20262E-07   293.6   end
Ti-47           216    0   3.79000E-07   293.6   end
Ti-48           216    0   3.75536E-06   293.6   end
Ti-49           216    0   2.75590E-07   293.6   end
Ti-50           216    0   2.63873E-07   293.6   end
Cr-50           216    0   5.30517E-07   293.6   end
Cr-52           216    0   1.02189E-05   293.6   end
Cr-53           216    0   1.15860E-06   293.6   end
Cr-54           216    0   2.87821E-07   293.6   end
Mn-55           216    0   6.46828E-06   293.6   end
Fe-54           216    0   2.35985E-06   293.6   end
Fe-56           216    0   3.70113E-05   293.6   end
Fe-57           216    0   8.55193E-07   293.6   end
Fe-58           216    0   1.12950E-07   293.6   end
Cu-63           216    0   1.88571E-05   293.6   end
Cu-65           216    0   8.40487E-06   293.6   end
 U-234          216    0   4.87661E-06   293.6   end
 U-235          216    0   4.54500E-04   293.6   end
 U-236          216    0   1.95066E-06   293.6   end
 U-238          216    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            217    0   3.32434E-02   293.6   end
 B-10           217    0   7.99507E-06   293.6   end
 B-11           217    0   3.23880E-05   293.6   end
 O-16           217    0   1.77805E-02   293.6   end
Mg-24           217    0   1.05686E-04   293.6   end
Mg-25           217    0   1.33797E-05   293.6   end
Mg-26           217    0   1.47310E-05   293.6   end
Al-27           217    0   2.82501E-02   293.6   end
Si-28           217    0   1.00972E-04   293.6   end
Si-29           217    0   5.11262E-06   293.6   end
Si-30           217    0   3.39382E-06   293.6   end
```

```
Ti-46           217    0   4.20262E-07   293.6   end
Ti-47           217    0   3.79000E-07   293.6   end
Ti-48           217    0   3.75536E-06   293.6   end
Ti-49           217    0   2.75590E-07   293.6   end
Ti-50           217    0   2.63873E-07   293.6   end
Cr-50           217    0   5.30517E-07   293.6   end
Cr-52           217    0   1.02189E-05   293.6   end
Cr-53           217    0   1.15860E-06   293.6   end
Cr-54           217    0   2.87821E-07   293.6   end
Mn-55           217    0   6.48467E-06   293.6   end
Fe-54           217    0   2.36928E-06   293.6   end
Fe-56           217    0   3.71592E-05   293.6   end
Fe-57           217    0   8.58611E-07   293.6   end
Fe-58           217    0   1.13401E-07   293.6   end
Cu-63           217    0   1.89118E-05   293.6   end
Cu-65           217    0   8.42923E-06   293.6   end
 U-234          217    0   4.47532E-06   293.6   end
 U-235          217    0   4.17100E-04   293.6   end
 U-236          217    0   1.79014E-06   293.6   end
 U-238          217    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            218    0   3.32434E-02   293.6   end
 B-10           218    0   1.06559E-05   293.6   end
 B-11           218    0   4.31670E-05   293.6   end
 O-16           218    0   1.76509E-02   293.6   end
Mg-24           218    0   1.05686E-04   293.6   end
Mg-25           218    0   1.33797E-05   293.6   end
Mg-26           218    0   1.47310E-05   293.6   end
Al-27           218    0   2.84107E-02   293.6   end
Si-28           218    0   1.01330E-04   293.6   end
Si-29           218    0   5.13079E-06   293.6   end
Si-30           218    0   3.40588E-06   293.6   end
Ti-46           218    0   4.20262E-07   293.6   end
Ti-47           218    0   3.79000E-07   293.6   end
Ti-48           218    0   3.75536E-06   293.6   end
Ti-49           218    0   2.75590E-07   293.6   end
Ti-50           218    0   2.63873E-07   293.6   end
Cr-50           218    0   5.30517E-07   293.6   end
Cr-52           218    0   1.02189E-05   293.6   end
Cr-53           218    0   1.15860E-06   293.6   end
Cr-54           218    0   2.87821E-07   293.6   end
Mn-55           218    0   6.50452E-06   293.6   end
Fe-54           218    0   2.38070E-06   293.6   end
Fe-56           218    0   3.73384E-05   293.6   end
Fe-57           218    0   8.62751E-07   293.6   end
Fe-58           218    0   1.13948E-07   293.6   end
Cu-63           218    0   1.89779E-05   293.6   end
Cu-65           218    0   8.45870E-06   293.6   end
 U-234          218    0   3.98927E-06   293.6   end
 U-235          218    0   3.71800E-04   293.6   end
 U-236          218    0   1.59572E-06   293.6   end
 U-238          218    0   2.15420E-05   293.6   end
'
'         Inner fuel element--fueled Axial region 2
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            221    0   3.32434E-02   293.6   end
 B-10           221    0   2.04121E-05   293.6   end
 B-11           221    0   8.26896E-05   293.6   end
 O-16           221    0   1.71757E-02   293.6   end
Mg-24           221    0   1.05686E-04   293.6   end
Mg-25           221    0   1.33797E-05   293.6   end
Mg-26           221    0   1.47310E-05   293.6   end
Al-27           221    0   2.89993E-02   293.6   end
Si-28           221    0   1.02644E-04   293.6   end
Si-29           221    0   5.19729E-06   293.6   end
Si-30           221    0   3.45002E-06   293.6   end
Ti-46           221    0   4.20262E-07   293.6   end
Ti-47           221    0   3.79000E-07   293.6   end
Ti-48           221    0   3.75536E-06   293.6   end
Ti-49           221    0   2.75590E-07   293.6   end
Ti-50           221    0   2.63873E-07   293.6   end
Cr-50           221    0   5.30517E-07   293.6   end
Cr-52           221    0   1.02189E-05   293.6   end
Cr-53           221    0   1.15860E-06   293.6   end
Cr-54           221    0   2.87821E-07   293.6   end
Mn-55           221    0   6.57731E-06   293.6   end
Fe-54           221    0   2.42259E-06   293.6   end
Fe-56           221    0   3.79953E-05   293.6   end
Fe-57           221    0   8.77930E-07   293.6   end
```

```
Fe-58           221    0   1.15953E-07   293.6   end
Cu-63           221    0   1.92203E-05   293.6   end
Cu-65           221    0   8.56676E-06   293.6   end
 U-234          221    0   2.20708E-06   293.6   end
 U-235          221    0   2.05700E-04   293.6   end
 U-236          221    0   8.82838E-07   293.6   end
 U-238          221    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            222    0   3.32434E-02   293.6   end
 B-10           222    0   1.77513E-05   293.6   end
 B-11           222    0   7.19107E-05   293.6   end
 O-16           222    0   1.73053E-02   293.6   end
Mg-24           222    0   1.05686E-04   293.6   end
Mg-25           222    0   1.33797E-05   293.6   end
Mg-26           222    0   1.47310E-05   293.6   end
Al-27           222    0   2.88388E-02   293.6   end
Si-28           222    0   1.02285E-04   293.6   end
Si-29           222    0   5.17912E-06   293.6   end
Si-30           222    0   3.43796E-06   293.6   end
Ti-46           222    0   4.20262E-07   293.6   end
Ti-47           222    0   3.79000E-07   293.6   end
Ti-48           222    0   3.75536E-06   293.6   end
Ti-49           222    0   2.75590E-07   293.6   end
Ti-50           222    0   2.63873E-07   293.6   end
Cr-50           222    0   5.30517E-07   293.6   end
Cr-52           222    0   1.02189E-05   293.6   end
Cr-53           222    0   1.15860E-06   293.6   end
Cr-54           222    0   2.87821E-07   293.6   end
Mn-55           222    0   6.55746E-06   293.6   end
Fe-54           222    0   2.41117E-06   293.6   end
Fe-56           222    0   3.78162E-05   293.6   end
Fe-57           222    0   8.73792E-07   293.6   end
Fe-58           222    0   1.15406E-07   293.6   end
Cu-63           222    0   1.91542E-05   293.6   end
Cu-65           222    0   8.53729E-06   293.6   end
 U-234          222    0   2.69313E-06   293.6   end
 U-235          222    0   2.51000E-04   293.6   end
 U-236          222    0   1.07726E-06   293.6   end
 U-238          222    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            223    0   3.32435E-02   293.6   end
 B-10           223    0   1.46911E-05   293.6   end
 B-11           223    0   5.95139E-05   293.6   end
 O-16           223    0   1.74543E-02   293.6   end
Mg-24           223    0   1.05686E-04   293.6   end
Mg-25           223    0   1.33797E-05   293.6   end
Mg-26           223    0   1.47310E-05   293.6   end
Al-27           223    0   2.86541E-02   293.6   end
Si-28           223    0   1.01874E-04   293.6   end
Si-29           223    0   5.15831E-06   293.6   end
Si-30           223    0   3.42415E-06   293.6   end
Ti-46           223    0   4.20263E-07   293.6   end
Ti-47           223    0   3.79001E-07   293.6   end
Ti-48           223    0   3.75537E-06   293.6   end
Ti-49           223    0   2.75590E-07   293.6   end
Ti-50           223    0   2.63873E-07   293.6   end
Cr-50           223    0   5.30518E-07   293.6   end
Cr-52           223    0   1.02189E-05   293.6   end
Cr-53           223    0   1.15860E-06   293.6   end
Cr-54           223    0   2.87821E-07   293.6   end
Mn-55           223    0   6.53464E-06   293.6   end
Fe-54           223    0   2.39803E-06   293.6   end
Fe-56           223    0   3.76103E-05   293.6   end
Fe-57           223    0   8.69031E-07   293.6   end
Fe-58           223    0   1.14778E-07   293.6   end
Cu-63           223    0   1.90782E-05   293.6   end
Cu-65           223    0   8.50342E-06   293.6   end
 U-234          223    0   3.25215E-06   293.6   end
 U-235          223    0   3.03100E-04   293.6   end
 U-236          223    0   1.30087E-06   293.6   end
 U-238          223    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            224    0   3.32434E-02   293.6   end
 B-10           224    0   1.03798E-05   293.6   end
 B-11           224    0   4.20486E-05   293.6   end
 O-16           224    0   1.76644E-02   293.6   end
Mg-24           224    0   1.05686E-04   293.6   end
Mg-25           224    0   1.33797E-05   293.6   end
```

```
Mg-26           224    0   1.47310E-05   293.6   end
Al-27           224    0   2.83940E-02   293.6   end
Si-28           224    0   1.01293E-04   293.6   end
Si-29           224    0   5.12887E-06   293.6   end
Si-30           224    0   3.40461E-06   293.6   end
Ti-46           224    0   4.20262E-07   293.6   end
Ti-47           224    0   3.79000E-07   293.6   end
Ti-48           224    0   3.75536E-06   293.6   end
Ti-49           224    0   2.75590E-07   293.6   end
Ti-50           224    0   2.63873E-07   293.6   end
Cr-50           224    0   5.30517E-07   293.6   end
Cr-52           224    0   1.02189E-05   293.6   end
Cr-53           224    0   1.15860E-06   293.6   end
Cr-54           224    0   2.87821E-07   293.6   end
Mn-55           224    0   6.50246E-06   293.6   end
Fe-54           224    0   2.37952E-06   293.6   end
Fe-56           224    0   3.73198E-05   293.6   end
Fe-57           224    0   8.62321E-07   293.6   end
Fe-58           224    0   1.13891E-07   293.6   end
Cu-63           224    0   1.89710E-05   293.6   end
Cu-65           224    0   8.45562E-06   293.6   end
 U-234          224    0   4.03970E-06   293.6   end
 U-235          224    0   3.76500E-04   293.6   end
 U-236          224    0   1.61589E-06   293.6   end
 U-238          224    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            225    0   3.32434E-02   293.6   end
 B-10           225    0   6.18010E-06   293.6   end
 B-11           225    0   2.50356E-05   293.6   end
 O-16           225    0   1.78689E-02   293.6   end
Mg-24           225    0   1.05686E-04   293.6   end
Mg-25           225    0   1.33797E-05   293.6   end
Mg-26           225    0   1.47310E-05   293.6   end
Al-27           225    0   2.81406E-02   293.6   end
Si-28           225    0   1.00727E-04   293.6   end
Si-29           225    0   5.10026E-06   293.6   end
Si-30           225    0   3.38560E-06   293.6   end
Ti-46           225    0   4.20262E-07   293.6   end
Ti-47           225    0   3.79000E-07   293.6   end
Ti-48           225    0   3.75536E-06   293.6   end
Ti-49           225    0   2.75590E-07   293.6   end
Ti-50           225    0   2.63873E-07   293.6   end
Cr-50           225    0   5.30518E-07   293.6   end
Cr-52           225    0   1.02189E-05   293.6   end
Cr-53           225    0   1.15860E-06   293.6   end
Cr-54           225    0   2.87821E-07   293.6   end
Mn-55           225    0   6.47114E-06   293.6   end
Fe-54           225    0   2.36149E-06   293.6   end
Fe-56           225    0   3.70370E-05   293.6   end
Fe-57           225    0   8.55788E-07   293.6   end
Fe-58           225    0   1.13028E-07   293.6   end
Cu-63           225    0   1.88666E-05   293.6   end
Cu-65           225    0   8.40911E-06   293.6   end
 U-234          225    0   4.80687E-06   293.6   end
 U-235          225    0   4.48000E-04   293.6   end
 U-236          225    0   1.92276E-06   293.6   end
 U-238          225    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            226    0   3.32434E-02   293.6   end
 B-10           226    0   5.79830E-06   293.6   end
 B-11           226    0   2.34889E-05   293.6   end
 O-16           226    0   1.78875E-02   293.6   end
Mg-24           226    0   1.05686E-04   293.6   end
Mg-25           226    0   1.33797E-05   293.6   end
Mg-26           226    0   1.47310E-05   293.6   end
Al-27           226    0   2.81176E-02   293.6   end
Si-28           226    0   1.00676E-04   293.6   end
Si-29           226    0   5.09768E-06   293.6   end
Si-30           226    0   3.38390E-06   293.6   end
Ti-46           226    0   4.20262E-07   293.6   end
Ti-47           226    0   3.79000E-07   293.6   end
Ti-48           226    0   3.75536E-06   293.6   end
Ti-49           226    0   2.75590E-07   293.6   end
Ti-50           226    0   2.63873E-07   293.6   end
Cr-50           226    0   5.30517E-07   293.6   end
Cr-52           226    0   1.02189E-05   293.6   end
Cr-53           226    0   1.15860E-06   293.6   end
Cr-54           226    0   2.87821E-07   293.6   end
Mn-55           226    0   6.46828E-06   293.6   end
```

```
Fe-54           226    0   2.35985E-06   293.6   end
Fe-56           226    0   3.70113E-05   293.6   end
Fe-57           226    0   8.55193E-07   293.6   end
Fe-58           226    0   1.12950E-07   293.6   end
Cu-63           226    0   1.88571E-05   293.6   end
Cu-65           226    0   8.40487E-06   293.6   end
 U-234          226    0   4.87661E-06   293.6   end
 U-235          226    0   4.54500E-04   293.6   end
 U-236          226    0   1.95066E-06   293.6   end
 U-238          226    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            227    0   3.32434E-02   293.6   end
 B-10           227    0   7.99507E-06   293.6   end
 B-11           227    0   3.23880E-05   293.6   end
 O-16           227    0   1.77805E-02   293.6   end
Mg-24           227    0   1.05686E-04   293.6   end
Mg-25           227    0   1.33797E-05   293.6   end
Mg-26           227    0   1.47310E-05   293.6   end
Al-27           227    0   2.82501E-02   293.6   end
Si-28           227    0   1.00972E-04   293.6   end
Si-29           227    0   5.11262E-06   293.6   end
Si-30           227    0   3.39382E-06   293.6   end
Ti-46           227    0   4.20262E-07   293.6   end
Ti-47           227    0   3.79000E-07   293.6   end
Ti-48           227    0   3.75536E-06   293.6   end
Ti-49           227    0   2.75590E-07   293.6   end
Ti-50           227    0   2.63873E-07   293.6   end
Cr-50           227    0   5.30517E-07   293.6   end
Cr-52           227    0   1.02189E-05   293.6   end
Cr-53           227    0   1.15860E-06   293.6   end
Cr-54           227    0   2.87821E-07   293.6   end
Mn-55           227    0   6.48467E-06   293.6   end
Fe-54           227    0   2.36928E-06   293.6   end
Fe-56           227    0   3.71592E-05   293.6   end
Fe-57           227    0   8.58611E-07   293.6   end
Fe-58           227    0   1.13401E-07   293.6   end
Cu-63           227    0   1.89118E-05   293.6   end
Cu-65           227    0   8.42923E-06   293.6   end
 U-234          227    0   4.47532E-06   293.6   end
 U-235          227    0   4.17100E-04   293.6   end
 U-236          227    0   1.79014E-06   293.6   end
 U-238          227    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            228    0   3.32434E-02   293.6   end
 B-10           228    0   1.06559E-05   293.6   end
 B-11           228    0   4.31670E-05   293.6   end
 O-16           228    0   1.76509E-02   293.6   end
Mg-24           228    0   1.05686E-04   293.6   end
Mg-25           228    0   1.33797E-05   293.6   end
Mg-26           228    0   1.47310E-05   293.6   end
Al-27           228    0   2.84107E-02   293.6   end
Si-28           228    0   1.01330E-04   293.6   end
Si-29           228    0   5.13079E-06   293.6   end
Si-30           228    0   3.40588E-06   293.6   end
Ti-46           228    0   4.20262E-07   293.6   end
Ti-47           228    0   3.79000E-07   293.6   end
Ti-48           228    0   3.75536E-06   293.6   end
Ti-49           228    0   2.75590E-07   293.6   end
Ti-50           228    0   2.63873E-07   293.6   end
Cr-50           228    0   5.30517E-07   293.6   end
Cr-52           228    0   1.02189E-05   293.6   end
Cr-53           228    0   1.15860E-06   293.6   end
Cr-54           228    0   2.87821E-07   293.6   end
Mn-55           228    0   6.50452E-06   293.6   end
Fe-54           228    0   2.38070E-06   293.6   end
Fe-56           228    0   3.73384E-05   293.6   end
Fe-57           228    0   8.62751E-07   293.6   end
Fe-58           228    0   1.13948E-07   293.6   end
Cu-63           228    0   1.89779E-05   293.6   end
Cu-65           228    0   8.45870E-06   293.6   end
 U-234          228    0   3.98927E-06   293.6   end
 U-235          228    0   3.71800E-04   293.6   end
 U-236          228    0   1.59572E-06   293.6   end
 U-238          228    0   2.15420E-05   293.6   end
'
'         Inner fuel element--fueled Axial region 3
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            231    0   3.32434E-02   293.6   end
```

```
 B-10           231    0   2.04121E-05   293.6   end
 B-11           231    0   8.26896E-05   293.6   end
 O-16           231    0   1.71757E-02   293.6   end
Mg-24           231    0   1.05686E-04   293.6   end
Mg-25           231    0   1.33797E-05   293.6   end
Mg-26           231    0   1.47310E-05   293.6   end
Al-27           231    0   2.89993E-02   293.6   end
Si-28           231    0   1.02644E-04   293.6   end
Si-29           231    0   5.19729E-06   293.6   end
Si-30           231    0   3.45002E-06   293.6   end
Ti-46           231    0   4.20262E-07   293.6   end
Ti-47           231    0   3.79000E-07   293.6   end
Ti-48           231    0   3.75536E-06   293.6   end
Ti-49           231    0   2.75590E-07   293.6   end
Ti-50           231    0   2.63873E-07   293.6   end
Cr-50           231    0   5.30517E-07   293.6   end
Cr-52           231    0   1.02189E-05   293.6   end
Cr-53           231    0   1.15860E-06   293.6   end
Cr-54           231    0   2.87821E-07   293.6   end
Mn-55           231    0   6.57731E-06   293.6   end
Fe-54           231    0   2.42259E-06   293.6   end
Fe-56           231    0   3.79953E-05   293.6   end
Fe-57           231    0   8.77930E-07   293.6   end
Fe-58           231    0   1.15953E-07   293.6   end
Cu-63           231    0   1.92203E-05   293.6   end
Cu-65           231    0   8.56676E-06   293.6   end
 U-234          231    0   2.20708E-06   293.6   end
 U-235          231    0   2.05700E-04   293.6   end
 U-236          231    0   8.82838E-07   293.6   end
 U-238          231    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            232    0   3.32434E-02   293.6   end
 B-10           232    0   1.77513E-05   293.6   end
 B-11           232    0   7.19107E-05   293.6   end
 O-16           232    0   1.73053E-02   293.6   end
Mg-24           232    0   1.05686E-04   293.6   end
Mg-25           232    0   1.33797E-05   293.6   end
Mg-26           232    0   1.47310E-05   293.6   end
Al-27           232    0   2.88388E-02   293.6   end
Si-28           232    0   1.02285E-04   293.6   end
Si-29           232    0   5.17912E-06   293.6   end
Si-30           232    0   3.43796E-06   293.6   end
Ti-46           232    0   4.20262E-07   293.6   end
Ti-47           232    0   3.79000E-07   293.6   end
Ti-48           232    0   3.75536E-06   293.6   end
Ti-49           232    0   2.75590E-07   293.6   end
Ti-50           232    0   2.63873E-07   293.6   end
Cr-50           232    0   5.30517E-07   293.6   end
Cr-52           232    0   1.02189E-05   293.6   end
Cr-53           232    0   1.15860E-06   293.6   end
Cr-54           232    0   2.87821E-07   293.6   end
Mn-55           232    0   6.55746E-06   293.6   end
Fe-54           232    0   2.41117E-06   293.6   end
Fe-56           232    0   3.78162E-05   293.6   end
Fe-57           232    0   8.73792E-07   293.6   end
Fe-58           232    0   1.15406E-07   293.6   end
Cu-63           232    0   1.91542E-05   293.6   end
Cu-65           232    0   8.53729E-06   293.6   end
 U-234          232    0   2.69313E-06   293.6   end
 U-235          232    0   2.51000E-04   293.6   end
 U-236          232    0   1.07726E-06   293.6   end
 U-238          232    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            233    0   3.32435E-02   293.6   end
 B-10           233    0   1.46911E-05   293.6   end
 B-11           233    0   5.95139E-05   293.6   end
 O-16           233    0   1.74543E-02   293.6   end
Mg-24           233    0   1.05686E-04   293.6   end
Mg-25           233    0   1.33797E-05   293.6   end
Mg-26           233    0   1.47310E-05   293.6   end
Al-27           233    0   2.86541E-02   293.6   end
Si-28           233    0   1.01874E-04   293.6   end
Si-29           233    0   5.15831E-06   293.6   end
Si-30           233    0   3.42415E-06   293.6   end
Ti-46           233    0   4.20263E-07   293.6   end
Ti-47           233    0   3.79001E-07   293.6   end
Ti-48           233    0   3.75537E-06   293.6   end
Ti-49           233    0   2.75590E-07   293.6   end
Ti-50           233    0   2.63873E-07   293.6   end
```

```
Cr-50           233    0   5.30518E-07   293.6   end
Cr-52           233    0   1.02189E-05   293.6   end
Cr-53           233    0   1.15860E-06   293.6   end
Cr-54           233    0   2.87821E-07   293.6   end
Mn-55           233    0   6.53464E-06   293.6   end
Fe-54           233    0   2.39803E-06   293.6   end
Fe-56           233    0   3.76103E-05   293.6   end
Fe-57           233    0   8.69031E-07   293.6   end
Fe-58           233    0   1.14778E-07   293.6   end
Cu-63           233    0   1.90782E-05   293.6   end
Cu-65           233    0   8.50342E-06   293.6   end
 U-234          233    0   3.25215E-06   293.6   end
 U-235          233    0   3.03100E-04   293.6   end
 U-236          233    0   1.30087E-06   293.6   end
 U-238          233    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            234    0   3.32434E-02   293.6   end
 B-10           234    0   1.03798E-05   293.6   end
 B-11           234    0   4.20486E-05   293.6   end
 O-16           234    0   1.76644E-02   293.6   end
Mg-24           234    0   1.05686E-04   293.6   end
Mg-25           234    0   1.33797E-05   293.6   end
Mg-26           234    0   1.47310E-05   293.6   end
Al-27           234    0   2.83940E-02   293.6   end
Si-28           234    0   1.01293E-04   293.6   end
Si-29           234    0   5.12887E-06   293.6   end
Si-30           234    0   3.40461E-06   293.6   end
Ti-46           234    0   4.20262E-07   293.6   end
Ti-47           234    0   3.79000E-07   293.6   end
Ti-48           234    0   3.75536E-06   293.6   end
Ti-49           234    0   2.75590E-07   293.6   end
Ti-50           234    0   2.63873E-07   293.6   end
Cr-50           234    0   5.30517E-07   293.6   end
Cr-52           234    0   1.02189E-05   293.6   end
Cr-53           234    0   1.15860E-06   293.6   end
Cr-54           234    0   2.87821E-07   293.6   end
Mn-55           234    0   6.50246E-06   293.6   end
Fe-54           234    0   2.37952E-06   293.6   end
Fe-56           234    0   3.73198E-05   293.6   end
Fe-57           234    0   8.62321E-07   293.6   end
Fe-58           234    0   1.13891E-07   293.6   end
Cu-63           234    0   1.89710E-05   293.6   end
Cu-65           234    0   8.45562E-06   293.6   end
 U-234          234    0   4.03970E-06   293.6   end
 U-235          234    0   3.76500E-04   293.6   end
 U-236          234    0   1.61589E-06   293.6   end
 U-238          234    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            235    0   3.32434E-02   293.6   end
 B-10           235    0   6.18010E-06   293.6   end
 B-11           235    0   2.50356E-05   293.6   end
 O-16           235    0   1.78689E-02   293.6   end
Mg-24           235    0   1.05686E-04   293.6   end
Mg-25           235    0   1.33797E-05   293.6   end
Mg-26           235    0   1.47310E-05   293.6   end
Al-27           235    0   2.81406E-02   293.6   end
Si-28           235    0   1.00727E-04   293.6   end
Si-29           235    0   5.10026E-06   293.6   end
Si-30           235    0   3.38560E-06   293.6   end
Ti-46           235    0   4.20262E-07   293.6   end
Ti-47           235    0   3.79000E-07   293.6   end
Ti-48           235    0   3.75536E-06   293.6   end
Ti-49           235    0   2.75590E-07   293.6   end
Ti-50           235    0   2.63873E-07   293.6   end
Cr-50           235    0   5.30518E-07   293.6   end
Cr-52           235    0   1.02189E-05   293.6   end
Cr-53           235    0   1.15860E-06   293.6   end
Cr-54           235    0   2.87821E-07   293.6   end
Mn-55           235    0   6.47114E-06   293.6   end
Fe-54           235    0   2.36149E-06   293.6   end
Fe-56           235    0   3.70370E-05   293.6   end
Fe-57           235    0   8.55788E-07   293.6   end
Fe-58           235    0   1.13028E-07   293.6   end
Cu-63           235    0   1.88666E-05   293.6   end
Cu-65           235    0   8.40911E-06   293.6   end
 U-234          235    0   4.80687E-06   293.6   end
 U-235          235    0   4.48000E-04   293.6   end
 U-236          235    0   1.92276E-06   293.6   end
 U-238          235    0   2.59571E-05   293.6   end
```

```
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            236    0   3.32434E-02   293.6   end
 B-10           236    0   5.79830E-06   293.6   end
 B-11           236    0   2.34889E-05   293.6   end
 O-16           236    0   1.78875E-02   293.6   end
Mg-24           236    0   1.05686E-04   293.6   end
Mg-25           236    0   1.33797E-05   293.6   end
Mg-26           236    0   1.47310E-05   293.6   end
Al-27           236    0   2.81176E-02   293.6   end
Si-28           236    0   1.00676E-04   293.6   end
Si-29           236    0   5.09768E-06   293.6   end
Si-30           236    0   3.38390E-06   293.6   end
Ti-46           236    0   4.20262E-07   293.6   end
Ti-47           236    0   3.79000E-07   293.6   end
Ti-48           236    0   3.75536E-06   293.6   end
Ti-49           236    0   2.75590E-07   293.6   end
Ti-50           236    0   2.63873E-07   293.6   end
Cr-50           236    0   5.30517E-07   293.6   end
Cr-52           236    0   1.02189E-05   293.6   end
Cr-53           236    0   1.15860E-06   293.6   end
Cr-54           236    0   2.87821E-07   293.6   end
Mn-55           236    0   6.46828E-06   293.6   end
Fe-54           236    0   2.35985E-06   293.6   end
Fe-56           236    0   3.70113E-05   293.6   end
Fe-57           236    0   8.55193E-07   293.6   end
Fe-58           236    0   1.12950E-07   293.6   end
Cu-63           236    0   1.88571E-05   293.6   end
Cu-65           236    0   8.40487E-06   293.6   end
 U-234          236    0   4.87661E-06   293.6   end
 U-235          236    0   4.54500E-04   293.6   end
 U-236          236    0   1.95066E-06   293.6   end
 U-238          236    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            237    0   3.32434E-02   293.6   end
 B-10           237    0   7.99507E-06   293.6   end
 B-11           237    0   3.23880E-05   293.6   end
 O-16           237    0   1.77805E-02   293.6   end
Mg-24           237    0   1.05686E-04   293.6   end
Mg-25           237    0   1.33797E-05   293.6   end
Mg-26           237    0   1.47310E-05   293.6   end
Al-27           237    0   2.82501E-02   293.6   end
Si-28           237    0   1.00972E-04   293.6   end
Si-29           237    0   5.11262E-06   293.6   end
Si-30           237    0   3.39382E-06   293.6   end
Ti-46           237    0   4.20262E-07   293.6   end
Ti-47           237    0   3.79000E-07   293.6   end
Ti-48           237    0   3.75536E-06   293.6   end
Ti-49           237    0   2.75590E-07   293.6   end
Ti-50           237    0   2.63873E-07   293.6   end
Cr-50           237    0   5.30517E-07   293.6   end
Cr-52           237    0   1.02189E-05   293.6   end
Cr-53           237    0   1.15860E-06   293.6   end
Cr-54           237    0   2.87821E-07   293.6   end
Mn-55           237    0   6.48467E-06   293.6   end
Fe-54           237    0   2.36928E-06   293.6   end
Fe-56           237    0   3.71592E-05   293.6   end
Fe-57           237    0   8.58611E-07   293.6   end
Fe-58           237    0   1.13401E-07   293.6   end
Cu-63           237    0   1.89118E-05   293.6   end
Cu-65           237    0   8.42923E-06   293.6   end
 U-234          237    0   4.47532E-06   293.6   end
 U-235          237    0   4.17100E-04   293.6   end
 U-236          237    0   1.79014E-06   293.6   end
 U-238          237    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            238    0   3.32434E-02   293.6   end
 B-10           238    0   1.06559E-05   293.6   end
 B-11           238    0   4.31670E-05   293.6   end
 O-16           238    0   1.76509E-02   293.6   end
Mg-24           238    0   1.05686E-04   293.6   end
Mg-25           238    0   1.33797E-05   293.6   end
Mg-26           238    0   1.47310E-05   293.6   end
Al-27           238    0   2.84107E-02   293.6   end
Si-28           238    0   1.01330E-04   293.6   end
Si-29           238    0   5.13079E-06   293.6   end
Si-30           238    0   3.40588E-06   293.6   end
Ti-46           238    0   4.20262E-07   293.6   end
Ti-47           238    0   3.79000E-07   293.6   end
```

```
Ti-48           238    0   3.75536E-06   293.6   end
Ti-49           238    0   2.75590E-07   293.6   end
Ti-50           238    0   2.63873E-07   293.6   end
Cr-50           238    0   5.30517E-07   293.6   end
Cr-52           238    0   1.02189E-05   293.6   end
Cr-53           238    0   1.15860E-06   293.6   end
Cr-54           238    0   2.87821E-07   293.6   end
Mn-55           238    0   6.50452E-06   293.6   end
Fe-54           238    0   2.38070E-06   293.6   end
Fe-56           238    0   3.73384E-05   293.6   end
Fe-57           238    0   8.62751E-07   293.6   end
Fe-58           238    0   1.13948E-07   293.6   end
Cu-63           238    0   1.89779E-05   293.6   end
Cu-65           238    0   8.45870E-06   293.6   end
 U-234          238    0   3.98927E-06   293.6   end
 U-235          238    0   3.71800E-04   293.6   end
 U-236          238    0   1.59572E-06   293.6   end
 U-238          238    0   2.15420E-05   293.6   end
'
'          Inner fuel element--fueled Axial region 4
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            241    0   3.32434E-02   293.6   end
 B-10           241    0   2.04121E-05   293.6   end
 B-11           241    0   8.26896E-05   293.6   end
 O-16           241    0   1.71757E-02   293.6   end
Mg-24           241    0   1.05686E-04   293.6   end
Mg-25           241    0   1.33797E-05   293.6   end
Mg-26           241    0   1.47310E-05   293.6   end
Al-27           241    0   2.89993E-02   293.6   end
Si-28           241    0   1.02644E-04   293.6   end
Si-29           241    0   5.19729E-06   293.6   end
Si-30           241    0   3.45002E-06   293.6   end
Ti-46           241    0   4.20262E-07   293.6   end
Ti-47           241    0   3.79000E-07   293.6   end
Ti-48           241    0   3.75536E-06   293.6   end
Ti-49           241    0   2.75590E-07   293.6   end
Ti-50           241    0   2.63873E-07   293.6   end
Cr-50           241    0   5.30517E-07   293.6   end
Cr-52           241    0   1.02189E-05   293.6   end
Cr-53           241    0   1.15860E-06   293.6   end
Cr-54           241    0   2.87821E-07   293.6   end
Mn-55           241    0   6.57731E-06   293.6   end
Fe-54           241    0   2.42259E-06   293.6   end
Fe-56           241    0   3.79953E-05   293.6   end
Fe-57           241    0   8.77930E-07   293.6   end
Fe-58           241    0   1.15953E-07   293.6   end
Cu-63           241    0   1.92203E-05   293.6   end
Cu-65           241    0   8.56676E-06   293.6   end
 U-234          241    0   2.20708E-06   293.6   end
 U-235          241    0   2.05700E-04   293.6   end
 U-236          241    0   8.82838E-07   293.6   end
 U-238          241    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            242    0   3.32434E-02   293.6   end
 B-10           242    0   1.77513E-05   293.6   end
 B-11           242    0   7.19107E-05   293.6   end
 O-16           242    0   1.73053E-02   293.6   end
Mg-24           242    0   1.05686E-04   293.6   end
Mg-25           242    0   1.33797E-05   293.6   end
Mg-26           242    0   1.47310E-05   293.6   end
Al-27           242    0   2.88388E-02   293.6   end
Si-28           242    0   1.02285E-04   293.6   end
Si-29           242    0   5.17912E-06   293.6   end
Si-30           242    0   3.43796E-06   293.6   end
Ti-46           242    0   4.20262E-07   293.6   end
Ti-47           242    0   3.79000E-07   293.6   end
Ti-48           242    0   3.75536E-06   293.6   end
Ti-49           242    0   2.75590E-07   293.6   end
Ti-50           242    0   2.63873E-07   293.6   end
Cr-50           242    0   5.30517E-07   293.6   end
Cr-52           242    0   1.02189E-05   293.6   end
Cr-53           242    0   1.15860E-06   293.6   end
Cr-54           242    0   2.87821E-07   293.6   end
Mn-55           242    0   6.55746E-06   293.6   end
Fe-54           242    0   2.41117E-06   293.6   end
Fe-56           242    0   3.78162E-05   293.6   end
Fe-57           242    0   8.73792E-07   293.6   end
Fe-58           242    0   1.15406E-07   293.6   end
Cu-63           242    0   1.91542E-05   293.6   end
```

```
Cu-65           242    0   8.53729E-06   293.6   end
 U-234          242    0   2.69313E-06   293.6   end
 U-235          242    0   2.51000E-04   293.6   end
 U-236          242    0   1.07726E-06   293.6   end
 U-238          242    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            243    0   3.32435E-02   293.6   end
 B-10           243    0   1.46911E-05   293.6   end
 B-11           243    0   5.95139E-05   293.6   end
 O-16           243    0   1.74543E-02   293.6   end
Mg-24           243    0   1.05686E-04   293.6   end
Mg-25           243    0   1.33797E-05   293.6   end
Mg-26           243    0   1.47310E-05   293.6   end
Al-27           243    0   2.86541E-02   293.6   end
Si-28           243    0   1.01874E-04   293.6   end
Si-29           243    0   5.15831E-06   293.6   end
Si-30           243    0   3.42415E-06   293.6   end
Ti-46           243    0   4.20263E-07   293.6   end
Ti-47           243    0   3.79001E-07   293.6   end
Ti-48           243    0   3.75537E-06   293.6   end
Ti-49           243    0   2.75590E-07   293.6   end
Ti-50           243    0   2.63873E-07   293.6   end
Cr-50           243    0   5.30518E-07   293.6   end
Cr-52           243    0   1.02189E-05   293.6   end
Cr-53           243    0   1.15860E-06   293.6   end
Cr-54           243    0   2.87821E-07   293.6   end
Mn-55           243    0   6.53464E-06   293.6   end
Fe-54           243    0   2.39803E-06   293.6   end
Fe-56           243    0   3.76103E-05   293.6   end
Fe-57           243    0   8.69031E-07   293.6   end
Fe-58           243    0   1.14778E-07   293.6   end
Cu-63           243    0   1.90782E-05   293.6   end
Cu-65           243    0   8.50342E-06   293.6   end
 U-234          243    0   3.25215E-06   293.6   end
 U-235          243    0   3.03100E-04   293.6   end
 U-236          243    0   1.30087E-06   293.6   end
 U-238          243    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            244    0   3.32434E-02   293.6   end
 B-10           244    0   1.03798E-05   293.6   end
 B-11           244    0   4.20486E-05   293.6   end
 O-16           244    0   1.76644E-02   293.6   end
Mg-24           244    0   1.05686E-04   293.6   end
Mg-25           244    0   1.33797E-05   293.6   end
Mg-26           244    0   1.47310E-05   293.6   end
Al-27           244    0   2.83940E-02   293.6   end
Si-28           244    0   1.01293E-04   293.6   end
Si-29           244    0   5.12887E-06   293.6   end
Si-30           244    0   3.40461E-06   293.6   end
Ti-46           244    0   4.20262E-07   293.6   end
Ti-47           244    0   3.79000E-07   293.6   end
Ti-48           244    0   3.75536E-06   293.6   end
Ti-49           244    0   2.75590E-07   293.6   end
Ti-50           244    0   2.63873E-07   293.6   end
Cr-50           244    0   5.30517E-07   293.6   end
Cr-52           244    0   1.02189E-05   293.6   end
Cr-53           244    0   1.15860E-06   293.6   end
Cr-54           244    0   2.87821E-07   293.6   end
Mn-55           244    0   6.50246E-06   293.6   end
Fe-54           244    0   2.37952E-06   293.6   end
Fe-56           244    0   3.73198E-05   293.6   end
Fe-57           244    0   8.62321E-07   293.6   end
Fe-58           244    0   1.13891E-07   293.6   end
Cu-63           244    0   1.89710E-05   293.6   end
Cu-65           244    0   8.45562E-06   293.6   end
 U-234          244    0   4.03970E-06   293.6   end
 U-235          244    0   3.76500E-04   293.6   end
 U-236          244    0   1.61589E-06   293.6   end
 U-238          244    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            245    0   3.32434E-02   293.6   end
 B-10           245    0   6.18010E-06   293.6   end
 B-11           245    0   2.50356E-05   293.6   end
 O-16           245    0   1.78689E-02   293.6   end
Mg-24           245    0   1.05686E-04   293.6   end
Mg-25           245    0   1.33797E-05   293.6   end
Mg-26           245    0   1.47310E-05   293.6   end
Al-27           245    0   2.81406E-02   293.6   end
```

```
Si-28           245    0   1.00727E-04   293.6   end
Si-29           245    0   5.10026E-06   293.6   end
Si-30           245    0   3.38560E-06   293.6   end
Ti-46           245    0   4.20262E-07   293.6   end
Ti-47           245    0   3.79000E-07   293.6   end
Ti-48           245    0   3.75536E-06   293.6   end
Ti-49           245    0   2.75590E-07   293.6   end
Ti-50           245    0   2.63873E-07   293.6   end
Cr-50           245    0   5.30518E-07   293.6   end
Cr-52           245    0   1.02189E-05   293.6   end
Cr-53           245    0   1.15860E-06   293.6   end
Cr-54           245    0   2.87821E-07   293.6   end
Mn-55           245    0   6.47114E-06   293.6   end
Fe-54           245    0   2.36149E-06   293.6   end
Fe-56           245    0   3.70370E-05   293.6   end
Fe-57           245    0   8.55788E-07   293.6   end
Fe-58           245    0   1.13028E-07   293.6   end
Cu-63           245    0   1.88666E-05   293.6   end
Cu-65           245    0   8.40911E-06   293.6   end
 U-234          245    0   4.80687E-06   293.6   end
 U-235          245    0   4.48000E-04   293.6   end
 U-236          245    0   1.92276E-06   293.6   end
 U-238          245    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            246    0   3.32434E-02   293.6   end
 B-10           246    0   5.79830E-06   293.6   end
 B-11           246    0   2.34889E-05   293.6   end
 O-16           246    0   1.78875E-02   293.6   end
Mg-24           246    0   1.05686E-04   293.6   end
Mg-25           246    0   1.33797E-05   293.6   end
Mg-26           246    0   1.47310E-05   293.6   end
Al-27           246    0   2.81176E-02   293.6   end
Si-28           246    0   1.00676E-04   293.6   end
Si-29           246    0   5.09768E-06   293.6   end
Si-30           246    0   3.38390E-06   293.6   end
Ti-46           246    0   4.20262E-07   293.6   end
Ti-47           246    0   3.79000E-07   293.6   end
Ti-48           246    0   3.75536E-06   293.6   end
Ti-49           246    0   2.75590E-07   293.6   end
Ti-50           246    0   2.63873E-07   293.6   end
Cr-50           246    0   5.30517E-07   293.6   end
Cr-52           246    0   1.02189E-05   293.6   end
Cr-53           246    0   1.15860E-06   293.6   end
Cr-54           246    0   2.87821E-07   293.6   end
Mn-55           246    0   6.46828E-06   293.6   end
Fe-54           246    0   2.35985E-06   293.6   end
Fe-56           246    0   3.70113E-05   293.6   end
Fe-57           246    0   8.55193E-07   293.6   end
Fe-58           246    0   1.12950E-07   293.6   end
Cu-63           246    0   1.88571E-05   293.6   end
Cu-65           246    0   8.40487E-06   293.6   end
 U-234          246    0   4.87661E-06   293.6   end
 U-235          246    0   4.54500E-04   293.6   end
 U-236          246    0   1.95066E-06   293.6   end
 U-238          246    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            247    0   3.32434E-02   293.6   end
 B-10           247    0   7.99507E-06   293.6   end
 B-11           247    0   3.23880E-05   293.6   end
 O-16           247    0   1.77805E-02   293.6   end
Mg-24           247    0   1.05686E-04   293.6   end
Mg-25           247    0   1.33797E-05   293.6   end
Mg-26           247    0   1.47310E-05   293.6   end
Al-27           247    0   2.82501E-02   293.6   end
Si-28           247    0   1.00972E-04   293.6   end
Si-29           247    0   5.11262E-06   293.6   end
Si-30           247    0   3.39382E-06   293.6   end
Ti-46           247    0   4.20262E-07   293.6   end
Ti-47           247    0   3.79000E-07   293.6   end
Ti-48           247    0   3.75536E-06   293.6   end
Ti-49           247    0   2.75590E-07   293.6   end
Ti-50           247    0   2.63873E-07   293.6   end
Cr-50           247    0   5.30517E-07   293.6   end
Cr-52           247    0   1.02189E-05   293.6   end
Cr-53           247    0   1.15860E-06   293.6   end
Cr-54           247    0   2.87821E-07   293.6   end
Mn-55           247    0   6.48467E-06   293.6   end
Fe-54           247    0   2.36928E-06   293.6   end
Fe-56           247    0   3.71592E-05   293.6   end
```

```
Fe-57           247    0   8.58611E-07   293.6   end
Fe-58           247    0   1.13401E-07   293.6   end
Cu-63           247    0   1.89118E-05   293.6   end
Cu-65           247    0   8.42923E-06   293.6   end
 U-234          247    0   4.47532E-06   293.6   end
 U-235          247    0   4.17100E-04   293.6   end
 U-236          247    0   1.79014E-06   293.6   end
 U-238          247    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            248    0   3.32434E-02   293.6   end
 B-10           248    0   1.06559E-05   293.6   end
 B-11           248    0   4.31670E-05   293.6   end
 O-16           248    0   1.76509E-02   293.6   end
Mg-24           248    0   1.05686E-04   293.6   end
Mg-25           248    0   1.33797E-05   293.6   end
Mg-26           248    0   1.47310E-05   293.6   end
Al-27           248    0   2.84107E-02   293.6   end
Si-28           248    0   1.01330E-04   293.6   end
Si-29           248    0   5.13079E-06   293.6   end
Si-30           248    0   3.40588E-06   293.6   end
Ti-46           248    0   4.20262E-07   293.6   end
Ti-47           248    0   3.79000E-07   293.6   end
Ti-48           248    0   3.75536E-06   293.6   end
Ti-49           248    0   2.75590E-07   293.6   end
Ti-50           248    0   2.63873E-07   293.6   end
Cr-50           248    0   5.30517E-07   293.6   end
Cr-52           248    0   1.02189E-05   293.6   end
Cr-53           248    0   1.15860E-06   293.6   end
Cr-54           248    0   2.87821E-07   293.6   end
Mn-55           248    0   6.50452E-06   293.6   end
Fe-54           248    0   2.38070E-06   293.6   end
Fe-56           248    0   3.73384E-05   293.6   end
Fe-57           248    0   8.62751E-07   293.6   end
Fe-58           248    0   1.13948E-07   293.6   end
Cu-63           248    0   1.89779E-05   293.6   end
Cu-65           248    0   8.45870E-06   293.6   end
 U-234          248    0   3.98927E-06   293.6   end
 U-235          248    0   3.71800E-04   293.6   end
 U-236          248    0   1.59572E-06   293.6   end
 U-238          248    0   2.15420E-05   293.6   end
'
'          Inner fuel element--fueled Axial region 5
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            251    0   3.32434E-02   293.6   end
 B-10           251    0   2.04121E-05   293.6   end
 B-11           251    0   8.26896E-05   293.6   end
 O-16           251    0   1.71757E-02   293.6   end
Mg-24           251    0   1.05686E-04   293.6   end
Mg-25           251    0   1.33797E-05   293.6   end
Mg-26           251    0   1.47310E-05   293.6   end
Al-27           251    0   2.89993E-02   293.6   end
Si-28           251    0   1.02644E-04   293.6   end
Si-29           251    0   5.19729E-06   293.6   end
Si-30           251    0   3.45002E-06   293.6   end
Ti-46           251    0   4.20262E-07   293.6   end
Ti-47           251    0   3.79000E-07   293.6   end
Ti-48           251    0   3.75536E-06   293.6   end
Ti-49           251    0   2.75590E-07   293.6   end
Ti-50           251    0   2.63873E-07   293.6   end
Cr-50           251    0   5.30517E-07   293.6   end
Cr-52           251    0   1.02189E-05   293.6   end
Cr-53           251    0   1.15860E-06   293.6   end
Cr-54           251    0   2.87821E-07   293.6   end
Mn-55           251    0   6.57731E-06   293.6   end
Fe-54           251    0   2.42259E-06   293.6   end
Fe-56           251    0   3.79953E-05   293.6   end
Fe-57           251    0   8.77930E-07   293.6   end
Fe-58           251    0   1.15953E-07   293.6   end
Cu-63           251    0   1.92203E-05   293.6   end
Cu-65           251    0   8.56676E-06   293.6   end
 U-234          251    0   2.20708E-06   293.6   end
 U-235          251    0   2.05700E-04   293.6   end
 U-236          251    0   8.82838E-07   293.6   end
 U-238          251    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            252    0   3.32434E-02   293.6   end
 B-10           252    0   1.77513E-05   293.6   end
 B-11           252    0   7.19107E-05   293.6   end
```

```
 O-16           252    0   1.73053E-02   293.6   end
Mg-24           252    0   1.05686E-04   293.6   end
Mg-25           252    0   1.33797E-05   293.6   end
Mg-26           252    0   1.47310E-05   293.6   end
Al-27           252    0   2.88388E-02   293.6   end
Si-28           252    0   1.02285E-04   293.6   end
Si-29           252    0   5.17912E-06   293.6   end
Si-30           252    0   3.43796E-06   293.6   end
Ti-46           252    0   4.20262E-07   293.6   end
Ti-47           252    0   3.79000E-07   293.6   end
Ti-48           252    0   3.75536E-06   293.6   end
Ti-49           252    0   2.75590E-07   293.6   end
Ti-50           252    0   2.63873E-07   293.6   end
Cr-50           252    0   5.30517E-07   293.6   end
Cr-52           252    0   1.02189E-05   293.6   end
Cr-53           252    0   1.15860E-06   293.6   end
Cr-54           252    0   2.87821E-07   293.6   end
Mn-55           252    0   6.55746E-06   293.6   end
Fe-54           252    0   2.41117E-06   293.6   end
Fe-56           252    0   3.78162E-05   293.6   end
Fe-57           252    0   8.73792E-07   293.6   end
Fe-58           252    0   1.15406E-07   293.6   end
Cu-63           252    0   1.91542E-05   293.6   end
Cu-65           252    0   8.53729E-06   293.6   end
 U-234          252    0   2.69313E-06   293.6   end
 U-235          252    0   2.51000E-04   293.6   end
 U-236          252    0   1.07726E-06   293.6   end
 U-238          252    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            253    0   3.32435E-02   293.6   end
 B-10           253    0   1.46911E-05   293.6   end
 B-11           253    0   5.95139E-05   293.6   end
 O-16           253    0   1.74543E-02   293.6   end
Mg-24           253    0   1.05686E-04   293.6   end
Mg-25           253    0   1.33797E-05   293.6   end
Mg-26           253    0   1.47310E-05   293.6   end
Al-27           253    0   2.86541E-02   293.6   end
Si-28           253    0   1.01874E-04   293.6   end
Si-29           253    0   5.15831E-06   293.6   end
Si-30           253    0   3.42415E-06   293.6   end
Ti-46           253    0   4.20263E-07   293.6   end
Ti-47           253    0   3.79001E-07   293.6   end
Ti-48           253    0   3.75537E-06   293.6   end
Ti-49           253    0   2.75590E-07   293.6   end
Ti-50           253    0   2.63873E-07   293.6   end
Cr-50           253    0   5.30518E-07   293.6   end
Cr-52           253    0   1.02189E-05   293.6   end
Cr-53           253    0   1.15860E-06   293.6   end
Cr-54           253    0   2.87821E-07   293.6   end
Mn-55           253    0   6.53464E-06   293.6   end
Fe-54           253    0   2.39803E-06   293.6   end
Fe-56           253    0   3.76103E-05   293.6   end
Fe-57           253    0   8.69031E-07   293.6   end
Fe-58           253    0   1.14778E-07   293.6   end
Cu-63           253    0   1.90782E-05   293.6   end
Cu-65           253    0   8.50342E-06   293.6   end
 U-234          253    0   3.25215E-06   293.6   end
 U-235          253    0   3.03100E-04   293.6   end
 U-236          253    0   1.30087E-06   293.6   end
 U-238          253    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            254    0   3.32434E-02   293.6   end
 B-10           254    0   1.03798E-05   293.6   end
 B-11           254    0   4.20486E-05   293.6   end
 O-16           254    0   1.76644E-02   293.6   end
Mg-24           254    0   1.05686E-04   293.6   end
Mg-25           254    0   1.33797E-05   293.6   end
Mg-26           254    0   1.47310E-05   293.6   end
Al-27           254    0   2.83940E-02   293.6   end
Si-28           254    0   1.01293E-04   293.6   end
Si-29           254    0   5.12887E-06   293.6   end
Si-30           254    0   3.40461E-06   293.6   end
Ti-46           254    0   4.20262E-07   293.6   end
Ti-47           254    0   3.79000E-07   293.6   end
Ti-48           254    0   3.75536E-06   293.6   end
Ti-49           254    0   2.75590E-07   293.6   end
Ti-50           254    0   2.63873E-07   293.6   end
Cr-50           254    0   5.30517E-07   293.6   end
Cr-52           254    0   1.02189E-05   293.6   end
```

```
Cr-53           254    0   1.15860E-06   293.6   end
Cr-54           254    0   2.87821E-07   293.6   end
Mn-55           254    0   6.50246E-06   293.6   end
Fe-54           254    0   2.37952E-06   293.6   end
Fe-56           254    0   3.73198E-05   293.6   end
Fe-57           254    0   8.62321E-07   293.6   end
Fe-58           254    0   1.13891E-07   293.6   end
Cu-63           254    0   1.89710E-05   293.6   end
Cu-65           254    0   8.45562E-06   293.6   end
 U-234          254    0   4.03970E-06   293.6   end
 U-235          254    0   3.76500E-04   293.6   end
 U-236          254    0   1.61589E-06   293.6   end
 U-238          254    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            255    0   3.32434E-02   293.6   end
 B-10           255    0   6.18010E-06   293.6   end
 B-11           255    0   2.50356E-05   293.6   end
 O-16           255    0   1.78689E-02   293.6   end
Mg-24           255    0   1.05686E-04   293.6   end
Mg-25           255    0   1.33797E-05   293.6   end
Mg-26           255    0   1.47310E-05   293.6   end
Al-27           255    0   2.81406E-02   293.6   end
Si-28           255    0   1.00727E-04   293.6   end
Si-29           255    0   5.10026E-06   293.6   end
Si-30           255    0   3.38560E-06   293.6   end
Ti-46           255    0   4.20262E-07   293.6   end
Ti-47           255    0   3.79000E-07   293.6   end
Ti-48           255    0   3.75536E-06   293.6   end
Ti-49           255    0   2.75590E-07   293.6   end
Ti-50           255    0   2.63873E-07   293.6   end
Cr-50           255    0   5.30518E-07   293.6   end
Cr-52           255    0   1.02189E-05   293.6   end
Cr-53           255    0   1.15860E-06   293.6   end
Cr-54           255    0   2.87821E-07   293.6   end
Mn-55           255    0   6.47114E-06   293.6   end
Fe-54           255    0   2.36149E-06   293.6   end
Fe-56           255    0   3.70370E-05   293.6   end
Fe-57           255    0   8.55788E-07   293.6   end
Fe-58           255    0   1.13028E-07   293.6   end
Cu-63           255    0   1.88666E-05   293.6   end
Cu-65           255    0   8.40911E-06   293.6   end
 U-234          255    0   4.80687E-06   293.6   end
 U-235          255    0   4.48000E-04   293.6   end
 U-236          255    0   1.92276E-06   293.6   end
 U-238          255    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            256    0   3.32434E-02   293.6   end
 B-10           256    0   5.79830E-06   293.6   end
 B-11           256    0   2.34889E-05   293.6   end
 O-16           256    0   1.78875E-02   293.6   end
Mg-24           256    0   1.05686E-04   293.6   end
Mg-25           256    0   1.33797E-05   293.6   end
Mg-26           256    0   1.47310E-05   293.6   end
Al-27           256    0   2.81176E-02   293.6   end
Si-28           256    0   1.00676E-04   293.6   end
Si-29           256    0   5.09768E-06   293.6   end
Si-30           256    0   3.38390E-06   293.6   end
Ti-46           256    0   4.20262E-07   293.6   end
Ti-47           256    0   3.79000E-07   293.6   end
Ti-48           256    0   3.75536E-06   293.6   end
Ti-49           256    0   2.75590E-07   293.6   end
Ti-50           256    0   2.63873E-07   293.6   end
Cr-50           256    0   5.30517E-07   293.6   end
Cr-52           256    0   1.02189E-05   293.6   end
Cr-53           256    0   1.15860E-06   293.6   end
Cr-54           256    0   2.87821E-07   293.6   end
Mn-55           256    0   6.46828E-06   293.6   end
Fe-54           256    0   2.35985E-06   293.6   end
Fe-56           256    0   3.70113E-05   293.6   end
Fe-57           256    0   8.55193E-07   293.6   end
Fe-58           256    0   1.12950E-07   293.6   end
Cu-63           256    0   1.88571E-05   293.6   end
Cu-65           256    0   8.40487E-06   293.6   end
 U-234          256    0   4.87661E-06   293.6   end
 U-235          256    0   4.54500E-04   293.6   end
 U-236          256    0   1.95066E-06   293.6   end
 U-238          256    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
```

```
 H-1            257    0   3.32434E-02   293.6   end
 B-10           257    0   7.99507E-06   293.6   end
 B-11           257    0   3.23880E-05   293.6   end
 O-16           257    0   1.77805E-02   293.6   end
Mg-24           257    0   1.05686E-04   293.6   end
Mg-25           257    0   1.33797E-05   293.6   end
Mg-26           257    0   1.47310E-05   293.6   end
Al-27           257    0   2.82501E-02   293.6   end
Si-28           257    0   1.00972E-04   293.6   end
Si-29           257    0   5.11262E-06   293.6   end
Si-30           257    0   3.39382E-06   293.6   end
Ti-46           257    0   4.20262E-07   293.6   end
Ti-47           257    0   3.79000E-07   293.6   end
Ti-48           257    0   3.75536E-06   293.6   end
Ti-49           257    0   2.75590E-07   293.6   end
Ti-50           257    0   2.63873E-07   293.6   end
Cr-50           257    0   5.30517E-07   293.6   end
Cr-52           257    0   1.02189E-05   293.6   end
Cr-53           257    0   1.15860E-06   293.6   end
Cr-54           257    0   2.87821E-07   293.6   end
Mn-55           257    0   6.48467E-06   293.6   end
Fe-54           257    0   2.36928E-06   293.6   end
Fe-56           257    0   3.71592E-05   293.6   end
Fe-57           257    0   8.58611E-07   293.6   end
Fe-58           257    0   1.13401E-07   293.6   end
Cu-63           257    0   1.89118E-05   293.6   end
Cu-65           257    0   8.42923E-06   293.6   end
 U-234          257    0   4.47532E-06   293.6   end
 U-235          257    0   4.17100E-04   293.6   end
 U-236          257    0   1.79014E-06   293.6   end
 U-238          257    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            258    0   3.32434E-02   293.6   end
 B-10           258    0   1.06559E-05   293.6   end
 B-11           258    0   4.31670E-05   293.6   end
 O-16           258    0   1.76509E-02   293.6   end
Mg-24           258    0   1.05686E-04   293.6   end
Mg-25           258    0   1.33797E-05   293.6   end
Mg-26           258    0   1.47310E-05   293.6   end
Al-27           258    0   2.84107E-02   293.6   end
Si-28           258    0   1.01330E-04   293.6   end
Si-29           258    0   5.13079E-06   293.6   end
Si-30           258    0   3.40588E-06   293.6   end
Ti-46           258    0   4.20262E-07   293.6   end
Ti-47           258    0   3.79000E-07   293.6   end
Ti-48           258    0   3.75536E-06   293.6   end
Ti-49           258    0   2.75590E-07   293.6   end
Ti-50           258    0   2.63873E-07   293.6   end
Cr-50           258    0   5.30517E-07   293.6   end
Cr-52           258    0   1.02189E-05   293.6   end
Cr-53           258    0   1.15860E-06   293.6   end
Cr-54           258    0   2.87821E-07   293.6   end
Mn-55           258    0   6.50452E-06   293.6   end
Fe-54           258    0   2.38070E-06   293.6   end
Fe-56           258    0   3.73384E-05   293.6   end
Fe-57           258    0   8.62751E-07   293.6   end
Fe-58           258    0   1.13948E-07   293.6   end
Cu-63           258    0   1.89779E-05   293.6   end
Cu-65           258    0   8.45870E-06   293.6   end
 U-234          258    0   3.98927E-06   293.6   end
 U-235          258    0   3.71800E-04   293.6   end
 U-236          258    0   1.59572E-06   293.6   end
 U-238          258    0   2.15420E-05   293.6   end
'
'         Inner fuel element--fueled Axial region 6
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            261    0   3.32434E-02   293.6   end
 B-10           261    0   2.04121E-05   293.6   end
 B-11           261    0   8.26896E-05   293.6   end
 O-16           261    0   1.71757E-02   293.6   end
Mg-24           261    0   1.05686E-04   293.6   end
Mg-25           261    0   1.33797E-05   293.6   end
Mg-26           261    0   1.47310E-05   293.6   end
Al-27           261    0   2.89993E-02   293.6   end
Si-28           261    0   1.02644E-04   293.6   end
Si-29           261    0   5.19729E-06   293.6   end
Si-30           261    0   3.45002E-06   293.6   end
Ti-46           261    0   4.20262E-07   293.6   end
Ti-47           261    0   3.79000E-07   293.6   end
```

```
Ti-48           261    0   3.75536E-06   293.6   end
Ti-49           261    0   2.75590E-07   293.6   end
Ti-50           261    0   2.63873E-07   293.6   end
Cr-50           261    0   5.30517E-07   293.6   end
Cr-52           261    0   1.02189E-05   293.6   end
Cr-53           261    0   1.15860E-06   293.6   end
Cr-54           261    0   2.87821E-07   293.6   end
Mn-55           261    0   6.57731E-06   293.6   end
Fe-54           261    0   2.42259E-06   293.6   end
Fe-56           261    0   3.79953E-05   293.6   end
Fe-57           261    0   8.77930E-07   293.6   end
Fe-58           261    0   1.15953E-07   293.6   end
Cu-63           261    0   1.92203E-05   293.6   end
Cu-65           261    0   8.56676E-06   293.6   end
 U-234          261    0   2.20708E-06   293.6   end
 U-235          261    0   2.05700E-04   293.6   end
 U-236          261    0   8.82838E-07   293.6   end
 U-238          261    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            262    0   3.32434E-02   293.6   end
 B-10           262    0   1.77513E-05   293.6   end
 B-11           262    0   7.19107E-05   293.6   end
 O-16           262    0   1.73053E-02   293.6   end
Mg-24           262    0   1.05686E-04   293.6   end
Mg-25           262    0   1.33797E-05   293.6   end
Mg-26           262    0   1.47310E-05   293.6   end
Al-27           262    0   2.88388E-02   293.6   end
Si-28           262    0   1.02285E-04   293.6   end
Si-29           262    0   5.17912E-06   293.6   end
Si-30           262    0   3.43796E-06   293.6   end
Ti-46           262    0   4.20262E-07   293.6   end
Ti-47           262    0   3.79000E-07   293.6   end
Ti-48           262    0   3.75536E-06   293.6   end
Ti-49           262    0   2.75590E-07   293.6   end
Ti-50           262    0   2.63873E-07   293.6   end
Cr-50           262    0   5.30517E-07   293.6   end
Cr-52           262    0   1.02189E-05   293.6   end
Cr-53           262    0   1.15860E-06   293.6   end
Cr-54           262    0   2.87821E-07   293.6   end
Mn-55           262    0   6.55746E-06   293.6   end
Fe-54           262    0   2.41117E-06   293.6   end
Fe-56           262    0   3.78162E-05   293.6   end
Fe-57           262    0   8.73792E-07   293.6   end
Fe-58           262    0   1.15406E-07   293.6   end
Cu-63           262    0   1.91542E-05   293.6   end
Cu-65           262    0   8.53729E-06   293.6   end
 U-234          262    0   2.69313E-06   293.6   end
 U-235          262    0   2.51000E-04   293.6   end
 U-236          262    0   1.07726E-06   293.6   end
 U-238          262    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            263    0   3.32435E-02   293.6   end
 B-10           263    0   1.46911E-05   293.6   end
 B-11           263    0   5.95139E-05   293.6   end
 O-16           263    0   1.74543E-02   293.6   end
Mg-24           263    0   1.05686E-04   293.6   end
Mg-25           263    0   1.33797E-05   293.6   end
Mg-26           263    0   1.47310E-05   293.6   end
Al-27           263    0   2.86541E-02   293.6   end
Si-28           263    0   1.01874E-04   293.6   end
Si-29           263    0   5.15831E-06   293.6   end
Si-30           263    0   3.42415E-06   293.6   end
Ti-46           263    0   4.20263E-07   293.6   end
Ti-47           263    0   3.79001E-07   293.6   end
Ti-48           263    0   3.75537E-06   293.6   end
Ti-49           263    0   2.75590E-07   293.6   end
Ti-50           263    0   2.63873E-07   293.6   end
Cr-50           263    0   5.30518E-07   293.6   end
Cr-52           263    0   1.02189E-05   293.6   end
Cr-53           263    0   1.15860E-06   293.6   end
Cr-54           263    0   2.87821E-07   293.6   end
Mn-55           263    0   6.53464E-06   293.6   end
Fe-54           263    0   2.39803E-06   293.6   end
Fe-56           263    0   3.76103E-05   293.6   end
Fe-57           263    0   8.69031E-07   293.6   end
Fe-58           263    0   1.14778E-07   293.6   end
Cu-63           263    0   1.90782E-05   293.6   end
Cu-65           263    0   8.50342E-06   293.6   end
 U-234          263    0   3.25215E-06   293.6   end
```

```
 U-235          263    0   3.03100E-04   293.6   end
 U-236          263    0   1.30087E-06   293.6   end
 U-238          263    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            264    0   3.32434E-02   293.6   end
 B-10           264    0   1.03798E-05   293.6   end
 B-11           264    0   4.20486E-05   293.6   end
 O-16           264    0   1.76644E-02   293.6   end
Mg-24           264    0   1.05686E-04   293.6   end
Mg-25           264    0   1.33797E-05   293.6   end
Mg-26           264    0   1.47310E-05   293.6   end
Al-27           264    0   2.83940E-02   293.6   end
Si-28           264    0   1.01293E-04   293.6   end
Si-29           264    0   5.12887E-06   293.6   end
Si-30           264    0   3.40461E-06   293.6   end
Ti-46           264    0   4.20262E-07   293.6   end
Ti-47           264    0   3.79000E-07   293.6   end
Ti-48           264    0   3.75536E-06   293.6   end
Ti-49           264    0   2.75590E-07   293.6   end
Ti-50           264    0   2.63873E-07   293.6   end
Cr-50           264    0   5.30517E-07   293.6   end
Cr-52           264    0   1.02189E-05   293.6   end
Cr-53           264    0   1.15860E-06   293.6   end
Cr-54           264    0   2.87821E-07   293.6   end
Mn-55           264    0   6.50246E-06   293.6   end
Fe-54           264    0   2.37952E-06   293.6   end
Fe-56           264    0   3.73198E-05   293.6   end
Fe-57           264    0   8.62321E-07   293.6   end
Fe-58           264    0   1.13891E-07   293.6   end
Cu-63           264    0   1.89710E-05   293.6   end
Cu-65           264    0   8.45562E-06   293.6   end
 U-234          264    0   4.03970E-06   293.6   end
 U-235          264    0   3.76500E-04   293.6   end
 U-236          264    0   1.61589E-06   293.6   end
 U-238          264    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            265    0   3.32434E-02   293.6   end
 B-10           265    0   6.18010E-06   293.6   end
 B-11           265    0   2.50356E-05   293.6   end
 O-16           265    0   1.78689E-02   293.6   end
Mg-24           265    0   1.05686E-04   293.6   end
Mg-25           265    0   1.33797E-05   293.6   end
Mg-26           265    0   1.47310E-05   293.6   end
Al-27           265    0   2.81406E-02   293.6   end
Si-28           265    0   1.00727E-04   293.6   end
Si-29           265    0   5.10026E-06   293.6   end
Si-30           265    0   3.38560E-06   293.6   end
Ti-46           265    0   4.20262E-07   293.6   end
Ti-47           265    0   3.79000E-07   293.6   end
Ti-48           265    0   3.75536E-06   293.6   end
Ti-49           265    0   2.75590E-07   293.6   end
Ti-50           265    0   2.63873E-07   293.6   end
Cr-50           265    0   5.30518E-07   293.6   end
Cr-52           265    0   1.02189E-05   293.6   end
Cr-53           265    0   1.15860E-06   293.6   end
Cr-54           265    0   2.87821E-07   293.6   end
Mn-55           265    0   6.47114E-06   293.6   end
Fe-54           265    0   2.36149E-06   293.6   end
Fe-56           265    0   3.70370E-05   293.6   end
Fe-57           265    0   8.55788E-07   293.6   end
Fe-58           265    0   1.13028E-07   293.6   end
Cu-63           265    0   1.88666E-05   293.6   end
Cu-65           265    0   8.40911E-06   293.6   end
 U-234          265    0   4.80687E-06   293.6   end
 U-235          265    0   4.48000E-04   293.6   end
 U-236          265    0   1.92276E-06   293.6   end
 U-238          265    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            266    0   3.32434E-02   293.6   end
 B-10           266    0   5.79830E-06   293.6   end
 B-11           266    0   2.34889E-05   293.6   end
 O-16           266    0   1.78875E-02   293.6   end
Mg-24           266    0   1.05686E-04   293.6   end
Mg-25           266    0   1.33797E-05   293.6   end
Mg-26           266    0   1.47310E-05   293.6   end
Al-27           266    0   2.81176E-02   293.6   end
Si-28           266    0   1.00676E-04   293.6   end
Si-29           266    0   5.09768E-06   293.6   end
```

```
Si-30           266    0   3.38390E-06   293.6   end
Ti-46           266    0   4.20262E-07   293.6   end
Ti-47           266    0   3.79000E-07   293.6   end
Ti-48           266    0   3.75536E-06   293.6   end
Ti-49           266    0   2.75590E-07   293.6   end
Ti-50           266    0   2.63873E-07   293.6   end
Cr-50           266    0   5.30517E-07   293.6   end
Cr-52           266    0   1.02189E-05   293.6   end
Cr-53           266    0   1.15860E-06   293.6   end
Cr-54           266    0   2.87821E-07   293.6   end
Mn-55           266    0   6.46828E-06   293.6   end
Fe-54           266    0   2.35985E-06   293.6   end
Fe-56           266    0   3.70113E-05   293.6   end
Fe-57           266    0   8.55193E-07   293.6   end
Fe-58           266    0   1.12950E-07   293.6   end
Cu-63           266    0   1.88571E-05   293.6   end
Cu-65           266    0   8.40487E-06   293.6   end
 U-234          266    0   4.87661E-06   293.6   end
 U-235          266    0   4.54500E-04   293.6   end
 U-236          266    0   1.95066E-06   293.6   end
 U-238          266    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            267    0   3.32434E-02   293.6   end
 B-10           267    0   7.99507E-06   293.6   end
 B-11           267    0   3.23880E-05   293.6   end
 O-16           267    0   1.77805E-02   293.6   end
Mg-24           267    0   1.05686E-04   293.6   end
Mg-25           267    0   1.33797E-05   293.6   end
Mg-26           267    0   1.47310E-05   293.6   end
Al-27           267    0   2.82501E-02   293.6   end
Si-28           267    0   1.00972E-04   293.6   end
Si-29           267    0   5.11262E-06   293.6   end
Si-30           267    0   3.39382E-06   293.6   end
Ti-46           267    0   4.20262E-07   293.6   end
Ti-47           267    0   3.79000E-07   293.6   end
Ti-48           267    0   3.75536E-06   293.6   end
Ti-49           267    0   2.75590E-07   293.6   end
Ti-50           267    0   2.63873E-07   293.6   end
Cr-50           267    0   5.30517E-07   293.6   end
Cr-52           267    0   1.02189E-05   293.6   end
Cr-53           267    0   1.15860E-06   293.6   end
Cr-54           267    0   2.87821E-07   293.6   end
Mn-55           267    0   6.48467E-06   293.6   end
Fe-54           267    0   2.36928E-06   293.6   end
Fe-56           267    0   3.71592E-05   293.6   end
Fe-57           267    0   8.58611E-07   293.6   end
Fe-58           267    0   1.13401E-07   293.6   end
Cu-63           267    0   1.89118E-05   293.6   end
Cu-65           267    0   8.42923E-06   293.6   end
 U-234          267    0   4.47532E-06   293.6   end
 U-235          267    0   4.17100E-04   293.6   end
 U-236          267    0   1.79014E-06   293.6   end
 U-238          267    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            268    0   3.32434E-02   293.6   end
 B-10           268    0   1.06559E-05   293.6   end
 B-11           268    0   4.31670E-05   293.6   end
 O-16           268    0   1.76509E-02   293.6   end
Mg-24           268    0   1.05686E-04   293.6   end
Mg-25           268    0   1.33797E-05   293.6   end
Mg-26           268    0   1.47310E-05   293.6   end
Al-27           268    0   2.84107E-02   293.6   end
Si-28           268    0   1.01330E-04   293.6   end
Si-29           268    0   5.13079E-06   293.6   end
Si-30           268    0   3.40588E-06   293.6   end
Ti-46           268    0   4.20262E-07   293.6   end
Ti-47           268    0   3.79000E-07   293.6   end
Ti-48           268    0   3.75536E-06   293.6   end
Ti-49           268    0   2.75590E-07   293.6   end
Ti-50           268    0   2.63873E-07   293.6   end
Cr-50           268    0   5.30517E-07   293.6   end
Cr-52           268    0   1.02189E-05   293.6   end
Cr-53           268    0   1.15860E-06   293.6   end
Cr-54           268    0   2.87821E-07   293.6   end
Mn-55           268    0   6.50452E-06   293.6   end
Fe-54           268    0   2.38070E-06   293.6   end
Fe-56           268    0   3.73384E-05   293.6   end
Fe-57           268    0   8.62751E-07   293.6   end
Fe-58           268    0   1.13948E-07   293.6   end
```

```
Cu-63           268    0   1.89779E-05   293.6   end
Cu-65           268    0   8.45870E-06   293.6   end
 U-234          268    0   3.98927E-06   293.6   end
 U-235          268    0   3.71800E-04   293.6   end
 U-236          268    0   1.59572E-06   293.6   end
 U-238          268    0   2.15420E-05   293.6   end
'
'          Inner fuel element--fueled Axial region 7
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            271    0   3.32434E-02   293.6   end
 B-10           271    0   2.04121E-05   293.6   end
 B-11           271    0   8.26896E-05   293.6   end
 O-16           271    0   1.71757E-02   293.6   end
Mg-24           271    0   1.05686E-04   293.6   end
Mg-25           271    0   1.33797E-05   293.6   end
Mg-26           271    0   1.47310E-05   293.6   end
Al-27           271    0   2.89993E-02   293.6   end
Si-28           271    0   1.02644E-04   293.6   end
Si-29           271    0   5.19729E-06   293.6   end
Si-30           271    0   3.45002E-06   293.6   end
Ti-46           271    0   4.20262E-07   293.6   end
Ti-47           271    0   3.79000E-07   293.6   end
Ti-48           271    0   3.75536E-06   293.6   end
Ti-49           271    0   2.75590E-07   293.6   end
Ti-50           271    0   2.63873E-07   293.6   end
Cr-50           271    0   5.30517E-07   293.6   end
Cr-52           271    0   1.02189E-05   293.6   end
Cr-53           271    0   1.15860E-06   293.6   end
Cr-54           271    0   2.87821E-07   293.6   end
Mn-55           271    0   6.57731E-06   293.6   end
Fe-54           271    0   2.42259E-06   293.6   end
Fe-56           271    0   3.79953E-05   293.6   end
Fe-57           271    0   8.77930E-07   293.6   end
Fe-58           271    0   1.15953E-07   293.6   end
Cu-63           271    0   1.92203E-05   293.6   end
Cu-65           271    0   8.56676E-06   293.6   end
 U-234          271    0   2.20708E-06   293.6   end
 U-235          271    0   2.05700E-04   293.6   end
 U-236          271    0   8.82838E-07   293.6   end
 U-238          271    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            272    0   3.32434E-02   293.6   end
 B-10           272    0   1.77513E-05   293.6   end
 B-11           272    0   7.19107E-05   293.6   end
 O-16           272    0   1.73053E-02   293.6   end
Mg-24           272    0   1.05686E-04   293.6   end
Mg-25           272    0   1.33797E-05   293.6   end
Mg-26           272    0   1.47310E-05   293.6   end
Al-27           272    0   2.88388E-02   293.6   end
Si-28           272    0   1.02285E-04   293.6   end
Si-29           272    0   5.17912E-06   293.6   end
Si-30           272    0   3.43796E-06   293.6   end
Ti-46           272    0   4.20262E-07   293.6   end
Ti-47           272    0   3.79000E-07   293.6   end
Ti-48           272    0   3.75536E-06   293.6   end
Ti-49           272    0   2.75590E-07   293.6   end
Ti-50           272    0   2.63873E-07   293.6   end
Cr-50           272    0   5.30517E-07   293.6   end
Cr-52           272    0   1.02189E-05   293.6   end
Cr-53           272    0   1.15860E-06   293.6   end
Cr-54           272    0   2.87821E-07   293.6   end
Mn-55           272    0   6.55746E-06   293.6   end
Fe-54           272    0   2.41117E-06   293.6   end
Fe-56           272    0   3.78162E-05   293.6   end
Fe-57           272    0   8.73792E-07   293.6   end
Fe-58           272    0   1.15406E-07   293.6   end
Cu-63           272    0   1.91542E-05   293.6   end
Cu-65           272    0   8.53729E-06   293.6   end
 U-234          272    0   2.69313E-06   293.6   end
 U-235          272    0   2.51000E-04   293.6   end
 U-236          272    0   1.07726E-06   293.6   end
 U-238          272    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            273    0   3.32435E-02   293.6   end
 B-10           273    0   1.46911E-05   293.6   end
 B-11           273    0   5.95139E-05   293.6   end
 O-16           273    0   1.74543E-02   293.6   end
Mg-24           273    0   1.05686E-04   293.6   end
```

```
Mg-25           273    0   1.33797E-05   293.6   end
Mg-26           273    0   1.47310E-05   293.6   end
Al-27           273    0   2.86541E-02   293.6   end
Si-28           273    0   1.01874E-04   293.6   end
Si-29           273    0   5.15831E-06   293.6   end
Si-30           273    0   3.42415E-06   293.6   end
Ti-46           273    0   4.20263E-07   293.6   end
Ti-47           273    0   3.79001E-07   293.6   end
Ti-48           273    0   3.75537E-06   293.6   end
Ti-49           273    0   2.75590E-07   293.6   end
Ti-50           273    0   2.63873E-07   293.6   end
Cr-50           273    0   5.30518E-07   293.6   end
Cr-52           273    0   1.02189E-05   293.6   end
Cr-53           273    0   1.15860E-06   293.6   end
Cr-54           273    0   2.87821E-07   293.6   end
Mn-55           273    0   6.53464E-06   293.6   end
Fe-54           273    0   2.39803E-06   293.6   end
Fe-56           273    0   3.76103E-05   293.6   end
Fe-57           273    0   8.69031E-07   293.6   end
Fe-58           273    0   1.14778E-07   293.6   end
Cu-63           273    0   1.90782E-05   293.6   end
Cu-65           273    0   8.50342E-06   293.6   end
 U-234          273    0   3.25215E-06   293.6   end
 U-235          273    0   3.03100E-04   293.6   end
 U-236          273    0   1.30087E-06   293.6   end
 U-238          273    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            274    0   3.32434E-02   293.6   end
 B-10           274    0   1.03798E-05   293.6   end
 B-11           274    0   4.20486E-05   293.6   end
 O-16           274    0   1.76644E-02   293.6   end
Mg-24           274    0   1.05686E-04   293.6   end
Mg-25           274    0   1.33797E-05   293.6   end
Mg-26           274    0   1.47310E-05   293.6   end
Al-27           274    0   2.83940E-02   293.6   end
Si-28           274    0   1.01293E-04   293.6   end
Si-29           274    0   5.12887E-06   293.6   end
Si-30           274    0   3.40461E-06   293.6   end
Ti-46           274    0   4.20262E-07   293.6   end
Ti-47           274    0   3.79000E-07   293.6   end
Ti-48           274    0   3.75536E-06   293.6   end
Ti-49           274    0   2.75590E-07   293.6   end
Ti-50           274    0   2.63873E-07   293.6   end
Cr-50           274    0   5.30517E-07   293.6   end
Cr-52           274    0   1.02189E-05   293.6   end
Cr-53           274    0   1.15860E-06   293.6   end
Cr-54           274    0   2.87821E-07   293.6   end
Mn-55           274    0   6.50246E-06   293.6   end
Fe-54           274    0   2.37952E-06   293.6   end
Fe-56           274    0   3.73198E-05   293.6   end
Fe-57           274    0   8.62321E-07   293.6   end
Fe-58           274    0   1.13891E-07   293.6   end
Cu-63           274    0   1.89710E-05   293.6   end
Cu-65           274    0   8.45562E-06   293.6   end
 U-234          274    0   4.03970E-06   293.6   end
 U-235          274    0   3.76500E-04   293.6   end
 U-236          274    0   1.61589E-06   293.6   end
 U-238          274    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            275    0   3.32434E-02   293.6   end
 B-10           275    0   6.18010E-06   293.6   end
 B-11           275    0   2.50356E-05   293.6   end
 O-16           275    0   1.78689E-02   293.6   end
Mg-24           275    0   1.05686E-04   293.6   end
Mg-25           275    0   1.33797E-05   293.6   end
Mg-26           275    0   1.47310E-05   293.6   end
Al-27           275    0   2.81406E-02   293.6   end
Si-28           275    0   1.00727E-04   293.6   end
Si-29           275    0   5.10026E-06   293.6   end
Si-30           275    0   3.38560E-06   293.6   end
Ti-46           275    0   4.20262E-07   293.6   end
Ti-47           275    0   3.79000E-07   293.6   end
Ti-48           275    0   3.75536E-06   293.6   end
Ti-49           275    0   2.75590E-07   293.6   end
Ti-50           275    0   2.63873E-07   293.6   end
Cr-50           275    0   5.30518E-07   293.6   end
Cr-52           275    0   1.02189E-05   293.6   end
Cr-53           275    0   1.15860E-06   293.6   end
Cr-54           275    0   2.87821E-07   293.6   end
```

```
Mn-55           275    0   6.47114E-06   293.6   end
Fe-54           275    0   2.36149E-06   293.6   end
Fe-56           275    0   3.70370E-05   293.6   end
Fe-57           275    0   8.55788E-07   293.6   end
Fe-58           275    0   1.13028E-07   293.6   end
Cu-63           275    0   1.88666E-05   293.6   end
Cu-65           275    0   8.40911E-06   293.6   end
 U-234          275    0   4.80687E-06   293.6   end
 U-235          275    0   4.48000E-04   293.6   end
 U-236          275    0   1.92276E-06   293.6   end
 U-238          275    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            276    0   3.32434E-02   293.6   end
 B-10           276    0   5.79830E-06   293.6   end
 B-11           276    0   2.34889E-05   293.6   end
 O-16           276    0   1.78875E-02   293.6   end
Mg-24           276    0   1.05686E-04   293.6   end
Mg-25           276    0   1.33797E-05   293.6   end
Mg-26           276    0   1.47310E-05   293.6   end
Al-27           276    0   2.81176E-02   293.6   end
Si-28           276    0   1.00676E-04   293.6   end
Si-29           276    0   5.09768E-06   293.6   end
Si-30           276    0   3.38390E-06   293.6   end
Ti-46           276    0   4.20262E-07   293.6   end
Ti-47           276    0   3.79000E-07   293.6   end
Ti-48           276    0   3.75536E-06   293.6   end
Ti-49           276    0   2.75590E-07   293.6   end
Ti-50           276    0   2.63873E-07   293.6   end
Cr-50           276    0   5.30517E-07   293.6   end
Cr-52           276    0   1.02189E-05   293.6   end
Cr-53           276    0   1.15860E-06   293.6   end
Cr-54           276    0   2.87821E-07   293.6   end
Mn-55           276    0   6.46828E-06   293.6   end
Fe-54           276    0   2.35985E-06   293.6   end
Fe-56           276    0   3.70113E-05   293.6   end
Fe-57           276    0   8.55193E-07   293.6   end
Fe-58           276    0   1.12950E-07   293.6   end
Cu-63           276    0   1.88571E-05   293.6   end
Cu-65           276    0   8.40487E-06   293.6   end
 U-234          276    0   4.87661E-06   293.6   end
 U-235          276    0   4.54500E-04   293.6   end
 U-236          276    0   1.95066E-06   293.6   end
 U-238          276    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            277    0   3.32434E-02   293.6   end
 B-10           277    0   7.99507E-06   293.6   end
 B-11           277    0   3.23880E-05   293.6   end
 O-16           277    0   1.77805E-02   293.6   end
Mg-24           277    0   1.05686E-04   293.6   end
Mg-25           277    0   1.33797E-05   293.6   end
Mg-26           277    0   1.47310E-05   293.6   end
Al-27           277    0   2.82501E-02   293.6   end
Si-28           277    0   1.00972E-04   293.6   end
Si-29           277    0   5.11262E-06   293.6   end
Si-30           277    0   3.39382E-06   293.6   end
Ti-46           277    0   4.20262E-07   293.6   end
Ti-47           277    0   3.79000E-07   293.6   end
Ti-48           277    0   3.75536E-06   293.6   end
Ti-49           277    0   2.75590E-07   293.6   end
Ti-50           277    0   2.63873E-07   293.6   end
Cr-50           277    0   5.30517E-07   293.6   end
Cr-52           277    0   1.02189E-05   293.6   end
Cr-53           277    0   1.15860E-06   293.6   end
Cr-54           277    0   2.87821E-07   293.6   end
Mn-55           277    0   6.48467E-06   293.6   end
Fe-54           277    0   2.36928E-06   293.6   end
Fe-56           277    0   3.71592E-05   293.6   end
Fe-57           277    0   8.58611E-07   293.6   end
Fe-58           277    0   1.13401E-07   293.6   end
Cu-63           277    0   1.89118E-05   293.6   end
Cu-65           277    0   8.42923E-06   293.6   end
 U-234          277    0   4.47532E-06   293.6   end
 U-235          277    0   4.17100E-04   293.6   end
 U-236          277    0   1.79014E-06   293.6   end
 U-238          277    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            278    0   3.32434E-02   293.6   end
 B-10           278    0   1.06559E-05   293.6   end
```

```
 B-11           278    0   4.31670E-05   293.6   end
 O-16           278    0   1.76509E-02   293.6   end
Mg-24           278    0   1.05686E-04   293.6   end
Mg-25           278    0   1.33797E-05   293.6   end
Mg-26           278    0   1.47310E-05   293.6   end
Al-27           278    0   2.84107E-02   293.6   end
Si-28           278    0   1.01330E-04   293.6   end
Si-29           278    0   5.13079E-06   293.6   end
Si-30           278    0   3.40588E-06   293.6   end
Ti-46           278    0   4.20262E-07   293.6   end
Ti-47           278    0   3.79000E-07   293.6   end
Ti-48           278    0   3.75536E-06   293.6   end
Ti-49           278    0   2.75590E-07   293.6   end
Ti-50           278    0   2.63873E-07   293.6   end
Cr-50           278    0   5.30517E-07   293.6   end
Cr-52           278    0   1.02189E-05   293.6   end
Cr-53           278    0   1.15860E-06   293.6   end
Cr-54           278    0   2.87821E-07   293.6   end
Mn-55           278    0   6.50452E-06   293.6   end
Fe-54           278    0   2.38070E-06   293.6   end
Fe-56           278    0   3.73384E-05   293.6   end
Fe-57           278    0   8.62751E-07   293.6   end
Fe-58           278    0   1.13948E-07   293.6   end
Cu-63           278    0   1.89779E-05   293.6   end
Cu-65           278    0   8.45870E-06   293.6   end
 U-234          278    0   3.98927E-06   293.6   end
 U-235          278    0   3.71800E-04   293.6   end
 U-236          278    0   1.59572E-06   293.6   end
 U-238          278    0   2.15420E-05   293.6   end
'
'          Inner fuel element--fueled Axial region 8
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            281    0   3.32434E-02   293.6   end
 B-10           281    0   2.04121E-05   293.6   end
 B-11           281    0   8.26896E-05   293.6   end
 O-16           281    0   1.71757E-02   293.6   end
Mg-24           281    0   1.05686E-04   293.6   end
Mg-25           281    0   1.33797E-05   293.6   end
Mg-26           281    0   1.47310E-05   293.6   end
Al-27           281    0   2.89993E-02   293.6   end
Si-28           281    0   1.02644E-04   293.6   end
Si-29           281    0   5.19729E-06   293.6   end
Si-30           281    0   3.45002E-06   293.6   end
Ti-46           281    0   4.20262E-07   293.6   end
Ti-47           281    0   3.79000E-07   293.6   end
Ti-48           281    0   3.75536E-06   293.6   end
Ti-49           281    0   2.75590E-07   293.6   end
Ti-50           281    0   2.63873E-07   293.6   end
Cr-50           281    0   5.30517E-07   293.6   end
Cr-52           281    0   1.02189E-05   293.6   end
Cr-53           281    0   1.15860E-06   293.6   end
Cr-54           281    0   2.87821E-07   293.6   end
Mn-55           281    0   6.57731E-06   293.6   end
Fe-54           281    0   2.42259E-06   293.6   end
Fe-56           281    0   3.79953E-05   293.6   end
Fe-57           281    0   8.77930E-07   293.6   end
Fe-58           281    0   1.15953E-07   293.6   end
Cu-63           281    0   1.92203E-05   293.6   end
Cu-65           281    0   8.56676E-06   293.6   end
 U-234          281    0   2.20708E-06   293.6   end
 U-235          281    0   2.05700E-04   293.6   end
 U-236          281    0   8.82838E-07   293.6   end
 U-238          281    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            282    0   3.32434E-02   293.6   end
 B-10           282    0   1.77513E-05   293.6   end
 B-11           282    0   7.19107E-05   293.6   end
 O-16           282    0   1.73053E-02   293.6   end
Mg-24           282    0   1.05686E-04   293.6   end
Mg-25           282    0   1.33797E-05   293.6   end
Mg-26           282    0   1.47310E-05   293.6   end
Al-27           282    0   2.88388E-02   293.6   end
Si-28           282    0   1.02285E-04   293.6   end
Si-29           282    0   5.17912E-06   293.6   end
Si-30           282    0   3.43796E-06   293.6   end
Ti-46           282    0   4.20262E-07   293.6   end
Ti-47           282    0   3.79000E-07   293.6   end
Ti-48           282    0   3.75536E-06   293.6   end
Ti-49           282    0   2.75590E-07   293.6   end
```

```
Ti-50           282    0   2.63873E-07   293.6   end
Cr-50           282    0   5.30517E-07   293.6   end
Cr-52           282    0   1.02189E-05   293.6   end
Cr-53           282    0   1.15860E-06   293.6   end
Cr-54           282    0   2.87821E-07   293.6   end
Mn-55           282    0   6.55746E-06   293.6   end
Fe-54           282    0   2.41117E-06   293.6   end
Fe-56           282    0   3.78162E-05   293.6   end
Fe-57           282    0   8.73792E-07   293.6   end
Fe-58           282    0   1.15406E-07   293.6   end
Cu-63           282    0   1.91542E-05   293.6   end
Cu-65           282    0   8.53729E-06   293.6   end
 U-234          282    0   2.69313E-06   293.6   end
 U-235          282    0   2.51000E-04   293.6   end
 U-236          282    0   1.07726E-06   293.6   end
 U-238          282    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            283    0   3.32435E-02   293.6   end
 B-10           283    0   1.46911E-05   293.6   end
 B-11           283    0   5.95139E-05   293.6   end
 O-16           283    0   1.74543E-02   293.6   end
Mg-24           283    0   1.05686E-04   293.6   end
Mg-25           283    0   1.33797E-05   293.6   end
Mg-26           283    0   1.47310E-05   293.6   end
Al-27           283    0   2.86541E-02   293.6   end
Si-28           283    0   1.01874E-04   293.6   end
Si-29           283    0   5.15831E-06   293.6   end
Si-30           283    0   3.42415E-06   293.6   end
Ti-46           283    0   4.20263E-07   293.6   end
Ti-47           283    0   3.79001E-07   293.6   end
Ti-48           283    0   3.75537E-06   293.6   end
Ti-49           283    0   2.75590E-07   293.6   end
Ti-50           283    0   2.63873E-07   293.6   end
Cr-50           283    0   5.30518E-07   293.6   end
Cr-52           283    0   1.02189E-05   293.6   end
Cr-53           283    0   1.15860E-06   293.6   end
Cr-54           283    0   2.87821E-07   293.6   end
Mn-55           283    0   6.53464E-06   293.6   end
Fe-54           283    0   2.39803E-06   293.6   end
Fe-56           283    0   3.76103E-05   293.6   end
Fe-57           283    0   8.69031E-07   293.6   end
Fe-58           283    0   1.14778E-07   293.6   end
Cu-63           283    0   1.90782E-05   293.6   end
Cu-65           283    0   8.50342E-06   293.6   end
 U-234          283    0   3.25215E-06   293.6   end
 U-235          283    0   3.03100E-04   293.6   end
 U-236          283    0   1.30087E-06   293.6   end
 U-238          283    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            284    0   3.32434E-02   293.6   end
 B-10           284    0   1.03798E-05   293.6   end
 B-11           284    0   4.20486E-05   293.6   end
 O-16           284    0   1.76644E-02   293.6   end
Mg-24           284    0   1.05686E-04   293.6   end
Mg-25           284    0   1.33797E-05   293.6   end
Mg-26           284    0   1.47310E-05   293.6   end
Al-27           284    0   2.83940E-02   293.6   end
Si-28           284    0   1.01293E-04   293.6   end
Si-29           284    0   5.12887E-06   293.6   end
Si-30           284    0   3.40461E-06   293.6   end
Ti-46           284    0   4.20262E-07   293.6   end
Ti-47           284    0   3.79000E-07   293.6   end
Ti-48           284    0   3.75536E-06   293.6   end
Ti-49           284    0   2.75590E-07   293.6   end
Ti-50           284    0   2.63873E-07   293.6   end
Cr-50           284    0   5.30517E-07   293.6   end
Cr-52           284    0   1.02189E-05   293.6   end
Cr-53           284    0   1.15860E-06   293.6   end
Cr-54           284    0   2.87821E-07   293.6   end
Mn-55           284    0   6.50246E-06   293.6   end
Fe-54           284    0   2.37952E-06   293.6   end
Fe-56           284    0   3.73198E-05   293.6   end
Fe-57           284    0   8.62321E-07   293.6   end
Fe-58           284    0   1.13891E-07   293.6   end
Cu-63           284    0   1.89710E-05   293.6   end
Cu-65           284    0   8.45562E-06   293.6   end
 U-234          284    0   4.03970E-06   293.6   end
 U-235          284    0   3.76500E-04   293.6   end
 U-236          284    0   1.61589E-06   293.6   end
```

```
 U-238          284    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            285    0   3.32434E-02   293.6   end
 B-10           285    0   6.18010E-06   293.6   end
 B-11           285    0   2.50356E-05   293.6   end
 O-16           285    0   1.78689E-02   293.6   end
Mg-24           285    0   1.05686E-04   293.6   end
Mg-25           285    0   1.33797E-05   293.6   end
Mg-26           285    0   1.47310E-05   293.6   end
Al-27           285    0   2.81406E-02   293.6   end
Si-28           285    0   1.00727E-04   293.6   end
Si-29           285    0   5.10026E-06   293.6   end
Si-30           285    0   3.38560E-06   293.6   end
Ti-46           285    0   4.20262E-07   293.6   end
Ti-47           285    0   3.79000E-07   293.6   end
Ti-48           285    0   3.75536E-06   293.6   end
Ti-49           285    0   2.75590E-07   293.6   end
Ti-50           285    0   2.63873E-07   293.6   end
Cr-50           285    0   5.30518E-07   293.6   end
Cr-52           285    0   1.02189E-05   293.6   end
Cr-53           285    0   1.15860E-06   293.6   end
Cr-54           285    0   2.87821E-07   293.6   end
Mn-55           285    0   6.47114E-06   293.6   end
Fe-54           285    0   2.36149E-06   293.6   end
Fe-56           285    0   3.70370E-05   293.6   end
Fe-57           285    0   8.55788E-07   293.6   end
Fe-58           285    0   1.13028E-07   293.6   end
Cu-63           285    0   1.88666E-05   293.6   end
Cu-65           285    0   8.40911E-06   293.6   end
 U-234          285    0   4.80687E-06   293.6   end
 U-235          285    0   4.48000E-04   293.6   end
 U-236          285    0   1.92276E-06   293.6   end
 U-238          285    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            286    0   3.32434E-02   293.6   end
 B-10           286    0   5.79830E-06   293.6   end
 B-11           286    0   2.34889E-05   293.6   end
 O-16           286    0   1.78875E-02   293.6   end
Mg-24           286    0   1.05686E-04   293.6   end
Mg-25           286    0   1.33797E-05   293.6   end
Mg-26           286    0   1.47310E-05   293.6   end
Al-27           286    0   2.81176E-02   293.6   end
Si-28           286    0   1.00676E-04   293.6   end
Si-29           286    0   5.09768E-06   293.6   end
Si-30           286    0   3.38390E-06   293.6   end
Ti-46           286    0   4.20262E-07   293.6   end
Ti-47           286    0   3.79000E-07   293.6   end
Ti-48           286    0   3.75536E-06   293.6   end
Ti-49           286    0   2.75590E-07   293.6   end
Ti-50           286    0   2.63873E-07   293.6   end
Cr-50           286    0   5.30517E-07   293.6   end
Cr-52           286    0   1.02189E-05   293.6   end
Cr-53           286    0   1.15860E-06   293.6   end
Cr-54           286    0   2.87821E-07   293.6   end
Mn-55           286    0   6.46828E-06   293.6   end
Fe-54           286    0   2.35985E-06   293.6   end
Fe-56           286    0   3.70113E-05   293.6   end
Fe-57           286    0   8.55193E-07   293.6   end
Fe-58           286    0   1.12950E-07   293.6   end
Cu-63           286    0   1.88571E-05   293.6   end
Cu-65           286    0   8.40487E-06   293.6   end
 U-234          286    0   4.87661E-06   293.6   end
 U-235          286    0   4.54500E-04   293.6   end
 U-236          286    0   1.95066E-06   293.6   end
 U-238          286    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            287    0   3.32434E-02   293.6   end
 B-10           287    0   7.99507E-06   293.6   end
 B-11           287    0   3.23880E-05   293.6   end
 O-16           287    0   1.77805E-02   293.6   end
Mg-24           287    0   1.05686E-04   293.6   end
Mg-25           287    0   1.33797E-05   293.6   end
Mg-26           287    0   1.47310E-05   293.6   end
Al-27           287    0   2.82501E-02   293.6   end
Si-28           287    0   1.00972E-04   293.6   end
Si-29           287    0   5.11262E-06   293.6   end
Si-30           287    0   3.39382E-06   293.6   end
Ti-46           287    0   4.20262E-07   293.6   end
```

```
Ti-47           287    0   3.79000E-07   293.6   end
Ti-48           287    0   3.75536E-06   293.6   end
Ti-49           287    0   2.75590E-07   293.6   end
Ti-50           287    0   2.63873E-07   293.6   end
Cr-50           287    0   5.30517E-07   293.6   end
Cr-52           287    0   1.02189E-05   293.6   end
Cr-53           287    0   1.15860E-06   293.6   end
Cr-54           287    0   2.87821E-07   293.6   end
Mn-55           287    0   6.48467E-06   293.6   end
Fe-54           287    0   2.36928E-06   293.6   end
Fe-56           287    0   3.71592E-05   293.6   end
Fe-57           287    0   8.58611E-07   293.6   end
Fe-58           287    0   1.13401E-07   293.6   end
Cu-63           287    0   1.89118E-05   293.6   end
Cu-65           287    0   8.42923E-06   293.6   end
 U-234          287    0   4.47532E-06   293.6   end
 U-235          287    0   4.17100E-04   293.6   end
 U-236          287    0   1.79014E-06   293.6   end
 U-238          287    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            288    0   3.32434E-02   293.6   end
 B-10           288    0   1.06559E-05   293.6   end
 B-11           288    0   4.31670E-05   293.6   end
 O-16           288    0   1.76509E-02   293.6   end
Mg-24           288    0   1.05686E-04   293.6   end
Mg-25           288    0   1.33797E-05   293.6   end
Mg-26           288    0   1.47310E-05   293.6   end
Al-27           288    0   2.84107E-02   293.6   end
Si-28           288    0   1.01330E-04   293.6   end
Si-29           288    0   5.13079E-06   293.6   end
Si-30           288    0   3.40588E-06   293.6   end
Ti-46           288    0   4.20262E-07   293.6   end
Ti-47           288    0   3.79000E-07   293.6   end
Ti-48           288    0   3.75536E-06   293.6   end
Ti-49           288    0   2.75590E-07   293.6   end
Ti-50           288    0   2.63873E-07   293.6   end
Cr-50           288    0   5.30517E-07   293.6   end
Cr-52           288    0   1.02189E-05   293.6   end
Cr-53           288    0   1.15860E-06   293.6   end
Cr-54           288    0   2.87821E-07   293.6   end
Mn-55           288    0   6.50452E-06   293.6   end
Fe-54           288    0   2.38070E-06   293.6   end
Fe-56           288    0   3.73384E-05   293.6   end
Fe-57           288    0   8.62751E-07   293.6   end
Fe-58           288    0   1.13948E-07   293.6   end
Cu-63           288    0   1.89779E-05   293.6   end
Cu-65           288    0   8.45870E-06   293.6   end
 U-234          288    0   3.98927E-06   293.6   end
 U-235          288    0   3.71800E-04   293.6   end
 U-236          288    0   1.59572E-06   293.6   end
 U-238          288    0   2.15420E-05   293.6   end
'
'         Inner fuel element--fueled Axial region 9
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            291    0   3.32434E-02   293.6   end
 B-10           291    0   2.04121E-05   293.6   end
 B-11           291    0   8.26896E-05   293.6   end
 O-16           291    0   1.71757E-02   293.6   end
Mg-24           291    0   1.05686E-04   293.6   end
Mg-25           291    0   1.33797E-05   293.6   end
Mg-26           291    0   1.47310E-05   293.6   end
Al-27           291    0   2.89993E-02   293.6   end
Si-28           291    0   1.02644E-04   293.6   end
Si-29           291    0   5.19729E-06   293.6   end
Si-30           291    0   3.45002E-06   293.6   end
Ti-46           291    0   4.20262E-07   293.6   end
Ti-47           291    0   3.79000E-07   293.6   end
Ti-48           291    0   3.75536E-06   293.6   end
Ti-49           291    0   2.75590E-07   293.6   end
Ti-50           291    0   2.63873E-07   293.6   end
Cr-50           291    0   5.30517E-07   293.6   end
Cr-52           291    0   1.02189E-05   293.6   end
Cr-53           291    0   1.15860E-06   293.6   end
Cr-54           291    0   2.87821E-07   293.6   end
Mn-55           291    0   6.57731E-06   293.6   end
Fe-54           291    0   2.42259E-06   293.6   end
Fe-56           291    0   3.79953E-05   293.6   end
Fe-57           291    0   8.77930E-07   293.6   end
Fe-58           291    0   1.15953E-07   293.6   end
```

```
Cu-63           291    0   1.92203E-05   293.6   end
Cu-65           291    0   8.56676E-06   293.6   end
 U-234          291    0   2.20708E-06   293.6   end
 U-235          291    0   2.05700E-04   293.6   end
 U-236          291    0   8.82838E-07   293.6   end
 U-238          291    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            292    0   3.32434E-02   293.6   end
 B-10           292    0   1.77513E-05   293.6   end
 B-11           292    0   7.19107E-05   293.6   end
 O-16           292    0   1.73053E-02   293.6   end
Mg-24           292    0   1.05686E-04   293.6   end
Mg-25           292    0   1.33797E-05   293.6   end
Mg-26           292    0   1.47310E-05   293.6   end
Al-27           292    0   2.88388E-02   293.6   end
Si-28           292    0   1.02285E-04   293.6   end
Si-29           292    0   5.17912E-06   293.6   end
Si-30           292    0   3.43796E-06   293.6   end
Ti-46           292    0   4.20262E-07   293.6   end
Ti-47           292    0   3.79000E-07   293.6   end
Ti-48           292    0   3.75536E-06   293.6   end
Ti-49           292    0   2.75590E-07   293.6   end
Ti-50           292    0   2.63873E-07   293.6   end
Cr-50           292    0   5.30517E-07   293.6   end
Cr-52           292    0   1.02189E-05   293.6   end
Cr-53           292    0   1.15860E-06   293.6   end
Cr-54           292    0   2.87821E-07   293.6   end
Mn-55           292    0   6.55746E-06   293.6   end
Fe-54           292    0   2.41117E-06   293.6   end
Fe-56           292    0   3.78162E-05   293.6   end
Fe-57           292    0   8.73792E-07   293.6   end
Fe-58           292    0   1.15406E-07   293.6   end
Cu-63           292    0   1.91542E-05   293.6   end
Cu-65           292    0   8.53729E-06   293.6   end
 U-234          292    0   2.69313E-06   293.6   end
 U-235          292    0   2.51000E-04   293.6   end
 U-236          292    0   1.07726E-06   293.6   end
 U-238          292    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            293    0   3.32435E-02   293.6   end
 B-10           293    0   1.46911E-05   293.6   end
 B-11           293    0   5.95139E-05   293.6   end
 O-16           293    0   1.74543E-02   293.6   end
Mg-24           293    0   1.05686E-04   293.6   end
Mg-25           293    0   1.33797E-05   293.6   end
Mg-26           293    0   1.47310E-05   293.6   end
Al-27           293    0   2.86541E-02   293.6   end
Si-28           293    0   1.01874E-04   293.6   end
Si-29           293    0   5.15831E-06   293.6   end
Si-30           293    0   3.42415E-06   293.6   end
Ti-46           293    0   4.20263E-07   293.6   end
Ti-47           293    0   3.79001E-07   293.6   end
Ti-48           293    0   3.75537E-06   293.6   end
Ti-49           293    0   2.75590E-07   293.6   end
Ti-50           293    0   2.63873E-07   293.6   end
Cr-50           293    0   5.30518E-07   293.6   end
Cr-52           293    0   1.02189E-05   293.6   end
Cr-53           293    0   1.15860E-06   293.6   end
Cr-54           293    0   2.87821E-07   293.6   end
Mn-55           293    0   6.53464E-06   293.6   end
Fe-54           293    0   2.39803E-06   293.6   end
Fe-56           293    0   3.76103E-05   293.6   end
Fe-57           293    0   8.69031E-07   293.6   end
Fe-58           293    0   1.14778E-07   293.6   end
Cu-63           293    0   1.90782E-05   293.6   end
Cu-65           293    0   8.50342E-06   293.6   end
 U-234          293    0   3.25215E-06   293.6   end
 U-235          293    0   3.03100E-04   293.6   end
 U-236          293    0   1.30087E-06   293.6   end
 U-238          293    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            294    0   3.32434E-02   293.6   end
 B-10           294    0   1.03798E-05   293.6   end
 B-11           294    0   4.20486E-05   293.6   end
 O-16           294    0   1.76644E-02   293.6   end
Mg-24           294    0   1.05686E-04   293.6   end
Mg-25           294    0   1.33797E-05   293.6   end
Mg-26           294    0   1.47310E-05   293.6   end
```

```
Al-27           294    0   2.83940E-02   293.6   end
Si-28           294    0   1.01293E-04   293.6   end
Si-29           294    0   5.12887E-06   293.6   end
Si-30           294    0   3.40461E-06   293.6   end
Ti-46           294    0   4.20262E-07   293.6   end
Ti-47           294    0   3.79000E-07   293.6   end
Ti-48           294    0   3.75536E-06   293.6   end
Ti-49           294    0   2.75590E-07   293.6   end
Ti-50           294    0   2.63873E-07   293.6   end
Cr-50           294    0   5.30517E-07   293.6   end
Cr-52           294    0   1.02189E-05   293.6   end
Cr-53           294    0   1.15860E-06   293.6   end
Cr-54           294    0   2.87821E-07   293.6   end
Mn-55           294    0   6.50246E-06   293.6   end
Fe-54           294    0   2.37952E-06   293.6   end
Fe-56           294    0   3.73198E-05   293.6   end
Fe-57           294    0   8.62321E-07   293.6   end
Fe-58           294    0   1.13891E-07   293.6   end
Cu-63           294    0   1.89710E-05   293.6   end
Cu-65           294    0   8.45562E-06   293.6   end
 U-234          294    0   4.03970E-06   293.6   end
 U-235          294    0   3.76500E-04   293.6   end
 U-236          294    0   1.61589E-06   293.6   end
 U-238          294    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            295    0   3.32434E-02   293.6   end
 B-10           295    0   6.18010E-06   293.6   end
 B-11           295    0   2.50356E-05   293.6   end
 O-16           295    0   1.78689E-02   293.6   end
Mg-24           295    0   1.05686E-04   293.6   end
Mg-25           295    0   1.33797E-05   293.6   end
Mg-26           295    0   1.47310E-05   293.6   end
Al-27           295    0   2.81406E-02   293.6   end
Si-28           295    0   1.00727E-04   293.6   end
Si-29           295    0   5.10026E-06   293.6   end
Si-30           295    0   3.38560E-06   293.6   end
Ti-46           295    0   4.20262E-07   293.6   end
Ti-47           295    0   3.79000E-07   293.6   end
Ti-48           295    0   3.75536E-06   293.6   end
Ti-49           295    0   2.75590E-07   293.6   end
Ti-50           295    0   2.63873E-07   293.6   end
Cr-50           295    0   5.30518E-07   293.6   end
Cr-52           295    0   1.02189E-05   293.6   end
Cr-53           295    0   1.15860E-06   293.6   end
Cr-54           295    0   2.87821E-07   293.6   end
Mn-55           295    0   6.47114E-06   293.6   end
Fe-54           295    0   2.36149E-06   293.6   end
Fe-56           295    0   3.70370E-05   293.6   end
Fe-57           295    0   8.55788E-07   293.6   end
Fe-58           295    0   1.13028E-07   293.6   end
Cu-63           295    0   1.88666E-05   293.6   end
Cu-65           295    0   8.40911E-06   293.6   end
 U-234          295    0   4.80687E-06   293.6   end
 U-235          295    0   4.48000E-04   293.6   end
 U-236          295    0   1.92276E-06   293.6   end
 U-238          295    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
'  8.009980E-02
 H-1            296    0   3.32434E-02   293.6   end
 B-10           296    0   5.79830E-06   293.6   end
 B-11           296    0   2.34889E-05   293.6   end
 O-16           296    0   1.78875E-02   293.6   end
Mg-24           296    0   1.05686E-04   293.6   end
Mg-25           296    0   1.33797E-05   293.6   end
Mg-26           296    0   1.47310E-05   293.6   end
Al-27           296    0   2.81176E-02   293.6   end
Si-28           296    0   1.00676E-04   293.6   end
Si-29           296    0   5.09768E-06   293.6   end
Si-30           296    0   3.38390E-06   293.6   end
Ti-46           296    0   4.20262E-07   293.6   end
Ti-47           296    0   3.79000E-07   293.6   end
Ti-48           296    0   3.75536E-06   293.6   end
Ti-49           296    0   2.75590E-07   293.6   end
Ti-50           296    0   2.63873E-07   293.6   end
Cr-50           296    0   5.30517E-07   293.6   end
Cr-52           296    0   1.02189E-05   293.6   end
Cr-53           296    0   1.15860E-06   293.6   end
Cr-54           296    0   2.87821E-07   293.6   end
Mn-55           296    0   6.46828E-06   293.6   end
Fe-54           296    0   2.35985E-06   293.6   end
```

```
Fe-56           296    0   3.70113E-05   293.6   end
Fe-57           296    0   8.55193E-07   293.6   end
Fe-58           296    0   1.12950E-07   293.6   end
Cu-63           296    0   1.88571E-05   293.6   end
Cu-65           296    0   8.40487E-06   293.6   end
 U-234          296    0   4.87661E-06   293.6   end
 U-235          296    0   4.54500E-04   293.6   end
 U-236          296    0   1.95066E-06   293.6   end
 U-238          296    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            297    0   3.32434E-02   293.6   end
 B-10           297    0   7.99507E-06   293.6   end
 B-11           297    0   3.23880E-05   293.6   end
 O-16           297    0   1.77805E-02   293.6   end
Mg-24           297    0   1.05686E-04   293.6   end
Mg-25           297    0   1.33797E-05   293.6   end
Mg-26           297    0   1.47310E-05   293.6   end
Al-27           297    0   2.82501E-02   293.6   end
Si-28           297    0   1.00972E-04   293.6   end
Si-29           297    0   5.11262E-06   293.6   end
Si-30           297    0   3.39382E-06   293.6   end
Ti-46           297    0   4.20262E-07   293.6   end
Ti-47           297    0   3.79000E-07   293.6   end
Ti-48           297    0   3.75536E-06   293.6   end
Ti-49           297    0   2.75590E-07   293.6   end
Ti-50           297    0   2.63873E-07   293.6   end
Cr-50           297    0   5.30517E-07   293.6   end
Cr-52           297    0   1.02189E-05   293.6   end
Cr-53           297    0   1.15860E-06   293.6   end
Cr-54           297    0   2.87821E-07   293.6   end
Mn-55           297    0   6.48467E-06   293.6   end
Fe-54           297    0   2.36928E-06   293.6   end
Fe-56           297    0   3.71592E-05   293.6   end
Fe-57           297    0   8.58611E-07   293.6   end
Fe-58           297    0   1.13401E-07   293.6   end
Cu-63           297    0   1.89118E-05   293.6   end
Cu-65           297    0   8.42923E-06   293.6   end
 U-234          297    0   4.47532E-06   293.6   end
 U-235          297    0   4.17100E-04   293.6   end
 U-236          297    0   1.79014E-06   293.6   end
 U-238          297    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            298    0   3.32434E-02   293.6   end
 B-10           298    0   1.06559E-05   293.6   end
 B-11           298    0   4.31670E-05   293.6   end
 O-16           298    0   1.76509E-02   293.6   end
Mg-24           298    0   1.05686E-04   293.6   end
Mg-25           298    0   1.33797E-05   293.6   end
Mg-26           298    0   1.47310E-05   293.6   end
Al-27           298    0   2.84107E-02   293.6   end
Si-28           298    0   1.01330E-04   293.6   end
Si-29           298    0   5.13079E-06   293.6   end
Si-30           298    0   3.40588E-06   293.6   end
Ti-46           298    0   4.20262E-07   293.6   end
Ti-47           298    0   3.79000E-07   293.6   end
Ti-48           298    0   3.75536E-06   293.6   end
Ti-49           298    0   2.75590E-07   293.6   end
Ti-50           298    0   2.63873E-07   293.6   end
Cr-50           298    0   5.30517E-07   293.6   end
Cr-52           298    0   1.02189E-05   293.6   end
Cr-53           298    0   1.15860E-06   293.6   end
Cr-54           298    0   2.87821E-07   293.6   end
Mn-55           298    0   6.50452E-06   293.6   end
Fe-54           298    0   2.38070E-06   293.6   end
Fe-56           298    0   3.73384E-05   293.6   end
Fe-57           298    0   8.62751E-07   293.6   end
Fe-58           298    0   1.13948E-07   293.6   end
Cu-63           298    0   1.89779E-05   293.6   end
Cu-65           298    0   8.45870E-06   293.6   end
 U-234          298    0   3.98927E-06   293.6   end
 U-235          298    0   3.71800E-04   293.6   end
 U-236          298    0   1.59572E-06   293.6   end
 U-238          298    0   2.15420E-05   293.6   end
'
'         Inner fuel element--fueled  central Axial region
'       total atom density =  8.00804E-02 a/b-cm
'  8.008040E-02
 H-1            201    0   3.32434E-02   293.6   end
 B-10           201    0   2.04121E-05   293.6   end
```

```
 B-11           201    0   8.26896E-05   293.6   end
 O-16           201    0   1.71757E-02   293.6   end
Mg-24           201    0   1.05686E-04   293.6   end
Mg-25           201    0   1.33797E-05   293.6   end
Mg-26           201    0   1.47310E-05   293.6   end
Al-27           201    0   2.89993E-02   293.6   end
Si-28           201    0   1.02644E-04   293.6   end
Si-29           201    0   5.19729E-06   293.6   end
Si-30           201    0   3.45002E-06   293.6   end
Ti-46           201    0   4.20262E-07   293.6   end
Ti-47           201    0   3.79000E-07   293.6   end
Ti-48           201    0   3.75536E-06   293.6   end
Ti-49           201    0   2.75590E-07   293.6   end
Ti-50           201    0   2.63873E-07   293.6   end
Cr-50           201    0   5.30517E-07   293.6   end
Cr-52           201    0   1.02189E-05   293.6   end
Cr-53           201    0   1.15860E-06   293.6   end
Cr-54           201    0   2.87821E-07   293.6   end
Mn-55           201    0   6.57731E-06   293.6   end
Fe-54           201    0   2.42259E-06   293.6   end
Fe-56           201    0   3.79953E-05   293.6   end
Fe-57           201    0   8.77930E-07   293.6   end
Fe-58           201    0   1.15953E-07   293.6   end
Cu-63           201    0   1.92203E-05   293.6   end
Cu-65           201    0   8.56676E-06   293.6   end
 U-234          201    0   2.20708E-06   293.6   end
 U-235          201    0   2.05700E-04   293.6   end
 U-236          201    0   8.82838E-07   293.6   end
 U-238          201    0   1.19182E-05   293.6   end
'       total atom density =  8.00839E-02 a/b-cm
'  8.008390E-02
 H-1            202    0   3.32434E-02   293.6   end
 B-10           202    0   1.77513E-05   293.6   end
 B-11           202    0   7.19107E-05   293.6   end
 O-16           202    0   1.73053E-02   293.6   end
Mg-24           202    0   1.05686E-04   293.6   end
Mg-25           202    0   1.33797E-05   293.6   end
Mg-26           202    0   1.47310E-05   293.6   end
Al-27           202    0   2.88388E-02   293.6   end
Si-28           202    0   1.02285E-04   293.6   end
Si-29           202    0   5.17912E-06   293.6   end
Si-30           202    0   3.43796E-06   293.6   end
Ti-46           202    0   4.20262E-07   293.6   end
Ti-47           202    0   3.79000E-07   293.6   end
Ti-48           202    0   3.75536E-06   293.6   end
Ti-49           202    0   2.75590E-07   293.6   end
Ti-50           202    0   2.63873E-07   293.6   end
Cr-50           202    0   5.30517E-07   293.6   end
Cr-52           202    0   1.02189E-05   293.6   end
Cr-53           202    0   1.15860E-06   293.6   end
Cr-54           202    0   2.87821E-07   293.6   end
Mn-55           202    0   6.55746E-06   293.6   end
Fe-54           202    0   2.41117E-06   293.6   end
Fe-56           202    0   3.78162E-05   293.6   end
Fe-57           202    0   8.73792E-07   293.6   end
Fe-58           202    0   1.15406E-07   293.6   end
Cu-63           202    0   1.91542E-05   293.6   end
Cu-65           202    0   8.53729E-06   293.6   end
 U-234          202    0   2.69313E-06   293.6   end
 U-235          202    0   2.51000E-04   293.6   end
 U-236          202    0   1.07726E-06   293.6   end
 U-238          202    0   1.45429E-05   293.6   end
'       total atom density =  8.00880E-02 a/b-cm
'  8.008800E-02
 H-1            203    0   3.32435E-02   293.6   end
 B-10           203    0   1.46911E-05   293.6   end
 B-11           203    0   5.95139E-05   293.6   end
 O-16           203    0   1.74543E-02   293.6   end
Mg-24           203    0   1.05686E-04   293.6   end
Mg-25           203    0   1.33797E-05   293.6   end
Mg-26           203    0   1.47310E-05   293.6   end
Al-27           203    0   2.86541E-02   293.6   end
Si-28           203    0   1.01874E-04   293.6   end
Si-29           203    0   5.15831E-06   293.6   end
Si-30           203    0   3.42415E-06   293.6   end
Ti-46           203    0   4.20263E-07   293.6   end
Ti-47           203    0   3.79001E-07   293.6   end
Ti-48           203    0   3.75537E-06   293.6   end
Ti-49           203    0   2.75590E-07   293.6   end
Ti-50           203    0   2.63873E-07   293.6   end
Cr-50           203    0   5.30518E-07   293.6   end
```

```
Cr-52           203    0   1.02189E-05   293.6   end
Cr-53           203    0   1.15860E-06   293.6   end
Cr-54           203    0   2.87821E-07   293.6   end
Mn-55           203    0   6.53464E-06   293.6   end
Fe-54           203    0   2.39803E-06   293.6   end
Fe-56           203    0   3.76103E-05   293.6   end
Fe-57           203    0   8.69031E-07   293.6   end
Fe-58           203    0   1.14778E-07   293.6   end
Cu-63           203    0   1.90782E-05   293.6   end
Cu-65           203    0   8.50342E-06   293.6   end
 U-234          203    0   3.25215E-06   293.6   end
 U-235          203    0   3.03100E-04   293.6   end
 U-236          203    0   1.30087E-06   293.6   end
 U-238          203    0   1.75616E-05   293.6   end
'       total atom density =  8.00937E-02 a/b-cm
'  8.009370E-02
 H-1            204    0   3.32434E-02   293.6   end
 B-10           204    0   1.03798E-05   293.6   end
 B-11           204    0   4.20486E-05   293.6   end
 O-16           204    0   1.76644E-02   293.6   end
Mg-24           204    0   1.05686E-04   293.6   end
Mg-25           204    0   1.33797E-05   293.6   end
Mg-26           204    0   1.47310E-05   293.6   end
Al-27           204    0   2.83940E-02   293.6   end
Si-28           204    0   1.01293E-04   293.6   end
Si-29           204    0   5.12887E-06   293.6   end
Si-30           204    0   3.40461E-06   293.6   end
Ti-46           204    0   4.20262E-07   293.6   end
Ti-47           204    0   3.79000E-07   293.6   end
Ti-48           204    0   3.75536E-06   293.6   end
Ti-49           204    0   2.75590E-07   293.6   end
Ti-50           204    0   2.63873E-07   293.6   end
Cr-50           204    0   5.30517E-07   293.6   end
Cr-52           204    0   1.02189E-05   293.6   end
Cr-53           204    0   1.15860E-06   293.6   end
Cr-54           204    0   2.87821E-07   293.6   end
Mn-55           204    0   6.50246E-06   293.6   end
Fe-54           204    0   2.37952E-06   293.6   end
Fe-56           204    0   3.73198E-05   293.6   end
Fe-57           204    0   8.62321E-07   293.6   end
Fe-58           204    0   1.13891E-07   293.6   end
Cu-63           204    0   1.89710E-05   293.6   end
Cu-65           204    0   8.45562E-06   293.6   end
 U-234          204    0   4.03970E-06   293.6   end
 U-235          204    0   3.76500E-04   293.6   end
 U-236          204    0   1.61589E-06   293.6   end
 U-238          204    0   2.18144E-05   293.6   end
'       total atom density =  8.00993E-02 a/b-cm
'  8.009930E-02
 H-1            205    0   3.32434E-02   293.6   end
 B-10           205    0   6.18010E-06   293.6   end
 B-11           205    0   2.50356E-05   293.6   end
 O-16           205    0   1.78689E-02   293.6   end
Mg-24           205    0   1.05686E-04   293.6   end
Mg-25           205    0   1.33797E-05   293.6   end
Mg-26           205    0   1.47310E-05   293.6   end
Al-27           205    0   2.81406E-02   293.6   end
Si-28           205    0   1.00727E-04   293.6   end
Si-29           205    0   5.10026E-06   293.6   end
Si-30           205    0   3.38560E-06   293.6   end
Ti-46           205    0   4.20262E-07   293.6   end
Ti-47           205    0   3.79000E-07   293.6   end
Ti-48           205    0   3.75536E-06   293.6   end
Ti-49           205    0   2.75590E-07   293.6   end
Ti-50           205    0   2.63873E-07   293.6   end
Cr-50           205    0   5.30518E-07   293.6   end
Cr-52           205    0   1.02189E-05   293.6   end
Cr-53           205    0   1.15860E-06   293.6   end
Cr-54           205    0   2.87821E-07   293.6   end
Mn-55           205    0   6.47114E-06   293.6   end
Fe-54           205    0   2.36149E-06   293.6   end
Fe-56           205    0   3.70370E-05   293.6   end
Fe-57           205    0   8.55788E-07   293.6   end
Fe-58           205    0   1.13028E-07   293.6   end
Cu-63           205    0   1.88666E-05   293.6   end
Cu-65           205    0   8.40911E-06   293.6   end
 U-234          205    0   4.80687E-06   293.6   end
 U-235          205    0   4.48000E-04   293.6   end
 U-236          205    0   1.92276E-06   293.6   end
 U-238          205    0   2.59571E-05   293.6   end
'       total atom density =  8.00998E-02 a/b-cm
```

```
'  8.009980E-02
 H-1            206    0   3.32434E-02   293.6   end
 B-10           206    0   5.79830E-06   293.6   end
 B-11           206    0   2.34889E-05   293.6   end
 O-16           206    0   1.78875E-02   293.6   end
Mg-24           206    0   1.05686E-04   293.6   end
Mg-25           206    0   1.33797E-05   293.6   end
Mg-26           206    0   1.47310E-05   293.6   end
Al-27           206    0   2.81176E-02   293.6   end
Si-28           206    0   1.00676E-04   293.6   end
Si-29           206    0   5.09768E-06   293.6   end
Si-30           206    0   3.38390E-06   293.6   end
Ti-46           206    0   4.20262E-07   293.6   end
Ti-47           206    0   3.79000E-07   293.6   end
Ti-48           206    0   3.75536E-06   293.6   end
Ti-49           206    0   2.75590E-07   293.6   end
Ti-50           206    0   2.63873E-07   293.6   end
Cr-50           206    0   5.30517E-07   293.6   end
Cr-52           206    0   1.02189E-05   293.6   end
Cr-53           206    0   1.15860E-06   293.6   end
Cr-54           206    0   2.87821E-07   293.6   end
Mn-55           206    0   6.46828E-06   293.6   end
Fe-54           206    0   2.35985E-06   293.6   end
Fe-56           206    0   3.70113E-05   293.6   end
Fe-57           206    0   8.55193E-07   293.6   end
Fe-58           206    0   1.12950E-07   293.6   end
Cu-63           206    0   1.88571E-05   293.6   end
Cu-65           206    0   8.40487E-06   293.6   end
 U-234          206    0   4.87661E-06   293.6   end
 U-235          206    0   4.54500E-04   293.6   end
 U-236          206    0   1.95066E-06   293.6   end
 U-238          206    0   2.63337E-05   293.6   end
'       total atom density =  8.00968E-02 a/b-cm
'  8.009680E-02
 H-1            207    0   3.32434E-02   293.6   end
 B-10           207    0   7.99507E-06   293.6   end
 B-11           207    0   3.23880E-05   293.6   end
 O-16           207    0   1.77805E-02   293.6   end
Mg-24           207    0   1.05686E-04   293.6   end
Mg-25           207    0   1.33797E-05   293.6   end
Mg-26           207    0   1.47310E-05   293.6   end
Al-27           207    0   2.82501E-02   293.6   end
Si-28           207    0   1.00972E-04   293.6   end
Si-29           207    0   5.11262E-06   293.6   end
Si-30           207    0   3.39382E-06   293.6   end
Ti-46           207    0   4.20262E-07   293.6   end
Ti-47           207    0   3.79000E-07   293.6   end
Ti-48           207    0   3.75536E-06   293.6   end
Ti-49           207    0   2.75590E-07   293.6   end
Ti-50           207    0   2.63873E-07   293.6   end
Cr-50           207    0   5.30517E-07   293.6   end
Cr-52           207    0   1.02189E-05   293.6   end
Cr-53           207    0   1.15860E-06   293.6   end
Cr-54           207    0   2.87821E-07   293.6   end
Mn-55           207    0   6.48467E-06   293.6   end
Fe-54           207    0   2.36928E-06   293.6   end
Fe-56           207    0   3.71592E-05   293.6   end
Fe-57           207    0   8.58611E-07   293.6   end
Fe-58           207    0   1.13401E-07   293.6   end
Cu-63           207    0   1.89118E-05   293.6   end
Cu-65           207    0   8.42923E-06   293.6   end
 U-234          207    0   4.47532E-06   293.6   end
 U-235          207    0   4.17100E-04   293.6   end
 U-236          207    0   1.79014E-06   293.6   end
 U-238          207    0   2.41667E-05   293.6   end
'       total atom density =  8.00933E-02 a/b-cm
'  8.009330E-02
 H-1            208    0   3.32434E-02   293.6   end
 B-10           208    0   1.06559E-05   293.6   end
 B-11           208    0   4.31670E-05   293.6   end
 O-16           208    0   1.76509E-02   293.6   end
Mg-24           208    0   1.05686E-04   293.6   end
Mg-25           208    0   1.33797E-05   293.6   end
Mg-26           208    0   1.47310E-05   293.6   end
Al-27           208    0   2.84107E-02   293.6   end
Si-28           208    0   1.01330E-04   293.6   end
Si-29           208    0   5.13079E-06   293.6   end
Si-30           208    0   3.40588E-06   293.6   end
Ti-46           208    0   4.20262E-07   293.6   end
Ti-47           208    0   3.79000E-07   293.6   end
Ti-48           208    0   3.75536E-06   293.6   end
```

```
Ti-49           208    0   2.75590E-07   293.6   end
Ti-50           208    0   2.63873E-07   293.6   end
Cr-50           208    0   5.30517E-07   293.6   end
Cr-52           208    0   1.02189E-05   293.6   end
Cr-53           208    0   1.15860E-06   293.6   end
Cr-54           208    0   2.87821E-07   293.6   end
Mn-55           208    0   6.50452E-06   293.6   end
Fe-54           208    0   2.38070E-06   293.6   end
Fe-56           208    0   3.73384E-05   293.6   end
Fe-57           208    0   8.62751E-07   293.6   end
Fe-58           208    0   1.13948E-07   293.6   end
Cu-63           208    0   1.89779E-05   293.6   end
Cu-65           208    0   8.45870E-06   293.6   end
 U-234          208    0   3.98927E-06   293.6   end
 U-235          208    0   3.71800E-04   293.6   end
 U-236          208    0   1.59572E-06   293.6   end
 U-238          208    0   2.15420E-05   293.6   end
'
'
'
'
'
'       Outer Fuel element Material Descriptions
'       ----------------------------------------
'
'       Aluminum Sidewalls
'
'         Outer fuel element--upper uncontrolled region
 H-1             72    0   3.35240E-02   293.6   end
 O-16            72    0   1.66756E-02   293.6   end
Al-27            72    0   2.92741E-02   293.6   end
Si-28            72    0   1.60187E-04   293.6   end
Si-29            72    0   8.11094E-06   293.6   end
Si-30            72    0   5.38413E-06   293.6   end
Ti-46            72    0   1.05065E-06   293.6   end
Ti-47            72    0   9.47498E-07   293.6   end
Ti-48            72    0   9.38838E-06   293.6   end
Ti-49            72    0   6.88973E-07   293.6   end
Ti-50            72    0   6.59682E-07   293.6   end
Cr-50            72    0   1.32629E-06   293.6   end
Cr-52            72    0   2.55471E-05   293.6   end
Cr-53            72    0   2.89649E-06   293.6   end
Cr-54            72    0   7.19549E-07   293.6   end
Mn-55            72    0   1.10987E-05   293.6   end
Fe-54            72    0   2.98072E-06   293.6   end
Fe-56            72    0   4.67489E-05   293.6   end
Fe-57            72    0   1.08019E-06   293.6   end
Fe-58            72    0   1.42667E-07   293.6   end
Cu-63            72    0   3.02466E-05   293.6   end
Cu-65            72    0   1.34813E-05   293.6   end
Mg-24            72    0   2.64216E-04   293.6   end
Mg-25            72    0   3.34493E-05   293.6   end
Mg-26            72    0   3.68277E-05   293.6   end
'         Outer fuel element--lower uncontrolled region
 H-1             73    0   3.31702E-02   293.6   end
 O-16            73    0   1.64987E-02   293.6   end
Al-27            73    0   2.92741E-02   293.6   end
Si-28            73    0   1.60187E-04   293.6   end
Si-29            73    0   8.11095E-06   293.6   end
Si-30            73    0   5.38414E-06   293.6   end
Ti-46            73    0   1.05065E-06   293.6   end
Ti-47            73    0   9.47499E-07   293.6   end
Ti-48            73    0   9.38839E-06   293.6   end
Ti-49            73    0   6.88974E-07   293.6   end
Ti-50            73    0   6.59683E-07   293.6   end
Cr-50            73    0   1.32629E-06   293.6   end
Cr-52            73    0   2.55471E-05   293.6   end
Cr-53            73    0   2.89649E-06   293.6   end
Cr-54            73    0   7.19550E-07   293.6   end
Mn-55            73    0   1.10987E-05   293.6   end
Fe-54            73    0   2.98072E-06   293.6   end
Fe-56            73    0   4.67489E-05   293.6   end
Fe-57            73    0   1.08019E-06   293.6   end
Fe-58            73    0   1.42667E-07   293.6   end
Cu-63            73    0   3.02466E-05   293.6   end
Cu-65            73    0   1.34813E-05   293.6   end
Mg-24            73    0   2.64216E-04   293.6   end
Mg-25            73    0   3.34493E-05   293.6   end
Mg-26            73    0   3.68277E-05   293.6   end
'
'       Outer Fuel Element  fueled region 1
```

```
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            311    0   3.32434E-02   293.6   end
 O-16           311    0   1.77945E-02   293.6   end
Mg-24           311    0   1.05686E-04   293.6   end
Mg-25           311    0   1.33797E-05   293.6   end
Mg-26           311    0   1.47310E-05   293.6   end
Al-27           311    0   2.82328E-02   293.6   end
Si-28           311    0   1.00933E-04   293.6   end
Si-29           311    0   5.11066E-06   293.6   end
Si-30           311    0   3.39252E-06   293.6   end
Ti-46           311    0   4.20262E-07   293.6   end
Ti-47           311    0   3.79000E-07   293.6   end
Ti-48           311    0   3.75536E-06   293.6   end
Ti-49           311    0   2.75590E-07   293.6   end
Ti-50           311    0   2.63873E-07   293.6   end
Cr-50           311    0   5.30517E-07   293.6   end
Cr-52           311    0   1.02189E-05   293.6   end
Cr-53           311    0   1.15860E-06   293.6   end
Cr-54           311    0   2.87821E-07   293.6   end
Mn-55           311    0   6.48252E-06   293.6   end
Fe-54           311    0   2.36804E-06   293.6   end
Fe-56           311    0   3.71398E-05   293.6   end
Fe-57           311    0   8.58163E-07   293.6   end
Fe-58           311    0   1.13342E-07   293.6   end
Cu-63           311    0   1.89046E-05   293.6   end
Cu-65           311    0   8.42602E-06   293.6   end
 U-234          311    0   4.52789E-06   293.6   end
 U-235          311    0   4.22000E-04   293.6   end
 U-236          311    0   1.81117E-06   293.6   end
 U-238          311    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            312    0   3.32434E-02   293.6   end
 O-16           312    0   1.80329E-02   293.6   end
Mg-24           312    0   1.05686E-04   293.6   end
Mg-25           312    0   1.33797E-05   293.6   end
Mg-26           312    0   1.47310E-05   293.6   end
Al-27           312    0   2.79375E-02   293.6   end
Si-28           312    0   1.00274E-04   293.6   end
Si-29           312    0   5.07732E-06   293.6   end
Si-30           312    0   3.37038E-06   293.6   end
Ti-46           312    0   4.20262E-07   293.6   end
Ti-47           312    0   3.79000E-07   293.6   end
Ti-48           312    0   3.75536E-06   293.6   end
Ti-49           312    0   2.75590E-07   293.6   end
Ti-50           312    0   2.63873E-07   293.6   end
Cr-50           312    0   5.30517E-07   293.6   end
Cr-52           312    0   1.02189E-05   293.6   end
Cr-53           312    0   1.15860E-06   293.6   end
Cr-54           312    0   2.87821E-07   293.6   end
Mn-55           312    0   6.44602E-06   293.6   end
Fe-54           312    0   2.34704E-06   293.6   end
Fe-56           312    0   3.68104E-05   293.6   end
Fe-57           312    0   8.50550E-07   293.6   end
Fe-58           312    0   1.12337E-07   293.6   end
Cu-63           312    0   1.87830E-05   293.6   end
Cu-65           312    0   8.37182E-06   293.6   end
 U-234          312    0   5.42167E-06   293.6   end
 U-235          312    0   5.05300E-04   293.6   end
 U-236          312    0   2.16868E-06   293.6   end
 U-238          312    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            313    0   3.32434E-02   293.6   end
 O-16           313    0   1.82870E-02   293.6   end
Mg-24           313    0   1.05686E-04   293.6   end
Mg-25           313    0   1.33797E-05   293.6   end
Mg-26           313    0   1.47310E-05   293.6   end
Al-27           313    0   2.76228E-02   293.6   end
Si-28           313    0   9.95724E-05   293.6   end
Si-29           313    0   5.04178E-06   293.6   end
Si-30           313    0   3.34679E-06   293.6   end
Ti-46           313    0   4.20262E-07   293.6   end
Ti-47           313    0   3.79000E-07   293.6   end
Ti-48           313    0   3.75536E-06   293.6   end
Ti-49           313    0   2.75590E-07   293.6   end
Ti-50           313    0   2.63873E-07   293.6   end
Cr-50           313    0   5.30517E-07   293.6   end
Cr-52           313    0   1.02189E-05   293.6   end
Cr-53           313    0   1.15860E-06   293.6   end
```

```
Cr-54           313    0   2.87821E-07   293.6   end
Mn-55           313    0   6.40711E-06   293.6   end
Fe-54           313    0   2.32464E-06   293.6   end
Fe-56           313    0   3.64591E-05   293.6   end
Fe-57           313    0   8.42433E-07   293.6   end
Fe-58           313    0   1.11265E-07   293.6   end
Cu-63           313    0   1.86534E-05   293.6   end
Cu-65           313    0   8.31405E-06   293.6   end
 U-234          313    0   6.37446E-06   293.6   end
 U-235          313    0   5.94100E-04   293.6   end
 U-236          313    0   2.54980E-06   293.6   end
 U-238          313    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            314    0   3.32434E-02   293.6   end
 O-16           314    0   1.85176E-02   293.6   end
Mg-24           314    0   1.05686E-04   293.6   end
Mg-25           314    0   1.33797E-05   293.6   end
Mg-26           314    0   1.47310E-05   293.6   end
Al-27           314    0   2.73372E-02   293.6   end
Si-28           314    0   9.89350E-05   293.6   end
Si-29           314    0   5.00951E-06   293.6   end
Si-30           314    0   3.32537E-06   293.6   end
Ti-46           314    0   4.20262E-07   293.6   end
Ti-47           314    0   3.79000E-07   293.6   end
Ti-48           314    0   3.75536E-06   293.6   end
Ti-49           314    0   2.75590E-07   293.6   end
Ti-50           314    0   2.63873E-07   293.6   end
Cr-50           314    0   5.30517E-07   293.6   end
Cr-52           314    0   1.02189E-05   293.6   end
Cr-53           314    0   1.15860E-06   293.6   end
Cr-54           314    0   2.87821E-07   293.6   end
Mn-55           314    0   6.37178E-06   293.6   end
Fe-54           314    0   2.30432E-06   293.6   end
Fe-56           314    0   3.61403E-05   293.6   end
Fe-57           314    0   8.35068E-07   293.6   end
Fe-58           314    0   1.10292E-07   293.6   end
Cu-63           314    0   1.85357E-05   293.6   end
Cu-65           314    0   8.26161E-06   293.6   end
 U-234          314    0   7.23926E-06   293.6   end
 U-235          314    0   6.74700E-04   293.6   end
 U-236          314    0   2.89573E-06   293.6   end
 U-238          314    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            315    0   3.32434E-02   293.6   end
 O-16           315    0   1.84469E-02   293.6   end
Mg-24           315    0   1.05686E-04   293.6   end
Mg-25           315    0   1.33797E-05   293.6   end
Mg-26           315    0   1.47310E-05   293.6   end
Al-27           315    0   2.74247E-02   293.6   end
Si-28           315    0   9.91306E-05   293.6   end
Si-29           315    0   5.01941E-06   293.6   end
Si-30           315    0   3.33194E-06   293.6   end
Ti-46           315    0   4.20262E-07   293.6   end
Ti-47           315    0   3.79000E-07   293.6   end
Ti-48           315    0   3.75536E-06   293.6   end
Ti-49           315    0   2.75590E-07   293.6   end
Ti-50           315    0   2.63873E-07   293.6   end
Cr-50           315    0   5.30517E-07   293.6   end
Cr-52           315    0   1.02189E-05   293.6   end
Cr-53           315    0   1.15860E-06   293.6   end
Cr-54           315    0   2.87821E-07   293.6   end
Mn-55           315    0   6.38261E-06   293.6   end
Fe-54           315    0   2.31055E-06   293.6   end
Fe-56           315    0   3.62380E-05   293.6   end
Fe-57           315    0   8.37326E-07   293.6   end
Fe-58           315    0   1.10590E-07   293.6   end
Cu-63           315    0   1.85717E-05   293.6   end
Cu-65           315    0   8.27767E-06   293.6   end
 U-234          315    0   6.97424E-06   293.6   end
 U-235          315    0   6.50000E-04   293.6   end
 U-236          315    0   2.78972E-06   293.6   end
 U-238          315    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            316    0   3.32434E-02   293.6   end
 O-16           316    0   1.81013E-02   293.6   end
Mg-24           316    0   1.05686E-04   293.6   end
Mg-25           316    0   1.33797E-05   293.6   end
Mg-26           316    0   1.47310E-05   293.6   end
```

```
Al-27           316    0   2.78528E-02   293.6   end
Si-28           316    0   1.00085E-04   293.6   end
Si-29           316    0   5.06774E-06   293.6   end
Si-30           316    0   3.36403E-06   293.6   end
Ti-46           316    0   4.20262E-07   293.6   end
Ti-47           316    0   3.79000E-07   293.6   end
Ti-48           316    0   3.75536E-06   293.6   end
Ti-49           316    0   2.75590E-07   293.6   end
Ti-50           316    0   2.63873E-07   293.6   end
Cr-50           316    0   5.30517E-07   293.6   end
Cr-52           316    0   1.02189E-05   293.6   end
Cr-53           316    0   1.15860E-06   293.6   end
Cr-54           316    0   2.87821E-07   293.6   end
Mn-55           316    0   6.43555E-06   293.6   end
Fe-54           316    0   2.34101E-06   293.6   end
Fe-56           316    0   3.67158E-05   293.6   end
Fe-57           316    0   8.48365E-07   293.6   end
Fe-58           316    0   1.12048E-07   293.6   end
Cu-63           316    0   1.87481E-05   293.6   end
Cu-65           316    0   8.35629E-06   293.6   end
 U-234          316    0   5.67811E-06   293.6   end
 U-235          316    0   5.29200E-04   293.6   end
 U-236          316    0   2.27126E-06   293.6   end
 U-238          316    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            317    0   3.32434E-02   293.6   end
 O-16           317    0   1.77731E-02   293.6   end
Mg-24           317    0   1.05686E-04   293.6   end
Mg-25           317    0   1.33797E-05   293.6   end
Mg-26           317    0   1.47310E-05   293.6   end
Al-27           317    0   2.82593E-02   293.6   end
Si-28           317    0   1.00993E-04   293.6   end
Si-29           317    0   5.11370E-06   293.6   end
Si-30           317    0   3.39453E-06   293.6   end
Ti-46           317    0   4.20262E-07   293.6   end
Ti-47           317    0   3.79000E-07   293.6   end
Ti-48           317    0   3.75536E-06   293.6   end
Ti-49           317    0   2.75590E-07   293.6   end
Ti-50           317    0   2.63873E-07   293.6   end
Cr-50           317    0   5.30517E-07   293.6   end
Cr-52           317    0   1.02189E-05   293.6   end
Cr-53           317    0   1.15860E-06   293.6   end
Cr-54           317    0   2.87821E-07   293.6   end
Mn-55           317    0   6.48581E-06   293.6   end
Fe-54           317    0   2.36993E-06   293.6   end
Fe-56           317    0   3.71695E-05   293.6   end
Fe-57           317    0   8.58848E-07   293.6   end
Fe-58           317    0   1.13433E-07   293.6   end
Cu-63           317    0   1.89155E-05   293.6   end
Cu-65           317    0   8.43090E-06   293.6   end
 U-234          317    0   4.44742E-06   293.6   end
 U-235          317    0   4.14500E-04   293.6   end
 U-236          317    0   1.77898E-06   293.6   end
 U-238          317    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            318    0   3.32434E-02   293.6   end
 O-16           318    0   1.75562E-02   293.6   end
Mg-24           318    0   1.05686E-04   293.6   end
Mg-25           318    0   1.33797E-05   293.6   end
Mg-26           318    0   1.47310E-05   293.6   end
Al-27           318    0   2.85280E-02   293.6   end
Si-28           318    0   1.01591E-04   293.6   end
Si-29           318    0   5.14401E-06   293.6   end
Si-30           318    0   3.41465E-06   293.6   end
Ti-46           318    0   4.20262E-07   293.6   end
Ti-47           318    0   3.79000E-07   293.6   end
Ti-48           318    0   3.75536E-06   293.6   end
Ti-49           318    0   2.75590E-07   293.6   end
Ti-50           318    0   2.63873E-07   293.6   end
Cr-50           318    0   5.30517E-07   293.6   end
Cr-52           318    0   1.02189E-05   293.6   end
Cr-53           318    0   1.15860E-06   293.6   end
Cr-54           318    0   2.87821E-07   293.6   end
Mn-55           318    0   6.51903E-06   293.6   end
Fe-54           318    0   2.38905E-06   293.6   end
Fe-56           318    0   3.74693E-05   293.6   end
Fe-57           318    0   8.65776E-07   293.6   end
Fe-58           318    0   1.14348E-07   293.6   end
Cu-63           318    0   1.90262E-05   293.6   end
```

```
Cu-65           318    0   8.48022E-06   293.6   end
 U-234          318    0   3.63412E-06   293.6   end
 U-235          318    0   3.38700E-04   293.6   end
 U-236          318    0   1.45366E-06   293.6   end
 U-238          318    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            319    0   3.32434E-02   293.6   end
 O-16           319    0   1.73591E-02   293.6   end
Mg-24           319    0   1.05686E-04   293.6   end
Mg-25           319    0   1.33797E-05   293.6   end
Mg-26           319    0   1.47310E-05   293.6   end
Al-27           319    0   2.87722E-02   293.6   end
Si-28           319    0   1.02136E-04   293.6   end
Si-29           319    0   5.17160E-06   293.6   end
Si-30           319    0   3.43297E-06   293.6   end
Ti-46           319    0   4.20262E-07   293.6   end
Ti-47           319    0   3.79000E-07   293.6   end
Ti-48           319    0   3.75536E-06   293.6   end
Ti-49           319    0   2.75590E-07   293.6   end
Ti-50           319    0   2.63873E-07   293.6   end
Cr-50           319    0   5.30517E-07   293.6   end
Cr-52           319    0   1.02189E-05   293.6   end
Cr-53           319    0   1.15860E-06   293.6   end
Cr-54           319    0   2.87821E-07   293.6   end
Mn-55           319    0   6.54922E-06   293.6   end
Fe-54           319    0   2.40643E-06   293.6   end
Fe-56           319    0   3.77418E-05   293.6   end
Fe-57           319    0   8.72072E-07   293.6   end
Fe-58           319    0   1.15179E-07   293.6   end
Cu-63           319    0   1.91268E-05   293.6   end
Cu-65           319    0   8.52504E-06   293.6   end
 U-234          319    0   2.89485E-06   293.6   end
 U-235          319    0   2.69800E-04   293.6   end
 U-236          319    0   1.15795E-06   293.6   end
 U-238          319    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 2
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            321    0   3.32434E-02   293.6   end
 O-16           321    0   1.77945E-02   293.6   end
Mg-24           321    0   1.05686E-04   293.6   end
Mg-25           321    0   1.33797E-05   293.6   end
Mg-26           321    0   1.47310E-05   293.6   end
Al-27           321    0   2.82328E-02   293.6   end
Si-28           321    0   1.00933E-04   293.6   end
Si-29           321    0   5.11066E-06   293.6   end
Si-30           321    0   3.39252E-06   293.6   end
Ti-46           321    0   4.20262E-07   293.6   end
Ti-47           321    0   3.79000E-07   293.6   end
Ti-48           321    0   3.75536E-06   293.6   end
Ti-49           321    0   2.75590E-07   293.6   end
Ti-50           321    0   2.63873E-07   293.6   end
Cr-50           321    0   5.30517E-07   293.6   end
Cr-52           321    0   1.02189E-05   293.6   end
Cr-53           321    0   1.15860E-06   293.6   end
Cr-54           321    0   2.87821E-07   293.6   end
Mn-55           321    0   6.48252E-06   293.6   end
Fe-54           321    0   2.36804E-06   293.6   end
Fe-56           321    0   3.71398E-05   293.6   end
Fe-57           321    0   8.58163E-07   293.6   end
Fe-58           321    0   1.13342E-07   293.6   end
Cu-63           321    0   1.89046E-05   293.6   end
Cu-65           321    0   8.42602E-06   293.6   end
 U-234          321    0   4.52789E-06   293.6   end
 U-235          321    0   4.22000E-04   293.6   end
 U-236          321    0   1.81117E-06   293.6   end
 U-238          321    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            322    0   3.32434E-02   293.6   end
 O-16           322    0   1.80329E-02   293.6   end
Mg-24           322    0   1.05686E-04   293.6   end
Mg-25           322    0   1.33797E-05   293.6   end
Mg-26           322    0   1.47310E-05   293.6   end
Al-27           322    0   2.79375E-02   293.6   end
Si-28           322    0   1.00274E-04   293.6   end
Si-29           322    0   5.07732E-06   293.6   end
Si-30           322    0   3.37038E-06   293.6   end
Ti-46           322    0   4.20262E-07   293.6   end
```

```
Ti-47           322    0   3.79000E-07   293.6   end
Ti-48           322    0   3.75536E-06   293.6   end
Ti-49           322    0   2.75590E-07   293.6   end
Ti-50           322    0   2.63873E-07   293.6   end
Cr-50           322    0   5.30517E-07   293.6   end
Cr-52           322    0   1.02189E-05   293.6   end
Cr-53           322    0   1.15860E-06   293.6   end
Cr-54           322    0   2.87821E-07   293.6   end
Mn-55           322    0   6.44602E-06   293.6   end
Fe-54           322    0   2.34704E-06   293.6   end
Fe-56           322    0   3.68104E-05   293.6   end
Fe-57           322    0   8.50550E-07   293.6   end
Fe-58           322    0   1.12337E-07   293.6   end
Cu-63           322    0   1.87830E-05   293.6   end
Cu-65           322    0   8.37182E-06   293.6   end
 U-234          322    0   5.42167E-06   293.6   end
 U-235          322    0   5.05300E-04   293.6   end
 U-236          322    0   2.16868E-06   293.6   end
 U-238          322    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            323    0   3.32434E-02   293.6   end
 O-16           323    0   1.82870E-02   293.6   end
Mg-24           323    0   1.05686E-04   293.6   end
Mg-25           323    0   1.33797E-05   293.6   end
Mg-26           323    0   1.47310E-05   293.6   end
Al-27           323    0   2.76228E-02   293.6   end
Si-28           323    0   9.95724E-05   293.6   end
Si-29           323    0   5.04178E-06   293.6   end
Si-30           323    0   3.34679E-06   293.6   end
Ti-46           323    0   4.20262E-07   293.6   end
Ti-47           323    0   3.79000E-07   293.6   end
Ti-48           323    0   3.75536E-06   293.6   end
Ti-49           323    0   2.75590E-07   293.6   end
Ti-50           323    0   2.63873E-07   293.6   end
Cr-50           323    0   5.30517E-07   293.6   end
Cr-52           323    0   1.02189E-05   293.6   end
Cr-53           323    0   1.15860E-06   293.6   end
Cr-54           323    0   2.87821E-07   293.6   end
Mn-55           323    0   6.40711E-06   293.6   end
Fe-54           323    0   2.32464E-06   293.6   end
Fe-56           323    0   3.64591E-05   293.6   end
Fe-57           323    0   8.42433E-07   293.6   end
Fe-58           323    0   1.11265E-07   293.6   end
Cu-63           323    0   1.86534E-05   293.6   end
Cu-65           323    0   8.31405E-06   293.6   end
 U-234          323    0   6.37446E-06   293.6   end
 U-235          323    0   5.94100E-04   293.6   end
 U-236          323    0   2.54980E-06   293.6   end
 U-238          323    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            324    0   3.32434E-02   293.6   end
 O-16           324    0   1.85176E-02   293.6   end
Mg-24           324    0   1.05686E-04   293.6   end
Mg-25           324    0   1.33797E-05   293.6   end
Mg-26           324    0   1.47310E-05   293.6   end
Al-27           324    0   2.73372E-02   293.6   end
Si-28           324    0   9.89350E-05   293.6   end
Si-29           324    0   5.00951E-06   293.6   end
Si-30           324    0   3.32537E-06   293.6   end
Ti-46           324    0   4.20262E-07   293.6   end
Ti-47           324    0   3.79000E-07   293.6   end
Ti-48           324    0   3.75536E-06   293.6   end
Ti-49           324    0   2.75590E-07   293.6   end
Ti-50           324    0   2.63873E-07   293.6   end
Cr-50           324    0   5.30517E-07   293.6   end
Cr-52           324    0   1.02189E-05   293.6   end
Cr-53           324    0   1.15860E-06   293.6   end
Cr-54           324    0   2.87821E-07   293.6   end
Mn-55           324    0   6.37178E-06   293.6   end
Fe-54           324    0   2.30432E-06   293.6   end
Fe-56           324    0   3.61403E-05   293.6   end
Fe-57           324    0   8.35068E-07   293.6   end
Fe-58           324    0   1.10292E-07   293.6   end
Cu-63           324    0   1.85357E-05   293.6   end
Cu-65           324    0   8.26161E-06   293.6   end
 U-234          324    0   7.23926E-06   293.6   end
 U-235          324    0   6.74700E-04   293.6   end
 U-236          324    0   2.89573E-06   293.6   end
 U-238          324    0   3.90920E-05   293.6   end
```

```
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            325    0   3.32434E-02   293.6   end
 O-16           325    0   1.84469E-02   293.6   end
Mg-24           325    0   1.05686E-04   293.6   end
Mg-25           325    0   1.33797E-05   293.6   end
Mg-26           325    0   1.47310E-05   293.6   end
Al-27           325    0   2.74247E-02   293.6   end
Si-28           325    0   9.91306E-05   293.6   end
Si-29           325    0   5.01941E-06   293.6   end
Si-30           325    0   3.33194E-06   293.6   end
Ti-46           325    0   4.20262E-07   293.6   end
Ti-47           325    0   3.79000E-07   293.6   end
Ti-48           325    0   3.75536E-06   293.6   end
Ti-49           325    0   2.75590E-07   293.6   end
Ti-50           325    0   2.63873E-07   293.6   end
Cr-50           325    0   5.30517E-07   293.6   end
Cr-52           325    0   1.02189E-05   293.6   end
Cr-53           325    0   1.15860E-06   293.6   end
Cr-54           325    0   2.87821E-07   293.6   end
Mn-55           325    0   6.38261E-06   293.6   end
Fe-54           325    0   2.31055E-06   293.6   end
Fe-56           325    0   3.62380E-05   293.6   end
Fe-57           325    0   8.37326E-07   293.6   end
Fe-58           325    0   1.10590E-07   293.6   end
Cu-63           325    0   1.85717E-05   293.6   end
Cu-65           325    0   8.27767E-06   293.6   end
 U-234          325    0   6.97424E-06   293.6   end
 U-235          325    0   6.50000E-04   293.6   end
 U-236          325    0   2.78972E-06   293.6   end
 U-238          325    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            326    0   3.32434E-02   293.6   end
 O-16           326    0   1.81013E-02   293.6   end
Mg-24           326    0   1.05686E-04   293.6   end
Mg-25           326    0   1.33797E-05   293.6   end
Mg-26           326    0   1.47310E-05   293.6   end
Al-27           326    0   2.78528E-02   293.6   end
Si-28           326    0   1.00085E-04   293.6   end
Si-29           326    0   5.06774E-06   293.6   end
Si-30           326    0   3.36403E-06   293.6   end
Ti-46           326    0   4.20262E-07   293.6   end
Ti-47           326    0   3.79000E-07   293.6   end
Ti-48           326    0   3.75536E-06   293.6   end
Ti-49           326    0   2.75590E-07   293.6   end
Ti-50           326    0   2.63873E-07   293.6   end
Cr-50           326    0   5.30517E-07   293.6   end
Cr-52           326    0   1.02189E-05   293.6   end
Cr-53           326    0   1.15860E-06   293.6   end
Cr-54           326    0   2.87821E-07   293.6   end
Mn-55           326    0   6.43555E-06   293.6   end
Fe-54           326    0   2.34101E-06   293.6   end
Fe-56           326    0   3.67158E-05   293.6   end
Fe-57           326    0   8.48365E-07   293.6   end
Fe-58           326    0   1.12048E-07   293.6   end
Cu-63           326    0   1.87481E-05   293.6   end
Cu-65           326    0   8.35629E-06   293.6   end
 U-234          326    0   5.67811E-06   293.6   end
 U-235          326    0   5.29200E-04   293.6   end
 U-236          326    0   2.27126E-06   293.6   end
 U-238          326    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            327    0   3.32434E-02   293.6   end
 O-16           327    0   1.77731E-02   293.6   end
Mg-24           327    0   1.05686E-04   293.6   end
Mg-25           327    0   1.33797E-05   293.6   end
Mg-26           327    0   1.47310E-05   293.6   end
Al-27           327    0   2.82593E-02   293.6   end
Si-28           327    0   1.00993E-04   293.6   end
Si-29           327    0   5.11370E-06   293.6   end
Si-30           327    0   3.39453E-06   293.6   end
Ti-46           327    0   4.20262E-07   293.6   end
Ti-47           327    0   3.79000E-07   293.6   end
Ti-48           327    0   3.75536E-06   293.6   end
Ti-49           327    0   2.75590E-07   293.6   end
Ti-50           327    0   2.63873E-07   293.6   end
Cr-50           327    0   5.30517E-07   293.6   end
Cr-52           327    0   1.02189E-05   293.6   end
Cr-53           327    0   1.15860E-06   293.6   end
```

```
Cr-54           327    0   2.87821E-07   293.6   end
Mn-55           327    0   6.48581E-06   293.6   end
Fe-54           327    0   2.36993E-06   293.6   end
Fe-56           327    0   3.71695E-05   293.6   end
Fe-57           327    0   8.58848E-07   293.6   end
Fe-58           327    0   1.13433E-07   293.6   end
Cu-63           327    0   1.89155E-05   293.6   end
Cu-65           327    0   8.43090E-06   293.6   end
 U-234          327    0   4.44742E-06   293.6   end
 U-235          327    0   4.14500E-04   293.6   end
 U-236          327    0   1.77898E-06   293.6   end
 U-238          327    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            328    0   3.32434E-02   293.6   end
 O-16           328    0   1.75562E-02   293.6   end
Mg-24           328    0   1.05686E-04   293.6   end
Mg-25           328    0   1.33797E-05   293.6   end
Mg-26           328    0   1.47310E-05   293.6   end
Al-27           328    0   2.85280E-02   293.6   end
Si-28           328    0   1.01591E-04   293.6   end
Si-29           328    0   5.14401E-06   293.6   end
Si-30           328    0   3.41465E-06   293.6   end
Ti-46           328    0   4.20262E-07   293.6   end
Ti-47           328    0   3.79000E-07   293.6   end
Ti-48           328    0   3.75536E-06   293.6   end
Ti-49           328    0   2.75590E-07   293.6   end
Ti-50           328    0   2.63873E-07   293.6   end
Cr-50           328    0   5.30517E-07   293.6   end
Cr-52           328    0   1.02189E-05   293.6   end
Cr-53           328    0   1.15860E-06   293.6   end
Cr-54           328    0   2.87821E-07   293.6   end
Mn-55           328    0   6.51903E-06   293.6   end
Fe-54           328    0   2.38905E-06   293.6   end
Fe-56           328    0   3.74693E-05   293.6   end
Fe-57           328    0   8.65776E-07   293.6   end
Fe-58           328    0   1.14348E-07   293.6   end
Cu-63           328    0   1.90262E-05   293.6   end
Cu-65           328    0   8.48022E-06   293.6   end
 U-234          328    0   3.63412E-06   293.6   end
 U-235          328    0   3.38700E-04   293.6   end
 U-236          328    0   1.45366E-06   293.6   end
 U-238          328    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            329    0   3.32434E-02   293.6   end
 O-16           329    0   1.73591E-02   293.6   end
Mg-24           329    0   1.05686E-04   293.6   end
Mg-25           329    0   1.33797E-05   293.6   end
Mg-26           329    0   1.47310E-05   293.6   end
Al-27           329    0   2.87722E-02   293.6   end
Si-28           329    0   1.02136E-04   293.6   end
Si-29           329    0   5.17160E-06   293.6   end
Si-30           329    0   3.43297E-06   293.6   end
Ti-46           329    0   4.20262E-07   293.6   end
Ti-47           329    0   3.79000E-07   293.6   end
Ti-48           329    0   3.75536E-06   293.6   end
Ti-49           329    0   2.75590E-07   293.6   end
Ti-50           329    0   2.63873E-07   293.6   end
Cr-50           329    0   5.30517E-07   293.6   end
Cr-52           329    0   1.02189E-05   293.6   end
Cr-53           329    0   1.15860E-06   293.6   end
Cr-54           329    0   2.87821E-07   293.6   end
Mn-55           329    0   6.54922E-06   293.6   end
Fe-54           329    0   2.40643E-06   293.6   end
Fe-56           329    0   3.77418E-05   293.6   end
Fe-57           329    0   8.72072E-07   293.6   end
Fe-58           329    0   1.15179E-07   293.6   end
Cu-63           329    0   1.91268E-05   293.6   end
Cu-65           329    0   8.52504E-06   293.6   end
 U-234          329    0   2.89485E-06   293.6   end
 U-235          329    0   2.69800E-04   293.6   end
 U-236          329    0   1.15795E-06   293.6   end
 U-238          329    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 3
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            331    0   3.32434E-02   293.6   end
 O-16           331    0   1.77945E-02   293.6   end
Mg-24           331    0   1.05686E-04   293.6   end
```

```
Mg-25           331    0   1.33797E-05   293.6   end
Mg-26           331    0   1.47310E-05   293.6   end
Al-27           331    0   2.82328E-02   293.6   end
Si-28           331    0   1.00933E-04   293.6   end
Si-29           331    0   5.11066E-06   293.6   end
Si-30           331    0   3.39252E-06   293.6   end
Ti-46           331    0   4.20262E-07   293.6   end
Ti-47           331    0   3.79000E-07   293.6   end
Ti-48           331    0   3.75536E-06   293.6   end
Ti-49           331    0   2.75590E-07   293.6   end
Ti-50           331    0   2.63873E-07   293.6   end
Cr-50           331    0   5.30517E-07   293.6   end
Cr-52           331    0   1.02189E-05   293.6   end
Cr-53           331    0   1.15860E-06   293.6   end
Cr-54           331    0   2.87821E-07   293.6   end
Mn-55           331    0   6.48252E-06   293.6   end
Fe-54           331    0   2.36804E-06   293.6   end
Fe-56           331    0   3.71398E-05   293.6   end
Fe-57           331    0   8.58163E-07   293.6   end
Fe-58           331    0   1.13342E-07   293.6   end
Cu-63           331    0   1.89046E-05   293.6   end
Cu-65           331    0   8.42602E-06   293.6   end
 U-234          331    0   4.52789E-06   293.6   end
 U-235          331    0   4.22000E-04   293.6   end
 U-236          331    0   1.81117E-06   293.6   end
 U-238          331    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            332    0   3.32434E-02   293.6   end
 O-16           332    0   1.80329E-02   293.6   end
Mg-24           332    0   1.05686E-04   293.6   end
Mg-25           332    0   1.33797E-05   293.6   end
Mg-26           332    0   1.47310E-05   293.6   end
Al-27           332    0   2.79375E-02   293.6   end
Si-28           332    0   1.00274E-04   293.6   end
Si-29           332    0   5.07732E-06   293.6   end
Si-30           332    0   3.37038E-06   293.6   end
Ti-46           332    0   4.20262E-07   293.6   end
Ti-47           332    0   3.79000E-07   293.6   end
Ti-48           332    0   3.75536E-06   293.6   end
Ti-49           332    0   2.75590E-07   293.6   end
Ti-50           332    0   2.63873E-07   293.6   end
Cr-50           332    0   5.30517E-07   293.6   end
Cr-52           332    0   1.02189E-05   293.6   end
Cr-53           332    0   1.15860E-06   293.6   end
Cr-54           332    0   2.87821E-07   293.6   end
Mn-55           332    0   6.44602E-06   293.6   end
Fe-54           332    0   2.34704E-06   293.6   end
Fe-56           332    0   3.68104E-05   293.6   end
Fe-57           332    0   8.50550E-07   293.6   end
Fe-58           332    0   1.12337E-07   293.6   end
Cu-63           332    0   1.87830E-05   293.6   end
Cu-65           332    0   8.37182E-06   293.6   end
 U-234          332    0   5.42167E-06   293.6   end
 U-235          332    0   5.05300E-04   293.6   end
 U-236          332    0   2.16868E-06   293.6   end
 U-238          332    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            333    0   3.32434E-02   293.6   end
 O-16           333    0   1.82870E-02   293.6   end
Mg-24           333    0   1.05686E-04   293.6   end
Mg-25           333    0   1.33797E-05   293.6   end
Mg-26           333    0   1.47310E-05   293.6   end
Al-27           333    0   2.76228E-02   293.6   end
Si-28           333    0   9.95724E-05   293.6   end
Si-29           333    0   5.04178E-06   293.6   end
Si-30           333    0   3.34679E-06   293.6   end
Ti-46           333    0   4.20262E-07   293.6   end
Ti-47           333    0   3.79000E-07   293.6   end
Ti-48           333    0   3.75536E-06   293.6   end
Ti-49           333    0   2.75590E-07   293.6   end
Ti-50           333    0   2.63873E-07   293.6   end
Cr-50           333    0   5.30517E-07   293.6   end
Cr-52           333    0   1.02189E-05   293.6   end
Cr-53           333    0   1.15860E-06   293.6   end
Cr-54           333    0   2.87821E-07   293.6   end
Mn-55           333    0   6.40711E-06   293.6   end
Fe-54           333    0   2.32464E-06   293.6   end
Fe-56           333    0   3.64591E-05   293.6   end
Fe-57           333    0   8.42433E-07   293.6   end
```

```
Fe-58           333    0   1.11265E-07   293.6   end
Cu-63           333    0   1.86534E-05   293.6   end
Cu-65           333    0   8.31405E-06   293.6   end
 U-234          333    0   6.37446E-06   293.6   end
 U-235          333    0   5.94100E-04   293.6   end
 U-236          333    0   2.54980E-06   293.6   end
 U-238          333    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            334    0   3.32434E-02   293.6   end
 O-16           334    0   1.85176E-02   293.6   end
Mg-24           334    0   1.05686E-04   293.6   end
Mg-25           334    0   1.33797E-05   293.6   end
Mg-26           334    0   1.47310E-05   293.6   end
Al-27           334    0   2.73372E-02   293.6   end
Si-28           334    0   9.89350E-05   293.6   end
Si-29           334    0   5.00951E-06   293.6   end
Si-30           334    0   3.32537E-06   293.6   end
Ti-46           334    0   4.20262E-07   293.6   end
Ti-47           334    0   3.79000E-07   293.6   end
Ti-48           334    0   3.75536E-06   293.6   end
Ti-49           334    0   2.75590E-07   293.6   end
Ti-50           334    0   2.63873E-07   293.6   end
Cr-50           334    0   5.30517E-07   293.6   end
Cr-52           334    0   1.02189E-05   293.6   end
Cr-53           334    0   1.15860E-06   293.6   end
Cr-54           334    0   2.87821E-07   293.6   end
Mn-55           334    0   6.37178E-06   293.6   end
Fe-54           334    0   2.30432E-06   293.6   end
Fe-56           334    0   3.61403E-05   293.6   end
Fe-57           334    0   8.35068E-07   293.6   end
Fe-58           334    0   1.10292E-07   293.6   end
Cu-63           334    0   1.85357E-05   293.6   end
Cu-65           334    0   8.26161E-06   293.6   end
 U-234          334    0   7.23926E-06   293.6   end
 U-235          334    0   6.74700E-04   293.6   end
 U-236          334    0   2.89573E-06   293.6   end
 U-238          334    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            335    0   3.32434E-02   293.6   end
 O-16           335    0   1.84469E-02   293.6   end
Mg-24           335    0   1.05686E-04   293.6   end
Mg-25           335    0   1.33797E-05   293.6   end
Mg-26           335    0   1.47310E-05   293.6   end
Al-27           335    0   2.74247E-02   293.6   end
Si-28           335    0   9.91306E-05   293.6   end
Si-29           335    0   5.01941E-06   293.6   end
Si-30           335    0   3.33194E-06   293.6   end
Ti-46           335    0   4.20262E-07   293.6   end
Ti-47           335    0   3.79000E-07   293.6   end
Ti-48           335    0   3.75536E-06   293.6   end
Ti-49           335    0   2.75590E-07   293.6   end
Ti-50           335    0   2.63873E-07   293.6   end
Cr-50           335    0   5.30517E-07   293.6   end
Cr-52           335    0   1.02189E-05   293.6   end
Cr-53           335    0   1.15860E-06   293.6   end
Cr-54           335    0   2.87821E-07   293.6   end
Mn-55           335    0   6.38261E-06   293.6   end
Fe-54           335    0   2.31055E-06   293.6   end
Fe-56           335    0   3.62380E-05   293.6   end
Fe-57           335    0   8.37326E-07   293.6   end
Fe-58           335    0   1.10590E-07   293.6   end
Cu-63           335    0   1.85717E-05   293.6   end
Cu-65           335    0   8.27767E-06   293.6   end
 U-234          335    0   6.97424E-06   293.6   end
 U-235          335    0   6.50000E-04   293.6   end
 U-236          335    0   2.78972E-06   293.6   end
 U-238          335    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            336    0   3.32434E-02   293.6   end
 O-16           336    0   1.81013E-02   293.6   end
Mg-24           336    0   1.05686E-04   293.6   end
Mg-25           336    0   1.33797E-05   293.6   end
Mg-26           336    0   1.47310E-05   293.6   end
Al-27           336    0   2.78528E-02   293.6   end
Si-28           336    0   1.00085E-04   293.6   end
Si-29           336    0   5.06774E-06   293.6   end
Si-30           336    0   3.36403E-06   293.6   end
Ti-46           336    0   4.20262E-07   293.6   end
```

```
Ti-47           336    0   3.79000E-07   293.6   end
Ti-48           336    0   3.75536E-06   293.6   end
Ti-49           336    0   2.75590E-07   293.6   end
Ti-50           336    0   2.63873E-07   293.6   end
Cr-50           336    0   5.30517E-07   293.6   end
Cr-52           336    0   1.02189E-05   293.6   end
Cr-53           336    0   1.15860E-06   293.6   end
Cr-54           336    0   2.87821E-07   293.6   end
Mn-55           336    0   6.43555E-06   293.6   end
Fe-54           336    0   2.34101E-06   293.6   end
Fe-56           336    0   3.67158E-05   293.6   end
Fe-57           336    0   8.48365E-07   293.6   end
Fe-58           336    0   1.12048E-07   293.6   end
Cu-63           336    0   1.87481E-05   293.6   end
Cu-65           336    0   8.35629E-06   293.6   end
 U-234          336    0   5.67811E-06   293.6   end
 U-235          336    0   5.29200E-04   293.6   end
 U-236          336    0   2.27126E-06   293.6   end
 U-238          336    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            337    0   3.32434E-02   293.6   end
 O-16           337    0   1.77731E-02   293.6   end
Mg-24           337    0   1.05686E-04   293.6   end
Mg-25           337    0   1.33797E-05   293.6   end
Mg-26           337    0   1.47310E-05   293.6   end
Al-27           337    0   2.82593E-02   293.6   end
Si-28           337    0   1.00993E-04   293.6   end
Si-29           337    0   5.11370E-06   293.6   end
Si-30           337    0   3.39453E-06   293.6   end
Ti-46           337    0   4.20262E-07   293.6   end
Ti-47           337    0   3.79000E-07   293.6   end
Ti-48           337    0   3.75536E-06   293.6   end
Ti-49           337    0   2.75590E-07   293.6   end
Ti-50           337    0   2.63873E-07   293.6   end
Cr-50           337    0   5.30517E-07   293.6   end
Cr-52           337    0   1.02189E-05   293.6   end
Cr-53           337    0   1.15860E-06   293.6   end
Cr-54           337    0   2.87821E-07   293.6   end
Mn-55           337    0   6.48581E-06   293.6   end
Fe-54           337    0   2.36993E-06   293.6   end
Fe-56           337    0   3.71695E-05   293.6   end
Fe-57           337    0   8.58848E-07   293.6   end
Fe-58           337    0   1.13433E-07   293.6   end
Cu-63           337    0   1.89155E-05   293.6   end
Cu-65           337    0   8.43090E-06   293.6   end
 U-234          337    0   4.44742E-06   293.6   end
 U-235          337    0   4.14500E-04   293.6   end
 U-236          337    0   1.77898E-06   293.6   end
 U-238          337    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            338    0   3.32434E-02   293.6   end
 O-16           338    0   1.75562E-02   293.6   end
Mg-24           338    0   1.05686E-04   293.6   end
Mg-25           338    0   1.33797E-05   293.6   end
Mg-26           338    0   1.47310E-05   293.6   end
Al-27           338    0   2.85280E-02   293.6   end
Si-28           338    0   1.01591E-04   293.6   end
Si-29           338    0   5.14401E-06   293.6   end
Si-30           338    0   3.41465E-06   293.6   end
Ti-46           338    0   4.20262E-07   293.6   end
Ti-47           338    0   3.79000E-07   293.6   end
Ti-48           338    0   3.75536E-06   293.6   end
Ti-49           338    0   2.75590E-07   293.6   end
Ti-50           338    0   2.63873E-07   293.6   end
Cr-50           338    0   5.30517E-07   293.6   end
Cr-52           338    0   1.02189E-05   293.6   end
Cr-53           338    0   1.15860E-06   293.6   end
Cr-54           338    0   2.87821E-07   293.6   end
Mn-55           338    0   6.51903E-06   293.6   end
Fe-54           338    0   2.38905E-06   293.6   end
Fe-56           338    0   3.74693E-05   293.6   end
Fe-57           338    0   8.65776E-07   293.6   end
Fe-58           338    0   1.14348E-07   293.6   end
Cu-63           338    0   1.90262E-05   293.6   end
Cu-65           338    0   8.48022E-06   293.6   end
 U-234          338    0   3.63412E-06   293.6   end
 U-235          338    0   3.38700E-04   293.6   end
 U-236          338    0   1.45366E-06   293.6   end
 U-238          338    0   1.96242E-05   293.6   end
```

```
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            339    0   3.32434E-02   293.6   end
 O-16           339    0   1.73591E-02   293.6   end
Mg-24           339    0   1.05686E-04   293.6   end
Mg-25           339    0   1.33797E-05   293.6   end
Mg-26           339    0   1.47310E-05   293.6   end
Al-27           339    0   2.87722E-02   293.6   end
Si-28           339    0   1.02136E-04   293.6   end
Si-29           339    0   5.17160E-06   293.6   end
Si-30           339    0   3.43297E-06   293.6   end
Ti-46           339    0   4.20262E-07   293.6   end
Ti-47           339    0   3.79000E-07   293.6   end
Ti-48           339    0   3.75536E-06   293.6   end
Ti-49           339    0   2.75590E-07   293.6   end
Ti-50           339    0   2.63873E-07   293.6   end
Cr-50           339    0   5.30517E-07   293.6   end
Cr-52           339    0   1.02189E-05   293.6   end
Cr-53           339    0   1.15860E-06   293.6   end
Cr-54           339    0   2.87821E-07   293.6   end
Mn-55           339    0   6.54922E-06   293.6   end
Fe-54           339    0   2.40643E-06   293.6   end
Fe-56           339    0   3.77418E-05   293.6   end
Fe-57           339    0   8.72072E-07   293.6   end
Fe-58           339    0   1.15179E-07   293.6   end
Cu-63           339    0   1.91268E-05   293.6   end
Cu-65           339    0   8.52504E-06   293.6   end
 U-234          339    0   2.89485E-06   293.6   end
 U-235          339    0   2.69800E-04   293.6   end
 U-236          339    0   1.15795E-06   293.6   end
 U-238          339    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 4
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            341    0   3.32434E-02   293.6   end
 O-16           341    0   1.77945E-02   293.6   end
Mg-24           341    0   1.05686E-04   293.6   end
Mg-25           341    0   1.33797E-05   293.6   end
Mg-26           341    0   1.47310E-05   293.6   end
Al-27           341    0   2.82328E-02   293.6   end
Si-28           341    0   1.00933E-04   293.6   end
Si-29           341    0   5.11066E-06   293.6   end
Si-30           341    0   3.39252E-06   293.6   end
Ti-46           341    0   4.20262E-07   293.6   end
Ti-47           341    0   3.79000E-07   293.6   end
Ti-48           341    0   3.75536E-06   293.6   end
Ti-49           341    0   2.75590E-07   293.6   end
Ti-50           341    0   2.63873E-07   293.6   end
Cr-50           341    0   5.30517E-07   293.6   end
Cr-52           341    0   1.02189E-05   293.6   end
Cr-53           341    0   1.15860E-06   293.6   end
Cr-54           341    0   2.87821E-07   293.6   end
Mn-55           341    0   6.48252E-06   293.6   end
Fe-54           341    0   2.36804E-06   293.6   end
Fe-56           341    0   3.71398E-05   293.6   end
Fe-57           341    0   8.58163E-07   293.6   end
Fe-58           341    0   1.13342E-07   293.6   end
Cu-63           341    0   1.89046E-05   293.6   end
Cu-65           341    0   8.42602E-06   293.6   end
 U-234          341    0   4.52789E-06   293.6   end
 U-235          341    0   4.22000E-04   293.6   end
 U-236          341    0   1.81117E-06   293.6   end
 U-238          341    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            342    0   3.32434E-02   293.6   end
 O-16           342    0   1.80329E-02   293.6   end
Mg-24           342    0   1.05686E-04   293.6   end
Mg-25           342    0   1.33797E-05   293.6   end
Mg-26           342    0   1.47310E-05   293.6   end
Al-27           342    0   2.79375E-02   293.6   end
Si-28           342    0   1.00274E-04   293.6   end
Si-29           342    0   5.07732E-06   293.6   end
Si-30           342    0   3.37038E-06   293.6   end
Ti-46           342    0   4.20262E-07   293.6   end
Ti-47           342    0   3.79000E-07   293.6   end
Ti-48           342    0   3.75536E-06   293.6   end
Ti-49           342    0   2.75590E-07   293.6   end
Ti-50           342    0   2.63873E-07   293.6   end
Cr-50           342    0   5.30517E-07   293.6   end
```

```
Cr-52           342    0   1.02189E-05   293.6   end
Cr-53           342    0   1.15860E-06   293.6   end
Cr-54           342    0   2.87821E-07   293.6   end
Mn-55           342    0   6.44602E-06   293.6   end
Fe-54           342    0   2.34704E-06   293.6   end
Fe-56           342    0   3.68104E-05   293.6   end
Fe-57           342    0   8.50550E-07   293.6   end
Fe-58           342    0   1.12337E-07   293.6   end
Cu-63           342    0   1.87830E-05   293.6   end
Cu-65           342    0   8.37182E-06   293.6   end
 U-234          342    0   5.42167E-06   293.6   end
 U-235          342    0   5.05300E-04   293.6   end
 U-236          342    0   2.16868E-06   293.6   end
 U-238          342    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            343    0   3.32434E-02   293.6   end
 O-16           343    0   1.82870E-02   293.6   end
Mg-24           343    0   1.05686E-04   293.6   end
Mg-25           343    0   1.33797E-05   293.6   end
Mg-26           343    0   1.47310E-05   293.6   end
Al-27           343    0   2.76228E-02   293.6   end
Si-28           343    0   9.95724E-05   293.6   end
Si-29           343    0   5.04178E-06   293.6   end
Si-30           343    0   3.34679E-06   293.6   end
Ti-46           343    0   4.20262E-07   293.6   end
Ti-47           343    0   3.79000E-07   293.6   end
Ti-48           343    0   3.75536E-06   293.6   end
Ti-49           343    0   2.75590E-07   293.6   end
Ti-50           343    0   2.63873E-07   293.6   end
Cr-50           343    0   5.30517E-07   293.6   end
Cr-52           343    0   1.02189E-05   293.6   end
Cr-53           343    0   1.15860E-06   293.6   end
Cr-54           343    0   2.87821E-07   293.6   end
Mn-55           343    0   6.40711E-06   293.6   end
Fe-54           343    0   2.32464E-06   293.6   end
Fe-56           343    0   3.64591E-05   293.6   end
Fe-57           343    0   8.42433E-07   293.6   end
Fe-58           343    0   1.11265E-07   293.6   end
Cu-63           343    0   1.86534E-05   293.6   end
Cu-65           343    0   8.31405E-06   293.6   end
 U-234          343    0   6.37446E-06   293.6   end
 U-235          343    0   5.94100E-04   293.6   end
 U-236          343    0   2.54980E-06   293.6   end
 U-238          343    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            344    0   3.32434E-02   293.6   end
 O-16           344    0   1.85176E-02   293.6   end
Mg-24           344    0   1.05686E-04   293.6   end
Mg-25           344    0   1.33797E-05   293.6   end
Mg-26           344    0   1.47310E-05   293.6   end
Al-27           344    0   2.73372E-02   293.6   end
Si-28           344    0   9.89350E-05   293.6   end
Si-29           344    0   5.00951E-06   293.6   end
Si-30           344    0   3.32537E-06   293.6   end
Ti-46           344    0   4.20262E-07   293.6   end
Ti-47           344    0   3.79000E-07   293.6   end
Ti-48           344    0   3.75536E-06   293.6   end
Ti-49           344    0   2.75590E-07   293.6   end
Ti-50           344    0   2.63873E-07   293.6   end
Cr-50           344    0   5.30517E-07   293.6   end
Cr-52           344    0   1.02189E-05   293.6   end
Cr-53           344    0   1.15860E-06   293.6   end
Cr-54           344    0   2.87821E-07   293.6   end
Mn-55           344    0   6.37178E-06   293.6   end
Fe-54           344    0   2.30432E-06   293.6   end
Fe-56           344    0   3.61403E-05   293.6   end
Fe-57           344    0   8.35068E-07   293.6   end
Fe-58           344    0   1.10292E-07   293.6   end
Cu-63           344    0   1.85357E-05   293.6   end
Cu-65           344    0   8.26161E-06   293.6   end
 U-234          344    0   7.23926E-06   293.6   end
 U-235          344    0   6.74700E-04   293.6   end
 U-236          344    0   2.89573E-06   293.6   end
 U-238          344    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            345    0   3.32434E-02   293.6   end
 O-16           345    0   1.84469E-02   293.6   end
Mg-24           345    0   1.05686E-04   293.6   end
```

```
Mg-25           345    0   1.33797E-05   293.6   end
Mg-26           345    0   1.47310E-05   293.6   end
Al-27           345    0   2.74247E-02   293.6   end
Si-28           345    0   9.91306E-05   293.6   end
Si-29           345    0   5.01941E-06   293.6   end
Si-30           345    0   3.33194E-06   293.6   end
Ti-46           345    0   4.20262E-07   293.6   end
Ti-47           345    0   3.79000E-07   293.6   end
Ti-48           345    0   3.75536E-06   293.6   end
Ti-49           345    0   2.75590E-07   293.6   end
Ti-50           345    0   2.63873E-07   293.6   end
Cr-50           345    0   5.30517E-07   293.6   end
Cr-52           345    0   1.02189E-05   293.6   end
Cr-53           345    0   1.15860E-06   293.6   end
Cr-54           345    0   2.87821E-07   293.6   end
Mn-55           345    0   6.38261E-06   293.6   end
Fe-54           345    0   2.31055E-06   293.6   end
Fe-56           345    0   3.62380E-05   293.6   end
Fe-57           345    0   8.37326E-07   293.6   end
Fe-58           345    0   1.10590E-07   293.6   end
Cu-63           345    0   1.85717E-05   293.6   end
Cu-65           345    0   8.27767E-06   293.6   end
 U-234          345    0   6.97424E-06   293.6   end
 U-235          345    0   6.50000E-04   293.6   end
 U-236          345    0   2.78972E-06   293.6   end
 U-238          345    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            346    0   3.32434E-02   293.6   end
 O-16           346    0   1.81013E-02   293.6   end
Mg-24           346    0   1.05686E-04   293.6   end
Mg-25           346    0   1.33797E-05   293.6   end
Mg-26           346    0   1.47310E-05   293.6   end
Al-27           346    0   2.78528E-02   293.6   end
Si-28           346    0   1.00085E-04   293.6   end
Si-29           346    0   5.06774E-06   293.6   end
Si-30           346    0   3.36403E-06   293.6   end
Ti-46           346    0   4.20262E-07   293.6   end
Ti-47           346    0   3.79000E-07   293.6   end
Ti-48           346    0   3.75536E-06   293.6   end
Ti-49           346    0   2.75590E-07   293.6   end
Ti-50           346    0   2.63873E-07   293.6   end
Cr-50           346    0   5.30517E-07   293.6   end
Cr-52           346    0   1.02189E-05   293.6   end
Cr-53           346    0   1.15860E-06   293.6   end
Cr-54           346    0   2.87821E-07   293.6   end
Mn-55           346    0   6.43555E-06   293.6   end
Fe-54           346    0   2.34101E-06   293.6   end
Fe-56           346    0   3.67158E-05   293.6   end
Fe-57           346    0   8.48365E-07   293.6   end
Fe-58           346    0   1.12048E-07   293.6   end
Cu-63           346    0   1.87481E-05   293.6   end
Cu-65           346    0   8.35629E-06   293.6   end
 U-234          346    0   5.67811E-06   293.6   end
 U-235          346    0   5.29200E-04   293.6   end
 U-236          346    0   2.27126E-06   293.6   end
 U-238          346    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            347    0   3.32434E-02   293.6   end
 O-16           347    0   1.77731E-02   293.6   end
Mg-24           347    0   1.05686E-04   293.6   end
Mg-25           347    0   1.33797E-05   293.6   end
Mg-26           347    0   1.47310E-05   293.6   end
Al-27           347    0   2.82593E-02   293.6   end
Si-28           347    0   1.00993E-04   293.6   end
Si-29           347    0   5.11370E-06   293.6   end
Si-30           347    0   3.39453E-06   293.6   end
Ti-46           347    0   4.20262E-07   293.6   end
Ti-47           347    0   3.79000E-07   293.6   end
Ti-48           347    0   3.75536E-06   293.6   end
Ti-49           347    0   2.75590E-07   293.6   end
Ti-50           347    0   2.63873E-07   293.6   end
Cr-50           347    0   5.30517E-07   293.6   end
Cr-52           347    0   1.02189E-05   293.6   end
Cr-53           347    0   1.15860E-06   293.6   end
Cr-54           347    0   2.87821E-07   293.6   end
Mn-55           347    0   6.48581E-06   293.6   end
Fe-54           347    0   2.36993E-06   293.6   end
Fe-56           347    0   3.71695E-05   293.6   end
Fe-57           347    0   8.58848E-07   293.6   end
```

```
Fe-58           347    0   1.13433E-07   293.6   end
Cu-63           347    0   1.89155E-05   293.6   end
Cu-65           347    0   8.43090E-06   293.6   end
 U-234          347    0   4.44742E-06   293.6   end
 U-235          347    0   4.14500E-04   293.6   end
 U-236          347    0   1.77898E-06   293.6   end
 U-238          347    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            348    0   3.32434E-02   293.6   end
 O-16           348    0   1.75562E-02   293.6   end
Mg-24           348    0   1.05686E-04   293.6   end
Mg-25           348    0   1.33797E-05   293.6   end
Mg-26           348    0   1.47310E-05   293.6   end
Al-27           348    0   2.85280E-02   293.6   end
Si-28           348    0   1.01591E-04   293.6   end
Si-29           348    0   5.14401E-06   293.6   end
Si-30           348    0   3.41465E-06   293.6   end
Ti-46           348    0   4.20262E-07   293.6   end
Ti-47           348    0   3.79000E-07   293.6   end
Ti-48           348    0   3.75536E-06   293.6   end
Ti-49           348    0   2.75590E-07   293.6   end
Ti-50           348    0   2.63873E-07   293.6   end
Cr-50           348    0   5.30517E-07   293.6   end
Cr-52           348    0   1.02189E-05   293.6   end
Cr-53           348    0   1.15860E-06   293.6   end
Cr-54           348    0   2.87821E-07   293.6   end
Mn-55           348    0   6.51903E-06   293.6   end
Fe-54           348    0   2.38905E-06   293.6   end
Fe-56           348    0   3.74693E-05   293.6   end
Fe-57           348    0   8.65776E-07   293.6   end
Fe-58           348    0   1.14348E-07   293.6   end
Cu-63           348    0   1.90262E-05   293.6   end
Cu-65           348    0   8.48022E-06   293.6   end
 U-234          348    0   3.63412E-06   293.6   end
 U-235          348    0   3.38700E-04   293.6   end
 U-236          348    0   1.45366E-06   293.6   end
 U-238          348    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            349    0   3.32434E-02   293.6   end
 O-16           349    0   1.73591E-02   293.6   end
Mg-24           349    0   1.05686E-04   293.6   end
Mg-25           349    0   1.33797E-05   293.6   end
Mg-26           349    0   1.47310E-05   293.6   end
Al-27           349    0   2.87722E-02   293.6   end
Si-28           349    0   1.02136E-04   293.6   end
Si-29           349    0   5.17160E-06   293.6   end
Si-30           349    0   3.43297E-06   293.6   end
Ti-46           349    0   4.20262E-07   293.6   end
Ti-47           349    0   3.79000E-07   293.6   end
Ti-48           349    0   3.75536E-06   293.6   end
Ti-49           349    0   2.75590E-07   293.6   end
Ti-50           349    0   2.63873E-07   293.6   end
Cr-50           349    0   5.30517E-07   293.6   end
Cr-52           349    0   1.02189E-05   293.6   end
Cr-53           349    0   1.15860E-06   293.6   end
Cr-54           349    0   2.87821E-07   293.6   end
Mn-55           349    0   6.54922E-06   293.6   end
Fe-54           349    0   2.40643E-06   293.6   end
Fe-56           349    0   3.77418E-05   293.6   end
Fe-57           349    0   8.72072E-07   293.6   end
Fe-58           349    0   1.15179E-07   293.6   end
Cu-63           349    0   1.91268E-05   293.6   end
Cu-65           349    0   8.52504E-06   293.6   end
 U-234          349    0   2.89485E-06   293.6   end
 U-235          349    0   2.69800E-04   293.6   end
 U-236          349    0   1.15795E-06   293.6   end
 U-238          349    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            351    0   3.32434E-02   293.6   end
 O-16           351    0   1.77945E-02   293.6   end
Mg-24           351    0   1.05686E-04   293.6   end
Mg-25           351    0   1.33797E-05   293.6   end
Mg-26           351    0   1.47310E-05   293.6   end
Al-27           351    0   2.82328E-02   293.6   end
Si-28           351    0   1.00933E-04   293.6   end
Si-29           351    0   5.11066E-06   293.6   end
```

```
Si-30           351    0   3.39252E-06   293.6   end
Ti-46           351    0   4.20262E-07   293.6   end
Ti-47           351    0   3.79000E-07   293.6   end
Ti-48           351    0   3.75536E-06   293.6   end
Ti-49           351    0   2.75590E-07   293.6   end
Ti-50           351    0   2.63873E-07   293.6   end
Cr-50           351    0   5.30517E-07   293.6   end
Cr-52           351    0   1.02189E-05   293.6   end
Cr-53           351    0   1.15860E-06   293.6   end
Cr-54           351    0   2.87821E-07   293.6   end
Mn-55           351    0   6.48252E-06   293.6   end
Fe-54           351    0   2.36804E-06   293.6   end
Fe-56           351    0   3.71398E-05   293.6   end
Fe-57           351    0   8.58163E-07   293.6   end
Fe-58           351    0   1.13342E-07   293.6   end
Cu-63           351    0   1.89046E-05   293.6   end
Cu-65           351    0   8.42602E-06   293.6   end
 U-234          351    0   4.52789E-06   293.6   end
 U-235          351    0   4.22000E-04   293.6   end
 U-236          351    0   1.81117E-06   293.6   end
 U-238          351    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            352    0   3.32434E-02   293.6   end
 O-16           352    0   1.80329E-02   293.6   end
Mg-24           352    0   1.05686E-04   293.6   end
Mg-25           352    0   1.33797E-05   293.6   end
Mg-26           352    0   1.47310E-05   293.6   end
Al-27           352    0   2.79375E-02   293.6   end
Si-28           352    0   1.00274E-04   293.6   end
Si-29           352    0   5.07732E-06   293.6   end
Si-30           352    0   3.37038E-06   293.6   end
Ti-46           352    0   4.20262E-07   293.6   end
Ti-47           352    0   3.79000E-07   293.6   end
Ti-48           352    0   3.75536E-06   293.6   end
Ti-49           352    0   2.75590E-07   293.6   end
Ti-50           352    0   2.63873E-07   293.6   end
Cr-50           352    0   5.30517E-07   293.6   end
Cr-52           352    0   1.02189E-05   293.6   end
Cr-53           352    0   1.15860E-06   293.6   end
Cr-54           352    0   2.87821E-07   293.6   end
Mn-55           352    0   6.44602E-06   293.6   end
Fe-54           352    0   2.34704E-06   293.6   end
Fe-56           352    0   3.68104E-05   293.6   end
Fe-57           352    0   8.50550E-07   293.6   end
Fe-58           352    0   1.12337E-07   293.6   end
Cu-63           352    0   1.87830E-05   293.6   end
Cu-65           352    0   8.37182E-06   293.6   end
 U-234          352    0   5.42167E-06   293.6   end
 U-235          352    0   5.05300E-04   293.6   end
 U-236          352    0   2.16868E-06   293.6   end
 U-238          352    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            353    0   3.32434E-02   293.6   end
 O-16           353    0   1.82870E-02   293.6   end
Mg-24           353    0   1.05686E-04   293.6   end
Mg-25           353    0   1.33797E-05   293.6   end
Mg-26           353    0   1.47310E-05   293.6   end
Al-27           353    0   2.76228E-02   293.6   end
Si-28           353    0   9.95724E-05   293.6   end
Si-29           353    0   5.04178E-06   293.6   end
Si-30           353    0   3.34679E-06   293.6   end
Ti-46           353    0   4.20262E-07   293.6   end
Ti-47           353    0   3.79000E-07   293.6   end
Ti-48           353    0   3.75536E-06   293.6   end
Ti-49           353    0   2.75590E-07   293.6   end
Ti-50           353    0   2.63873E-07   293.6   end
Cr-50           353    0   5.30517E-07   293.6   end
Cr-52           353    0   1.02189E-05   293.6   end
Cr-53           353    0   1.15860E-06   293.6   end
Cr-54           353    0   2.87821E-07   293.6   end
Mn-55           353    0   6.40711E-06   293.6   end
Fe-54           353    0   2.32464E-06   293.6   end
Fe-56           353    0   3.64591E-05   293.6   end
Fe-57           353    0   8.42433E-07   293.6   end
Fe-58           353    0   1.11265E-07   293.6   end
Cu-63           353    0   1.86534E-05   293.6   end
Cu-65           353    0   8.31405E-06   293.6   end
 U-234          353    0   6.37446E-06   293.6   end
 U-235          353    0   5.94100E-04   293.6   end
```

```
 U-236          353    0   2.54980E-06   293.6   end
 U-238          353    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            354    0   3.32434E-02   293.6   end
 O-16           354    0   1.85176E-02   293.6   end
Mg-24           354    0   1.05686E-04   293.6   end
Mg-25           354    0   1.33797E-05   293.6   end
Mg-26           354    0   1.47310E-05   293.6   end
Al-27           354    0   2.73372E-02   293.6   end
Si-28           354    0   9.89350E-05   293.6   end
Si-29           354    0   5.00951E-06   293.6   end
Si-30           354    0   3.32537E-06   293.6   end
Ti-46           354    0   4.20262E-07   293.6   end
Ti-47           354    0   3.79000E-07   293.6   end
Ti-48           354    0   3.75536E-06   293.6   end
Ti-49           354    0   2.75590E-07   293.6   end
Ti-50           354    0   2.63873E-07   293.6   end
Cr-50           354    0   5.30517E-07   293.6   end
Cr-52           354    0   1.02189E-05   293.6   end
Cr-53           354    0   1.15860E-06   293.6   end
Cr-54           354    0   2.87821E-07   293.6   end
Mn-55           354    0   6.37178E-06   293.6   end
Fe-54           354    0   2.30432E-06   293.6   end
Fe-56           354    0   3.61403E-05   293.6   end
Fe-57           354    0   8.35068E-07   293.6   end
Fe-58           354    0   1.10292E-07   293.6   end
Cu-63           354    0   1.85357E-05   293.6   end
Cu-65           354    0   8.26161E-06   293.6   end
 U-234          354    0   7.23926E-06   293.6   end
 U-235          354    0   6.74700E-04   293.6   end
 U-236          354    0   2.89573E-06   293.6   end
 U-238          354    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            355    0   3.32434E-02   293.6   end
 O-16           355    0   1.84469E-02   293.6   end
Mg-24           355    0   1.05686E-04   293.6   end
Mg-25           355    0   1.33797E-05   293.6   end
Mg-26           355    0   1.47310E-05   293.6   end
Al-27           355    0   2.74247E-02   293.6   end
Si-28           355    0   9.91306E-05   293.6   end
Si-29           355    0   5.01941E-06   293.6   end
Si-30           355    0   3.33194E-06   293.6   end
Ti-46           355    0   4.20262E-07   293.6   end
Ti-47           355    0   3.79000E-07   293.6   end
Ti-48           355    0   3.75536E-06   293.6   end
Ti-49           355    0   2.75590E-07   293.6   end
Ti-50           355    0   2.63873E-07   293.6   end
Cr-50           355    0   5.30517E-07   293.6   end
Cr-52           355    0   1.02189E-05   293.6   end
Cr-53           355    0   1.15860E-06   293.6   end
Cr-54           355    0   2.87821E-07   293.6   end
Mn-55           355    0   6.38261E-06   293.6   end
Fe-54           355    0   2.31055E-06   293.6   end
Fe-56           355    0   3.62380E-05   293.6   end
Fe-57           355    0   8.37326E-07   293.6   end
Fe-58           355    0   1.10590E-07   293.6   end
Cu-63           355    0   1.85717E-05   293.6   end
Cu-65           355    0   8.27767E-06   293.6   end
 U-234          355    0   6.97424E-06   293.6   end
 U-235          355    0   6.50000E-04   293.6   end
 U-236          355    0   2.78972E-06   293.6   end
 U-238          355    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            356    0   3.32434E-02   293.6   end
 O-16           356    0   1.81013E-02   293.6   end
Mg-24           356    0   1.05686E-04   293.6   end
Mg-25           356    0   1.33797E-05   293.6   end
Mg-26           356    0   1.47310E-05   293.6   end
Al-27           356    0   2.78528E-02   293.6   end
Si-28           356    0   1.00085E-04   293.6   end
Si-29           356    0   5.06774E-06   293.6   end
Si-30           356    0   3.36403E-06   293.6   end
Ti-46           356    0   4.20262E-07   293.6   end
Ti-47           356    0   3.79000E-07   293.6   end
Ti-48           356    0   3.75536E-06   293.6   end
Ti-49           356    0   2.75590E-07   293.6   end
Ti-50           356    0   2.63873E-07   293.6   end
Cr-50           356    0   5.30517E-07   293.6   end
```

```
Cr-52           356    0   1.02189E-05   293.6   end
Cr-53           356    0   1.15860E-06   293.6   end
Cr-54           356    0   2.87821E-07   293.6   end
Mn-55           356    0   6.43555E-06   293.6   end
Fe-54           356    0   2.34101E-06   293.6   end
Fe-56           356    0   3.67158E-05   293.6   end
Fe-57           356    0   8.48365E-07   293.6   end
Fe-58           356    0   1.12048E-07   293.6   end
Cu-63           356    0   1.87481E-05   293.6   end
Cu-65           356    0   8.35629E-06   293.6   end
 U-234          356    0   5.67811E-06   293.6   end
 U-235          356    0   5.29200E-04   293.6   end
 U-236          356    0   2.27126E-06   293.6   end
 U-238          356    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            357    0   3.32434E-02   293.6   end
 O-16           357    0   1.77731E-02   293.6   end
Mg-24           357    0   1.05686E-04   293.6   end
Mg-25           357    0   1.33797E-05   293.6   end
Mg-26           357    0   1.47310E-05   293.6   end
Al-27           357    0   2.82593E-02   293.6   end
Si-28           357    0   1.00993E-04   293.6   end
Si-29           357    0   5.11370E-06   293.6   end
Si-30           357    0   3.39453E-06   293.6   end
Ti-46           357    0   4.20262E-07   293.6   end
Ti-47           357    0   3.79000E-07   293.6   end
Ti-48           357    0   3.75536E-06   293.6   end
Ti-49           357    0   2.75590E-07   293.6   end
Ti-50           357    0   2.63873E-07   293.6   end
Cr-50           357    0   5.30517E-07   293.6   end
Cr-52           357    0   1.02189E-05   293.6   end
Cr-53           357    0   1.15860E-06   293.6   end
Cr-54           357    0   2.87821E-07   293.6   end
Mn-55           357    0   6.48581E-06   293.6   end
Fe-54           357    0   2.36993E-06   293.6   end
Fe-56           357    0   3.71695E-05   293.6   end
Fe-57           357    0   8.58848E-07   293.6   end
Fe-58           357    0   1.13433E-07   293.6   end
Cu-63           357    0   1.89155E-05   293.6   end
Cu-65           357    0   8.43090E-06   293.6   end
 U-234          357    0   4.44742E-06   293.6   end
 U-235          357    0   4.14500E-04   293.6   end
 U-236          357    0   1.77898E-06   293.6   end
 U-238          357    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            358    0   3.32434E-02   293.6   end
 O-16           358    0   1.75562E-02   293.6   end
Mg-24           358    0   1.05686E-04   293.6   end
Mg-25           358    0   1.33797E-05   293.6   end
Mg-26           358    0   1.47310E-05   293.6   end
Al-27           358    0   2.85280E-02   293.6   end
Si-28           358    0   1.01591E-04   293.6   end
Si-29           358    0   5.14401E-06   293.6   end
Si-30           358    0   3.41465E-06   293.6   end
Ti-46           358    0   4.20262E-07   293.6   end
Ti-47           358    0   3.79000E-07   293.6   end
Ti-48           358    0   3.75536E-06   293.6   end
Ti-49           358    0   2.75590E-07   293.6   end
Ti-50           358    0   2.63873E-07   293.6   end
Cr-50           358    0   5.30517E-07   293.6   end
Cr-52           358    0   1.02189E-05   293.6   end
Cr-53           358    0   1.15860E-06   293.6   end
Cr-54           358    0   2.87821E-07   293.6   end
Mn-55           358    0   6.51903E-06   293.6   end
Fe-54           358    0   2.38905E-06   293.6   end
Fe-56           358    0   3.74693E-05   293.6   end
Fe-57           358    0   8.65776E-07   293.6   end
Fe-58           358    0   1.14348E-07   293.6   end
Cu-63           358    0   1.90262E-05   293.6   end
Cu-65           358    0   8.48022E-06   293.6   end
 U-234          358    0   3.63412E-06   293.6   end
 U-235          358    0   3.38700E-04   293.6   end
 U-236          358    0   1.45366E-06   293.6   end
 U-238          358    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            359    0   3.32434E-02   293.6   end
 O-16           359    0   1.73591E-02   293.6   end
Mg-24           359    0   1.05686E-04   293.6   end
```

```
Mg-25           359    0   1.33797E-05   293.6   end
Mg-26           359    0   1.47310E-05   293.6   end
Al-27           359    0   2.87722E-02   293.6   end
Si-28           359    0   1.02136E-04   293.6   end
Si-29           359    0   5.17160E-06   293.6   end
Si-30           359    0   3.43297E-06   293.6   end
Ti-46           359    0   4.20262E-07   293.6   end
Ti-47           359    0   3.79000E-07   293.6   end
Ti-48           359    0   3.75536E-06   293.6   end
Ti-49           359    0   2.75590E-07   293.6   end
Ti-50           359    0   2.63873E-07   293.6   end
Cr-50           359    0   5.30517E-07   293.6   end
Cr-52           359    0   1.02189E-05   293.6   end
Cr-53           359    0   1.15860E-06   293.6   end
Cr-54           359    0   2.87821E-07   293.6   end
Mn-55           359    0   6.54922E-06   293.6   end
Fe-54           359    0   2.40643E-06   293.6   end
Fe-56           359    0   3.77418E-05   293.6   end
Fe-57           359    0   8.72072E-07   293.6   end
Fe-58           359    0   1.15179E-07   293.6   end
Cu-63           359    0   1.91268E-05   293.6   end
Cu-65           359    0   8.52504E-06   293.6   end
 U-234          359    0   2.89485E-06   293.6   end
 U-235          359    0   2.69800E-04   293.6   end
 U-236          359    0   1.15795E-06   293.6   end
 U-238          359    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 6
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            361    0   3.32434E-02   293.6   end
 O-16           361    0   1.77945E-02   293.6   end
Mg-24           361    0   1.05686E-04   293.6   end
Mg-25           361    0   1.33797E-05   293.6   end
Mg-26           361    0   1.47310E-05   293.6   end
Al-27           361    0   2.82328E-02   293.6   end
Si-28           361    0   1.00933E-04   293.6   end
Si-29           361    0   5.11066E-06   293.6   end
Si-30           361    0   3.39252E-06   293.6   end
Ti-46           361    0   4.20262E-07   293.6   end
Ti-47           361    0   3.79000E-07   293.6   end
Ti-48           361    0   3.75536E-06   293.6   end
Ti-49           361    0   2.75590E-07   293.6   end
Ti-50           361    0   2.63873E-07   293.6   end
Cr-50           361    0   5.30517E-07   293.6   end
Cr-52           361    0   1.02189E-05   293.6   end
Cr-53           361    0   1.15860E-06   293.6   end
Cr-54           361    0   2.87821E-07   293.6   end
Mn-55           361    0   6.48252E-06   293.6   end
Fe-54           361    0   2.36804E-06   293.6   end
Fe-56           361    0   3.71398E-05   293.6   end
Fe-57           361    0   8.58163E-07   293.6   end
Fe-58           361    0   1.13342E-07   293.6   end
Cu-63           361    0   1.89046E-05   293.6   end
Cu-65           361    0   8.42602E-06   293.6   end
 U-234          361    0   4.52789E-06   293.6   end
 U-235          361    0   4.22000E-04   293.6   end
 U-236          361    0   1.81117E-06   293.6   end
 U-238          361    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            362    0   3.32434E-02   293.6   end
 O-16           362    0   1.80329E-02   293.6   end
Mg-24           362    0   1.05686E-04   293.6   end
Mg-25           362    0   1.33797E-05   293.6   end
Mg-26           362    0   1.47310E-05   293.6   end
Al-27           362    0   2.79375E-02   293.6   end
Si-28           362    0   1.00274E-04   293.6   end
Si-29           362    0   5.07732E-06   293.6   end
Si-30           362    0   3.37038E-06   293.6   end
Ti-46           362    0   4.20262E-07   293.6   end
Ti-47           362    0   3.79000E-07   293.6   end
Ti-48           362    0   3.75536E-06   293.6   end
Ti-49           362    0   2.75590E-07   293.6   end
Ti-50           362    0   2.63873E-07   293.6   end
Cr-50           362    0   5.30517E-07   293.6   end
Cr-52           362    0   1.02189E-05   293.6   end
Cr-53           362    0   1.15860E-06   293.6   end
Cr-54           362    0   2.87821E-07   293.6   end
Mn-55           362    0   6.44602E-06   293.6   end
Fe-54           362    0   2.34704E-06   293.6   end
```

```
Fe-56           362    0   3.68104E-05   293.6   end
Fe-57           362    0   8.50550E-07   293.6   end
Fe-58           362    0   1.12337E-07   293.6   end
Cu-63           362    0   1.87830E-05   293.6   end
Cu-65           362    0   8.37182E-06   293.6   end
 U-234          362    0   5.42167E-06   293.6   end
 U-235          362    0   5.05300E-04   293.6   end
 U-236          362    0   2.16868E-06   293.6   end
 U-238          362    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            363    0   3.32434E-02   293.6   end
 O-16           363    0   1.82870E-02   293.6   end
Mg-24           363    0   1.05686E-04   293.6   end
Mg-25           363    0   1.33797E-05   293.6   end
Mg-26           363    0   1.47310E-05   293.6   end
Al-27           363    0   2.76228E-02   293.6   end
Si-28           363    0   9.95724E-05   293.6   end
Si-29           363    0   5.04178E-06   293.6   end
Si-30           363    0   3.34679E-06   293.6   end
Ti-46           363    0   4.20262E-07   293.6   end
Ti-47           363    0   3.79000E-07   293.6   end
Ti-48           363    0   3.75536E-06   293.6   end
Ti-49           363    0   2.75590E-07   293.6   end
Ti-50           363    0   2.63873E-07   293.6   end
Cr-50           363    0   5.30517E-07   293.6   end
Cr-52           363    0   1.02189E-05   293.6   end
Cr-53           363    0   1.15860E-06   293.6   end
Cr-54           363    0   2.87821E-07   293.6   end
Mn-55           363    0   6.40711E-06   293.6   end
Fe-54           363    0   2.32464E-06   293.6   end
Fe-56           363    0   3.64591E-05   293.6   end
Fe-57           363    0   8.42433E-07   293.6   end
Fe-58           363    0   1.11265E-07   293.6   end
Cu-63           363    0   1.86534E-05   293.6   end
Cu-65           363    0   8.31405E-06   293.6   end
 U-234          363    0   6.37446E-06   293.6   end
 U-235          363    0   5.94100E-04   293.6   end
 U-236          363    0   2.54980E-06   293.6   end
 U-238          363    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            364    0   3.32434E-02   293.6   end
 O-16           364    0   1.85176E-02   293.6   end
Mg-24           364    0   1.05686E-04   293.6   end
Mg-25           364    0   1.33797E-05   293.6   end
Mg-26           364    0   1.47310E-05   293.6   end
Al-27           364    0   2.73372E-02   293.6   end
Si-28           364    0   9.89350E-05   293.6   end
Si-29           364    0   5.00951E-06   293.6   end
Si-30           364    0   3.32537E-06   293.6   end
Ti-46           364    0   4.20262E-07   293.6   end
Ti-47           364    0   3.79000E-07   293.6   end
Ti-48           364    0   3.75536E-06   293.6   end
Ti-49           364    0   2.75590E-07   293.6   end
Ti-50           364    0   2.63873E-07   293.6   end
Cr-50           364    0   5.30517E-07   293.6   end
Cr-52           364    0   1.02189E-05   293.6   end
Cr-53           364    0   1.15860E-06   293.6   end
Cr-54           364    0   2.87821E-07   293.6   end
Mn-55           364    0   6.37178E-06   293.6   end
Fe-54           364    0   2.30432E-06   293.6   end
Fe-56           364    0   3.61403E-05   293.6   end
Fe-57           364    0   8.35068E-07   293.6   end
Fe-58           364    0   1.10292E-07   293.6   end
Cu-63           364    0   1.85357E-05   293.6   end
Cu-65           364    0   8.26161E-06   293.6   end
 U-234          364    0   7.23926E-06   293.6   end
 U-235          364    0   6.74700E-04   293.6   end
 U-236          364    0   2.89573E-06   293.6   end
 U-238          364    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            365    0   3.32434E-02   293.6   end
 O-16           365    0   1.84469E-02   293.6   end
Mg-24           365    0   1.05686E-04   293.6   end
Mg-25           365    0   1.33797E-05   293.6   end
Mg-26           365    0   1.47310E-05   293.6   end
Al-27           365    0   2.74247E-02   293.6   end
Si-28           365    0   9.91306E-05   293.6   end
Si-29           365    0   5.01941E-06   293.6   end
```

```
Si-30           365    0   3.33194E-06   293.6   end
Ti-46           365    0   4.20262E-07   293.6   end
Ti-47           365    0   3.79000E-07   293.6   end
Ti-48           365    0   3.75536E-06   293.6   end
Ti-49           365    0   2.75590E-07   293.6   end
Ti-50           365    0   2.63873E-07   293.6   end
Cr-50           365    0   5.30517E-07   293.6   end
Cr-52           365    0   1.02189E-05   293.6   end
Cr-53           365    0   1.15860E-06   293.6   end
Cr-54           365    0   2.87821E-07   293.6   end
Mn-55           365    0   6.38261E-06   293.6   end
Fe-54           365    0   2.31055E-06   293.6   end
Fe-56           365    0   3.62380E-05   293.6   end
Fe-57           365    0   8.37326E-07   293.6   end
Fe-58           365    0   1.10590E-07   293.6   end
Cu-63           365    0   1.85717E-05   293.6   end
Cu-65           365    0   8.27767E-06   293.6   end
 U-234          365    0   6.97424E-06   293.6   end
 U-235          365    0   6.50000E-04   293.6   end
 U-236          365    0   2.78972E-06   293.6   end
 U-238          365    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            366    0   3.32434E-02   293.6   end
 O-16           366    0   1.81013E-02   293.6   end
Mg-24           366    0   1.05686E-04   293.6   end
Mg-25           366    0   1.33797E-05   293.6   end
Mg-26           366    0   1.47310E-05   293.6   end
Al-27           366    0   2.78528E-02   293.6   end
Si-28           366    0   1.00085E-04   293.6   end
Si-29           366    0   5.06774E-06   293.6   end
Si-30           366    0   3.36403E-06   293.6   end
Ti-46           366    0   4.20262E-07   293.6   end
Ti-47           366    0   3.79000E-07   293.6   end
Ti-48           366    0   3.75536E-06   293.6   end
Ti-49           366    0   2.75590E-07   293.6   end
Ti-50           366    0   2.63873E-07   293.6   end
Cr-50           366    0   5.30517E-07   293.6   end
Cr-52           366    0   1.02189E-05   293.6   end
Cr-53           366    0   1.15860E-06   293.6   end
Cr-54           366    0   2.87821E-07   293.6   end
Mn-55           366    0   6.43555E-06   293.6   end
Fe-54           366    0   2.34101E-06   293.6   end
Fe-56           366    0   3.67158E-05   293.6   end
Fe-57           366    0   8.48365E-07   293.6   end
Fe-58           366    0   1.12048E-07   293.6   end
Cu-63           366    0   1.87481E-05   293.6   end
Cu-65           366    0   8.35629E-06   293.6   end
 U-234          366    0   5.67811E-06   293.6   end
 U-235          366    0   5.29200E-04   293.6   end
 U-236          366    0   2.27126E-06   293.6   end
 U-238          366    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            367    0   3.32434E-02   293.6   end
 O-16           367    0   1.77731E-02   293.6   end
Mg-24           367    0   1.05686E-04   293.6   end
Mg-25           367    0   1.33797E-05   293.6   end
Mg-26           367    0   1.47310E-05   293.6   end
Al-27           367    0   2.82593E-02   293.6   end
Si-28           367    0   1.00993E-04   293.6   end
Si-29           367    0   5.11370E-06   293.6   end
Si-30           367    0   3.39453E-06   293.6   end
Ti-46           367    0   4.20262E-07   293.6   end
Ti-47           367    0   3.79000E-07   293.6   end
Ti-48           367    0   3.75536E-06   293.6   end
Ti-49           367    0   2.75590E-07   293.6   end
Ti-50           367    0   2.63873E-07   293.6   end
Cr-50           367    0   5.30517E-07   293.6   end
Cr-52           367    0   1.02189E-05   293.6   end
Cr-53           367    0   1.15860E-06   293.6   end
Cr-54           367    0   2.87821E-07   293.6   end
Mn-55           367    0   6.48581E-06   293.6   end
Fe-54           367    0   2.36993E-06   293.6   end
Fe-56           367    0   3.71695E-05   293.6   end
Fe-57           367    0   8.58848E-07   293.6   end
Fe-58           367    0   1.13433E-07   293.6   end
Cu-63           367    0   1.89155E-05   293.6   end
Cu-65           367    0   8.43090E-06   293.6   end
 U-234          367    0   4.44742E-06   293.6   end
 U-235          367    0   4.14500E-04   293.6   end
```

```
 U-236          367    0   1.77898E-06   293.6   end
 U-238          367    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            368    0   3.32434E-02   293.6   end
 O-16           368    0   1.75562E-02   293.6   end
Mg-24           368    0   1.05686E-04   293.6   end
Mg-25           368    0   1.33797E-05   293.6   end
Mg-26           368    0   1.47310E-05   293.6   end
Al-27           368    0   2.85280E-02   293.6   end
Si-28           368    0   1.01591E-04   293.6   end
Si-29           368    0   5.14401E-06   293.6   end
Si-30           368    0   3.41465E-06   293.6   end
Ti-46           368    0   4.20262E-07   293.6   end
Ti-47           368    0   3.79000E-07   293.6   end
Ti-48           368    0   3.75536E-06   293.6   end
Ti-49           368    0   2.75590E-07   293.6   end
Ti-50           368    0   2.63873E-07   293.6   end
Cr-50           368    0   5.30517E-07   293.6   end
Cr-52           368    0   1.02189E-05   293.6   end
Cr-53           368    0   1.15860E-06   293.6   end
Cr-54           368    0   2.87821E-07   293.6   end
Mn-55           368    0   6.51903E-06   293.6   end
Fe-54           368    0   2.38905E-06   293.6   end
Fe-56           368    0   3.74693E-05   293.6   end
Fe-57           368    0   8.65776E-07   293.6   end
Fe-58           368    0   1.14348E-07   293.6   end
Cu-63           368    0   1.90262E-05   293.6   end
Cu-65           368    0   8.48022E-06   293.6   end
 U-234          368    0   3.63412E-06   293.6   end
 U-235          368    0   3.38700E-04   293.6   end
 U-236          368    0   1.45366E-06   293.6   end
 U-238          368    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            369    0   3.32434E-02   293.6   end
 O-16           369    0   1.73591E-02   293.6   end
Mg-24           369    0   1.05686E-04   293.6   end
Mg-25           369    0   1.33797E-05   293.6   end
Mg-26           369    0   1.47310E-05   293.6   end
Al-27           369    0   2.87722E-02   293.6   end
Si-28           369    0   1.02136E-04   293.6   end
Si-29           369    0   5.17160E-06   293.6   end
Si-30           369    0   3.43297E-06   293.6   end
Ti-46           369    0   4.20262E-07   293.6   end
Ti-47           369    0   3.79000E-07   293.6   end
Ti-48           369    0   3.75536E-06   293.6   end
Ti-49           369    0   2.75590E-07   293.6   end
Ti-50           369    0   2.63873E-07   293.6   end
Cr-50           369    0   5.30517E-07   293.6   end
Cr-52           369    0   1.02189E-05   293.6   end
Cr-53           369    0   1.15860E-06   293.6   end
Cr-54           369    0   2.87821E-07   293.6   end
Mn-55           369    0   6.54922E-06   293.6   end
Fe-54           369    0   2.40643E-06   293.6   end
Fe-56           369    0   3.77418E-05   293.6   end
Fe-57           369    0   8.72072E-07   293.6   end
Fe-58           369    0   1.15179E-07   293.6   end
Cu-63           369    0   1.91268E-05   293.6   end
Cu-65           369    0   8.52504E-06   293.6   end
 U-234          369    0   2.89485E-06   293.6   end
 U-235          369    0   2.69800E-04   293.6   end
 U-236          369    0   1.15795E-06   293.6   end
 U-238          369    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 7
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            371    0   3.32434E-02   293.6   end
 O-16           371    0   1.77945E-02   293.6   end
Mg-24           371    0   1.05686E-04   293.6   end
Mg-25           371    0   1.33797E-05   293.6   end
Mg-26           371    0   1.47310E-05   293.6   end
Al-27           371    0   2.82328E-02   293.6   end
Si-28           371    0   1.00933E-04   293.6   end
Si-29           371    0   5.11066E-06   293.6   end
Si-30           371    0   3.39252E-06   293.6   end
Ti-46           371    0   4.20262E-07   293.6   end
Ti-47           371    0   3.79000E-07   293.6   end
Ti-48           371    0   3.75536E-06   293.6   end
Ti-49           371    0   2.75590E-07   293.6   end
```

```
Ti-50           371    0   2.63873E-07   293.6   end
Cr-50           371    0   5.30517E-07   293.6   end
Cr-52           371    0   1.02189E-05   293.6   end
Cr-53           371    0   1.15860E-06   293.6   end
Cr-54           371    0   2.87821E-07   293.6   end
Mn-55           371    0   6.48252E-06   293.6   end
Fe-54           371    0   2.36804E-06   293.6   end
Fe-56           371    0   3.71398E-05   293.6   end
Fe-57           371    0   8.58163E-07   293.6   end
Fe-58           371    0   1.13342E-07   293.6   end
Cu-63           371    0   1.89046E-05   293.6   end
Cu-65           371    0   8.42602E-06   293.6   end
 U-234          371    0   4.52789E-06   293.6   end
 U-235          371    0   4.22000E-04   293.6   end
 U-236          371    0   1.81117E-06   293.6   end
 U-238          371    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            372    0   3.32434E-02   293.6   end
 O-16           372    0   1.80329E-02   293.6   end
Mg-24           372    0   1.05686E-04   293.6   end
Mg-25           372    0   1.33797E-05   293.6   end
Mg-26           372    0   1.47310E-05   293.6   end
Al-27           372    0   2.79375E-02   293.6   end
Si-28           372    0   1.00274E-04   293.6   end
Si-29           372    0   5.07732E-06   293.6   end
Si-30           372    0   3.37038E-06   293.6   end
Ti-46           372    0   4.20262E-07   293.6   end
Ti-47           372    0   3.79000E-07   293.6   end
Ti-48           372    0   3.75536E-06   293.6   end
Ti-49           372    0   2.75590E-07   293.6   end
Ti-50           372    0   2.63873E-07   293.6   end
Cr-50           372    0   5.30517E-07   293.6   end
Cr-52           372    0   1.02189E-05   293.6   end
Cr-53           372    0   1.15860E-06   293.6   end
Cr-54           372    0   2.87821E-07   293.6   end
Mn-55           372    0   6.44602E-06   293.6   end
Fe-54           372    0   2.34704E-06   293.6   end
Fe-56           372    0   3.68104E-05   293.6   end
Fe-57           372    0   8.50550E-07   293.6   end
Fe-58           372    0   1.12337E-07   293.6   end
Cu-63           372    0   1.87830E-05   293.6   end
Cu-65           372    0   8.37182E-06   293.6   end
 U-234          372    0   5.42167E-06   293.6   end
 U-235          372    0   5.05300E-04   293.6   end
 U-236          372    0   2.16868E-06   293.6   end
 U-238          372    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            373    0   3.32434E-02   293.6   end
 O-16           373    0   1.82870E-02   293.6   end
Mg-24           373    0   1.05686E-04   293.6   end
Mg-25           373    0   1.33797E-05   293.6   end
Mg-26           373    0   1.47310E-05   293.6   end
Al-27           373    0   2.76228E-02   293.6   end
Si-28           373    0   9.95724E-05   293.6   end
Si-29           373    0   5.04178E-06   293.6   end
Si-30           373    0   3.34679E-06   293.6   end
Ti-46           373    0   4.20262E-07   293.6   end
Ti-47           373    0   3.79000E-07   293.6   end
Ti-48           373    0   3.75536E-06   293.6   end
Ti-49           373    0   2.75590E-07   293.6   end
Ti-50           373    0   2.63873E-07   293.6   end
Cr-50           373    0   5.30517E-07   293.6   end
Cr-52           373    0   1.02189E-05   293.6   end
Cr-53           373    0   1.15860E-06   293.6   end
Cr-54           373    0   2.87821E-07   293.6   end
Mn-55           373    0   6.40711E-06   293.6   end
Fe-54           373    0   2.32464E-06   293.6   end
Fe-56           373    0   3.64591E-05   293.6   end
Fe-57           373    0   8.42433E-07   293.6   end
Fe-58           373    0   1.11265E-07   293.6   end
Cu-63           373    0   1.86534E-05   293.6   end
Cu-65           373    0   8.31405E-06   293.6   end
 U-234          373    0   6.37446E-06   293.6   end
 U-235          373    0   5.94100E-04   293.6   end
 U-236          373    0   2.54980E-06   293.6   end
 U-238          373    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            374    0   3.32434E-02   293.6   end
```

```
 O-16           374    0   1.85176E-02   293.6   end
Mg-24           374    0   1.05686E-04   293.6   end
Mg-25           374    0   1.33797E-05   293.6   end
Mg-26           374    0   1.47310E-05   293.6   end
Al-27           374    0   2.73372E-02   293.6   end
Si-28           374    0   9.89350E-05   293.6   end
Si-29           374    0   5.00951E-06   293.6   end
Si-30           374    0   3.32537E-06   293.6   end
Ti-46           374    0   4.20262E-07   293.6   end
Ti-47           374    0   3.79000E-07   293.6   end
Ti-48           374    0   3.75536E-06   293.6   end
Ti-49           374    0   2.75590E-07   293.6   end
Ti-50           374    0   2.63873E-07   293.6   end
Cr-50           374    0   5.30517E-07   293.6   end
Cr-52           374    0   1.02189E-05   293.6   end
Cr-53           374    0   1.15860E-06   293.6   end
Cr-54           374    0   2.87821E-07   293.6   end
Mn-55           374    0   6.37178E-06   293.6   end
Fe-54           374    0   2.30432E-06   293.6   end
Fe-56           374    0   3.61403E-05   293.6   end
Fe-57           374    0   8.35068E-07   293.6   end
Fe-58           374    0   1.10292E-07   293.6   end
Cu-63           374    0   1.85357E-05   293.6   end
Cu-65           374    0   8.26161E-06   293.6   end
 U-234          374    0   7.23926E-06   293.6   end
 U-235          374    0   6.74700E-04   293.6   end
 U-236          374    0   2.89573E-06   293.6   end
 U-238          374    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            375    0   3.32434E-02   293.6   end
 O-16           375    0   1.84469E-02   293.6   end
Mg-24           375    0   1.05686E-04   293.6   end
Mg-25           375    0   1.33797E-05   293.6   end
Mg-26           375    0   1.47310E-05   293.6   end
Al-27           375    0   2.74247E-02   293.6   end
Si-28           375    0   9.91306E-05   293.6   end
Si-29           375    0   5.01941E-06   293.6   end
Si-30           375    0   3.33194E-06   293.6   end
Ti-46           375    0   4.20262E-07   293.6   end
Ti-47           375    0   3.79000E-07   293.6   end
Ti-48           375    0   3.75536E-06   293.6   end
Ti-49           375    0   2.75590E-07   293.6   end
Ti-50           375    0   2.63873E-07   293.6   end
Cr-50           375    0   5.30517E-07   293.6   end
Cr-52           375    0   1.02189E-05   293.6   end
Cr-53           375    0   1.15860E-06   293.6   end
Cr-54           375    0   2.87821E-07   293.6   end
Mn-55           375    0   6.38261E-06   293.6   end
Fe-54           375    0   2.31055E-06   293.6   end
Fe-56           375    0   3.62380E-05   293.6   end
Fe-57           375    0   8.37326E-07   293.6   end
Fe-58           375    0   1.10590E-07   293.6   end
Cu-63           375    0   1.85717E-05   293.6   end
Cu-65           375    0   8.27767E-06   293.6   end
 U-234          375    0   6.97424E-06   293.6   end
 U-235          375    0   6.50000E-04   293.6   end
 U-236          375    0   2.78972E-06   293.6   end
 U-238          375    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            376    0   3.32434E-02   293.6   end
 O-16           376    0   1.81013E-02   293.6   end
Mg-24           376    0   1.05686E-04   293.6   end
Mg-25           376    0   1.33797E-05   293.6   end
Mg-26           376    0   1.47310E-05   293.6   end
Al-27           376    0   2.78528E-02   293.6   end
Si-28           376    0   1.00085E-04   293.6   end
Si-29           376    0   5.06774E-06   293.6   end
Si-30           376    0   3.36403E-06   293.6   end
Ti-46           376    0   4.20262E-07   293.6   end
Ti-47           376    0   3.79000E-07   293.6   end
Ti-48           376    0   3.75536E-06   293.6   end
Ti-49           376    0   2.75590E-07   293.6   end
Ti-50           376    0   2.63873E-07   293.6   end
Cr-50           376    0   5.30517E-07   293.6   end
Cr-52           376    0   1.02189E-05   293.6   end
Cr-53           376    0   1.15860E-06   293.6   end
Cr-54           376    0   2.87821E-07   293.6   end
Mn-55           376    0   6.43555E-06   293.6   end
Fe-54           376    0   2.34101E-06   293.6   end
```

```
Fe-56           376    0   3.67158E-05   293.6   end
Fe-57           376    0   8.48365E-07   293.6   end
Fe-58           376    0   1.12048E-07   293.6   end
Cu-63           376    0   1.87481E-05   293.6   end
Cu-65           376    0   8.35629E-06   293.6   end
 U-234          376    0   5.67811E-06   293.6   end
 U-235          376    0   5.29200E-04   293.6   end
 U-236          376    0   2.27126E-06   293.6   end
 U-238          376    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            377    0   3.32434E-02   293.6   end
 O-16           377    0   1.77731E-02   293.6   end
Mg-24           377    0   1.05686E-04   293.6   end
Mg-25           377    0   1.33797E-05   293.6   end
Mg-26           377    0   1.47310E-05   293.6   end
Al-27           377    0   2.82593E-02   293.6   end
Si-28           377    0   1.00993E-04   293.6   end
Si-29           377    0   5.11370E-06   293.6   end
Si-30           377    0   3.39453E-06   293.6   end
Ti-46           377    0   4.20262E-07   293.6   end
Ti-47           377    0   3.79000E-07   293.6   end
Ti-48           377    0   3.75536E-06   293.6   end
Ti-49           377    0   2.75590E-07   293.6   end
Ti-50           377    0   2.63873E-07   293.6   end
Cr-50           377    0   5.30517E-07   293.6   end
Cr-52           377    0   1.02189E-05   293.6   end
Cr-53           377    0   1.15860E-06   293.6   end
Cr-54           377    0   2.87821E-07   293.6   end
Mn-55           377    0   6.48581E-06   293.6   end
Fe-54           377    0   2.36993E-06   293.6   end
Fe-56           377    0   3.71695E-05   293.6   end
Fe-57           377    0   8.58848E-07   293.6   end
Fe-58           377    0   1.13433E-07   293.6   end
Cu-63           377    0   1.89155E-05   293.6   end
Cu-65           377    0   8.43090E-06   293.6   end
 U-234          377    0   4.44742E-06   293.6   end
 U-235          377    0   4.14500E-04   293.6   end
 U-236          377    0   1.77898E-06   293.6   end
 U-238          377    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            378    0   3.32434E-02   293.6   end
 O-16           378    0   1.75562E-02   293.6   end
Mg-24           378    0   1.05686E-04   293.6   end
Mg-25           378    0   1.33797E-05   293.6   end
Mg-26           378    0   1.47310E-05   293.6   end
Al-27           378    0   2.85280E-02   293.6   end
Si-28           378    0   1.01591E-04   293.6   end
Si-29           378    0   5.14401E-06   293.6   end
Si-30           378    0   3.41465E-06   293.6   end
Ti-46           378    0   4.20262E-07   293.6   end
Ti-47           378    0   3.79000E-07   293.6   end
Ti-48           378    0   3.75536E-06   293.6   end
Ti-49           378    0   2.75590E-07   293.6   end
Ti-50           378    0   2.63873E-07   293.6   end
Cr-50           378    0   5.30517E-07   293.6   end
Cr-52           378    0   1.02189E-05   293.6   end
Cr-53           378    0   1.15860E-06   293.6   end
Cr-54           378    0   2.87821E-07   293.6   end
Mn-55           378    0   6.51903E-06   293.6   end
Fe-54           378    0   2.38905E-06   293.6   end
Fe-56           378    0   3.74693E-05   293.6   end
Fe-57           378    0   8.65776E-07   293.6   end
Fe-58           378    0   1.14348E-07   293.6   end
Cu-63           378    0   1.90262E-05   293.6   end
Cu-65           378    0   8.48022E-06   293.6   end
 U-234          378    0   3.63412E-06   293.6   end
 U-235          378    0   3.38700E-04   293.6   end
 U-236          378    0   1.45366E-06   293.6   end
 U-238          378    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            379    0   3.32434E-02   293.6   end
 O-16           379    0   1.73591E-02   293.6   end
Mg-24           379    0   1.05686E-04   293.6   end
Mg-25           379    0   1.33797E-05   293.6   end
Mg-26           379    0   1.47310E-05   293.6   end
Al-27           379    0   2.87722E-02   293.6   end
Si-28           379    0   1.02136E-04   293.6   end
Si-29           379    0   5.17160E-06   293.6   end
```

```
Si-30           379    0   3.43297E-06   293.6   end
Ti-46           379    0   4.20262E-07   293.6   end
Ti-47           379    0   3.79000E-07   293.6   end
Ti-48           379    0   3.75536E-06   293.6   end
Ti-49           379    0   2.75590E-07   293.6   end
Ti-50           379    0   2.63873E-07   293.6   end
Cr-50           379    0   5.30517E-07   293.6   end
Cr-52           379    0   1.02189E-05   293.6   end
Cr-53           379    0   1.15860E-06   293.6   end
Cr-54           379    0   2.87821E-07   293.6   end
Mn-55           379    0   6.54922E-06   293.6   end
Fe-54           379    0   2.40643E-06   293.6   end
Fe-56           379    0   3.77418E-05   293.6   end
Fe-57           379    0   8.72072E-07   293.6   end
Fe-58           379    0   1.15179E-07   293.6   end
Cu-63           379    0   1.91268E-05   293.6   end
Cu-65           379    0   8.52504E-06   293.6   end
 U-234          379    0   2.89485E-06   293.6   end
 U-235          379    0   2.69800E-04   293.6   end
 U-236          379    0   1.15795E-06   293.6   end
 U-238          379    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 8
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            381    0   3.32434E-02   293.6   end
 O-16           381    0   1.77945E-02   293.6   end
Mg-24           381    0   1.05686E-04   293.6   end
Mg-25           381    0   1.33797E-05   293.6   end
Mg-26           381    0   1.47310E-05   293.6   end
Al-27           381    0   2.82328E-02   293.6   end
Si-28           381    0   1.00933E-04   293.6   end
Si-29           381    0   5.11066E-06   293.6   end
Si-30           381    0   3.39252E-06   293.6   end
Ti-46           381    0   4.20262E-07   293.6   end
Ti-47           381    0   3.79000E-07   293.6   end
Ti-48           381    0   3.75536E-06   293.6   end
Ti-49           381    0   2.75590E-07   293.6   end
Ti-50           381    0   2.63873E-07   293.6   end
Cr-50           381    0   5.30517E-07   293.6   end
Cr-52           381    0   1.02189E-05   293.6   end
Cr-53           381    0   1.15860E-06   293.6   end
Cr-54           381    0   2.87821E-07   293.6   end
Mn-55           381    0   6.48252E-06   293.6   end
Fe-54           381    0   2.36804E-06   293.6   end
Fe-56           381    0   3.71398E-05   293.6   end
Fe-57           381    0   8.58163E-07   293.6   end
Fe-58           381    0   1.13342E-07   293.6   end
Cu-63           381    0   1.89046E-05   293.6   end
Cu-65           381    0   8.42602E-06   293.6   end
 U-234          381    0   4.52789E-06   293.6   end
 U-235          381    0   4.22000E-04   293.6   end
 U-236          381    0   1.81117E-06   293.6   end
 U-238          381    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            382    0   3.32434E-02   293.6   end
 O-16           382    0   1.80329E-02   293.6   end
Mg-24           382    0   1.05686E-04   293.6   end
Mg-25           382    0   1.33797E-05   293.6   end
Mg-26           382    0   1.47310E-05   293.6   end
Al-27           382    0   2.79375E-02   293.6   end
Si-28           382    0   1.00274E-04   293.6   end
Si-29           382    0   5.07732E-06   293.6   end
Si-30           382    0   3.37038E-06   293.6   end
Ti-46           382    0   4.20262E-07   293.6   end
Ti-47           382    0   3.79000E-07   293.6   end
Ti-48           382    0   3.75536E-06   293.6   end
Ti-49           382    0   2.75590E-07   293.6   end
Ti-50           382    0   2.63873E-07   293.6   end
Cr-50           382    0   5.30517E-07   293.6   end
Cr-52           382    0   1.02189E-05   293.6   end
Cr-53           382    0   1.15860E-06   293.6   end
Cr-54           382    0   2.87821E-07   293.6   end
Mn-55           382    0   6.44602E-06   293.6   end
Fe-54           382    0   2.34704E-06   293.6   end
Fe-56           382    0   3.68104E-05   293.6   end
Fe-57           382    0   8.50550E-07   293.6   end
Fe-58           382    0   1.12337E-07   293.6   end
Cu-63           382    0   1.87830E-05   293.6   end
Cu-65           382    0   8.37182E-06   293.6   end
```

```
 U-234          382    0   5.42167E-06   293.6   end
 U-235          382    0   5.05300E-04   293.6   end
 U-236          382    0   2.16868E-06   293.6   end
 U-238          382    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            383    0   3.32434E-02   293.6   end
 O-16           383    0   1.82870E-02   293.6   end
Mg-24           383    0   1.05686E-04   293.6   end
Mg-25           383    0   1.33797E-05   293.6   end
Mg-26           383    0   1.47310E-05   293.6   end
Al-27           383    0   2.76228E-02   293.6   end
Si-28           383    0   9.95724E-05   293.6   end
Si-29           383    0   5.04178E-06   293.6   end
Si-30           383    0   3.34679E-06   293.6   end
Ti-46           383    0   4.20262E-07   293.6   end
Ti-47           383    0   3.79000E-07   293.6   end
Ti-48           383    0   3.75536E-06   293.6   end
Ti-49           383    0   2.75590E-07   293.6   end
Ti-50           383    0   2.63873E-07   293.6   end
Cr-50           383    0   5.30517E-07   293.6   end
Cr-52           383    0   1.02189E-05   293.6   end
Cr-53           383    0   1.15860E-06   293.6   end
Cr-54           383    0   2.87821E-07   293.6   end
Mn-55           383    0   6.40711E-06   293.6   end
Fe-54           383    0   2.32464E-06   293.6   end
Fe-56           383    0   3.64591E-05   293.6   end
Fe-57           383    0   8.42433E-07   293.6   end
Fe-58           383    0   1.11265E-07   293.6   end
Cu-63           383    0   1.86534E-05   293.6   end
Cu-65           383    0   8.31405E-06   293.6   end
 U-234          383    0   6.37446E-06   293.6   end
 U-235          383    0   5.94100E-04   293.6   end
 U-236          383    0   2.54980E-06   293.6   end
 U-238          383    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            384    0   3.32434E-02   293.6   end
 O-16           384    0   1.85176E-02   293.6   end
Mg-24           384    0   1.05686E-04   293.6   end
Mg-25           384    0   1.33797E-05   293.6   end
Mg-26           384    0   1.47310E-05   293.6   end
Al-27           384    0   2.73372E-02   293.6   end
Si-28           384    0   9.89350E-05   293.6   end
Si-29           384    0   5.00951E-06   293.6   end
Si-30           384    0   3.32537E-06   293.6   end
Ti-46           384    0   4.20262E-07   293.6   end
Ti-47           384    0   3.79000E-07   293.6   end
Ti-48           384    0   3.75536E-06   293.6   end
Ti-49           384    0   2.75590E-07   293.6   end
Ti-50           384    0   2.63873E-07   293.6   end
Cr-50           384    0   5.30517E-07   293.6   end
Cr-52           384    0   1.02189E-05   293.6   end
Cr-53           384    0   1.15860E-06   293.6   end
Cr-54           384    0   2.87821E-07   293.6   end
Mn-55           384    0   6.37178E-06   293.6   end
Fe-54           384    0   2.30432E-06   293.6   end
Fe-56           384    0   3.61403E-05   293.6   end
Fe-57           384    0   8.35068E-07   293.6   end
Fe-58           384    0   1.10292E-07   293.6   end
Cu-63           384    0   1.85357E-05   293.6   end
Cu-65           384    0   8.26161E-06   293.6   end
 U-234          384    0   7.23926E-06   293.6   end
 U-235          384    0   6.74700E-04   293.6   end
 U-236          384    0   2.89573E-06   293.6   end
 U-238          384    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            385    0   3.32434E-02   293.6   end
 O-16           385    0   1.84469E-02   293.6   end
Mg-24           385    0   1.05686E-04   293.6   end
Mg-25           385    0   1.33797E-05   293.6   end
Mg-26           385    0   1.47310E-05   293.6   end
Al-27           385    0   2.74247E-02   293.6   end
Si-28           385    0   9.91306E-05   293.6   end
Si-29           385    0   5.01941E-06   293.6   end
Si-30           385    0   3.33194E-06   293.6   end
Ti-46           385    0   4.20262E-07   293.6   end
Ti-47           385    0   3.79000E-07   293.6   end
Ti-48           385    0   3.75536E-06   293.6   end
Ti-49           385    0   2.75590E-07   293.6   end
```

```
Ti-50           385    0   2.63873E-07   293.6   end
Cr-50           385    0   5.30517E-07   293.6   end
Cr-52           385    0   1.02189E-05   293.6   end
Cr-53           385    0   1.15860E-06   293.6   end
Cr-54           385    0   2.87821E-07   293.6   end
Mn-55           385    0   6.38261E-06   293.6   end
Fe-54           385    0   2.31055E-06   293.6   end
Fe-56           385    0   3.62380E-05   293.6   end
Fe-57           385    0   8.37326E-07   293.6   end
Fe-58           385    0   1.10590E-07   293.6   end
Cu-63           385    0   1.85717E-05   293.6   end
Cu-65           385    0   8.27767E-06   293.6   end
 U-234          385    0   6.97424E-06   293.6   end
 U-235          385    0   6.50000E-04   293.6   end
 U-236          385    0   2.78972E-06   293.6   end
 U-238          385    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            386    0   3.32434E-02   293.6   end
 O-16           386    0   1.81013E-02   293.6   end
Mg-24           386    0   1.05686E-04   293.6   end
Mg-25           386    0   1.33797E-05   293.6   end
Mg-26           386    0   1.47310E-05   293.6   end
Al-27           386    0   2.78528E-02   293.6   end
Si-28           386    0   1.00085E-04   293.6   end
Si-29           386    0   5.06774E-06   293.6   end
Si-30           386    0   3.36403E-06   293.6   end
Ti-46           386    0   4.20262E-07   293.6   end
Ti-47           386    0   3.79000E-07   293.6   end
Ti-48           386    0   3.75536E-06   293.6   end
Ti-49           386    0   2.75590E-07   293.6   end
Ti-50           386    0   2.63873E-07   293.6   end
Cr-50           386    0   5.30517E-07   293.6   end
Cr-52           386    0   1.02189E-05   293.6   end
Cr-53           386    0   1.15860E-06   293.6   end
Cr-54           386    0   2.87821E-07   293.6   end
Mn-55           386    0   6.43555E-06   293.6   end
Fe-54           386    0   2.34101E-06   293.6   end
Fe-56           386    0   3.67158E-05   293.6   end
Fe-57           386    0   8.48365E-07   293.6   end
Fe-58           386    0   1.12048E-07   293.6   end
Cu-63           386    0   1.87481E-05   293.6   end
Cu-65           386    0   8.35629E-06   293.6   end
 U-234          386    0   5.67811E-06   293.6   end
 U-235          386    0   5.29200E-04   293.6   end
 U-236          386    0   2.27126E-06   293.6   end
 U-238          386    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            387    0   3.32434E-02   293.6   end
 O-16           387    0   1.77731E-02   293.6   end
Mg-24           387    0   1.05686E-04   293.6   end
Mg-25           387    0   1.33797E-05   293.6   end
Mg-26           387    0   1.47310E-05   293.6   end
Al-27           387    0   2.82593E-02   293.6   end
Si-28           387    0   1.00993E-04   293.6   end
Si-29           387    0   5.11370E-06   293.6   end
Si-30           387    0   3.39453E-06   293.6   end
Ti-46           387    0   4.20262E-07   293.6   end
Ti-47           387    0   3.79000E-07   293.6   end
Ti-48           387    0   3.75536E-06   293.6   end
Ti-49           387    0   2.75590E-07   293.6   end
Ti-50           387    0   2.63873E-07   293.6   end
Cr-50           387    0   5.30517E-07   293.6   end
Cr-52           387    0   1.02189E-05   293.6   end
Cr-53           387    0   1.15860E-06   293.6   end
Cr-54           387    0   2.87821E-07   293.6   end
Mn-55           387    0   6.48581E-06   293.6   end
Fe-54           387    0   2.36993E-06   293.6   end
Fe-56           387    0   3.71695E-05   293.6   end
Fe-57           387    0   8.58848E-07   293.6   end
Fe-58           387    0   1.13433E-07   293.6   end
Cu-63           387    0   1.89155E-05   293.6   end
Cu-65           387    0   8.43090E-06   293.6   end
 U-234          387    0   4.44742E-06   293.6   end
 U-235          387    0   4.14500E-04   293.6   end
 U-236          387    0   1.77898E-06   293.6   end
 U-238          387    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            388    0   3.32434E-02   293.6   end
```

```
 O-16           388    0   1.75562E-02   293.6   end
Mg-24           388    0   1.05686E-04   293.6   end
Mg-25           388    0   1.33797E-05   293.6   end
Mg-26           388    0   1.47310E-05   293.6   end
Al-27           388    0   2.85280E-02   293.6   end
Si-28           388    0   1.01591E-04   293.6   end
Si-29           388    0   5.14401E-06   293.6   end
Si-30           388    0   3.41465E-06   293.6   end
Ti-46           388    0   4.20262E-07   293.6   end
Ti-47           388    0   3.79000E-07   293.6   end
Ti-48           388    0   3.75536E-06   293.6   end
Ti-49           388    0   2.75590E-07   293.6   end
Ti-50           388    0   2.63873E-07   293.6   end
Cr-50           388    0   5.30517E-07   293.6   end
Cr-52           388    0   1.02189E-05   293.6   end
Cr-53           388    0   1.15860E-06   293.6   end
Cr-54           388    0   2.87821E-07   293.6   end
Mn-55           388    0   6.51903E-06   293.6   end
Fe-54           388    0   2.38905E-06   293.6   end
Fe-56           388    0   3.74693E-05   293.6   end
Fe-57           388    0   8.65776E-07   293.6   end
Fe-58           388    0   1.14348E-07   293.6   end
Cu-63           388    0   1.90262E-05   293.6   end
Cu-65           388    0   8.48022E-06   293.6   end
 U-234          388    0   3.63412E-06   293.6   end
 U-235          388    0   3.38700E-04   293.6   end
 U-236          388    0   1.45366E-06   293.6   end
 U-238          388    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            389    0   3.32434E-02   293.6   end
 O-16           389    0   1.73591E-02   293.6   end
Mg-24           389    0   1.05686E-04   293.6   end
Mg-25           389    0   1.33797E-05   293.6   end
Mg-26           389    0   1.47310E-05   293.6   end
Al-27           389    0   2.87722E-02   293.6   end
Si-28           389    0   1.02136E-04   293.6   end
Si-29           389    0   5.17160E-06   293.6   end
Si-30           389    0   3.43297E-06   293.6   end
Ti-46           389    0   4.20262E-07   293.6   end
Ti-47           389    0   3.79000E-07   293.6   end
Ti-48           389    0   3.75536E-06   293.6   end
Ti-49           389    0   2.75590E-07   293.6   end
Ti-50           389    0   2.63873E-07   293.6   end
Cr-50           389    0   5.30517E-07   293.6   end
Cr-52           389    0   1.02189E-05   293.6   end
Cr-53           389    0   1.15860E-06   293.6   end
Cr-54           389    0   2.87821E-07   293.6   end
Mn-55           389    0   6.54922E-06   293.6   end
Fe-54           389    0   2.40643E-06   293.6   end
Fe-56           389    0   3.77418E-05   293.6   end
Fe-57           389    0   8.72072E-07   293.6   end
Fe-58           389    0   1.15179E-07   293.6   end
Cu-63           389    0   1.91268E-05   293.6   end
Cu-65           389    0   8.52504E-06   293.6   end
 U-234          389    0   2.89485E-06   293.6   end
 U-235          389    0   2.69800E-04   293.6   end
 U-236          389    0   1.15795E-06   293.6   end
 U-238          389    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 9
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            391    0   3.32434E-02   293.6   end
 O-16           391    0   1.77945E-02   293.6   end
Mg-24           391    0   1.05686E-04   293.6   end
Mg-25           391    0   1.33797E-05   293.6   end
Mg-26           391    0   1.47310E-05   293.6   end
Al-27           391    0   2.82328E-02   293.6   end
Si-28           391    0   1.00933E-04   293.6   end
Si-29           391    0   5.11066E-06   293.6   end
Si-30           391    0   3.39252E-06   293.6   end
Ti-46           391    0   4.20262E-07   293.6   end
Ti-47           391    0   3.79000E-07   293.6   end
Ti-48           391    0   3.75536E-06   293.6   end
Ti-49           391    0   2.75590E-07   293.6   end
Ti-50           391    0   2.63873E-07   293.6   end
Cr-50           391    0   5.30517E-07   293.6   end
Cr-52           391    0   1.02189E-05   293.6   end
Cr-53           391    0   1.15860E-06   293.6   end
Cr-54           391    0   2.87821E-07   293.6   end
```

```
Mn-55           391    0   6.48252E-06   293.6   end
Fe-54           391    0   2.36804E-06   293.6   end
Fe-56           391    0   3.71398E-05   293.6   end
Fe-57           391    0   8.58163E-07   293.6   end
Fe-58           391    0   1.13342E-07   293.6   end
Cu-63           391    0   1.89046E-05   293.6   end
Cu-65           391    0   8.42602E-06   293.6   end
 U-234          391    0   4.52789E-06   293.6   end
 U-235          391    0   4.22000E-04   293.6   end
 U-236          391    0   1.81117E-06   293.6   end
 U-238          391    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            392    0   3.32434E-02   293.6   end
 O-16           392    0   1.80329E-02   293.6   end
Mg-24           392    0   1.05686E-04   293.6   end
Mg-25           392    0   1.33797E-05   293.6   end
Mg-26           392    0   1.47310E-05   293.6   end
Al-27           392    0   2.79375E-02   293.6   end
Si-28           392    0   1.00274E-04   293.6   end
Si-29           392    0   5.07732E-06   293.6   end
Si-30           392    0   3.37038E-06   293.6   end
Ti-46           392    0   4.20262E-07   293.6   end
Ti-47           392    0   3.79000E-07   293.6   end
Ti-48           392    0   3.75536E-06   293.6   end
Ti-49           392    0   2.75590E-07   293.6   end
Ti-50           392    0   2.63873E-07   293.6   end
Cr-50           392    0   5.30517E-07   293.6   end
Cr-52           392    0   1.02189E-05   293.6   end
Cr-53           392    0   1.15860E-06   293.6   end
Cr-54           392    0   2.87821E-07   293.6   end
Mn-55           392    0   6.44602E-06   293.6   end
Fe-54           392    0   2.34704E-06   293.6   end
Fe-56           392    0   3.68104E-05   293.6   end
Fe-57           392    0   8.50550E-07   293.6   end
Fe-58           392    0   1.12337E-07   293.6   end
Cu-63           392    0   1.87830E-05   293.6   end
Cu-65           392    0   8.37182E-06   293.6   end
 U-234          392    0   5.42167E-06   293.6   end
 U-235          392    0   5.05300E-04   293.6   end
 U-236          392    0   2.16868E-06   293.6   end
 U-238          392    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
'  8.012280E-02
 H-1            393    0   3.32434E-02   293.6   end
 O-16           393    0   1.82870E-02   293.6   end
Mg-24           393    0   1.05686E-04   293.6   end
Mg-25           393    0   1.33797E-05   293.6   end
Mg-26           393    0   1.47310E-05   293.6   end
Al-27           393    0   2.76228E-02   293.6   end
Si-28           393    0   9.95724E-05   293.6   end
Si-29           393    0   5.04178E-06   293.6   end
Si-30           393    0   3.34679E-06   293.6   end
Ti-46           393    0   4.20262E-07   293.6   end
Ti-47           393    0   3.79000E-07   293.6   end
Ti-48           393    0   3.75536E-06   293.6   end
Ti-49           393    0   2.75590E-07   293.6   end
Ti-50           393    0   2.63873E-07   293.6   end
Cr-50           393    0   5.30517E-07   293.6   end
Cr-52           393    0   1.02189E-05   293.6   end
Cr-53           393    0   1.15860E-06   293.6   end
Cr-54           393    0   2.87821E-07   293.6   end
Mn-55           393    0   6.40711E-06   293.6   end
Fe-54           393    0   2.32464E-06   293.6   end
Fe-56           393    0   3.64591E-05   293.6   end
Fe-57           393    0   8.42433E-07   293.6   end
Fe-58           393    0   1.11265E-07   293.6   end
Cu-63           393    0   1.86534E-05   293.6   end
Cu-65           393    0   8.31405E-06   293.6   end
 U-234          393    0   6.37446E-06   293.6   end
 U-235          393    0   5.94100E-04   293.6   end
 U-236          393    0   2.54980E-06   293.6   end
 U-238          393    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            394    0   3.32434E-02   293.6   end
 O-16           394    0   1.85176E-02   293.6   end
Mg-24           394    0   1.05686E-04   293.6   end
Mg-25           394    0   1.33797E-05   293.6   end
Mg-26           394    0   1.47310E-05   293.6   end
Al-27           394    0   2.73372E-02   293.6   end
```

```
Si-28           394    0   9.89350E-05   293.6   end
Si-29           394    0   5.00951E-06   293.6   end
Si-30           394    0   3.32537E-06   293.6   end
Ti-46           394    0   4.20262E-07   293.6   end
Ti-47           394    0   3.79000E-07   293.6   end
Ti-48           394    0   3.75536E-06   293.6   end
Ti-49           394    0   2.75590E-07   293.6   end
Ti-50           394    0   2.63873E-07   293.6   end
Cr-50           394    0   5.30517E-07   293.6   end
Cr-52           394    0   1.02189E-05   293.6   end
Cr-53           394    0   1.15860E-06   293.6   end
Cr-54           394    0   2.87821E-07   293.6   end
Mn-55           394    0   6.37178E-06   293.6   end
Fe-54           394    0   2.30432E-06   293.6   end
Fe-56           394    0   3.61403E-05   293.6   end
Fe-57           394    0   8.35068E-07   293.6   end
Fe-58           394    0   1.10292E-07   293.6   end
Cu-63           394    0   1.85357E-05   293.6   end
Cu-65           394    0   8.26161E-06   293.6   end
 U-234          394    0   7.23926E-06   293.6   end
 U-235          394    0   6.74700E-04   293.6   end
 U-236          394    0   2.89573E-06   293.6   end
 U-238          394    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            395    0   3.32434E-02   293.6   end
 O-16           395    0   1.84469E-02   293.6   end
Mg-24           395    0   1.05686E-04   293.6   end
Mg-25           395    0   1.33797E-05   293.6   end
Mg-26           395    0   1.47310E-05   293.6   end
Al-27           395    0   2.74247E-02   293.6   end
Si-28           395    0   9.91306E-05   293.6   end
Si-29           395    0   5.01941E-06   293.6   end
Si-30           395    0   3.33194E-06   293.6   end
Ti-46           395    0   4.20262E-07   293.6   end
Ti-47           395    0   3.79000E-07   293.6   end
Ti-48           395    0   3.75536E-06   293.6   end
Ti-49           395    0   2.75590E-07   293.6   end
Ti-50           395    0   2.63873E-07   293.6   end
Cr-50           395    0   5.30517E-07   293.6   end
Cr-52           395    0   1.02189E-05   293.6   end
Cr-53           395    0   1.15860E-06   293.6   end
Cr-54           395    0   2.87821E-07   293.6   end
Mn-55           395    0   6.38261E-06   293.6   end
Fe-54           395    0   2.31055E-06   293.6   end
Fe-56           395    0   3.62380E-05   293.6   end
Fe-57           395    0   8.37326E-07   293.6   end
Fe-58           395    0   1.10590E-07   293.6   end
Cu-63           395    0   1.85717E-05   293.6   end
Cu-65           395    0   8.27767E-06   293.6   end
 U-234          395    0   6.97424E-06   293.6   end
 U-235          395    0   6.50000E-04   293.6   end
 U-236          395    0   2.78972E-06   293.6   end
 U-238          395    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            396    0   3.32434E-02   293.6   end
 O-16           396    0   1.81013E-02   293.6   end
Mg-24           396    0   1.05686E-04   293.6   end
Mg-25           396    0   1.33797E-05   293.6   end
Mg-26           396    0   1.47310E-05   293.6   end
Al-27           396    0   2.78528E-02   293.6   end
Si-28           396    0   1.00085E-04   293.6   end
Si-29           396    0   5.06774E-06   293.6   end
Si-30           396    0   3.36403E-06   293.6   end
Ti-46           396    0   4.20262E-07   293.6   end
Ti-47           396    0   3.79000E-07   293.6   end
Ti-48           396    0   3.75536E-06   293.6   end
Ti-49           396    0   2.75590E-07   293.6   end
Ti-50           396    0   2.63873E-07   293.6   end
Cr-50           396    0   5.30517E-07   293.6   end
Cr-52           396    0   1.02189E-05   293.6   end
Cr-53           396    0   1.15860E-06   293.6   end
Cr-54           396    0   2.87821E-07   293.6   end
Mn-55           396    0   6.43555E-06   293.6   end
Fe-54           396    0   2.34101E-06   293.6   end
Fe-56           396    0   3.67158E-05   293.6   end
Fe-57           396    0   8.48365E-07   293.6   end
Fe-58           396    0   1.12048E-07   293.6   end
Cu-63           396    0   1.87481E-05   293.6   end
Cu-65           396    0   8.35629E-06   293.6   end
```

```
 U-234          396    0   5.67811E-06   293.6   end
 U-235          396    0   5.29200E-04   293.6   end
 U-236          396    0   2.27126E-06   293.6   end
 U-238          396    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            397    0   3.32434E-02   293.6   end
 O-16           397    0   1.77731E-02   293.6   end
Mg-24           397    0   1.05686E-04   293.6   end
Mg-25           397    0   1.33797E-05   293.6   end
Mg-26           397    0   1.47310E-05   293.6   end
Al-27           397    0   2.82593E-02   293.6   end
Si-28           397    0   1.00993E-04   293.6   end
Si-29           397    0   5.11370E-06   293.6   end
Si-30           397    0   3.39453E-06   293.6   end
Ti-46           397    0   4.20262E-07   293.6   end
Ti-47           397    0   3.79000E-07   293.6   end
Ti-48           397    0   3.75536E-06   293.6   end
Ti-49           397    0   2.75590E-07   293.6   end
Ti-50           397    0   2.63873E-07   293.6   end
Cr-50           397    0   5.30517E-07   293.6   end
Cr-52           397    0   1.02189E-05   293.6   end
Cr-53           397    0   1.15860E-06   293.6   end
Cr-54           397    0   2.87821E-07   293.6   end
Mn-55           397    0   6.48581E-06   293.6   end
Fe-54           397    0   2.36993E-06   293.6   end
Fe-56           397    0   3.71695E-05   293.6   end
Fe-57           397    0   8.58848E-07   293.6   end
Fe-58           397    0   1.13433E-07   293.6   end
Cu-63           397    0   1.89155E-05   293.6   end
Cu-65           397    0   8.43090E-06   293.6   end
 U-234          397    0   4.44742E-06   293.6   end
 U-235          397    0   4.14500E-04   293.6   end
 U-236          397    0   1.77898E-06   293.6   end
 U-238          397    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            398    0   3.32434E-02   293.6   end
 O-16           398    0   1.75562E-02   293.6   end
Mg-24           398    0   1.05686E-04   293.6   end
Mg-25           398    0   1.33797E-05   293.6   end
Mg-26           398    0   1.47310E-05   293.6   end
Al-27           398    0   2.85280E-02   293.6   end
Si-28           398    0   1.01591E-04   293.6   end
Si-29           398    0   5.14401E-06   293.6   end
Si-30           398    0   3.41465E-06   293.6   end
Ti-46           398    0   4.20262E-07   293.6   end
Ti-47           398    0   3.79000E-07   293.6   end
Ti-48           398    0   3.75536E-06   293.6   end
Ti-49           398    0   2.75590E-07   293.6   end
Ti-50           398    0   2.63873E-07   293.6   end
Cr-50           398    0   5.30517E-07   293.6   end
Cr-52           398    0   1.02189E-05   293.6   end
Cr-53           398    0   1.15860E-06   293.6   end
Cr-54           398    0   2.87821E-07   293.6   end
Mn-55           398    0   6.51903E-06   293.6   end
Fe-54           398    0   2.38905E-06   293.6   end
Fe-56           398    0   3.74693E-05   293.6   end
Fe-57           398    0   8.65776E-07   293.6   end
Fe-58           398    0   1.14348E-07   293.6   end
Cu-63           398    0   1.90262E-05   293.6   end
Cu-65           398    0   8.48022E-06   293.6   end
 U-234          398    0   3.63412E-06   293.6   end
 U-235          398    0   3.38700E-04   293.6   end
 U-236          398    0   1.45366E-06   293.6   end
 U-238          398    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            399    0   3.32434E-02   293.6   end
 O-16           399    0   1.73591E-02   293.6   end
Mg-24           399    0   1.05686E-04   293.6   end
Mg-25           399    0   1.33797E-05   293.6   end
Mg-26           399    0   1.47310E-05   293.6   end
Al-27           399    0   2.87722E-02   293.6   end
Si-28           399    0   1.02136E-04   293.6   end
Si-29           399    0   5.17160E-06   293.6   end
Si-30           399    0   3.43297E-06   293.6   end
Ti-46           399    0   4.20262E-07   293.6   end
Ti-47           399    0   3.79000E-07   293.6   end
Ti-48           399    0   3.75536E-06   293.6   end
Ti-49           399    0   2.75590E-07   293.6   end
```

```
Ti-50           399    0   2.63873E-07   293.6   end
Cr-50           399    0   5.30517E-07   293.6   end
Cr-52           399    0   1.02189E-05   293.6   end
Cr-53           399    0   1.15860E-06   293.6   end
Cr-54           399    0   2.87821E-07   293.6   end
Mn-55           399    0   6.54922E-06   293.6   end
Fe-54           399    0   2.40643E-06   293.6   end
Fe-56           399    0   3.77418E-05   293.6   end
Fe-57           399    0   8.72072E-07   293.6   end
Fe-58           399    0   1.15179E-07   293.6   end
Cu-63           399    0   1.91268E-05   293.6   end
Cu-65           399    0   8.52504E-06   293.6   end
 U-234          399    0   2.89485E-06   293.6   end
 U-235          399    0   2.69800E-04   293.6   end
 U-236          399    0   1.15795E-06   293.6   end
 U-238          399    0   1.56322E-05   293.6   end
'
'       Outer Fuel Element  fueled region 0 Central
'       total atom density =  8.00583E-02 a/b-cm
'  8.005830E-02
 H-1            301    0   3.32434E-02   293.6   end
 O-16           301    0   1.77945E-02   293.6   end
Mg-24           301    0   1.05686E-04   293.6   end
Mg-25           301    0   1.33797E-05   293.6   end
Mg-26           301    0   1.47310E-05   293.6   end
Al-27           301    0   2.82328E-02   293.6   end
Si-28           301    0   1.00933E-04   293.6   end
Si-29           301    0   5.11066E-06   293.6   end
Si-30           301    0   3.39252E-06   293.6   end
Ti-46           301    0   4.20262E-07   293.6   end
Ti-47           301    0   3.79000E-07   293.6   end
Ti-48           301    0   3.75536E-06   293.6   end
Ti-49           301    0   2.75590E-07   293.6   end
Ti-50           301    0   2.63873E-07   293.6   end
Cr-50           301    0   5.30517E-07   293.6   end
Cr-52           301    0   1.02189E-05   293.6   end
Cr-53           301    0   1.15860E-06   293.6   end
Cr-54           301    0   2.87821E-07   293.6   end
Mn-55           301    0   6.48252E-06   293.6   end
Fe-54           301    0   2.36804E-06   293.6   end
Fe-56           301    0   3.71398E-05   293.6   end
Fe-57           301    0   8.58163E-07   293.6   end
Fe-58           301    0   1.13342E-07   293.6   end
Cu-63           301    0   1.89046E-05   293.6   end
Cu-65           301    0   8.42602E-06   293.6   end
 U-234          301    0   4.52789E-06   293.6   end
 U-235          301    0   4.22000E-04   293.6   end
 U-236          301    0   1.81117E-06   293.6   end
 U-238          301    0   2.44506E-05   293.6   end
'       total atom density =  8.00895E-02 a/b-cm
'  8.008950E-02
 H-1            302    0   3.32434E-02   293.6   end
 O-16           302    0   1.80329E-02   293.6   end
Mg-24           302    0   1.05686E-04   293.6   end
Mg-25           302    0   1.33797E-05   293.6   end
Mg-26           302    0   1.47310E-05   293.6   end
Al-27           302    0   2.79375E-02   293.6   end
Si-28           302    0   1.00274E-04   293.6   end
Si-29           302    0   5.07732E-06   293.6   end
Si-30           302    0   3.37038E-06   293.6   end
Ti-46           302    0   4.20262E-07   293.6   end
Ti-47           302    0   3.79000E-07   293.6   end
Ti-48           302    0   3.75536E-06   293.6   end
Ti-49           302    0   2.75590E-07   293.6   end
Ti-50           302    0   2.63873E-07   293.6   end
Cr-50           302    0   5.30517E-07   293.6   end
Cr-52           302    0   1.02189E-05   293.6   end
Cr-53           302    0   1.15860E-06   293.6   end
Cr-54           302    0   2.87821E-07   293.6   end
Mn-55           302    0   6.44602E-06   293.6   end
Fe-54           302    0   2.34704E-06   293.6   end
Fe-56           302    0   3.68104E-05   293.6   end
Fe-57           302    0   8.50550E-07   293.6   end
Fe-58           302    0   1.12337E-07   293.6   end
Cu-63           302    0   1.87830E-05   293.6   end
Cu-65           302    0   8.37182E-06   293.6   end
 U-234          302    0   5.42167E-06   293.6   end
 U-235          302    0   5.05300E-04   293.6   end
 U-236          302    0   2.16868E-06   293.6   end
 U-238          302    0   2.92770E-05   293.6   end
'       total atom density =  8.01228E-02 a/b-cm
```

```
'  8.012280E-02
 H-1            303    0   3.32434E-02   293.6   end
 O-16           303    0   1.82870E-02   293.6   end
Mg-24           303    0   1.05686E-04   293.6   end
Mg-25           303    0   1.33797E-05   293.6   end
Mg-26           303    0   1.47310E-05   293.6   end
Al-27           303    0   2.76228E-02   293.6   end
Si-28           303    0   9.95724E-05   293.6   end
Si-29           303    0   5.04178E-06   293.6   end
Si-30           303    0   3.34679E-06   293.6   end
Ti-46           303    0   4.20262E-07   293.6   end
Ti-47           303    0   3.79000E-07   293.6   end
Ti-48           303    0   3.75536E-06   293.6   end
Ti-49           303    0   2.75590E-07   293.6   end
Ti-50           303    0   2.63873E-07   293.6   end
Cr-50           303    0   5.30517E-07   293.6   end
Cr-52           303    0   1.02189E-05   293.6   end
Cr-53           303    0   1.15860E-06   293.6   end
Cr-54           303    0   2.87821E-07   293.6   end
Mn-55           303    0   6.40711E-06   293.6   end
Fe-54           303    0   2.32464E-06   293.6   end
Fe-56           303    0   3.64591E-05   293.6   end
Fe-57           303    0   8.42433E-07   293.6   end
Fe-58           303    0   1.11265E-07   293.6   end
Cu-63           303    0   1.86534E-05   293.6   end
Cu-65           303    0   8.31405E-06   293.6   end
 U-234          303    0   6.37446E-06   293.6   end
 U-235          303    0   5.94100E-04   293.6   end
 U-236          303    0   2.54980E-06   293.6   end
 U-238          303    0   3.44221E-05   293.6   end
'       total atom density =  8.01530E-02 a/b-cm
'  8.015300E-02
 H-1            304    0   3.32434E-02   293.6   end
 O-16           304    0   1.85176E-02   293.6   end
Mg-24           304    0   1.05686E-04   293.6   end
Mg-25           304    0   1.33797E-05   293.6   end
Mg-26           304    0   1.47310E-05   293.6   end
Al-27           304    0   2.73372E-02   293.6   end
Si-28           304    0   9.89350E-05   293.6   end
Si-29           304    0   5.00951E-06   293.6   end
Si-30           304    0   3.32537E-06   293.6   end
Ti-46           304    0   4.20262E-07   293.6   end
Ti-47           304    0   3.79000E-07   293.6   end
Ti-48           304    0   3.75536E-06   293.6   end
Ti-49           304    0   2.75590E-07   293.6   end
Ti-50           304    0   2.63873E-07   293.6   end
Cr-50           304    0   5.30517E-07   293.6   end
Cr-52           304    0   1.02189E-05   293.6   end
Cr-53           304    0   1.15860E-06   293.6   end
Cr-54           304    0   2.87821E-07   293.6   end
Mn-55           304    0   6.37178E-06   293.6   end
Fe-54           304    0   2.30432E-06   293.6   end
Fe-56           304    0   3.61403E-05   293.6   end
Fe-57           304    0   8.35068E-07   293.6   end
Fe-58           304    0   1.10292E-07   293.6   end
Cu-63           304    0   1.85357E-05   293.6   end
Cu-65           304    0   8.26161E-06   293.6   end
 U-234          304    0   7.23926E-06   293.6   end
 U-235          304    0   6.74700E-04   293.6   end
 U-236          304    0   2.89573E-06   293.6   end
 U-238          304    0   3.90920E-05   293.6   end
'       total atom density =  8.01437E-02 a/b-cm
'  8.014370E-02
 H-1            305    0   3.32434E-02   293.6   end
 O-16           305    0   1.84469E-02   293.6   end
Mg-24           305    0   1.05686E-04   293.6   end
Mg-25           305    0   1.33797E-05   293.6   end
Mg-26           305    0   1.47310E-05   293.6   end
Al-27           305    0   2.74247E-02   293.6   end
Si-28           305    0   9.91306E-05   293.6   end
Si-29           305    0   5.01941E-06   293.6   end
Si-30           305    0   3.33194E-06   293.6   end
Ti-46           305    0   4.20262E-07   293.6   end
Ti-47           305    0   3.79000E-07   293.6   end
Ti-48           305    0   3.75536E-06   293.6   end
Ti-49           305    0   2.75590E-07   293.6   end
Ti-50           305    0   2.63873E-07   293.6   end
Cr-50           305    0   5.30517E-07   293.6   end
Cr-52           305    0   1.02189E-05   293.6   end
Cr-53           305    0   1.15860E-06   293.6   end
Cr-54           305    0   2.87821E-07   293.6   end
```

```
Mn-55           305    0   6.38261E-06   293.6   end
Fe-54           305    0   2.31055E-06   293.6   end
Fe-56           305    0   3.62380E-05   293.6   end
Fe-57           305    0   8.37326E-07   293.6   end
Fe-58           305    0   1.10590E-07   293.6   end
Cu-63           305    0   1.85717E-05   293.6   end
Cu-65           305    0   8.27767E-06   293.6   end
 U-234          305    0   6.97424E-06   293.6   end
 U-235          305    0   6.50000E-04   293.6   end
 U-236          305    0   2.78972E-06   293.6   end
 U-238          305    0   3.76609E-05   293.6   end
'       total atom density =  8.00985E-02 a/b-cm
'  8.009850E-02
 H-1            306    0   3.32434E-02   293.6   end
 O-16           306    0   1.81013E-02   293.6   end
Mg-24           306    0   1.05686E-04   293.6   end
Mg-25           306    0   1.33797E-05   293.6   end
Mg-26           306    0   1.47310E-05   293.6   end
Al-27           306    0   2.78528E-02   293.6   end
Si-28           306    0   1.00085E-04   293.6   end
Si-29           306    0   5.06774E-06   293.6   end
Si-30           306    0   3.36403E-06   293.6   end
Ti-46           306    0   4.20262E-07   293.6   end
Ti-47           306    0   3.79000E-07   293.6   end
Ti-48           306    0   3.75536E-06   293.6   end
Ti-49           306    0   2.75590E-07   293.6   end
Ti-50           306    0   2.63873E-07   293.6   end
Cr-50           306    0   5.30517E-07   293.6   end
Cr-52           306    0   1.02189E-05   293.6   end
Cr-53           306    0   1.15860E-06   293.6   end
Cr-54           306    0   2.87821E-07   293.6   end
Mn-55           306    0   6.43555E-06   293.6   end
Fe-54           306    0   2.34101E-06   293.6   end
Fe-56           306    0   3.67158E-05   293.6   end
Fe-57           306    0   8.48365E-07   293.6   end
Fe-58           306    0   1.12048E-07   293.6   end
Cu-63           306    0   1.87481E-05   293.6   end
Cu-65           306    0   8.35629E-06   293.6   end
 U-234          306    0   5.67811E-06   293.6   end
 U-235          306    0   5.29200E-04   293.6   end
 U-236          306    0   2.27126E-06   293.6   end
 U-238          306    0   3.06618E-05   293.6   end
'       total atom density =  8.00555E-02 a/b-cm
'  8.005550E-02
 H-1            307    0   3.32434E-02   293.6   end
 O-16           307    0   1.77731E-02   293.6   end
Mg-24           307    0   1.05686E-04   293.6   end
Mg-25           307    0   1.33797E-05   293.6   end
Mg-26           307    0   1.47310E-05   293.6   end
Al-27           307    0   2.82593E-02   293.6   end
Si-28           307    0   1.00993E-04   293.6   end
Si-29           307    0   5.11370E-06   293.6   end
Si-30           307    0   3.39453E-06   293.6   end
Ti-46           307    0   4.20262E-07   293.6   end
Ti-47           307    0   3.79000E-07   293.6   end
Ti-48           307    0   3.75536E-06   293.6   end
Ti-49           307    0   2.75590E-07   293.6   end
Ti-50           307    0   2.63873E-07   293.6   end
Cr-50           307    0   5.30517E-07   293.6   end
Cr-52           307    0   1.02189E-05   293.6   end
Cr-53           307    0   1.15860E-06   293.6   end
Cr-54           307    0   2.87821E-07   293.6   end
Mn-55           307    0   6.48581E-06   293.6   end
Fe-54           307    0   2.36993E-06   293.6   end
Fe-56           307    0   3.71695E-05   293.6   end
Fe-57           307    0   8.58848E-07   293.6   end
Fe-58           307    0   1.13433E-07   293.6   end
Cu-63           307    0   1.89155E-05   293.6   end
Cu-65           307    0   8.43090E-06   293.6   end
 U-234          307    0   4.44742E-06   293.6   end
 U-235          307    0   4.14500E-04   293.6   end
 U-236          307    0   1.77898E-06   293.6   end
 U-238          307    0   2.40161E-05   293.6   end
'       total atom density =  8.00271E-02 a/b-cm
'  8.002710E-02
 H-1            308    0   3.32434E-02   293.6   end
 O-16           308    0   1.75562E-02   293.6   end
Mg-24           308    0   1.05686E-04   293.6   end
Mg-25           308    0   1.33797E-05   293.6   end
Mg-26           308    0   1.47310E-05   293.6   end
Al-27           308    0   2.85280E-02   293.6   end
```

```
Si-28           308    0   1.01591E-04   293.6   end
Si-29           308    0   5.14401E-06   293.6   end
Si-30           308    0   3.41465E-06   293.6   end
Ti-46           308    0   4.20262E-07   293.6   end
Ti-47           308    0   3.79000E-07   293.6   end
Ti-48           308    0   3.75536E-06   293.6   end
Ti-49           308    0   2.75590E-07   293.6   end
Ti-50           308    0   2.63873E-07   293.6   end
Cr-50           308    0   5.30517E-07   293.6   end
Cr-52           308    0   1.02189E-05   293.6   end
Cr-53           308    0   1.15860E-06   293.6   end
Cr-54           308    0   2.87821E-07   293.6   end
Mn-55           308    0   6.51903E-06   293.6   end
Fe-54           308    0   2.38905E-06   293.6   end
Fe-56           308    0   3.74693E-05   293.6   end
Fe-57           308    0   8.65776E-07   293.6   end
Fe-58           308    0   1.14348E-07   293.6   end
Cu-63           308    0   1.90262E-05   293.6   end
Cu-65           308    0   8.48022E-06   293.6   end
 U-234          308    0   3.63412E-06   293.6   end
 U-235          308    0   3.38700E-04   293.6   end
 U-236          308    0   1.45366E-06   293.6   end
 U-238          308    0   1.96242E-05   293.6   end
'       total atom density =  8.00013E-02 a/b-cm
'  8.000130E-02
 H-1            309    0   3.32434E-02   293.6   end
 O-16           309    0   1.73591E-02   293.6   end
Mg-24           309    0   1.05686E-04   293.6   end
Mg-25           309    0   1.33797E-05   293.6   end
Mg-26           309    0   1.47310E-05   293.6   end
Al-27           309    0   2.87722E-02   293.6   end
Si-28           309    0   1.02136E-04   293.6   end
Si-29           309    0   5.17160E-06   293.6   end
Si-30           309    0   3.43297E-06   293.6   end
Ti-46           309    0   4.20262E-07   293.6   end
Ti-47           309    0   3.79000E-07   293.6   end
Ti-48           309    0   3.75536E-06   293.6   end
Ti-49           309    0   2.75590E-07   293.6   end
Ti-50           309    0   2.63873E-07   293.6   end
Cr-50           309    0   5.30517E-07   293.6   end
Cr-52           309    0   1.02189E-05   293.6   end
Cr-53           309    0   1.15860E-06   293.6   end
Cr-54           309    0   2.87821E-07   293.6   end
Mn-55           309    0   6.54922E-06   293.6   end
Fe-54           309    0   2.40643E-06   293.6   end
Fe-56           309    0   3.77418E-05   293.6   end
Fe-57           309    0   8.72072E-07   293.6   end
Fe-58           309    0   1.15179E-07   293.6   end
Cu-63           309    0   1.91268E-05   293.6   end
Cu-65           309    0   8.52504E-06   293.6   end
 U-234          309    0   2.89485E-06   293.6   end
 U-235          309    0   2.69800E-04   293.6   end
 U-236          309    0   1.15795E-06   293.6   end
 U-238          309    0   1.56322E-05   293.6   end
'
'
'
'
'
'
'       Region IV Control Element Material Descriptions
'      ------------------------------------------------
'
'        Aluminum clad of control elements
Al-27            21    0   5.85482E-02   293.6   end
 H-1             21    0   3.45716E-04   293.6   end
Mg-24            21    0   5.28432E-04   293.6   end
Mg-25            21    0   6.68986E-05   293.6   end
Mg-26            21    0   7.36554E-05   293.6   end
Si-28            21    0   3.20373E-04   293.6   end
Si-29            21    0   1.62219E-05   293.6   end
Si-30            21    0   1.07683E-05   293.6   end
Ti-46            21    0   2.10131E-06   293.6   end
Ti-47            21    0   1.89500E-06   293.6   end
Ti-48            21    0   1.87768E-05   293.6   end
Ti-49            21    0   1.37795E-06   293.6   end
Ti-50            21    0   1.31937E-06   293.6   end
Cr-50            21    0   2.65258E-06   293.6   end
Cr-52            21    0   5.10942E-05   293.6   end
Cr-53            21    0   5.79300E-06   293.6   end
Cr-54            21    0   1.43910E-06   293.6   end
```

```
Mn-55            21    0   2.21974E-05   293.6   end
Fe-54            21    0   5.96144E-06   293.6   end
Fe-56            21    0   9.34978E-05   293.6   end
Fe-57            21    0   2.16039E-06   293.6   end
Fe-58            21    0   2.85334E-07   293.6   end
Cu-63            21    0   6.04931E-05   293.6   end
Cu-65            21    0   2.69626E-05   293.6   end
'
'      Inner Control Element
'
'        Inner control element--Gray Ta-Al/H2O region
' The total number density on MCNP material cards ( 5.85987E-02)
'   is not the same as on cell cards ( 5.88250E-02)
Ta-181          400    0   1.42950E-02   293.6   end
Al-27           400    0   3.36997E-02   293.6   end
 H-1            400    0   2.83089E-03   293.6   end
 O-16           400    0   1.40541E-03   293.6   end
Ta-182          400    0   3.39607E-05   293.6   end
 W-182          400    0   2.85398E-04   293.6   end
 W-183          400    0   4.63182E-03   293.6   end
 W-184          400    0   1.64131E-03   293.6   end
 W-186          400    0   1.54595E-06   293.6   end
'        Inner control element--black EuO-Al region
Eu-151          401    0   2.69002E-03   293.6   end
Eu-153          401    0   4.47203E-03   293.6   end
Al-27           401    0   3.93803E-02   293.6   end
 O-16           401    0   1.31201E-02   293.6   end
Eu-152          401    0   6.75405E-04   293.6   end
Eu-154          401    0   2.61202E-04   293.6   end
Eu-155          401    0   2.44802E-05   293.6   end
Sm-152          401    0   1.71301E-04   293.6   end
Gd-152          401    0   3.84303E-04   293.6   end
Gd-154          401    0   4.22003E-05   293.6   end
Gd-155          401    0   3.59803E-06   293.6   end
Gd-156          401    0   7.06105E-06   293.6   end
'        Inner control element-upper Al/H2O region
 H-1            402    0   3.26363E-03   293.6   end
 O-16           402    0   1.63181E-03   293.6   end
Al-27           402    0   5.72948E-02   293.6   end
'        Inner control element-lower Al/H2O region
 H-1            403    0   3.19976E-03   293.6   end
 O-16           403    0   1.59988E-03   293.6   end
Al-27           403    0   5.73525E-02   293.6   end
'
'      Outer Control Element
'
'        Outer control element--Gray Ta-Al/H2O region
Ta-181          411    0   1.79700E-02   293.6   end
Al-27           411    0   3.22700E-02   293.6   end
 H-1            411    0   2.77400E-03   293.6   end
 O-16           411    0   1.39300E-03   293.6   end
Ta-182          411    0   2.83800E-05   293.6   end
 W-182          411    0   1.19700E-04   293.6   end
 W-183          411    0   1.77700E-03   293.6   end
 W-184          411    0   1.44900E-04   293.6   end
 W-186          411    0   1.74200E-08   293.6   end
'        Outer control element--black EuO-Al region
Eu-151          410    0   3.58098E-03   293.6   end
Eu-153          410    0   4.28997E-03   293.6   end
Al-27           410    0   3.78298E-02   293.6   end
 O-16           410    0   1.25999E-02   293.6   end
Eu-152          410    0   2.68998E-04   293.6   end
Eu-154          410    0   8.15595E-05   293.6   end
Eu-155          410    0   2.47898E-06   293.6   end
Sm-152          410    0   4.87897E-05   293.6   end
Gd-152          410    0   1.16999E-04   293.6   end
Gd-154          410    0   5.18597E-06   293.6   end
Gd-155          410    0   2.14399E-07   293.6   end
Gd-156          410    0   1.53199E-07   293.6   end
'        Outer control element-upper Al/H2O region
 H-1            412    0   3.01443E-03   293.6   end
 O-16           412    0   1.50722E-03   293.6   end
Al-27           412    0   5.75198E-02   293.6   end
'        Outer control element-lower Al/H2O region
 H-1            413    0   3.19012E-03   293.6   end
 O-16           413    0   1.59506E-03   293.6   end
Al-27           413    0   5.73611E-02   293.6   end
'
'
'
'
```

```
'
'
'        Region V Removable  Reflector Material Descriptions
'        ------------------------------------------------------
'
'         Water above removable reflector region --Density= 0.9794 g/cm^3
 H-1              4    0   6.59947E-02   293.6   end
 O-16             4    0   3.29974E-02   293.6   end
'         Water gaps in removable reflector region    --Avg. Density= 0.98465 g/cm^3
 H-1              5    0   6.63485E-02   293.6   end
 O-16             5    0   3.31742E-02   293.6   end
'         Water below removable reflector region --Density= 0.9899 g/cm^3
 H-1              6    0   6.67020E-02   293.6   end
 O-16             6    0   3.33510E-02   293.6   end
'
'        Aluminum clad of removable refl. reg.
Al-27            22    0   5.85482E-02   293.6   end
 H-1             22    0   3.45716E-04   293.6   end
Mg-24            22    0   5.28432E-04   293.6   end
Mg-25            22    0   6.68986E-05   293.6   end
Mg-26            22    0   7.36554E-05   293.6   end
Si-28            22    0   3.20373E-04   293.6   end
Si-29            22    0   1.62219E-05   293.6   end
Si-30            22    0   1.07683E-05   293.6   end
Ti-46            22    0   2.10131E-06   293.6   end
Ti-47            22    0   1.89500E-06   293.6   end
Ti-48            22    0   1.87768E-05   293.6   end
Ti-49            22    0   1.37795E-06   293.6   end
Ti-50            22    0   1.31937E-06   293.6   end
Cr-50            22    0   2.65258E-06   293.6   end
Cr-52            22    0   5.10942E-05   293.6   end
Cr-53            22    0   5.79300E-06   293.6   end
Cr-54            22    0   1.43910E-06   293.6   end
Mn-55            22    0   2.21974E-05   293.6   end
Fe-54            22    0   5.96144E-06   293.6   end
Fe-56            22    0   9.34978E-05   293.6   end
Fe-57            22    0   2.16039E-06   293.6   end
Fe-58            22    0   2.85334E-07   293.6   end
Cu-63            22    0   6.04931E-05   293.6   end
Cu-65            22    0   2.69626E-05   293.6   end
'
'        Aluminum liners in Be reflectors also outside Be reflector container
Al-27            24    0   5.85482E-02   293.6   end
 H-1             24    0   3.45716E-04   293.6   end
Mg-24            24    0   5.28432E-04   293.6   end
Mg-25            24    0   6.68986E-05   293.6   end
Mg-26            24    0   7.36554E-05   293.6   end
Si-28            24    0   3.20373E-04   293.6   end
Si-29            24    0   1.62219E-05   293.6   end
Si-30            24    0   1.07683E-05   293.6   end
Ti-46            24    0   2.10131E-06   293.6   end
Ti-47            24    0   1.89500E-06   293.6   end
Ti-48            24    0   1.87768E-05   293.6   end
Ti-49            24    0   1.37795E-06   293.6   end
Ti-50            24    0   1.31937E-06   293.6   end
Cr-50            24    0   2.65258E-06   293.6   end
Cr-52            24    0   5.10942E-05   293.6   end
Cr-53            24    0   5.79300E-06   293.6   end
Cr-54            24    0   1.43910E-06   293.6   end
Mn-55            24    0   2.21974E-05   293.6   end
Fe-54            24    0   5.96144E-06   293.6   end
Fe-56            24    0   9.34978E-05   293.6   end
Fe-57            24    0   2.16039E-06   293.6   end
Fe-58            24    0   2.85334E-07   293.6   end
Cu-63            24    0   6.04931E-05   293.6   end
Cu-65            24    0   2.69626E-05   293.6   end
'
'        Beryllium plugs
Bebound          33    0   1.23606E-01   293.6   end
 H-1             33    0   6.73828E-07   293.6   end
 O-16            33    0   3.36914E-07   293.6   end
'
'
'        Eu Liner in RB-7A
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 7.68237E+00)
Fe-54            38    0   3.45417E-03   293.6   end
Fe-56            38    0   5.41745E-02   293.6   end
Fe-57            38    0   1.25177E-03   293.6   end
Fe-58            38    0   1.65328E-04   293.6   end
Eu-151           38    0   3.61102E-03   293.6   end
```

```
Eu-153           38    0   3.94184E-03   293.6   end
 O-16            38    0   1.13293E-02   293.6   end
'
'        Eu  in RB-7A
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 4.66136E+00)
Fe-54            39    0   2.83677E-03   293.6   end
Fe-56            39    0   4.44912E-02   293.6   end
Fe-57            39    0   1.02803E-03   293.6   end
Fe-58            39    0   1.35777E-04   293.6   end
 B-10            39    0   8.93840E-05   293.6   end
Eu-151           39    0   1.59355E-04   293.6   end
Eu-153           39    0   1.73955E-04   293.6   end
 O-16            39    0   4.99965E-04   293.6   end
Al-27            39    0   1.46655E-03   293.6   end
'
'      Beryllium removable reflector
'        At the start of cycle 400, a new removable beryllium reflector was placed in the reactor
'        No Li-6, or He-3 present (100% Be - H2O gaps are explicitly modelled)
'
' Removable reflector Rgn 1 material
Bebound          101    0   1.23607E-01   293.6   end
' Removable reflector Rgn 2 material
Bebound          102    0   1.23607E-01   293.6   end
' Removable reflector Rgn 3 material
Bebound          103    0   1.23607E-01   293.6   end
'semi-permanent refl. reg
Bebound          104    0   1.23607E-01   293.6   end
Li-6             104    0   3.14455E-07   293.6   end
He-3             104    0   9.25938E-09   293.6   end
'
'
'       Region VI  Permanent  Reflector Material
'      ----------------------------------------
'
'         Water in Irradiation Facilities  - Density= 0.98465 g/cc
 H-1               9    0   6.63485E-02   293.6   end
 O-16              9    0   3.31742E-02   293.6   end
'
'        Beryllium permanent reflector(with he-3 and li-6)
Bebound          105    0   1.21134E-01   293.6   end
 H-1             105    0   1.34765E-03   293.6   end
 O-16            105    0   6.73824E-04   293.6   end
Li-6             105    0   1.74119E-07   293.6   end
He-3             105    0   5.11966E-09   293.6   end
Bebound          106    0   1.21134E-01   293.6   end
 H-1             106    0   1.34765E-03   293.6   end
 O-16            106    0   6.73825E-04   293.6   end
Li-6             106    0   1.08524E-07   293.6   end
He-3             106    0   4.29664E-09   293.6   end
Bebound          107    0   1.21134E-01   293.6   end
 H-1             107    0   1.34765E-03   293.6   end
 O-16            107    0   6.73825E-04   293.6   end
Li-6             107    0   7.10575E-08   293.6   end
He-3             107    0   2.07746E-09   293.6   end
Bebound          108    0   1.21134E-01   293.6   end
 H-1             108    0   1.34765E-03   293.6   end
 O-16            108    0   6.73825E-04   293.6   end
Li-6             108    0   4.80662E-08   293.6   end
He-3             108    0   1.39910E-09   293.6   end
Bebound          109    0   1.21134E-01   293.6   end
 H-1             109    0   1.34765E-03   293.6   end
 O-16            109    0   6.73825E-04   293.6   end
Li-6             109    0   3.32030E-08   293.6   end
He-3             109    0   9.59627E-10   293.6   end
Bebound          110    0   1.21134E-01   293.6   end
 H-1             110    0   1.34765E-03   293.6   end
 O-16            110    0   6.73825E-04   293.6   end
Li-6             110    0   2.46751E-08   293.6   end
He-3             110    0   7.06335E-10   293.6   end
Bebound          111    0   1.21135E-01   293.6   end
 H-1             111    0   1.34765E-03   293.6   end
 O-16            111    0   6.73825E-04   293.6   end
Li-6             111    0   1.84488E-08   293.6   end
He-3             111    0   5.19304E-10   293.6   end
'
'        H-Tube material                       Total =   6.03240E-02
' The total number density on MCNP material cards ( 6.03240E-02)
'   is not the same as on cell cards ( 6.02423E-02)
Al-27            520    0   5.99811E-02   293.6   end
Si-28            520    0   1.33801E-04   293.6   end
```

```
Si-29           520    0   6.77497E-06   293.6   end
Si-30           520    0   4.49730E-06   293.6   end
Mn-55           520    0   7.41649E-06   293.6   end
Fe-54           520    0   4.26815E-06   293.6   end
Fe-56           520    0   6.69406E-05   293.6   end
Fe-57           520    0   1.54675E-06   293.6   end
Fe-58           520    0   2.04288E-07   293.6   end
Cu-63           520    0   2.47065E-05   293.6   end
Cu-65           520    0   1.10121E-05   293.6   end
'       H-Tube clad
Al-27           521    0   6.02423E-02   293.6   end
'
'
'       Water Reflector --Density= 0.9899 g/cm^3
 H-1             7    0   6.67020E-02   293.6   end
 O-16            7    0   3.33510E-02   293.6   end
'        H2O Pool  --Density= 1.0000 g/cm^3
 H-1             8    0   6.73827E-02   293.6   end
 O-16            8    0   3.36913E-02   293.6   end
'
'       Pressure Vessel Stainless steel liner - SCALE SS304 (69.5 w/o Fe, 19.0 w/o Cr,
'                                                    9.5 w/o Ni,  2.0 w/o Mn)
'       also used for ss liners in vxfs
Fe-54           40    0   3.47221E-03   293.6   end
Fe-56           40    0   5.44574E-02   293.6   end
Fe-57           40    0   1.25831E-03   293.6   end
Fe-58           40    0   1.66191E-04   293.6   end
Cr-50           40    0   7.58122E-04   293.6   end
Cr-52           40    0   1.46030E-02   293.6   end
Cr-53           40    0   1.65567E-03   293.6   end
Cr-54           40    0   4.11303E-04   293.6   end
Ni-58           40    0   5.25498E-03   293.6   end
Ni-60           40    0   2.02388E-03   293.6   end
Ni-61           40    0   8.79947E-05   293.6   end
Ni-62           40    0   2.80194E-04   293.6   end
Ni-64           40    0   7.17851E-05   293.6   end
Mn-55           40    0   1.73629E-03   293.6   end
'
'       Carbon steel PV -- SCALE Carbon Steel (99.0 w/o Fe, 1.0 w/o C)
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 8.16000E+00)
Fe-54           50    0   5.09626E-03   293.6   end
Fe-56           50    0   7.99285E-02   293.6   end
Fe-57           50    0   1.84685E-03   293.6   end
Fe-58           50    0   2.43924E-04   293.6   end
 C              50    0   4.09148E-03   293.6   end
'
'       Air Void in reflector components
 H-1            60    0   1.00000E-15   293.6   end
 O-16           60    0   1.00000E-15   293.6   end
'
'      Barytes concrete at 3.09725 g/cc (used for biological shield); shown below are atoms/(barn*cm) by nuclide
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 3.09725E+00)
 H-1            62    0   1.67197E-02   293.6   end
 B-10           62    0   3.35986E-04   293.6   end
 B-11           62    0   1.36065E-03   293.6   end
 O-16           62    0   4.17247E-02   293.6   end
Na-23           62    0   3.17585E-04   293.6   end
Mg-24           62    0   1.21699E-04   293.6   end
Mg-25           62    0   1.54068E-05   293.6   end
Mg-26           62    0   1.69629E-05   293.6   end
Al-27           62    0   7.49354E-04   293.6   end
Si-28           62    0   1.15586E-03   293.6   end
Si-29           62    0   5.85260E-05   293.6   end
Si-30           62    0   3.88503E-05   293.6   end
 S-32           62    0   5.37200E-03   293.6   end
Ti-46           62    0   1.09628E-05   293.6   end
Ti-47           62    0   9.88646E-06   293.6   end
Ti-48           62    0   9.79610E-05   293.6   end
Ti-49           62    0   7.18895E-06   293.6   end
Ti-50           62    0   6.88332E-06   293.6   end
Mn-55           62    0   1.70380E-04   293.6   end
Fe-54           62    0   4.00028E-05   293.6   end
Fe-56           62    0   6.27394E-04   293.6   end
Fe-57           62    0   1.44967E-05   293.6   end
Fe-58           62    0   1.91466E-06   293.6   end
Ba-138          62    0   5.36503E-03   293.6   end
Ca-40           62    0   3.15581E-03   293.6   end
Ca-42           62    0   2.10301E-05   293.6   end
Ca-43           62    0   4.36227E-06   293.6   end
```

```
Ca-44            62    0   6.80384E-05   293.6   end
Ca-46            62    0   1.30217E-07   293.6   end
Ca-48            62    0   6.05509E-06   293.6   end
'        real concentration for ba-138 = 3.8787e-3 atoms/(barn*cm); it is available;
'        other nuclide concentrations for which there is no mcnp xsect data:
'        ba-134=1.3037e-4;  ba-135=3.5557e-4;  ba-136=4.2364e-4;  ba-137=6.0575e-4
'        total number density for all barium nuclides in barytes concrete: 5.394030e-3
'        total number density for all nuclides in barytes concrete:  7.801382e-2
'        while this barytes concrete (for ANS project) was 3.09725 g/cc, it can
'        sometimes be made as dense as 3.5 g/cc; see book by Schaffer
'
'        Replace with 1014.51c and parah.96t
'        Liquid H at 20 deg.K, 15 bar pressure; Total = 0.04372 atoms/(b*cm) = 0.0726 g/cc (revised as per Trevor Lucas, 5-
3-96)
' The number densities for this material on MCNP material cards were manually
'   verified for consistency with density on cell cards ( 7.26000E-02)
 H-1           560    0   8.10550E-04   293.6   end
' mt560    hpara.60t
'  There is a total of  264 materials in this problem
'
end comp

read parm
  cfx=yes gen=11 nsk=1 npg=10000 tba=100 htm=no plt=yes flx=yes fdn=yes
end parm

read geometry
'
'
'     --------------------
'     Region 1  cell Cards
'     --------------------
'
'     Target site A-2  (shrouded Al dummy)
unit 410
 cylinder    410  0.24765    25.4       -25.4
 cylinder    411  0.31623    25.4       -25.4
 cylinder    412  0.47625    49.2125    -39.6875
 cylinder    413  0.755015   40.3225    -25.40100
 cylinder   1413  0.755015   49.2125    -39.6875
 cylinder    414  0.83058    40.3225    -25.40100
 cylinder    415  0.83500    49.2125    -39.6875
 media       512     1     410
 media       511     1     411    -410
 media        25     1     412    -411
 media        25     1     414    -413
 media         2     1    1413    -412
 media         2     1     415   -1413    -414
 boundary    415
' end unit 410
'
'     Target site A-3  (shrouded Al dummy)
unit 420
 cylinder    420  0.24765    25.4       -25.4
 cylinder    421  0.31623    25.4       -25.4
 cylinder    422  0.47625    49.2125    -39.6875
 cylinder    423  0.755015   40.3225    -25.40100
 cylinder   1423  0.755015   49.2125    -39.6875
 cylinder    424  0.83058    40.3225    -25.40100
 cylinder    425  0.83500    49.2125    -39.6875
 media       512     1     420
 media       511     1     421    -420
 media        25     1     422    -421
 media        25     1     424    -423
 media         2     1    1423    -422
 media         2     1     425   -1423    -424
 boundary    425
' end unit 420
'
'     Target site B-1  (shrouded Al dummy)
unit 430
 cylinder    430  0.24765    25.4       -25.4
 cylinder    431  0.31623    25.4       -25.4
 cylinder    432  0.47625    49.2125    -39.6875
 cylinder    433  0.755015   40.3225    -25.40100
 cylinder   1433  0.755015   49.2125    -39.6875
 cylinder    434  0.83058    40.3225    -25.40100
 cylinder    435  0.83500    49.2125    -39.6875
 media       512     1     430
 media       511     1     431    -430
 media        25     1     432    -431
```

```
 media        25     1     434    -433
 media         2     1    1433    -432
 media         2     1     435   -1433    -434
 boundary    435
' end unit 430
'
'     Target site B-2  (shrouded Al dummy)
unit 440
 cylinder    440  0.24765    25.4       -25.4
 cylinder    441  0.31623    25.4       -25.4
 cylinder    442  0.47625    49.2125    -39.6875
 cylinder    443  0.755015   40.3225    -25.40100
 cylinder   1443  0.755015   49.2125    -39.6875
 cylinder    444  0.83058    40.3225    -25.40100
 cylinder    445  0.83500    49.2125    -39.6875
 media       512     1     440
 media       511     1     441    -440
 media        25     1     442    -441
 media        25     1     444    -443
 media         2     1    1443    -442
 media         2     1     445   -1443    -444
 boundary    445
' end unit 440
'
'     Target site B-3  (HT tube)
unit 750
 cylinder    750  0.32385    28.80800    23.251795
 cylinder    751  0.32385    22.300565   16.744315
 cylinder    752  0.32385    15.793085   10.236835
 cylinder    753  0.32385     9.285605    3.729355
 cylinder    754  0.32385     2.778125   -2.778125
 cylinder    755  0.32385    -3.729355   -9.285605
 cylinder    756  0.32385   -10.236835  -15.793085
 cylinder    757  0.32385   -16.744315  -22.300565
 cylinder    758  0.32385   -23.251795  -28.80800
'
 cylinder    760  0.55499    29.28366    22.77618
 cylinder    761  0.55499    29.28366    16.26870
 cylinder    762  0.55499    29.28366     9.76122
 cylinder    763  0.55499    29.28366     3.25374
 cylinder    764  0.55499    29.28366    -3.25374
 cylinder    765  0.55499    29.28366    -9.76122
 cylinder    766  0.55499    29.28366   -16.26870
 cylinder    767  0.55499    29.28366   -22.77618
 cylinder    768  0.55499    29.28366   -29.28366
'
 cylinder    452  0.63500    29.28366   -29.28366
 cylinder    453  0.787400   29.28366   -29.28366
 cylinder    454  0.83500    29.28366   -29.28366
'
 cylinder    455  0.787400   29.28366   -39.6875
 cylinder    456  0.83500    29.28366   -39.6875
'
 cylinder    446  0.55499    49.2125    -29.28366
 cylinder    447  0.63500    49.2125    -29.28366
 cylinder    448  0.787400   49.2125    -39.6875
 cylinder    449  0.83500    49.2125    -39.6875
'
 media       520     1     750
 media       520     1     751
 media       520     1     752
 media       520     1     753
 media       520     1     754
 media       520     1     755
 media       520     1     756
 media       520     1     757
 media       520     1     758
 media       521     1     760    -750
 media       521     1     761    -751    -760
 media       521     1     762    -752    -761
 media       521     1     763    -753    -762
 media       521     1     764    -754    -763
 media       521     1     765    -755    -764
 media       521     1     766    -756    -765
 media       521     1     767    -757    -766
 media       521     1     768    -758    -767
 media        60     1     452    -768
 media        25     1     453    -452
 media         2     1     454    -453
 media        25     1     455    -453
 media         2     1     456    -455    -454
```

```
 media        60     1     446    -768
 media        60     1     447    -446    -452
 media        25     1     448    -447    -455
 media         2     1     449    -448    -456
 boundary    449
' end unit 750
'
'     Target site B-4  (shrouded Al dummy)
unit 460
 cylinder    460  0.24765    25.4       -25.4
 cylinder    461  0.31623    25.4       -25.4
 cylinder    462  0.47625    49.2125    -39.6875
 cylinder    463  0.755015   40.3225    -25.40100
 cylinder   1463  0.755015   49.2125    -39.6875
 cylinder    464  0.83058    40.3225    -25.40100
 cylinder    465  0.83500    49.2125    -39.6875
 media       512     1     460
 media       511     1     461    -460
 media        25     1     462    -461
 media        25     1     464    -463
 media         2     1    1463    -462
 media         2     1     465   -1463    -464
 boundary    465
' end unit 460
'
'     Target site B-5  (shrouded Al dummy)
unit 470
 cylinder    470  0.24765    25.4       -25.4
 cylinder    471  0.31623    25.4       -25.4
 cylinder    472  0.47625    49.2125    -39.6875
 cylinder    473  0.755015   40.3225    -25.40100
 cylinder   1473  0.755015   49.2125    -39.6875
 cylinder    474  0.83058    40.3225    -25.40100
 cylinder    475  0.83500    49.2125    -39.6875
 media       512     1     470
 media       511     1     471    -470
 media        25     1     472    -471
 media        25     1     474    -473
 media         2     1    1473    -472
 media         2     1     475   -1473    -474
 boundary    475
' end unit 470
'
'     Target site C-1  (shrouded Al dummy)
unit 480
 cylinder    480  0.24765    25.4       -25.4
 cylinder    481  0.31623    25.4       -25.4
 cylinder    482  0.47625    49.2125    -39.6875
 cylinder    483  0.755015   40.3225    -25.40100
 cylinder   1483  0.755015   49.2125    -39.6875
 cylinder    484  0.83058    40.3225    -25.40100
 cylinder    485  0.83500    49.2125    -39.6875
 media       512     1     480
 media       511     1     481    -480
 media        25     1     482    -481
 media        25     1     484    -483
 media         2     1    1483    -482
 media         2     1     485   -1483    -484
 boundary    485
' end unit 480
'
'     Target site C-2  (solid Al dummy)
unit 490
 cylinder    492  0.47625    49.2125    -39.6875
 cylinder    494  0.83058    40.3225    -25.40100
 cylinder    495  0.83500    49.2125    -39.6875
 media       530     1     492
 media       530     1     494    -492
 media         2     1     495    -492    -494
 boundary    495
' end unit 490
'
'     Target site C-3  (shrouded Al dummy)
unit 510
 cylinder    510  0.24765    25.4       -25.4
 cylinder    511  0.31623    25.4       -25.4
 cylinder    512  0.47625    49.2125    -39.6875
 cylinder    513  0.755015   40.3225    -25.40100
 cylinder   1513  0.755015   49.2125    -39.6875
 cylinder    514  0.83058    40.3225    -25.40100
 cylinder    515  0.83500    49.2125    -39.6875
```

```
 media       512     1     510
 media       511     1     511    -510
 media        25     1     512    -511
 media        25     1     514    -513
 media         2     1    1513    -512
 media         2     1     515   -1513    -514
 boundary    515
' end unit 510
'
'     Target site C-4  (shrouded Al dummy)
unit 520
 cylinder    520  0.24765    25.4       -25.4
 cylinder    521  0.31623    25.4       -25.4
 cylinder    522  0.47625    49.2125    -39.6875
 cylinder    523  0.755015   40.3225    -25.40100
 cylinder   1523  0.755015   49.2125    -39.6875
 cylinder    524  0.83058    40.3225    -25.40100
 cylinder    525  0.83500    49.2125    -39.6875
 media       512     1     520
 media       511     1     521    -520
 media        25     1     522    -521
 media        25     1     524    -523
 media         2     1    1523    -522
 media         2     1     525   -1523    -524
 boundary    525
' end unit 520
'
'     Target site C-5  (solid Al dummy)
unit 530
 cylinder    532  0.47625    49.2125    -39.6875
 cylinder    534  0.83058    40.3225    -25.40100
 cylinder    535  0.83500    49.2125    -39.6875
 media       530     1     532
 media       530     1     534    -532
 media         2     1     535    -532    -534
 boundary    535
' end unit 530
'
'     Target site C-6  JP-26 (solid SST-304)
'     Jp-26 & Jp-27 solid SSt targets in Al holders  , (dimensions communication w/ Randy Hobbs 8/9/2004)
unit 540
 cylinder    542  0.635      25.4       -25.4
 cylinder   1542  0.635      49.2125    -39.6875
 cylinder    543  0.75565    40.3225    -25.40100
 cylinder   1543  0.75565    49.2125    -39.6875
 cylinder    544  0.83058    40.3225    -25.40100
 cylinder    545  0.83500    49.2125    -39.6875
 media       535     1     542
 media        25     1    1542    -542
 media        25     1     544    -543
 media         2     1    1543   -1542
 media         2     1     545   -1543    -544
 boundary    545
' end unit 540
'
'     Target site D-2  (shrouded Al dummy)
unit 550
 cylinder    550  0.24765    25.4       -25.4
 cylinder    551  0.31623    25.4       -25.4
 cylinder    552  0.47625    49.2125    -39.6875
 cylinder    553  0.755015   40.3225    -25.40100
 cylinder   1553  0.755015   49.2125    -39.6875
 cylinder    554  0.83058    40.3225    -25.40100
 cylinder    555  0.83500    49.2125    -39.6875
 media       512     1     550
 media       511     1     551    -550
 media        25     1     552    -551
 media        25     1     554    -553
 media         2     1    1553    -552
 media         2     1     555   -1553    -554
 boundary    555
' end unit 550
'
'     Target site D-3  (solid Al dummy)
unit 560
 cylinder    562  0.47625    49.2125    -39.6875
 cylinder    564  0.83058    40.3225    -25.40100
 cylinder    565  0.83500    49.2125    -39.6875
 media       530     1     562
 media       530     1     564    -562
 media         2     1     565    -562    -564
```

```
 boundary    565
' end unit 560
'
'     Target site D-4  (solid Al dummy)
unit 570
 cylinder    572  0.47625    49.2125      0.100
 cylinder    578  0.47625    -0.100     -39.6875
 cylinder    579  0.47625     0.100      -0.100
 cylinder    574  0.83058    40.3225    -25.40100
 cylinder    575  0.83500    49.2125    -39.6875
 media       530     1     572
 media       530     1     578
 media       530     1     579
 media       530     1     574    -572    -578    -579
 media         2     1     575    -572    -578    -579    -574
 boundary    575
' end unit 570
'
'     Target site D-5  (shrouded Al dummy)
unit 580
 cylinder    580  0.24765    25.4       -25.4
 cylinder    581  0.31623    25.4       -25.4
 cylinder    582  0.47625    49.2125    -39.6875
 cylinder    583  0.755015   40.3225    -25.40100
 cylinder   1583  0.755015   49.2125    -39.6875
 cylinder    584  0.83058    40.3225    -25.40100
 cylinder    585  0.83500    49.2125    -39.6875
 media       512     1     580
 media       511     1     581    -580
 media        25     1     582    -581
 media        25     1     584    -583
 media         2     1    1583    -582
 media         2     1     585   -1583    -584
 boundary    585
' end unit 580
'
'     Target site D-6  (shrouded Al dummy)
unit 590
 cylinder    590  0.24765    25.4       -25.4
 cylinder    591  0.31623    25.4       -25.4
 cylinder    592  0.47625    49.2125    -39.6875
 cylinder    593  0.755015   40.3225    -25.40100
 cylinder   1593  0.755015   49.2125    -39.6875
 cylinder    594  0.83058    40.3225    -25.40100
 cylinder    595  0.83500    49.2125    -39.6875
 media       512     1     590
 media       511     1     591    -590
 media        25     1     592    -591
 media        25     1     594    -593
 media         2     1    1593    -592
 media         2     1     595   -1593    -594
 boundary    595
' end unit 590
'
'     Target site E-2  (JP-27 SST-304  targets)
'    Jp-26 & Jp-27 solid SSt targets in Al holders  , (dimensions communication w/ Randy Hobbs 8/9/2004)
unit 610
 cylinder    612  0.635      25.4       -25.4
 cylinder   1612  0.635      49.2125    -39.6875
 cylinder    613  0.75565    40.3225    -25.40100
 cylinder   1613  0.75565    49.2125    -39.6875
 cylinder    614  0.83058    40.3225    -25.40100
 cylinder    615  0.83500    49.2125    -39.6875
 media       535     1     612
 media        25     1    1612    -612
 media        25     1     614    -613
 media         2     1    1613   -1612
 media         2     1     615   -1613    -614
 boundary    615
' end unit 610
'
'     Target site E-3  (shrouded Al dummy)
unit 620
 cylinder    620  0.24765    25.4       -25.4
 cylinder    621  0.31623    25.4       -25.4
 cylinder    622  0.47625    49.2125    -39.6875
 cylinder    623  0.755015   40.3225    -25.40100
 cylinder   1623  0.755015   49.2125    -39.6875
 cylinder    624  0.83058    40.3225    -25.40100
 cylinder    625  0.83500    49.2125    -39.6875
 media       512     1     620
```

```
 media       511     1     621    -620
 media        25     1     622    -621
 media        25     1     624    -623
 media         2     1    1623    -622
 media         2     1     625   -1623    -624
 boundary    625
' end unit 620
'
'     Target site E-4  (shrouded Al dummy)
unit 630
 cylinder    630  0.24765    25.4       -25.4
 cylinder    631  0.31623    25.4       -25.4
 cylinder    632  0.47625    49.2125    -39.6875
 cylinder    633  0.755015   40.3225    -25.40100
 cylinder   1633  0.755015   49.2125    -39.6875
 cylinder    634  0.83058    40.3225    -25.40100
 cylinder    635  0.83500    49.2125    -39.6875
 media       512     1     630
 media       511     1     631    -630
 media        25     1     632    -631
 media        25     1     634    -633
 media         2     1    1633    -632
 media         2     1     635   -1633    -634
 boundary    635
' end unit 630
'
'     Target site E-5  (solid Al dummy)
unit 640
 cylinder    642  0.47625    49.2125      0.100
 cylinder    648  0.47625    -0.100     -39.6875
 cylinder    649  0.47625     0.100      -0.100
 cylinder    644  0.83058    40.3225    -25.40100
 cylinder    645  0.83500    49.2125    -39.6875
 media       530     1     642
 media       530     1     648
 media       530     1     649
 media       530     1     644    -642    -648    -649
 media         2     1     645    -642    -648    -649    -644
 boundary    645
' end unit 640
'
'     Target site E-6  (solid Al dummy)
unit 650
 cylinder    652  0.47625    49.2125    -39.6875
 cylinder    654  0.83058    40.3225    -25.40100
 cylinder    655  0.83500    49.2125    -39.6875
 media       530     1     652
 media       530     1     654    -652
 media         2     1     655    -652    -654
 boundary    655
' end unit 650
'
'     Target site E-7  (shrouded Al dummy)
unit 660
 cylinder    660  0.24765    25.4       -25.4
 cylinder    661  0.31623    25.4       -25.4
 cylinder    662  0.47625    49.2125    -39.6875
 cylinder    663  0.755015   40.3225    -25.40100
 cylinder   1663  0.755015   49.2125    -39.6875
 cylinder    664  0.83058    40.3225    -25.40100
 cylinder    665  0.83500    49.2125    -39.6875
 media       512     1     660
 media       511     1     661    -660
 media        25     1     662    -661
 media        25     1     664    -663
 media         2     1    1663    -662
 media         2     1     665   -1663    -664
 boundary    665
' end unit 660
'
'     Target site F-3  (shrouded Al dummy)
unit 670
 cylinder    670  0.24765    25.4       -25.4
 cylinder    671  0.31623    25.4       -25.4
 cylinder    672  0.47625    49.2125    -39.6875
 cylinder    673  0.755015   40.3225    -25.40100
 cylinder   1673  0.755015   49.2125    -39.6875
 cylinder    674  0.83058    40.3225    -25.40100
 cylinder    675  0.83500    49.2125    -39.6875
 media       512     1     670
 media       511     1     671    -670
```

```
 media        25     1     672    -671
 media        25     1     674    -673
 media         2     1    1673    -672
 media         2     1     675   -1673    -674
 boundary    675
' end unit 670
'
'     Target site F-4  ((shrouded Al dummy)
unit 680
 cylinder    680  0.24765    25.4       -25.4
 cylinder    681  0.31623    25.4       -25.4
 cylinder    682  0.47625    49.2125    -39.6875
 cylinder    683  0.755015   40.3225    -25.40100
 cylinder   1683  0.755015   49.2125    -39.6875
 cylinder    684  0.83058    40.3225    -25.40100
 cylinder    685  0.83500    49.2125    -39.6875
 media       512     1     680
 media       511     1     681    -680
 media        25     1     682    -681
 media        25     1     684    -683
 media         2     1    1683    -682
 media         2     1     685   -1683    -684
 boundary    685
' end unit 680
'
'     Target site F-5  (solid Al dummy)
unit 690
 cylinder    692  0.47625    49.2125    -39.6875
 cylinder    694  0.83058    40.3225    -25.40100
 cylinder    695  0.83500    49.2125    -39.6875
 media       530     1     692
 media       530     1     694    -692
 media         2     1     695    -692    -694
 boundary    695
' end unit 690
'
'     Target site F-6  (shrouded Al dummy)
unit 710
 cylinder    710  0.24765    -0.100     -25.4
 cylinder    718  0.24765    25.4         0.100
 cylinder    719  0.24765     0.100      -0.100
 cylinder    711  0.31623    25.4       -25.4
 cylinder    712  0.47625    49.2125    -39.6875
 cylinder    713  0.755015   40.3225    -25.40100
 cylinder   1713  0.755015   49.2125    -39.6875
 cylinder    714  0.83058    40.3225    -25.40100
 cylinder    715  0.83500    49.2125    -39.6875
 media       512     1     710
 media       512     1     718
 media       512     1     719
 media       511     1     711    -710    -718    -719
 media        25     1     712    -711
 media        25     1     714    -713
 media         2     1    1713    -712
 media         2     1     715   -1713    -714
 boundary    715
' end unit 710
'
'     Target site F-7  (shrouded Al dummy)
unit 720
 cylinder    720  0.24765    25.4       -25.4
 cylinder    721  0.31623    25.4       -25.4
 cylinder    722  0.47625    49.2125    -39.6875
 cylinder    723  0.755015   40.3225    -25.40100
 cylinder   1723  0.755015   49.2125    -39.6875
 cylinder    724  0.83058    40.3225    -25.40100
 cylinder    725  0.83500    49.2125    -39.6875
 media       512     1     720
 media       511     1     721    -720
 media        25     1     722    -721
 media        25     1     724    -723
 media         2     1    1723    -722
 media         2     1     725   -1723    -724
 boundary    725
' end unit 720
'
'     Target site G-5  (shrouded Al dummy)
unit 730
 cylinder    730  0.24765    25.4       -25.4
 cylinder    731  0.31623    25.4       -25.4
 cylinder    732  0.47625    49.2125    -39.6875
```

```
 cylinder    733  0.755015   40.3225    -25.40100
 cylinder   1733  0.755015   49.2125    -39.6875
 cylinder    734  0.83058    40.3225    -25.40100
 cylinder    735  0.83500    49.2125    -39.6875
 media       512     1     730
 media       511     1     731    -730
 media        25     1     732    -731
 media        25     1     734    -733
 media         2     1    1733    -732
 media         2     1     735   -1733    -734
 boundary    735
' end unit 730
'
'     Target site G-6  (solid Al dummy)
unit 740
 cylinder    740  0.24765    25.4       -25.4
 cylinder    741  0.31623    25.4       -25.4
 cylinder    742  0.47625    49.2125    -39.6875
 cylinder    743  0.755015   40.3225    -25.40100
 cylinder   1743  0.755015   49.2125    -39.6875
 cylinder    744  0.83058    40.3225    -25.40100
 cylinder    745  0.83500    49.2125    -39.6875
 media       512     1     740
 media       511     1     741    -740
 media        25     1     742    -741
 media        25     1     744    -743
 media         2     1    1743    -742
 media         2     1     745   -1743    -744
 boundary    745
' end unit 740
'
'
'
'   **** PTP Experimental Loading ***
'
'     Target site PTP-1  (A-4)
'
unit 811
 cylinder    811  0.548640  -18.469660  -25.0
 cylinder    812  0.548640  -11.939320  -25.0
 cylinder    813  0.548640   -5.408980  -25.0
 cylinder    814  0.548640    1.121360  -25.0
 cylinder    815  0.548640    7.651700  -25.0
 cylinder    816  0.548640   14.182040  -25.0
 cylinder    817  0.548640   20.712380  -25.0
'
 cylinder    920  0.548640   27.861895  -25.0
 cylinder    921  0.548640   27.861895  -34.60623
 cylinder    922  0.7874     27.861895  -34.60623
 cylinder    923  0.8890     27.861895  -31.74873
 cylinder    924  0.8890     27.861895  -34.60623
'
 media       711     1     811
 media       712     1     812    -811
 media       713     1     813    -812
 media       714     1     814    -813
 media       715     1     815    -814
 media       716     1     816    -815
 media       717     1     817    -816
 media        25     1     920    -817
 media        25     1     921    -920
 media         2     1     922    -921
 media        25     1     923    -922
 media         2     1     924    -923    -922
 boundary    924
' end unit 811
'
'     Target site PTP-2  (D-1)
'
unit 821
 cylinder    821  0.548640  -18.469660  -25.0
 cylinder    822  0.548640  -11.939320  -25.0
 cylinder    823  0.548640   -5.408980  -25.0
 cylinder    824  0.548640    1.121360  -25.0
 cylinder    825  0.548640    7.651700  -25.0
 cylinder    826  0.548640   14.182040  -25.0
 cylinder    827  0.548640   20.712380  -25.0
'
 cylinder    940  0.548640   27.861895  -25.0
 cylinder    941  0.548640   27.861895  -34.60623
 cylinder    942  0.7874     27.861895  -34.60623
```

```
 cylinder    943  0.8890     27.861895  -31.74873
 cylinder    944  0.8890     27.861895  -34.60623
'
 media       721     1     821
 media       722     1     822    -821
 media       723     1     823    -822
 media       724     1     824    -823
 media       725     1     825    -824
 media       726     1     826    -825
 media       727     1     827    -826
 media        25     1     940    -827
 media        25     1     941    -940
 media         2     1     942    -941
 media        25     1     943    -942
 media         2     1     944    -943    -942
 boundary    944
' end unit 821
'
'     Target site PTP-3 (A-1)
'
unit 831
 cylinder    831  0.548640  -18.469660  -25.0
 cylinder    832  0.548640  -11.939320  -25.0
 cylinder    833  0.548640   -5.408980  -25.0
 cylinder    834  0.548640    1.121360  -25.0
 cylinder    835  0.548640    7.651700  -25.0
 cylinder    836  0.548640   14.182040  -25.0
 cylinder    837  0.548640   20.712380  -25.0
'
 cylinder    930  0.548640   27.861895  -25.0
 cylinder    931  0.548640   27.861895  -34.60623
 cylinder    932  0.7874     27.861895  -34.60623
 cylinder    933  0.8890     27.861895  -31.74873
 cylinder    934  0.8890     27.861895  -34.60623
'
 media       731     1     831
 media       732     1     832    -831
 media       733     1     833    -832
 media       734     1     834    -833
 media       735     1     835    -834
 media       736     1     836    -835
 media       737     1     837    -836
 media        25     1     930    -837
 media        25     1     931    -930
 media         2     1     932    -931
 media        25     1     933    -932
 media         2     1     934    -933    -932
 boundary    934
' end unit 831
'
'     Target site PTP-4 (D-7)
'
unit 841
 cylinder    841  0.548640  -18.469660  -25.0
 cylinder    842  0.548640  -11.939320  -25.0
 cylinder    843  0.548640   -5.408980  -25.0
 cylinder    844  0.548640    1.121360  -25.0
 cylinder    845  0.548640    7.651700  -25.0
 cylinder    846  0.548640   14.182040  -25.0
 cylinder    847  0.548640   20.712380  -25.0
'
 cylinder    910  0.548640   27.861895  -25.0
 cylinder    911  0.548640   27.861895  -34.60623
 cylinder    912  0.7874     27.861895  -34.60623
 cylinder    913  0.8890     27.861895  -31.74873
 cylinder    914  0.8890     27.861895  -34.60623
'
 media       741     1     841
 media       742     1     842    -841
 media       743     1     843    -842
 media       744     1     844    -843
 media       745     1     845    -844
 media       746     1     846    -845
 media       747     1     847    -846
 media        25     1     910    -847
 media        25     1     911    -910
 media         2     1     912    -911
 media        25     1     913    -912
 media         2     1     914    -913    -912
 boundary    914
' end unit 841
```

```
'
'     Target site PTP-5 (G-7)
'
unit 851
 cylinder    851  0.548640  -18.469660  -25.0
 cylinder    852  0.548640  -11.939320  -25.0
 cylinder    853  0.548640   -5.408980  -25.0
 cylinder    854  0.548640    1.121360  -25.0
 cylinder    855  0.548640    7.651700  -25.0
 cylinder    856  0.548640   14.182040  -25.0
 cylinder    857  0.548640   20.712380  -25.0
'
 cylinder    900  0.548640   27.861895  -25.0
 cylinder    901  0.548640   27.861895  -34.60623
 cylinder    902  0.7874     27.861895  -34.60623
 cylinder    903  0.8890     27.861895  -31.74873
 cylinder    904  0.8890     27.861895  -34.60623
'
 media       751     1     851
 media       752     1     852    -851
 media       753     1     853    -852
 media       754     1     854    -853
 media       755     1     855    -854
 media       756     1     856    -855
 media       757     1     857    -856
 media        25     1     900    -857
 media        25     1     901    -900
 media         2     1     902    -901
 media        25     1     903    -902
 media         2     1     904    -903    -902
 boundary    904
' end unit 851
'
'     Target site PTP-6 (G-4   Al dummy )
'
unit 861
 cylinder    861  0.548640  -18.469660  -25.0
 cylinder    862  0.548640  -11.939320  -25.0
 cylinder    863  0.548640   -5.408980  -25.0
 cylinder    864  0.548640    1.121360  -25.0
 cylinder    865  0.548640    7.651700  -25.0
 cylinder    866  0.548640   14.182040  -25.0
 cylinder    867  0.548640   20.712380  -25.0
'
 cylinder    950  0.548640   27.861895  -25.0
 cylinder    951  0.548640   27.861895  -34.60623
 cylinder    952  0.7874     27.861895  -34.60623
 cylinder    953  0.8890     27.861895  -31.74873
 cylinder    954  0.8890     27.861895  -34.60623
'
 media       761     1     861
 media       762     1     862    -861
 media       763     1     863    -862
 media       764     1     864    -863
 media       765     1     865    -864
 media       766     1     866    -865
 media       767     1     867    -866
 media        25     1     950    -867
 media        25     1     951    -950
 media         2     1     952    -951
 media        25     1     953    -952
 media         2     1     954    -953    -952
 boundary    954
' end unit 861
'
'      Target basket and water above and below target area
'
unit 800
 cylinder    800  5.71500    49.2125    -39.6875
 hole        410  origin x=-4.388400  y=-0.844550
 hole        420  origin x=-4.388400  y=0.844550
 hole        430  origin x=-2.925600  y=-3.378200
 hole        440  origin x=-2.925600  y=-1.689100
 hole        750  origin x=-2.925600  y=0.000000
 hole        460  origin x=-2.925600  y=1.689100
 hole        470  origin x=-2.925600  y=3.378200
 hole        480  origin x=-1.462800  y=-4.222750
 hole        490  origin x=-1.462800  y=-2.533650
 hole        510  origin x=-1.462800  y=-0.844550
 hole        520  origin x=-1.462800  y=0.844550
 hole        530  origin x=-1.462800  y=2.533650
```

```
hole        540  origin x=-1.462800  y=4.222750
hole        550  origin x=0.000000   y=-3.378200
hole        560  origin x=0.000000   y=-1.689100
hole        570  origin x=0.000000   y=0.000000
hole        580  origin x=0.000000   y=1.689100
hole        590  origin x=0.000000   y=3.378200
hole        610  origin x=1.462800   y=-4.222750
hole        620  origin x=1.462800   y=-2.533650
hole        630  origin x=1.462800   y=-0.844550
hole        640  origin x=1.462800   y=0.844550
hole        650  origin x=1.462800   y=2.533650
hole        660  origin x=1.462800   y=4.222750
hole        670  origin x=2.925600   y=-3.378200
hole        680  origin x=2.925600   y=-1.689100
hole        690  origin x=2.925600   y=0.000000
hole        710  origin x=2.925600   y=1.689100
hole        720  origin x=2.925600   y=3.378200
hole        730  origin x=4.388400   y=-0.844550
hole        740  origin x=4.388400   y=0.844550
'
cylinder    926  0.92964    49.2125    -39.6875      origin x=-4.661173  y=2.691130
cylinder    927  1.00076    49.2125    -39.6875      origin x=-4.661173  y=2.691130
cylinder    946  0.92964    49.2125    -39.6875      origin x=0.000000   y=-5.382260
cylinder    947  1.00076    49.2125    -39.6875      origin x=0.000000   y=-5.382260
cylinder    936  0.92964    49.2125    -39.6875      origin x=-4.661173  y=-2.691130
cylinder    937  1.00076    49.2125    -39.6875      origin x=-4.661173  y=-2.691130
cylinder    916  0.92964    49.2125    -39.6875      origin x=0.000000   y=5.382260
cylinder    917  1.00076    49.2125    -39.6875      origin x=0.000000   y=5.382260
cylinder    906  0.92964    49.2125    -39.6875      origin x=4.661173   y=2.691130
cylinder    907  1.00076    49.2125    -39.6875      origin x=4.661173   y=2.691130
cylinder    956  0.92964    49.2125    -39.6875      origin x=4.661173   y=-2.691130
cylinder    957  1.00076    49.2125    -39.6875      origin x=4.661173   y=-2.691130
'
cylinder    804  5.87375    49.2125    -39.6875
'
hole        811  origin x=-4.661173  y=2.691130
hole        821  origin x=0.000000   y=-5.382260
hole        831  origin x=-4.661173  y=-2.691130
hole        841  origin x=0.000000   y=5.382260
hole        851  origin x=4.661173   y=2.691130
hole        861  origin x=4.661173   y=-2.691130
'
cylinder    805  6.4350     49.2125    -39.6875
cylinder   1001  6.4350    149.99      -39.6875
cylinder   1002  6.4350    149.99     -149.9899
cylinder   2000  6.8830    149.99     -149.9899
'
media         2     1     800    -907    -917    -927    -937    -947    -957
media        25     1     804    -800    -907    -917    -927    -937    -947    -957
media        25     1     804     907    -906
media        25     1     804     917    -916
media        25     1     804     927    -926
media        25     1     804     937    -936
media        25     1     804     947    -946
media        25     1     804     957    -956
'
media         2     1     804     906
media         2     1     804     916
media         2     1     804     926
media         2     1     804     936
media         2     1     804     946
media         2     1     804     956
media         2     1     805    -804
media         3     1    1001    -805
media         1     1    1002   -1001
media        20     1    2000   -1002
boundary   2000
' end unit 800
'
'
'       ----------------------------------------
'                       Region II
'
'                INNER FUEL ELEMENT REGION
'       ----------------------------------------
'
'  The inner fuel element (IFE) consists of 171 fuel plates arranged in an involutes shape. Each plate contains 15.18g +-1% of U-235
'  The IFE fueled area is modeled by Homogenizing the Uranium, Aluminum and water, in 8 radial fueled regions that reflect the
```

```
'  different  U-235 concentrations in each fuel plate. The IFE is divided into 56 cells, 8 radial fueled regions and 7 axial
fueled layers
'
'     ------------------
'      IFE Cell Cards
'     ------------------
'
unit 2000
 cylinder   2000  6.88302   149.9901   -149.9901
 hole        800
 media        20     1    2000
'
'    inner unfuelled region
 cylinder   2100  7.14       25.4       -25.4
 media       200     1    2100   -2000
'
'     Top -  Axial Layer 1  (25.4  - 25.0 cm)
 cylinder   2101  7.5        25.4        25.0
 cylinder   2102  8.0        25.4        25.0
 cylinder   2103  8.5        25.4        25.0
 cylinder   2104  9.5        25.4        25.0
 cylinder   2105 10.5        25.4        25.0
 cylinder   2106 11.5        25.4        25.0
 cylinder   2107 12.0        25.4        25.0
 cylinder   2108 12.60       25.4        25.0
 media       211     1    2101   -2100
 media       212     1    2102   -2101
 media       213     1    2103   -2102
 media       214     1    2104   -2103
 media       215     1    2105   -2104
 media       216     1    2106   -2105
 media       217     1    2107   -2106
 media       218     1    2108   -2107
'
'     Top -  Axial Layer 2  (25.0  - 22.0 cm)
 cylinder   2111  7.5        25.4        22.0
 cylinder   2112  8.0        25.4        22.0
 cylinder   2113  8.5        25.4        22.0
 cylinder   2114  9.5        25.4        22.0
 cylinder   2115 10.5        25.4        22.0
 cylinder   2116 11.5        25.4        22.0
 cylinder   2117 12.0        25.4        22.0
 cylinder   2118 12.60       25.4        22.0
 media       221     1    2111   -2100   -2108
 media       222     1    2112   -2111   -2108
 media       223     1    2113   -2112   -2108
 media       224     1    2114   -2113   -2108
 media       225     1    2115   -2114   -2108
 media       226     1    2116   -2115   -2108
 media       227     1    2117   -2116   -2108
 media       228     1    2118   -2117   -2108
'
'     Top -  Axial Layer 3  (22.0  - 19.0 cm)
 cylinder   2121  7.5        25.4        19.0
 cylinder   2122  8.0        25.4        19.0
 cylinder   2123  8.5        25.4        19.0
 cylinder   2124  9.5        25.4        19.0
 cylinder   2125 10.5        25.4        19.0
 cylinder   2126 11.5        25.4        19.0
 cylinder   2127 12.0        25.4        19.0
 cylinder   2128 12.60       25.4        19.0
 media       231     1    2121   -2100   -2118
 media       232     1    2122   -2121   -2118
 media       233     1    2123   -2122   -2118
 media       234     1    2124   -2123   -2118
 media       235     1    2125   -2124   -2118
 media       236     1    2126   -2125   -2118
 media       237     1    2127   -2126   -2118
 media       238     1    2128   -2127   -2118
'
'     Top -  Axial Layer 4  (19.0 - 16.0 cm)
 cylinder   2131  7.5        25.4        16.0
 cylinder   2132  8.0        25.4        16.0
 cylinder   2133  8.5        25.4        16.0
 cylinder   2134  9.5        25.4        16.0
 cylinder   2135 10.5        25.4        16.0
 cylinder   2136 11.5        25.4        16.0
 cylinder   2137 12.0        25.4        16.0
 cylinder   2138 12.60       25.4        16.0
 media       241     1    2131   -2100   -2128
 media       242     1    2132   -2131   -2128
```

```
media       243     1    2133   -2132   -2128
media       244     1    2134   -2133   -2128
media       245     1    2135   -2134   -2128
media       246     1    2136   -2135   -2128
media       247     1    2137   -2136   -2128
media       248     1    2138   -2137   -2128
'
'     Top -  Axial Layer 5  (16.0  - 13.0 cm)
cylinder   2141  7.5        25.4         13.0
cylinder   2142  8.0        25.4         13.0
cylinder   2143  8.5        25.4         13.0
cylinder   2144  9.5        25.4         13.0
cylinder   2145 10.5        25.4         13.0
cylinder   2146 11.5        25.4         13.0
cylinder   2147 12.0        25.4         13.0
cylinder   2148 12.60       25.4         13.0
media       251     1    2141   -2100   -2138
media       252     1    2142   -2141   -2138
media       253     1    2143   -2142   -2138
media       254     1    2144   -2143   -2138
media       255     1    2145   -2144   -2138
media       256     1    2146   -2145   -2138
media       257     1    2147   -2146   -2138
media       258     1    2148   -2147   -2138
'
'     Top -  Axial Layer 6  (13.0  - 10.0 cm)
cylinder   2151  7.5        25.4         10.0
cylinder   2152  8.0        25.4         10.0
cylinder   2153  8.5        25.4         10.0
cylinder   2154  9.5        25.4         10.0
cylinder   2155 10.5        25.4         10.0
cylinder   2156 11.5        25.4         10.0
cylinder   2157 12.0        25.4         10.0
cylinder   2158 12.60       25.4         10.0
media       261     1    2151   -2100   -2148
media       262     1    2152   -2151   -2148
media       263     1    2153   -2152   -2148
media       264     1    2154   -2153   -2148
media       265     1    2155   -2154   -2148
media       266     1    2156   -2155   -2148
media       267     1    2157   -2156   -2148
media       268     1    2158   -2157   -2148
'
'     Top -  Axial Layer 7  (10.0  -  7.0  cm)
cylinder   2161  7.5        25.4          7.0
cylinder   2162  8.0        25.4          7.0
cylinder   2163  8.5        25.4          7.0
cylinder   2164  9.5        25.4          7.0
cylinder   2165 10.5        25.4          7.0
cylinder   2166 11.5        25.4          7.0
cylinder   2167 12.0        25.4          7.0
cylinder   2168 12.60       25.4          7.0
media       271     1    2161   -2100   -2158
media       272     1    2162   -2161   -2158
media       273     1    2163   -2162   -2158
media       274     1    2164   -2163   -2158
media       275     1    2165   -2164   -2158
media       276     1    2166   -2165   -2158
media       277     1    2167   -2166   -2158
media       278     1    2168   -2167   -2158
'
'     Top -  Axial Layer 8  (7.0  - 4.0 cm)
cylinder   2171  7.5        25.4          4.0
cylinder   2172  8.0        25.4          4.0
cylinder   2173  8.5        25.4          4.0
cylinder   2174  9.5        25.4          4.0
cylinder   2175 10.5        25.4          4.0
cylinder   2176 11.5        25.4          4.0
cylinder   2177 12.0        25.4          4.0
cylinder   2178 12.60       25.4          4.0
media       281     1    2171   -2100   -2168
media       282     1    2172   -2171   -2168
media       283     1    2173   -2172   -2168
media       284     1    2174   -2173   -2168
media       285     1    2175   -2174   -2168
media       286     1    2176   -2175   -2168
media       287     1    2177   -2176   -2168
media       288     1    2178   -2177   -2168
'
'     Top -  Axial Layer 9  (4.0  -  1.0  cm)
cylinder   2181  7.5        25.4          1.0
```

```
cylinder   2182  8.0        25.4         1.0
cylinder   2183  8.5        25.4         1.0
cylinder   2184  9.5        25.4         1.0
cylinder   2185 10.5        25.4         1.0
cylinder   2186 11.5        25.4         1.0
cylinder   2187 12.0        25.4         1.0
cylinder   2188 12.60       25.4         1.0
media       291     1    2181   -2100   -2178
media       292     1    2182   -2181   -2178
media       293     1    2183   -2182   -2178
media       294     1    2184   -2183   -2178
media       295     1    2185   -2184   -2178
media       296     1    2186   -2185   -2178
media       297     1    2187   -2186   -2178
media       298     1    2188   -2187   -2178
'
'     Top -  Axial Layer 10  (+1.0  -  -1.0 cm)
cylinder   2191  7.5        25.4        -1.0
cylinder   2192  8.0        25.4        -1.0
cylinder   2193  8.5        25.4        -1.0
cylinder   2194  9.5        25.4        -1.0
cylinder   2195 10.5        25.4        -1.0
cylinder   2196 11.5        25.4        -1.0
cylinder   2197 12.0        25.4        -1.0
cylinder   2198 12.60       25.4        -1.0
media       201     1    2191   -2100   -2188
media       202     1    2192   -2191   -2188
media       203     1    2193   -2192   -2188
media       204     1    2194   -2193   -2188
media       205     1    2195   -2194   -2188
media       206     1    2196   -2195   -2188
media       207     1    2197   -2196   -2188
media       208     1    2198   -2197   -2188
'
'     Top -  Axial Layer 11  (-1.0  -  -4.0 cm)
cylinder   2201  7.5        25.4        -4.0
cylinder   2202  8.0        25.4        -4.0
cylinder   2203  8.5        25.4        -4.0
cylinder   2204  9.5        25.4        -4.0
cylinder   2205 10.5        25.4        -4.0
cylinder   2206 11.5        25.4        -4.0
cylinder   2207 12.0        25.4        -4.0
cylinder   2208 12.60       25.4        -4.0
media       291     1    2201   -2100   -2198
media       292     1    2202   -2201   -2198
media       293     1    2203   -2202   -2198
media       294     1    2204   -2203   -2198
media       295     1    2205   -2204   -2198
media       296     1    2206   -2205   -2198
media       297     1    2207   -2206   -2198
media       298     1    2208   -2207   -2198
'
'     Top -  Axial Layer 12  (-4.0   -  7.0 cm)
cylinder   2211  7.5        25.4        -7.0
cylinder   2212  8.0        25.4        -7.0
cylinder   2213  8.5        25.4        -7.0
cylinder   2214  9.5        25.4        -7.0
cylinder   2215 10.5        25.4        -7.0
cylinder   2216 11.5        25.4        -7.0
cylinder   2217 12.0        25.4        -7.0
cylinder   2218 12.60       25.4        -7.0
media       281     1    2211   -2100   -2208
media       282     1    2212   -2211   -2208
media       283     1    2213   -2212   -2208
media       284     1    2214   -2213   -2208
media       285     1    2215   -2214   -2208
media       286     1    2216   -2215   -2208
media       287     1    2217   -2216   -2208
media       288     1    2218   -2217   -2208
'
'     Top -  Axial Layer 13  (-7.0   -   -10.0 cm)
cylinder   2221  7.5        25.4       -10.0
cylinder   2222  8.0        25.4       -10.0
cylinder   2223  8.5        25.4       -10.0
cylinder   2224  9.5        25.4       -10.0
cylinder   2225 10.5        25.4       -10.0
cylinder   2226 11.5        25.4       -10.0
cylinder   2227 12.0        25.4       -10.0
cylinder   2228 12.60       25.4       -10.0
media       271     1    2221   -2100   -2218
media       272     1    2222   -2221   -2218
```

```
media       273     1    2223   -2222   -2218
media       274     1    2224   -2223   -2218
media       275     1    2225   -2224   -2218
media       276     1    2226   -2225   -2218
media       277     1    2227   -2226   -2218
media       278     1    2228   -2227   -2218
'
'     Top -  Axial Layer 14  (-10.0  -   -13.0 cm)
cylinder   2231  7.5        25.4       -13.0
cylinder   2232  8.0        25.4       -13.0
cylinder   2233  8.5        25.4       -13.0
cylinder   2234  9.5        25.4       -13.0
cylinder   2235 10.5        25.4       -13.0
cylinder   2236 11.5        25.4       -13.0
cylinder   2237 12.0        25.4       -13.0
cylinder   2238 12.60       25.4       -13.0
media       261     1    2231   -2100   -2228
media       262     1    2232   -2231   -2228
media       263     1    2233   -2232   -2228
media       264     1    2234   -2233   -2228
media       265     1    2235   -2234   -2228
media       266     1    2236   -2235   -2228
media       267     1    2237   -2236   -2228
media       268     1    2238   -2237   -2228
'
'     Top -  Axial Layer 15  (-13.0  -  -16.0 cm)
cylinder   2241  7.5        25.4       -16.0
cylinder   2242  8.0        25.4       -16.0
cylinder   2243  8.5        25.4       -16.0
cylinder   2244  9.5        25.4       -16.0
cylinder   2245 10.5        25.4       -16.0
cylinder   2246 11.5        25.4       -16.0
cylinder   2247 12.0        25.4       -16.0
cylinder   2248 12.60       25.4       -16.0
media       251     1    2241   -2100   -2238
media       252     1    2242   -2241   -2238
media       253     1    2243   -2242   -2238
media       254     1    2244   -2243   -2238
media       255     1    2245   -2244   -2238
media       256     1    2246   -2245   -2238
media       257     1    2247   -2246   -2238
media       258     1    2248   -2247   -2238
'
'     Top -  Axial Layer 16  (-16.0  - -19.0 cm)
cylinder   2251  7.5        25.4       -19.0
cylinder   2252  8.0        25.4       -19.0
cylinder   2253  8.5        25.4       -19.0
cylinder   2254  9.5        25.4       -19.0
cylinder   2255 10.5        25.4       -19.0
cylinder   2256 11.5        25.4       -19.0
cylinder   2257 12.0        25.4       -19.0
cylinder   2258 12.60       25.4       -19.0
media       241     1    2251   -2100   -2248
media       242     1    2252   -2251   -2248
media       243     1    2253   -2252   -2248
media       244     1    2254   -2253   -2248
media       245     1    2255   -2254   -2248
media       246     1    2256   -2255   -2248
media       247     1    2257   -2256   -2248
media       248     1    2258   -2257   -2248
'
'     Top -  Axial Layer 17  (-19.0  - 22.0 cm)
cylinder   2261  7.5        25.4       -22.0
cylinder   2262  8.0        25.4       -22.0
cylinder   2263  8.5        25.4       -22.0
cylinder   2264  9.5        25.4       -22.0
cylinder   2265 10.5        25.4       -22.0
cylinder   2266 11.5        25.4       -22.0
cylinder   2267 12.0        25.4       -22.0
cylinder   2268 12.60       25.4       -22.0
media       231     1    2261   -2100   -2258
media       232     1    2262   -2261   -2258
media       233     1    2263   -2262   -2258
media       234     1    2264   -2263   -2258
media       235     1    2265   -2264   -2258
media       236     1    2266   -2265   -2258
media       237     1    2267   -2266   -2258
media       238     1    2268   -2267   -2258
'
'     Top -  Axial Layer 18  (-22.0  - 25.0 cm)
cylinder   2271  7.5        25.4       -25.0
```

```
 cylinder   2272  8.0        25.4       -25.0
 cylinder   2273  8.5        25.4       -25.0
 cylinder   2274  9.5        25.4       -25.0
 cylinder   2275 10.5        25.4       -25.0
 cylinder   2276 11.5        25.4       -25.0
 cylinder   2277 12.0        25.4       -25.0
 cylinder   2278 12.60       25.4       -25.0
 media       221     1    2271   -2100   -2268
 media       222     1    2272   -2271   -2268
 media       223     1    2273   -2272   -2268
 media       224     1    2274   -2273   -2268
 media       225     1    2275   -2274   -2268
 media       226     1    2276   -2275   -2268
 media       227     1    2277   -2276   -2268
 media       228     1    2278   -2277   -2268
'
'     Top -  Axial Layer 19  (-25.0  -  -25.4 cm)
 cylinder   2281  7.5        25.4       -25.4
 cylinder   2282  8.0        25.4       -25.4
 cylinder   2283  8.5        25.4       -25.4
 cylinder   2284  9.5        25.4       -25.4
 cylinder   2285 10.5        25.4       -25.4
 cylinder   2286 11.5        25.4       -25.4
 cylinder   2287 12.0        25.4       -25.4
 cylinder   2288 12.60       25.4       -25.4
 media       211     1    2281   -2100   -2278
 media       212     1    2282   -2281   -2278
 media       213     1    2283   -2282   -2278
 media       214     1    2284   -2283   -2278
 media       215     1    2285   -2284   -2278
 media       216     1    2286   -2285   -2278
 media       217     1    2287   -2286   -2278
 media       218     1    2288   -2287   -2278
'
'     inner unfuelled region
 cylinder   2199 12.82700    25.4       -25.4
 media       200     1    2199   -2288
'     IFE unfuelled - upper region
 cylinder   2600 12.82700    30.48      -25.4
 media        70     1    2600   -2199   -2000
'     water above IFE upper region
 cylinder   2601 12.82700   149.9902    -25.4
 media         3     1    2601   -2600   -2000
'     IFE unfuelled - lower region
 cylinder   2602 12.82700   149.9902    -30.48
 media        71     1    2602   -2601   -2000
'     water below IFE upper region
 cylinder   2603 12.82700   149.9902   -149.9902
 media         1     1    2603   -2602   -2000
'     IFE outer sidewall
 cylinder   2200 13.44930    25.4       -25.4
 media        20     1    2200   -2603
'     water between fuel elements--active fuel region
 cylinder   2624 14.28740    25.4       -25.4
 media         2     1    2624   -2200
'     IFE outer sidewall lower extension
 cylinder   2620 14.28740    25.4       -37.1475
 media        20     1    2620   -2603   -2624
'     water below IFE outer sidewall lower extension
 cylinder   2622 14.28740    25.4      -149.9902
 media         1     1    2622   -2603   -2620
'     IFE outer sidewall upper extension
 cylinder   2630 14.28740    41.91     -149.9902
 media        20     1    2630   -2603   -2622
'     water above IFE outer sidewall outer extension
 cylinder   2632 14.28740   149.9902   -149.9902
 media         3     1    2632   -2603   -2630
 boundary   2632
' end unit 2000
'
'
'
'
'           ----------------------------------------
'                           Region III
'
'                   OUTER FUEL ELEMENT (OFE)
'           ----------------------------------------
'
'  The outer fuel element is region-3
```

```
'  The outer fuel element (OFE) consists of 369 fuel plates arranged in an involutes shape. Each plate contains 18.44g +-1%
of U-235
'  The IFE fueled area is modeled by by Homogenizing the Uranium, Aluminum and water, in 9 radial fueled regions that
reflect the
'  different  U-235 concentrations in each fuel plate. The OFE is divided into 63 cells, 9 radial fueled regions and 7 axial
fueled layers
'
'
'    --------------------
'      OEF Cell Cards
'    --------------------
'
'
unit 2300
 cylinder   2632 14.28750   149.9902   -149.9902
 hole       2000
 media         1     1    2632
'
'    OFE inner sidewall
 cylinder   2300 14.91869    25.4       -25.4
 media        20     1    2300   -2632
'
'    OFE inner sidewall lower extension
 cylinder   2621 14.91869    25.4       -37.1475
 media        20     1    2621   -2300   -2632
'
'    water below OFE inner sidewall lower extension
 cylinder   2623 14.91869    25.4      -149.9902
 media         1     1    2623   -2621   -2632
'
'    OFE inner sidewall upper extension
 cylinder   2631 14.91869    41.91     -149.9902
 media        20     1    2631   -2623   -2632
'
'    water below OFE inner sidewall lower extension
 cylinder   2633 14.91869   149.9902   -149.9902
 media         3     1    2633   -2631   -2632
'
'    outer unfueled region
 cylinder   2400 15.12951    25.4       -25.4
 media       200     1    2400   -2300
'
'     Top - Axial  Layer 1    (25.4  - 25.0 cm)
 cylinder   2401 15.5         25.4         25.0
 cylinder   2402 16.0         25.4         25.0
 cylinder   2403 16.5         25.4         25.0
 cylinder   2404 17.5         25.4         25.0
 cylinder   2405 18.5         25.4         25.0
 cylinder   2406 19.5         25.4         25.0
 cylinder   2407 20.0         25.4         25.0
 cylinder   2408 20.5         25.4         25.0
 cylinder   2409 20.978       25.4         25.0
 media       311     1    2401   -2400
 media       312     1    2402   -2401
 media       313     1    2403   -2402
 media       314     1    2404   -2403
 media       315     1    2405   -2404
 media       316     1    2406   -2405
 media       317     1    2407   -2406
 media       318     1    2408   -2407
 media       319     1    2409   -2408
'
'     Top - Axial  Layer 2    (25.0  - 22.0 cm)
 cylinder   2411 15.5         25.4         22.0
 cylinder   2412 16.0         25.4         22.0
 cylinder   2413 16.5         25.4         22.0
 cylinder   2414 17.5         25.4         22.0
 cylinder   2415 18.5         25.4         22.0
 cylinder   2416 19.5         25.4         22.0
 cylinder   2417 20.0         25.4         22.0
 cylinder   2418 20.5         25.4         22.0
 cylinder   2419 20.978       25.4         22.0
 media       321     1    2411   -2400   -2409
 media       322     1    2412   -2411   -2409
 media       323     1    2413   -2412   -2409
 media       324     1    2414   -2413   -2409
 media       325     1    2415   -2414   -2409
 media       326     1    2416   -2415   -2409
 media       327     1    2417   -2416   -2409
 media       328     1    2418   -2417   -2409
 media       329     1    2419   -2418   -2409
```

```
'
'     Top - Axial  Layer 3    (22.0  - 19.0 cm)
 cylinder   2421 15.5         25.4        19.0
 cylinder   2422 16.0         25.4        19.0
 cylinder   2423 16.5         25.4        19.0
 cylinder   2424 17.5         25.4        19.0
 cylinder   2425 18.5         25.4        19.0
 cylinder   2426 19.5         25.4        19.0
 cylinder   2427 20.0         25.4        19.0
 cylinder   2428 20.5         25.4        19.0
 cylinder   2429 20.978       25.4        19.0
 media       331     1    2421   -2400   -2419
 media       332     1    2422   -2421   -2419
 media       333     1    2423   -2422   -2419
 media       334     1    2424   -2423   -2419
 media       335     1    2425   -2424   -2419
 media       336     1    2426   -2425   -2419
 media       337     1    2427   -2426   -2419
 media       338     1    2428   -2427   -2419
 media       339     1    2429   -2428   -2419
'
'     Top - Axial  Layer 4    (19.0  - 16.0 cm)
 cylinder   2431 15.5         25.4        16.0
 cylinder   2432 16.0         25.4        16.0
 cylinder   2433 16.5         25.4        16.0
 cylinder   2434 17.5         25.4        16.0
 cylinder   2435 18.5         25.4        16.0
 cylinder   2436 19.5         25.4        16.0
 cylinder   2437 20.0         25.4        16.0
 cylinder   2438 20.5         25.4        16.0
 cylinder   2439 20.978       25.4        16.0
 media       341     1    2431   -2400   -2429
 media       342     1    2432   -2431   -2429
 media       343     1    2433   -2432   -2429
 media       344     1    2434   -2433   -2429
 media       345     1    2435   -2434   -2429
 media       346     1    2436   -2435   -2429
 media       347     1    2437   -2436   -2429
 media       348     1    2438   -2437   -2429
 media       349     1    2439   -2438   -2429
'
'     Top - Axial  Layer 5    (16.0  - 13.0 cm)
 cylinder   2441 15.5         25.4        13.0
 cylinder   2442 16.0         25.4        13.0
 cylinder   2443 16.5         25.4        13.0
 cylinder   2444 17.5         25.4        13.0
 cylinder   2445 18.5         25.4        13.0
 cylinder   2446 19.5         25.4        13.0
 cylinder   2447 20.0         25.4        13.0
 cylinder   2448 20.5         25.4        13.0
 cylinder   2449 20.978       25.4        13.0
 media       351     1    2441   -2400   -2439
 media       352     1    2442   -2441   -2439
 media       353     1    2443   -2442   -2439
 media       354     1    2444   -2443   -2439
 media       355     1    2445   -2444   -2439
 media       356     1    2446   -2445   -2439
 media       357     1    2447   -2446   -2439
 media       358     1    2448   -2447   -2439
 media       359     1    2449   -2448   -2439
'
'     Top - Axial  Layer 6    (13.0  - 10.0 cm)
 cylinder   2451 15.5         25.4        10.0
 cylinder   2452 16.0         25.4        10.0
 cylinder   2453 16.5         25.4        10.0
 cylinder   2454 17.5         25.4        10.0
 cylinder   2455 18.5         25.4        10.0
 cylinder   2456 19.5         25.4        10.0
 cylinder   2457 20.0         25.4        10.0
 cylinder   2458 20.5         25.4        10.0
 cylinder   2459 20.978       25.4        10.0
 media       361     1    2451   -2400   -2449
 media       362     1    2452   -2451   -2449
 media       363     1    2453   -2452   -2449
 media       364     1    2454   -2453   -2449
 media       365     1    2455   -2454   -2449
 media       366     1    2456   -2455   -2449
 media       367     1    2457   -2456   -2449
 media       368     1    2458   -2457   -2449
 media       369     1    2459   -2458   -2449
'
```

```
'     Top - Axial  Layer 7    (10.0  - 7.0 cm)
 cylinder   2461 15.5         25.4         7.0
 cylinder   2462 16.0         25.4         7.0
 cylinder   2463 16.5         25.4         7.0
 cylinder   2464 17.5         25.4         7.0
 cylinder   2465 18.5         25.4         7.0
 cylinder   2466 19.5         25.4         7.0
 cylinder   2467 20.0         25.4         7.0
 cylinder   2468 20.5         25.4         7.0
 cylinder   2469 20.978       25.4         7.0
 media       371     1    2461   -2400   -2459
 media       372     1    2462   -2461   -2459
 media       373     1    2463   -2462   -2459
 media       374     1    2464   -2463   -2459
 media       375     1    2465   -2464   -2459
 media       376     1    2466   -2465   -2459
 media       377     1    2467   -2466   -2459
 media       378     1    2468   -2467   -2459
 media       379     1    2469   -2468   -2459
'
'     Top - Axial  Layer 8    (7.0  - 4.0 cm)
 cylinder   2471 15.5         25.4         4.0
 cylinder   2472 16.0         25.4         4.0
 cylinder   2473 16.5         25.4         4.0
 cylinder   2474 17.5         25.4         4.0
 cylinder   2475 18.5         25.4         4.0
 cylinder   2476 19.5         25.4         4.0
 cylinder   2477 20.0         25.4         4.0
 cylinder   2478 20.5         25.4         4.0
 cylinder   2479 20.978       25.4         4.0
 media       381     1    2471   -2400   -2469
 media       382     1    2472   -2471   -2469
 media       383     1    2473   -2472   -2469
 media       384     1    2474   -2473   -2469
 media       385     1    2475   -2474   -2469
 media       386     1    2476   -2475   -2469
 media       387     1    2477   -2476   -2469
 media       388     1    2478   -2477   -2469
 media       389     1    2479   -2478   -2469
'
'     Top - Axial  Layer 9    (4.0  - 1.0 cm)
 cylinder   2481 15.5         25.4         1.0
 cylinder   2482 16.0         25.4         1.0
 cylinder   2483 16.5         25.4         1.0
 cylinder   2484 17.5         25.4         1.0
 cylinder   2485 18.5         25.4         1.0
 cylinder   2486 19.5         25.4         1.0
 cylinder   2487 20.0         25.4         1.0
 cylinder   2488 20.5         25.4         1.0
 cylinder   2489 20.978       25.4         1.0
 media       391     1    2481   -2400   -2479
 media       392     1    2482   -2481   -2479
 media       393     1    2483   -2482   -2479
 media       394     1    2484   -2483   -2479
 media       395     1    2485   -2484   -2479
 media       396     1    2486   -2485   -2479
 media       397     1    2487   -2486   -2479
 media       398     1    2488   -2487   -2479
 media       399     1    2489   -2488   -2479
'
'     Top - Axial  Layer 10    (1.0  - 1.0 cm)
 cylinder   2491 15.5         25.4        -1.0
 cylinder   2492 16.0         25.4        -1.0
 cylinder   2493 16.5         25.4        -1.0
 cylinder   2494 17.5         25.4        -1.0
 cylinder   2495 18.5         25.4        -1.0
 cylinder   2496 19.5         25.4        -1.0
 cylinder   2497 20.0         25.4        -1.0
 cylinder   2498 20.5         25.4        -1.0
 cylinder   2499 20.978       25.4        -1.0
 media       301     1    2491   -2400   -2489
 media       302     1    2492   -2491   -2489
 media       303     1    2493   -2492   -2489
 media       304     1    2494   -2493   -2489
 media       305     1    2495   -2494   -2489
 media       306     1    2496   -2495   -2489
 media       307     1    2497   -2496   -2489
 media       308     1    2498   -2497   -2489
 media       309     1    2499   -2498   -2489
'
'     Top - Axial  Layer 11    (-1.0  -  -4.0 cm)
```

```
cylinder   2501 15.5         25.4        -4.0
cylinder   2502 16.0         25.4        -4.0
cylinder   2503 16.5         25.4        -4.0
cylinder   2504 17.5         25.4        -4.0
cylinder   2505 18.5         25.4        -4.0
cylinder   2506 19.5         25.4        -4.0
cylinder   2507 20.0         25.4        -4.0
cylinder   2508 20.5         25.4        -4.0
cylinder   2509 20.978       25.4        -4.0
media       391     1    2501   -2400   -2499
media       392     1    2502   -2501   -2499
media       393     1    2503   -2502   -2499
media       394     1    2504   -2503   -2499
media       395     1    2505   -2504   -2499
media       396     1    2506   -2505   -2499
media       397     1    2507   -2506   -2499
media       398     1    2508   -2507   -2499
media       399     1    2509   -2508   -2499
'
'     Top - Axial  Layer 12    (-4.0  - -7.0 cm)
cylinder   2511 15.5         25.4        -7.0
cylinder   2512 16.0         25.4        -7.0
cylinder   2513 16.5         25.4        -7.0
cylinder   2514 17.5         25.4        -7.0
cylinder   2515 18.5         25.4        -7.0
cylinder   2516 19.5         25.4        -7.0
cylinder   2517 20.0         25.4        -7.0
cylinder   2518 20.5         25.4        -7.0
cylinder   2519 20.978       25.4        -7.0
media       381     1    2511   -2400   -2509
media       382     1    2512   -2511   -2509
media       383     1    2513   -2512   -2509
media       384     1    2514   -2513   -2509
media       385     1    2515   -2514   -2509
media       386     1    2516   -2515   -2509
media       387     1    2517   -2516   -2509
media       388     1    2518   -2517   -2509
media       389     1    2519   -2518   -2509
'
'     Top - Axial  Layer 13    (-7.0  -  -10.0 cm)
cylinder   2521 15.5         25.4       -10.0
cylinder   2522 16.0         25.4       -10.0
cylinder   2523 16.5         25.4       -10.0
cylinder   2524 17.5         25.4       -10.0
cylinder   2525 18.5         25.4       -10.0
cylinder   2526 19.5         25.4       -10.0
cylinder   2527 20.0         25.4       -10.0
cylinder   2528 20.5         25.4       -10.0
cylinder   2529 20.978       25.4       -10.0
media       371     1    2521   -2400   -2519
media       372     1    2522   -2521   -2519
media       373     1    2523   -2522   -2519
media       374     1    2524   -2523   -2519
media       375     1    2525   -2524   -2519
media       376     1    2526   -2525   -2519
media       377     1    2527   -2526   -2519
media       378     1    2528   -2527   -2519
media       379     1    2529   -2528   -2519
'
'     Top - Axial  Layer 14    (-10.0  -  -13.0 cm)
cylinder   2531 15.5         25.4       -13.0
cylinder   2532 16.0         25.4       -13.0
cylinder   2533 16.5         25.4       -13.0
cylinder   2534 17.5         25.4       -13.0
cylinder   2535 18.5         25.4       -13.0
cylinder   2536 19.5         25.4       -13.0
cylinder   2537 20.0         25.4       -13.0
cylinder   2538 20.5         25.4       -13.0
cylinder   2539 20.978       25.4       -13.0
media       361     1    2531   -2400   -2529
media       362     1    2532   -2531   -2529
media       363     1    2533   -2532   -2529
media       364     1    2534   -2533   -2529
media       365     1    2535   -2534   -2529
media       366     1    2536   -2535   -2529
media       367     1    2537   -2536   -2529
media       368     1    2538   -2537   -2529
media       369     1    2539   -2538   -2529
'
'     Top - Axial  Layer 15    (-13.0  -  -16.0 cm)
cylinder   2541 15.5         25.4       -16.0
```

```
cylinder   2542 16.0         25.4       -16.0
cylinder   2543 16.5         25.4       -16.0
cylinder   2544 17.5         25.4       -16.0
cylinder   2545 18.5         25.4       -16.0
cylinder   2546 19.5         25.4       -16.0
cylinder   2547 20.0         25.4       -16.0
cylinder   2548 20.5         25.4       -16.0
cylinder   2549 20.978       25.4       -16.0
media       351     1    2541   -2400   -2539
media       352     1    2542   -2541   -2539
media       353     1    2543   -2542   -2539
media       354     1    2544   -2543   -2539
media       355     1    2545   -2544   -2539
media       356     1    2546   -2545   -2539
media       357     1    2547   -2546   -2539
media       358     1    2548   -2547   -2539
media       359     1    2549   -2548   -2539
'
'     Top - Axial  Layer 16    (-16.0  - 19.0 cm)
cylinder   2551 15.5         25.4       -19.0
cylinder   2552 16.0         25.4       -19.0
cylinder   2553 16.5         25.4       -19.0
cylinder   2554 17.5         25.4       -19.0
cylinder   2555 18.5         25.4       -19.0
cylinder   2556 19.5         25.4       -19.0
cylinder   2557 20.0         25.4       -19.0
cylinder   2558 20.5         25.4       -19.0
cylinder   2559 20.978       25.4       -19.0
media       341     1    2551   -2400   -2549
media       342     1    2552   -2551   -2549
media       343     1    2553   -2552   -2549
media       344     1    2554   -2553   -2549
media       345     1    2555   -2554   -2549
media       346     1    2556   -2555   -2549
media       347     1    2557   -2556   -2549
media       348     1    2558   -2557   -2549
media       349     1    2559   -2558   -2549
'
'     Top - Axial  Layer 17    (-19.0  -  -22.0 cm)
cylinder   2561 15.5         25.4       -22.0
cylinder   2562 16.0         25.4       -22.0
cylinder   2563 16.5         25.4       -22.0
cylinder   2564 17.5         25.4       -22.0
cylinder   2565 18.5         25.4       -22.0
cylinder   2566 19.5         25.4       -22.0
cylinder   2567 20.0         25.4       -22.0
cylinder   2568 20.5         25.4       -22.0
cylinder   2569 20.978       25.4       -22.0
media       331     1    2561   -2400   -2559
media       332     1    2562   -2561   -2559
media       333     1    2563   -2562   -2559
media       334     1    2564   -2563   -2559
media       335     1    2565   -2564   -2559
media       336     1    2566   -2565   -2559
media       337     1    2567   -2566   -2559
media       338     1    2568   -2567   -2559
media       339     1    2569   -2568   -2559
'
'     Top - Axial  Layer 18    (-22.0  -   -25.0 cm)
cylinder   2571 15.5         25.4       -25.0
cylinder   2572 16.0         25.4       -25.0
cylinder   2573 16.5         25.4       -25.0
cylinder   2574 17.5         25.4       -25.0
cylinder   2575 18.5         25.4       -25.0
cylinder   2576 19.5         25.4       -25.0
cylinder   2577 20.0         25.4       -25.0
cylinder   2578 20.5         25.4       -25.0
cylinder   2579 20.978       25.4       -25.0
media       321     1    2571   -2400   -2569
media       322     1    2572   -2571   -2569
media       323     1    2573   -2572   -2569
media       324     1    2574   -2573   -2569
media       325     1    2575   -2574   -2569
media       326     1    2576   -2575   -2569
media       327     1    2577   -2576   -2569
media       328     1    2578   -2577   -2569
media       329     1    2579   -2578   -2569
'
'     Top - Axial  Layer 19    (-25.0  -   -25.4 cm)
cylinder   2581 15.5         25.4       -25.4
cylinder   2582 16.0         25.4       -25.4
```

```
 cylinder   2583 16.5         25.4       -25.4
 cylinder   2584 17.5         25.4       -25.4
 cylinder   2585 18.5         25.4       -25.4
 cylinder   2586 19.5         25.4       -25.4
 cylinder   2587 20.0         25.4       -25.4
 cylinder   2588 20.5         25.4       -25.4
 cylinder   2589 20.978       25.4       -25.4
 media       311     1    2581   -2400   -2579
 media       312     1    2582   -2581   -2579
 media       313     1    2583   -2582   -2579
 media       314     1    2584   -2583   -2579
 media       315     1    2585   -2584   -2579
 media       316     1    2586   -2585   -2579
 media       317     1    2587   -2586   -2579
 media       318     1    2588   -2587   -2579
 media       319     1    2589   -2588   -2579
'
'     outer unfuelled region
 cylinder   2619 21.13026    25.4       -25.4
 media       200     1    2619   -2589
'     OFE unfuelled - upper region
 cylinder   2610 21.13026    30.48      -25.4
 media        72     1    2610   -2619   -2633
'     water above OFE upper region
 cylinder   2611 21.13026   149.9902    -25.4
 media         3     1    2611   -2610   -2633
'     OFE unfuelled - lower region
 cylinder   2612 21.13026   149.9902    -30.48
 media        73     1    2612   -2611   -2633
'     water below IFE upper region
 cylinder   2613 21.13026   149.9902   -149.9902
 media         1     1    2613   -2612   -2633
'     OFE outer sidewall
 cylinder   2500 21.7474    149.9902   -149.9902
 media        20     1    2500   -2613
 boundary   2500
' end unit 2300
'
'
'
'
'
'       ------------------------------------------
'                         Region IV
'
'                CONTROL ELEMENTS REGION  (CR)
'       ------------------------------------------
'
'
'  The  control element is region-4
'  The control element region (CR) consists of 2 thin-walled (0.25 in) concentric cylindrical control elements.
'  The inner cylinder is used for both shim and regulation. This rod moves upward to insert poison.
'  The outer control cylinder is divided into 4 quadrants, and is used for shim and safety.
'  Each control rod contains three longitudinal (Axial) regions. A black region containing Europium (Eu2O3),
' a gray region containing tantalum, and a white region containing Aluminum, all clad with Aluminum,
' making it an Aluminum plate containing a black and gray cores.
'  Control elements position is set using surface transformation cards (see CR  surfaces)
'
'
'   ----------------------------
'    Control Element Cell Cards
'   ----------------------------
'
'       Inner control element
'       ---------------------
'
unit 3000
'     OFE outer sidewall
 cylinder   2400 21.7475    149.9903   -149.9903
 hole       2300
 media        20     1    2400
'
'    water between OFE outer sidewall and inner CR--active region
 cylinder   3000 22.02434    25.4       -25.4
 media         2     1    3000   -2400
'
'    water between OFE outer sidewall and inner CR--above active region
 cylinder   3001 22.02434   149.9903    -25.4
 media         3     1    3001   -3000   -2400
'
'    water between OFE outer sidewall and inner CR--below active region
```

```
 cylinder   3002 22.02434   149.9903   -149.9903
 media         1     1    3002   -3001   -2400
'
'       Inner control element
 cylinder   3005 22.659340  149.9903   -149.9903
'
'    Inner element--Upper H2O (assume to top of model)
 cylinder   3100 22.659340  449.9903    111.91875    origin x=0. y=0. z=-45.720
 media         3     1    3100    3005   -3002
'
'    Inner element--Lower H2O (assume to bottom of model)
 cylinder   3101 22.659340  -61.75375  -449.9903     origin x=0. y=0. z=-45.720
 media         1     1    3101    3005   -3002
'
'    Inner element--Inner clad
 cylinder   3110 22.103715  111.91875   -61.75375    origin x=0. y=0. z=-45.720
 media        21     1    3110   -3002
'    Inner element--Upper white region
 cylinder   3111 22.579965  111.91875    43.18       origin x=0. y=0. z=-45.720
 media       402     1    3111   -3110
'
 plane       700          ypl=1.0     con=1.27       rotate a1=20.60990454
 plane       701          ypl=1.0     con=-1.27      rotate a1=20.60990454
 plane       702          xpl=1.0     con=1.27       rotate a1=20.60990454
 plane       703          xpl=1.0     con=-1.27      rotate a1=20.60990454
'    Inner element-Al gap region 1
 cylinder   3112 22.579965   43.18      -25.40       origin x=0. y=0. z=-45.720
 media        21     1    3112   -3110     700    -701
'    Inner element-Al gap region 2
 cylinder   3113 22.579965   43.18      -25.40       origin x=0. y=0. z=-45.720
 media        21     1    3113   -3110     702    -703
'
'    Inner element--Gray region--Quad 1
 cylinder   3114 22.579965   43.18       30.48       origin x=0. y=0. z=-45.720
 media       400     1    3114   -3110    -700    -702
'                            --Quad 2
 media       400     1    3114   -3110    -700     703
'                            --Quad 3
 media       400     1    3114   -3110     701     703
'                            --Quad 4
 media       400     1    3114   -3110     701    -702
'
'    Inner element--Black region--Quad 1
 cylinder   3115 22.579965   43.18      -25.40       origin x=0. y=0. z=-45.720
 media       401     1    3115   -3110    -700    -702   -3114
'                             --Quad 2
 media       401     1    3115   -3110    -700     703   -3114
'                             --Quad 3
 media       401     1    3115   -3110     701     703   -3114
'                             --Quad 4
 media       401     1    3115   -3110     701    -702   -3114
'
'    Inner element--Lower white region
 cylinder   3122 22.579965  -25.40      -61.75375    origin x=0. y=0. z=-45.720
 media       403     1    3122   -3110
'    Inner element--Outer clad
 cylinder   3123 22.659340  111.91875   -61.75375    origin x=0. y=0. z=-45.720
 media        21     1    3123   -3111   -3115   -3122
'
'       Water between control elements
'
'    water between inner CR and outer CR--active region
 cylinder   3200 22.9869     25.4       -24.4
 media         2     1    3200   -3005
'    water between inner CR and outer CR--above active region
 cylinder   3201 22.9869    149.9903    -24.4
 media         3     1    3201   -3200   -3005
'    water between inner CR and outer CR--below active region
 cylinder   3202 22.9869    149.9903   -149.9903
 media         1     1    3202   -3201   -3005
 boundary   3202
' end unit 3000
'
'      Outer control element
'      ---------------------
'
unit 3300
'     water between inner CR and outer CR
 cylinder   3202 22.987     149.9904   -149.9904
 hole       3000
 media         2     1    3202
```

```
'
'       Outer control element
 cylinder   3205 23.622     149.9904   -149.9904
'
'    Outer element--Upper H2O (assume to top of model)
 cylinder   3300 23.622     449.9904     47.3075     origin x=0. y=0. z=45.720
 media         3     1    3300    3205   -3202
'
'    Outer element--Lower H2O (assume to bottom of model)
 cylinder   3301 23.622    -120.80875  -449.9904     origin x=0. y=0. z=45.720
 media         1     1    3301    3205   -3202
'
 plane       700          ypl=1.0     con=1.27       rotate a1=20.60990454
 plane       701          ypl=1.0     con=-1.27      rotate a1=20.60990454
 plane       702          xpl=1.0     con=1.27       rotate a1=20.60990454
 plane       703          xpl=1.0     con=-1.27      rotate a1=20.60990454
'
'    Outer element--Total Water gap  1 (50% h2o,50% al)
 cylinder   3302 23.622     47.3075  -120.80875      origin x=0. y=0. z=45.720
 media        70     1    3302   -3202     700    -701
'
'    Outer element--Total Water gap  2 (50% h2o,50% al)
 media        70     1    3302   -3202     702    -703
'
'    Outer element--Inner clad-Quad 1
 cylinder   3304 23.066375  47.3075  -120.80875      origin x=0. y=0. z=45.720
 media        21     1    3304   -3202    -700    -702
'                           -Quad 2
 media        21     1    3304   -3202    -700     703
'                           -Quad 3
 media        21     1    3304   -3202     701     703
'                           -Quad 4
 media        21     1    3304   -3202     701    -702
'
'    Outer element--Upper white region-Quad 1
 cylinder   3308 23.542625  47.3075    25.40         origin x=0. y=0. z=45.720
 media       412     1    3308   -3304    -700    -702
'                                    -Quad 2
 media       412     1    3308   -3304    -700     703
'                                    -Quad 3
 media       412     1    3308   -3304     701     703
'                                    -Quad 4
 media       412     1    3308   -3304     701    -702
'
'    Outer element--Black region-Quad 1
 cylinder   3312 23.542625  47.3075   -30.48         origin x=0. y=0. z=45.720
 media       410     1    3312   -3304   -3308    -700    -702
'                                -Quad 2
 media       410     1    3312   -3304   -3308    -700     703
'                                -Quad 3
 media       410     1    3312   -3304   -3308     701     703
'                                -Quad 4
 media       410     1    3312   -3304   -3308     701    -702
'
'    Outer element--Gray region-Quad 1
 cylinder   3313 23.542625  47.3075   -43.18         origin x=0. y=0. z=45.720
 media       411     1    3313   -3304   -3312    -700    -702
'                               -Quad 2
 media       411     1    3313   -3304   -3312    -700     703
'                               -Quad 3
 media       411     1    3313   -3304   -3312     701     703
'                               -Quad 4
 media       411     1    3313   -3304   -3312     701    -702
'
'    Outer element--Lower white region-Quad 1
 cylinder   3320 23.542625  47.3075  -120.80875      origin x=0. y=0. z=45.720
 media       413     1    3320   -3304   -3313    -700    -702
'                                    -Quad 2
 media       413     1    3320   -3304   -3313    -700     703
'                                    -Quad 3
 media       413     1    3320   -3304   -3313     701     703
'                                    -Quad 4
 media       413     1    3320   -3304   -3313     701    -702
'
'    Outer element--Outer clad-Quad 1
 cylinder   3324 23.622     47.3075  -120.80875      origin x=0. y=0. z=45.720
 media        21     1    3324   -3320    -700    -702
'                           -Quad 2
 media        21     1    3324   -3320    -700     703
'                           -Quad 3
 media        21     1    3324   -3320     701     703
```

```
'                          -Quad 4
 media        21     1    3324   -3320     701    -702
'
'    Water between OCE and removable Be reflector
'
'    water just outside outer CR--core region
 cylinder   4000 23.8124     30.48     -30.48
 media         2     1    4000   -3205
'    water just outside outer CR--above core region
 cylinder   4001 23.8124    149.9904   -30.48
 media         3     1    4001   -4000   -3205
'    water just outside outer CR--below core region
 cylinder   4002 23.8124    149.9904  -149.9904
 media         1     1    4002   -4001   -3205
 boundary   4002
' end unit 3300
'
'
'
'          ----------------------------------------
'                          Region V
'
'                  REMOVABLE REFLECTOR REGION
'          ----------------------------------------
'
'  The removabel reflector is region-5
'   The  Beryllium reflector region  is devided into 2 radial regions, the inner most  is removable and can be replaced
periodically.
'   The  Beryllium reflector  is 24 cm in height
'   The  inner (Removable) reflector dimensions are OD = 23.756 in  ID = 18.872 in Height = 24 cm
'   The reflector region has 20 vertical experiment facilities as follow:
'        Large removable beryllium (RB)  ...........8
'        Small removable beryllium (RB)  ...........4
'        Control-rod access plug facilities (CR) ...8
'
'     ----------------------------------------
'      Removable Reflector Irradiation Facilities
'     ----------------------------------------
'
'    RB-1A
unit 6301
 cylinder   6301  2.32918    30.48     -30.48   origin x=7.296944   y=26.311930
 media        33     1    6301
 boundary   6301
' end unit 6301
'
'    RB-1B
unit 6351
 cylinder   6351  2.32918    30.48     -30.48   origin x=13.445625  y=23.765063
 media       530     1    6351
 boundary   6351
' end unit 6351
'
'    RB-2
unit 6400
 cylinder   6400  0.63500    30.48     -30.48
 media        33     1    6400
 boundary   6400
' end unit 6400
'
'    RB-3A
unit 6501
 cylinder   6501  2.32918    30.48     -30.48   origin x=-26.311929 y=7.296944
 media       530     1    6501
 boundary   6501
' end unit 6501
'
'    RB-3B
unit 6551
 cylinder   6551  2.32918    30.48     -30.48   origin x=-23.765062 y=13.445625
 media       530     1    6551
 boundary   6551
' end unit 6551
'
'    RB-4
unit 6600
 cylinder   6600  0.63500    30.48     -30.48
 media        33     1    6600
 boundary   6600
' end unit 6600
'
```

```
'    RB-5A
unit 6701
 cylinder   6701  2.32918    30.48     -30.48   origin x=-7.296944  y=-26.311929
 media        33     1    6701
 boundary   6701
' end unit 6701
'
'    RB-5B
unit 6751
 cylinder   6751  2.32918    30.48     -30.48   origin x=-13.445625 y=-23.765062
 media        33     1    6751
 boundary   6751
' end unit 6751
'
'    RB-6
unit 6800
 cylinder   6800  0.63500    30.48     -30.48
 media        33     1    6800
 boundary   6800
' end unit 6800
'
'    RB-7A (RB - 7J)
unit 6901
 cylinder   6901  2.049      30.48     -30.48   origin x=26.311929  y=-7.296944
 media        39     1    6901
 boundary   6901
' end unit 6901
'
'    RB-7B
unit 6951
 cylinder   6951  2.049      30.48     -30.48   origin x=23.765062  y=-13.445625
 media       530     1    6951
 boundary   6951
' end unit 6951
'
'    RB-8
unit 7000
 cylinder   7000  0.63500    30.48     -30.48
 media        33     1    7000
 boundary   7000
' end unit 7000
'
'
'                  Removable Reflector
'          ---------------------------------------
'
unit 4000
'     water just outside outer CR
 cylinder   4002 23.8125    149.9905   -149.9905
 hole       3300
 media         2     1    4002
'
'    Al clad of removable refl. reg. 1--core region
 cylinder   4010 24.4475     30.48     -30.48
 media        22     1    4010   -4002
'    water--above al clad
 cylinder   4011 24.4475    149.9905   -30.48
 media         3     1    4011   -4010   -4002
'    water--below al clad
 cylinder   4012 24.4475    149.9905  -149.9905
 media         1     1    4012   -4011   -4002
'
'      Removable Reflector Irradiation Facilities (odd numbers)
'
'    RB-1A
 cylinder   6300  2.59080    30.48     -30.48   origin x=7.296944   y=26.311930
 hole       6301
 media        24     1    6300
'    RB-1B
 cylinder   6350  2.59080    30.48     -30.48   origin x=13.445625  y=23.765063
 hole       6351
 media        24     1    6350
'    RB-3A
 cylinder   6500  2.59080    30.48     -30.48   origin x=-26.311929 y=7.296944
 hole       6501
 media        24     1    6500
'    RB-3B
 cylinder   6550  2.59080    30.48     -30.48   origin x=-23.765062 y=13.445625
 hole       6551
 media        24     1    6550
'    RB-5A
```

```
cylinder   6700  2.59080    30.48     -30.48   origin x=-7.296944  y=-26.311929
hole       6701
media        24     1    6700
'    RB-5B
cylinder   6750  2.59080    30.48     -30.48   origin x=-13.445625 y=-23.765062
hole       6751
media        24     1    6750
'    RB-7A (RB - 7J)
cylinder   6900  2.54       30.48     -30.48   origin x=26.311929  y=-7.296944
hole       6901
media        38     1    6900
'    RB-7B
cylinder   6950  2.54       30.48     -30.48   origin x=23.765062  y=-13.445625
hole       6951
media        24     1    6950
'
'      Removable Be Reflector Reg. 1
'      -----------------------------
'
'    removable refl. reg. 1--core region
cylinder   4020 25.0825     30.48     -30.48
media       101     1    4020   -4012   -6300   -6350   -6500   -6550
                                       -6700   -6750   -6900   -6950
'    water--above removable refl. reg. 1
cylinder   4021 25.0825    149.9905   -30.48
media         6     1    4021   -4020   -4012
'    water--below removable refl. reg. 1
cylinder   4022 25.0825    149.9905  -149.9905
media         4     1    4022   -4021   -4012
'
'    water region--core region
cylinder   4030 25.15108    30.48     -30.48
media         5     1    4030   -4022   -6300   -6350   -6500   -6550
                                       -6700   -6750   -6900   -6950
'    water region--above core region
cylinder   4031 25.15108   149.9905   -30.48
media         6     1    4031   -4030   -4022
'    water region--below core region
cylinder   4032 25.15108   149.9905  -149.9905
media         4     1    4032   -4031   -4022
'
'      Removable Be Reflector Reg. 2
'      -----------------------------
'
'    removable refl. reg. 2--core region
cylinder   4040 27.46375    30.48     -30.48
'      Removable Reflector Irradiation Facilities (even numbers)
hole       6400   origin x=-12.970338  y=22.924995
hole       6600   origin x=-22.924995  y=-12.970338
hole       6800   origin x=12.970338   y=-22.924995
hole       7000   origin x=22.924995   y=12.970388
media       102     1    4040   -4032   -6300   -6350   -6500   -6550
                                       -6700   -6750   -6900   -6950
'    water--above removable refl. reg. 2
cylinder   4041 27.46375   149.9905   -30.48
media         6     1    4041   -4040   -4032
'    water--below removable refl. reg. 2
cylinder   4042 27.46375   149.9905  -149.9905
media         4     1    4042   -4041   -4032
'
'    water region--core region
cylinder   4050 27.53233    30.48     -30.48
media         5     1    4050   -4042   -6300   -6350   -6500   -6550
                                       -6700   -6750   -6900   -6950
'    water region--above core region
cylinder   4051 27.53233   149.9905   -30.48
media         6     1    4051   -4050   -4042
'    water region--below core region
cylinder   4052 27.53233   149.9905  -149.9905
media         4     1    4052   -4051   -4042
'
'      Removable Be Reflector Reg. 3
'      -----------------------------
'
'    removable refl. reg. 3--core region
cylinder   4060 30.25267    30.48     -30.48
media       103     1    4060   -4052   -6300   -6350   -6500   -6550
                                       -6700   -6750   -6900   -6950
'    water--above removable refl. reg. 2
cylinder   4061 30.25267   149.9905   -30.48
media         6     1    4061   -4060   -4052
```

```
'    water--below removable refl. reg. 2
 cylinder   4062 30.25267   149.9905  -149.9905
 media         4     1    4062   -4061   -4052
'
'    water region--core region
 cylinder   4070 30.32125    30.48     -30.48
 media         5     1    4070   -4062   -6300   -6350   -6500   -6550
                                         -6700   -6750   -6900   -6950
'    water region--above core region
 cylinder   4071 30.32125   149.9905   -30.48
 media         6     1    4071   -4070   -4062
'    water region--below core region
 cylinder   4072 30.32125   149.9905  -149.9905
 media         4     1    4072   -4071   -4062
'
 boundary   4072
' end unit 4000
'
'
'    ----------------------------
'     RB Control Rod Access Plugs
'    ----------------------------
'
'       CR-1 or CR-1A  (Control Rod Access Plug 1)
unit 7100
 cylinder   7100  0.63500    30.48     -30.48
 media        33     1    7100
 boundary   7100
' end unit 7100
'
'       CR-2 or CR-1B
unit 7200
 cylinder   7200  0.63500    30.48     -30.48
 media        33     1    7200
 boundary   7200
' end unit 7200
'
'       CR-3 or CR-2A
unit 7300
 cylinder   7300  0.63500    30.48     -30.48
 media        33     1    7300
 boundary   7300
' end unit 7300
'
'       CR-4 or CR-2B
unit 7400
 cylinder   7400  0.63500    30.48     -30.48
 media        33     1    7400
 boundary   7400
' end unit 7400
'
'       CR-5 or CR-3A
unit 7500
 cylinder   7500  0.63500    30.48     -30.48
 media        33     1    7500
 boundary   7500
' end unit 7500
'
'       CR-6 or CR-3B
unit 7600
 cylinder   7600  0.63500    30.48     -30.48
 media        33     1    7600
 boundary   7600
' end unit 7600
'
'       CR-7 or CR-4A
unit 7700
 cylinder   7700  0.63500    30.48     -30.48
 media        33     1    7700
 boundary   7700
' end unit 7700
'
'       CR-8 or CR-4B
unit 7800
 cylinder   7800  0.63500    30.48     -30.48
 media        33     1    7800
 boundary   7800
' end unit 7800
'
'
'       Semi-permanent Be Reflector Region
```

```
'       ---------------------------------
unit 4080
 cylinder   4072 30.32125   149.9906  -149.9906
 hole       4000
 media         4     1    4072
'
'    HB-1
 sphere     8864  7.3025        chord +z=0.0       origin x=27.09160   y=29.78398  rotate a1=30  a2=90
 sphere     8865  6.985         chord +z=0.0       origin x=27.09160   y=29.78398  rotate a1=30  a2=90
 media        24     1    4090    8864   -8865
 media         5     1    4090    8865
'    HB-2 (Radial Tube)
 sphere     7915 11.7475        chord +z=0.0       origin x=-43.28142  y=0.0       rotate a1=90  a2=90
 sphere     7914 11.43          chord +z=0.0       origin x=-43.28142  y=0.0       rotate a1=90  a2=90
 sphere     7913 10.795         chord +z=0.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 sphere     7911 10.45464       chord +z=0.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4090    7915   -7914
 media         5     1    4090    7914   -7913
 media         5     1    4090    7913   -7911
 media        24     1    4090    7911
'    HB-3
 sphere     8015  7.3025        chord +z=0.0       origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
 sphere     8014  6.985         chord +z=0.0       origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
 sphere     8013  6.35          chord +z=0.0       origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 sphere     8011  6.02996       chord +z=0.0       origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 plane      8021          zpl=1.0    con=-5.83438  origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 media        24     1    4090    8015   -8014
 media         5     1    4090    8014   -8013
 media         5     1    4090    8013    8021   -8011
 media        24     1    4090    8013   -8021   -8011
 media        24     1    4090    8011
'    HB-4 (Cold Source)
 sphere     8830  8.5725        chord +z=0.0       origin x=39.09437   y=8.99457   rotate a1=210 a2=90
 sphere     8831  8.255         chord +z=0.0       origin x=39.09437   y=8.99457   rotate a1=210 a2=90
 sphere     8832  7.62          chord +z=0.0       origin x=39.25439   y=8.71740   rotate a1=210 a2=90
 media        24     1    4090    8830   -8831
 media         5     1    4090    8831   -8832
 media        24     1    4090    8832
 cylinder   8822  8.5725      0.0     -193.04      origin x=39.09437   y=8.99457   rotate a1=210 a2=90
 cylinder   8823  8.255       0.0     -193.04      origin x=39.09437   y=8.99457   rotate a1=210 a2=90
 cylinder   8814  7.62        0.0     -193.04      origin x=39.25439   y=8.71740   rotate a1=210 a2=90
 media        24     1    4090    8822   -8823   -8830
 media         5     1    4090    8823   -8814   -8831   -8832
 media        24     1    4090    8814   -8832
'    Semi-permanent region with CR positions
 cylinder   4080 33.02       30.48     -30.48
 hole       7100   origin x=15.859584   y=28.031720
 hole       7200   origin x=8.607000    y=31.035839
 hole       7300   origin x=-28.031720  y=15.859584
 hole       7400   origin x=-31.035839  y=8.606999
 hole       7500   origin x=-15.859584  y=-28.031720
 hole       7600   origin x=-8.607000   y=-31.035839
 hole       7700   origin x=28.031720   y=-15.859580
 hole       7800   origin x=31.035839   y=-8.607000
 media       104     1    4080   -4072   -8864   -7915   -8015   -8822   -8830
'    water--above semi-permanent refl. reg.
 cylinder   4081 33.02      149.9905   -30.48
 media         6     1    4081   -4080   -4072
'    water--below semi-permanent refl. reg.
 cylinder   4082 33.02      149.9906  -149.9906
 media         4     1    4082   -4081   -4072
'
'    water gap
 cylinder   4090 33.3375     30.48     -30.48
 media       100     1    4090   -4082   -8864   -7915   -8015   -8822   -8830
'    water region--above core region
 cylinder   4091 33.3375    149.9906   -30.48
 media         6     1    4091   -4090   -4082
'    water region--below core region
 cylinder   4092 33.3375    149.9906  -149.9906
 media         4     1    4092   -4091   -4082
 boundary   4092
' end unit 4080
'
'
'
'       ---------------------------------------------
'                        Region VI
'
'                PERMANENT REFLECTOR REGION
'       ---------------------------------------------
```

```
'
'  The permanent is region-6
'  The  Beryllium reflector region  is devided into 2 radial regions, the outer most  is permanent .
'   The  outer (Permanent) reflector dimensions are OD = 43.0  Height = 24 cm
'   The reflector region has 4 engineering facilities and  22 vertical experiment facilities as follow
'         Large VXF           6
'         Inner small VXF     11
'         outer small VXF      5
'  many parts of this region is modeld by Pepplo
'
'      ----------------------
'      Permanent Be Reflector
'      ----------------------
'
'      -------------------------------
'      VXF - located in outer reflector
'      -------------------------------
'
'    VXF-1   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 4201
 cylinder   4201  2.01168    30.48     -30.48   origin x=3.076479   y=39.090375
 cylinder   4202  1.90240    30.48     -30.48   origin x=3.076479   y=39.090375
 cylinder   4203  1.77800    30.48     -30.48   origin x=3.076479   y=39.090375
 media         9     1    4201   -4202
 media        40     1    4202   -4203
 media         9     1    4203
 boundary   4201
' end unit 4201
'
'    VXF-2   (Small Vertical Experiment Facility)
unit 4301
 cylinder   4301  2.01168    30.48     -30.48   origin x=-3.456418  y=43.917957
 media        33     1    4301
 boundary   4301
' end unit 4301
'
'    VXF-3   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 4401
 cylinder   4401  2.01168    30.48     -30.48   origin x=-9.153685  y=38.127840
 cylinder   4402  1.90240    30.48     -30.48   origin x=-9.153685  y=38.127840
 cylinder   4403  1.77800    30.48     -30.48   origin x=-9.153685  y=38.127840
 media         9     1    4401   -4402
 media        40     1    4402   -4403
 media         9     1    4403
 boundary   4401
' end unit 4401
'
'    VXF-4   (Small Vertical Experiment Facility)
unit 4501
 cylinder   4501  2.01168    30.48     -30.48   origin x=-16.858640 y=40.700367
 media        33     1    4501
 boundary   4501
' end unit 4501
'
'    VXF-5   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 4601
 cylinder   4601  2.01168    30.48     -30.48   origin x=-20.487822 y=33.433087
 cylinder   4602  1.90240    30.48     -30.48   origin x=-20.487822 y=33.433087
 cylinder   4603  1.77800    30.48     -30.48   origin x=-20.487822 y=33.433087
 media         9     1    4601   -4602
 media        40     1    4602   -4603
 media         9     1    4603
 boundary   4601
' end unit 4601
'
'    VXF-6   (Large Vertical Experiment Facility)
unit 4701
 cylinder   4701  3.59918    30.48     -30.48   origin x=-30.054027 y=35.188744
 media        33     1    4701
 boundary   4701
' end unit 4701
'
'    VXF-7  (Small Vertical Experiment Facility--Vertical Irradiation Facility)
unit 4801
 cylinder   4801  2.01168   149.9906   -30.48   origin x=-29.816468 y=25.465670
 cylinder   4802  1.90240   149.9906   -30.48   origin x=-29.816468 y=25.465670
 cylinder   4803  1.77800   149.9906   -30.48   origin x=-29.816468 y=25.465670
 sphere     4809  1.7                         origin x=-29.816468 y=25.465670
 media        60     1    4801   -4802
 media        24     1    4802   -4803
 media        60     1    4803   -4809
```

```
 media        60     1    4809
 boundary   4801
' end unit 4801
'
'    VXF-8   (Small Vertical Experiment Facility)
unit 4901
 cylinder   4901  2.01168    30.48     -30.48   origin x=-37.562005 y=23.018026
 media        33     1    4901
 boundary   4901
' end unit 4901
'
'    VXF-9   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 5001
 cylinder   5001  2.01168    30.48     -30.48   origin x=-36.226471 y=15.005496
 cylinder   5002  1.90240    30.48     -30.48   origin x=-36.226471 y=15.005496
 cylinder   5003  1.77800    30.48     -30.48   origin x=-36.226471 y=15.005496
 media         9     1    5001   -5002
 media        40     1    5002   -5003
 media         9     1    5003
 boundary   5001
' end unit 5001
'
'    VXF-10   (Small Vertical Experiment Facility)
unit 5101
 cylinder   5101  2.01168    30.48     -30.48   origin x=-40.700368 y=-16.858644
 media        33     1    5101
 boundary   5101
' end unit 5101
'
'    VXF-11   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 5201
 cylinder   5201  2.01168    30.48     -30.48   origin x=-33.433087 y=-20.487822
 cylinder   5202  1.90240    30.48     -30.48   origin x=-33.433087 y=-20.487822
 cylinder   5203  1.77800    30.48     -30.48   origin x=-33.433087 y=-20.487822
 media         9     1    5201   -5202
 media        40     1    5202   -5203
 media         9     1    5203
 boundary   5201
' end unit 5201
'
'    VXF-12   (Small Vertical Experiment Facility)
unit 5301
 cylinder   5301  2.01168    30.48     -30.48   origin x=-33.498742 y=-28.610628
 media        33     1    5301
 boundary   5301
' end unit 5301
'
'    VXF-13   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 5401
 cylinder   5401  2.01168    30.48     -30.48   origin x=-25.465670 y=-29.816468
 cylinder   5402  1.90240    30.48     -30.48   origin x=-25.465670 y=-29.816468
 cylinder   5403  1.77800    30.48     -30.48   origin x=-25.465670 y=-29.816468
 media         9     1    5401   -5402
 media        40     1    5402   -5403
 media         9     1    5403
 boundary   5401
' end unit 5401
'
'    VXF-14   (Large Vertical Experiment Facility)
unit 5501
 cylinder   5501  3.59918    30.48     -30.48   origin x=-24.179279 y=-39.456998
 media        33     1    5501
 boundary   5501
' end unit 5501
'
'    VXF-15   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 5601
 cylinder   5601  2.01168    30.48     -30.48   origin x=-15.005496 y=-36.226471
 cylinder   5602  1.90240    30.48     -30.48   origin x=-15.005496 y=-36.226471
 cylinder   5603  1.77800    30.48     -30.48   origin x=-15.005496 y=-36.226471
 media         9     1    5601   -5602
 media        40     1    5602   -5603
 media         9     1    5603
 boundary   5601
' end unit 5601
'
'    VXF-16   (Large Vertical Experiment Facility)
unit 5701
 cylinder   5701  3.59918    30.48     -30.48   origin x=-10.802978 y=-44.997643
 media        33     1    5701
 boundary   5701
```

```
' end unit 5701
'
'    VXF-17   (Large Vertical Experiment Facility)
unit 5801
 cylinder   5801  3.59918    30.48     -30.48   origin x=21.008982  y=-41.232450
 media        33     1    5801
 boundary   5801
' end unit 5801
'
'    VXF-18   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 5901
 cylinder   5901  2.01168    30.48     -30.48   origin x=23.047795  y=-31.722568
 cylinder   5902  1.90240    30.48     -30.48   origin x=23.047795  y=-31.722568
 cylinder   5903  1.77800    30.48     -30.48   origin x=23.047795  y=-31.722568
 media         9     1    5901   -5902
 media        40     1    5902   -5903
 media         9     1    5903
 boundary   5901
' end unit 5901
'
'    VXF-19   (Large Vertical Experiment Facility)
unit 6001
 cylinder   6001  3.59918    30.48     -30.48   origin x=32.722257  y=-32.722257
 media        33     1    6001
 boundary   6001
' end unit 6001
'
'    VXF-20   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 6101
 cylinder   6101  2.01168    30.48     -30.48   origin x=31.722568  y=-23.047794
 cylinder   6102  1.90240    30.48     -30.48   origin x=31.722568  y=-23.047794
 cylinder   6103  1.77800    30.48     -30.48   origin x=31.722568  y=-23.047794
 media         9     1    6101   -6102
 media        40     1    6102   -6103
 media         9     1    6103
 boundary   6101
' end unit 6101
'
'    VXF-21   (Large Vertical Experiment Facility)
unit 6201
 cylinder   6201  3.59918    30.48     -30.48   origin x=41.232450  y=-21.008982
 media        33     1    6201
 boundary   6201
' end unit 6201
'
'    VXF-22   (Small Vertical Experiment Facility)  (water filled, ss liner)
unit 6251
 cylinder   6251  2.01168    30.48     -30.48   origin x=37.292115  y=-12.116943
 cylinder   6252  1.90240    30.48     -30.48   origin x=37.292115  y=-12.116943
 cylinder   6253  1.77800    30.48     -30.48   origin x=37.292115  y=-12.116943
 media         9     1    6251   -6252
 media        40     1    6252   -6253
 media         9     1    6253
 boundary   6251
' end unit 6251
'
unit 4100
'     Permanent reflector
 cylinder   4092 33.3375    149.9907  -149.9907
 hole       4080
 media         1     1    4092
'
'      VXF - located in outer reflector
'
'    VXF-1   (Small Vertical Experiment Facility)  (water filled, ss liner)
 cylinder   4200  2.22250    30.48     -30.48   origin x=3.076479   y=39.090375
 hole       4201
 media        24     1    4200
'    VXF-2   (Small Vertical Experiment Facility)
 cylinder   4300  2.22250    30.48     -30.48   origin x=-3.456418  y=43.917957
 hole       4301
 media        24     1    4300
'    VXF-3   (Small Vertical Experiment Facility)  (water filled, ss liner)
 cylinder   4400  2.22250    30.48     -30.48   origin x=-9.153685  y=38.127840
 hole       4401
 media        24     1    4400
'    VXF-4   (Small Vertical Experiment Facility)
 cylinder   4500  2.22250    30.48     -30.48   origin x=-16.858640 y=40.700367
 hole       4501
 media        24     1    4500
'    VXF-5   (Small Vertical Experiment Facility)  (water filled, ss liner)
```

```
cylinder   4600  2.22250    30.48     -30.48   origin x=-20.487822 y=33.433087
hole       4601
media        24     1    4600
'    VXF-6   (Large Vertical Experiment Facility)
cylinder   4700  3.81000    30.48     -30.48   origin x=-30.054027 y=35.188744
hole       4701
media        24     1    4700
'    VXF-7  (Small Vertical Experiment Facility--Vertical Irradiation Facility)
cylinder   4800  2.22250   149.9907   -30.48   origin x=-29.816468 y=25.465670
hole       4801
media        24     1    4800
'    VXF-8   (Small Vertical Experiment Facility)
cylinder   4900  2.22250    30.48     -30.48   origin x=-37.562005 y=23.018026
hole       4901
media        24     1    4900
'    VXF-9   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   5000  2.22250    30.48     -30.48   origin x=-36.226471 y=15.005496
hole       5001
media        24     1    5000
'    VXF-10   (Small Vertical Experiment Facility)
cylinder   5100  2.22250    30.48     -30.48   origin x=-40.700368 y=-16.858644
hole       5101
media        24     1    5100
'    VXF-11   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   5200  2.22250    30.48     -30.48   origin x=-33.433087 y=-20.487822
hole       5201
media        24     1    5200
'    VXF-12   (Small Vertical Experiment Facility)
cylinder   5300  2.22250    30.48     -30.48   origin x=-33.498742 y=-28.610628
hole       5301
media        24     1    5300
'    VXF-13   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   5400  2.22250    30.48     -30.48   origin x=-25.465670 y=-29.816468
hole       5401
media        24     1    5400
'    VXF-14   (Large Vertical Experiment Facility)
cylinder   5500  3.81000    30.48     -30.48   origin x=-24.179279 y=-39.456998
hole       5501
media        24     1    5500
'    VXF-15   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   5600  2.22250    30.48     -30.48   origin x=-15.005496 y=-36.226471
hole       5601
media        24     1    5600
'    VXF-16   (Large Vertical Experiment Facility)
cylinder   5700  3.81000    30.48     -30.48   origin x=-10.802978 y=-44.997643
hole       5701
media        24     1    5700
'    VXF-17   (Large Vertical Experiment Facility)
cylinder   5800  3.81000    30.48     -30.48   origin x=21.008982  y=-41.232450
hole       5801
media        24     1    5800
'    VXF-18   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   5900  2.22250    30.48     -30.48   origin x=23.047795  y=-31.722568
hole       5901
media        24     1    5900
'    VXF-19   (Large Vertical Experiment Facility)
cylinder   6000  3.81000    30.48     -30.48   origin x=32.722257  y=-32.722257
hole       6001
media        24     1    6000
'    VXF-20   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   6100  2.22250    30.48     -30.48   origin x=31.722568  y=-23.047794
hole       6101
media        24     1    6100
'    VXF-21   (Large Vertical Experiment Facility)
cylinder   6200  3.81000    30.48     -30.48   origin x=41.232450  y=-21.008982
hole       6201
media        24     1    6200
'    VXF-22   (Small Vertical Experiment Facility)  (water filled, ss liner)
cylinder   6250  2.22250    30.48     -30.48   origin x=37.292115  y=-12.116943
hole       6251
media        24     1    6250
'    HB-1
sphere     8864  7.3025        chord +z=0.0       origin x=27.09160   y=29.78398  rotate a1=30  a2=90
sphere     8865  6.985         chord +z=0.0       origin x=27.09160   y=29.78398  rotate a1=30  a2=90
sphere     8883  6.35          chord +z=0.0       origin x=27.05350   y=29.84997  rotate a1=30  a2=90
sphere     8881  6.02996       chord +z=0.0       origin x=27.05350   y=29.84997  rotate a1=30  a2=90
sphere     8880  5.08          chord +z=0.0       origin x=27.19193   y=29.61020  rotate a1=30  a2=90
plane      8850          zpl=1.0    con=-5.83438  origin x=27.05350   y=29.84997  rotate a1=30  a2=90
media        24     1   -4092    8864   -8865
media         5     1   -4092    8865   -8883
media         5     1   -4092    8883    8850   -8881
```

```
media        24     1   -4092    8883   -8850   -8881
media        24     1   -4092    8881   -8880   -8870
media        60     1    8880
cylinder   8861  7.62       -7.04088 -193.04      origin x=27.09160   y=29.78398  rotate a1=30  a2=90
cylinder   8862  7.3025      0.0     -193.04      origin x=27.09160   y=29.78398  rotate a1=30  a2=90
cylinder   8863  6.985       0.0     -193.04      origin x=27.09160   y=29.78398  rotate a1=30  a2=90
cylinder   8875  6.35        0.0     -193.04      origin x=27.05350   y=29.84997  rotate a1=30  a2=90
cylinder   8870  5.08        0.0     -193.04      origin x=27.19193   y=29.61020  rotate a1=30  a2=90
media        24     1    4120    8861   -8862
media        24     1    4120    8862   -8863   -8864
media         5     1    4120    8863   -8875   -8883   -8865
media        24     1    4120    8875   -8870   -8883
media        60     1    4120    8870   -8880
'    HB-2 (Radial Tube)
sphere     7915 11.7475        chord +z=0.0       origin x=-43.28142  y=0.0       rotate a1=90  a2=90
sphere     7914 11.43          chord +z=0.0       origin x=-43.28142  y=0.0       rotate a1=90  a2=90
sphere     7913 10.795         chord +z=0.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
sphere     7911 10.45464       chord +z=0.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
sphere     7910  8.95604       chord +z=0.0       origin x=-43.14426  y=0.0       rotate a1=90  a2=90
plane      7953           zpl=1.0    con=-9.56564  origin x=-43.57606  y=0.0       rotate a1=90  a2=90
plane      7920  xpl=1.0 ypl=9.550703   con=-6.341945
plane      7921  xpl=1.0 ypl=-9.550703  con=-6.341945
media        24     1   -4092    7915   -7914
media         5     1   -4092    7914   -7913
media         5     1   -4092    7913    7953   -7911
media        24     1   -4092    7913   -7953   -7911
media        24     1   -4092    7911   -7910   -7900
media        60     1            7910   -7920   -7921
media       105     1            7910    7920    9001
media       105     1            7910    7921    9001
media       106     1            7910    7920   -9001    9002
media       106     1            7910    7921   -9001    9002
media       107     1            7910    7920   -9002    9003
media       107     1            7910    7921   -9002    9003
media       108     1            7910    7920   -9003
media       108     1            7910    7921   -9003
cylinder   7905 12.065       -3.7084  -193.04      origin x=-43.28142  y=0.0       rotate a1=90  a2=90
cylinder   7906 11.7475        0.0     -193.04      origin x=-43.28142  y=0.0       rotate a1=90  a2=90
cylinder   7904 11.43          0.0     -193.04      origin x=-43.28142  y=0.0       rotate a1=90  a2=90
cylinder   7903 10.795         0.0     -193.04      origin x=-43.57606  y=0.0       rotate a1=90  a2=90
cylinder   7900  8.95604       0.0     -193.04      origin x=-43.14426  y=0.0       rotate a1=90  a2=90
plane      7924           zpl=1.0    con=10.72896  origin x=-43.57606  y=0.0       rotate a1=90  a2=90
media        24     1    4120    7905   -7906
media        24     1    4120    7906   -7904   -7915
media         5     1    4120    7904   -7903   -7913   -7914
media        24     1    4120    7903   -7900   -7913
media        60     1    7924    7900   -7920   -7921   -7910
media        60     1    4120    7900   -7924
media       108     1            7900    7920    9004
media       108     1            7900    7921    9004
media       109     1            7900    7920   -9004    9005
media       109     1            7900    7921   -9004    9005
media       110     1            7900    7920   -9005    9006
media       110     1            7900    7921   -9005    9006
media       111     1            7900    7920   -9006    7924
media       111     1            7900    7921   -9006    7924
'    HB-3
sphere     8015  7.3025        chord +z=0.0       origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
sphere     8014  6.985         chord +z=0.0       origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
sphere     8013  6.35          chord +z=0.0       origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
sphere     8011  6.02996       chord +z=0.0       origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
sphere     8010  5.08          chord +z=0.0       origin x=9.06086    y=-37.64613 rotate a1=150 a2=90
plane      8021           zpl=1.0    con=-5.83438  origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
media        24     1   -4092    8015   -8014
media         5     1   -4092    8014   -8013
media         5     1   -4092    8013    8021   -8011
media        24     1   -4092    8013   -8021   -8011
media        24     1   -4092    8011   -8010   -8000
media        60     1            8010
cylinder   8005  7.62       -8.20166 -193.04      origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
cylinder   8006  7.3025      0.0     -193.04      origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
cylinder   8004  6.985       0.0     -193.04      origin x=8.98085    y=-37.78472 rotate a1=150 a2=90
cylinder   8003  6.35        0.0     -193.04      origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
cylinder   8000  5.08        0.0     -193.04      origin x=9.06086    y=-37.64613 rotate a1=150 a2=90
media        24     1    4120    8005   -8006
media        24     1    4120    8006   -8004   -8015
media         5     1    4120    8004   -8003   -8013   -8014
media        24     1    4120    8003   -8000   -8013
media        60     1    4120    8000   -8010
'    HB-4 (Cold Source)
sphere     8830  8.5725        chord +z=0.0       origin x=39.09437   y=8.99457   rotate a1=210 a2=90
```

```
sphere     8831  8.255         chord +z=0.0       origin x=39.09437   y=8.99457   rotate a1=210 a2=90
sphere     8832  7.62          chord +z=0.0       origin x=39.25439   y=8.71740   rotate a1=210 a2=90
sphere     8833  7.30250       chord +z=0.0       origin x=39.25439   y=8.71740   rotate a1=210 a2=90
sphere     8835  5.63245       chord +z=0.0       origin x=38.99277   y=9.17054   rotate a1=210 a2=90
sphere     8602  4.92125       chord +z=0.0       origin x=38.99277   y=9.17054   rotate a1=210 a2=90
sphere     8601  4.67360       chord +z=0.0       origin x=38.93054   y=9.27833   rotate a1=210 a2=90
plane      8841          zpl=1.0    con=-5.9309   origin x=39.25439   y=8.71740   rotate a1=210 a2=90
media        24     1   -4092    8830   -8831
media         5     1   -4092    8831   -8832
media         5     1            8832    8841   -8833
media        24     1   -4092    8832   -8841   -8833
media        24     1   -4092    8833   -8835   -8817
media        60     1            8835   -8602
media        24     1            8602   -8601   -8603
media       560     1            8601
media       560     1            8602   -8601    8603
'
cylinder   8800  8.89       -9.2075  -193.04      origin x=39.09437   y=8.99457   rotate a1=210 a2=90
cylinder   8822  8.5725      0.0     -193.04      origin x=39.09437   y=8.99457   rotate a1=210 a2=90
cylinder   8823  8.255       0.0     -193.04      origin x=39.09437   y=8.99457   rotate a1=210 a2=90
cylinder   8814  7.62        0.0     -193.04      origin x=39.25439   y=8.71740   rotate a1=210 a2=90
cylinder   8817  5.63245     0.0     -193.04      origin x=38.99277   y=9.17054   rotate a1=210 a2=90
cylinder   8604  4.92125     0.0     -193.04      origin x=38.99277   y=9.17054   rotate a1=210 a2=90
cylinder   8603  4.67360     0.0     -193.04      origin x=38.93054   y=9.27833   rotate a1=210 a2=90
cylinder  86254  5.02031     0.0       -0.9398    origin x=39.41314   y=8.44244   rotate a1=210 a2=90
media        24     1            4120    8800   -8822
media        24     1   -4092    4120    8822   -8823   -8830
media         5     1   -4092    4120    8823   -8814   -8831   -8832
media        24     1   -4092    4120    8814   -8817   -8832
media        60     1            8553    8817   -8604   -8835  -86254
media        24     1    8553   -8616           -8618    8604   -8603   -8602
media        60     1    8553    8616                    8604   -8603
media        60     1    8553                    8618    8604   -8603
media        24     1                  86254   -8604
media       560     1    8626                                    8603   -8602   -8606
media       560     1    8553   -8626   -8615           -8617            8603           -8612
media        24     1    8553   -8626    8615   -8616                    8603           -8612
media        24     1    8553   -8626                    8617   -8618    8603           -8612
media        60     1    8553   -8626            8616                    8603           -8612
media        60     1    8553   -8626                             8618    8603           -8612
media        60     1   -8553    8629    8817   -8604
media        60     1   -8553    8629            8604  -86221  -86241
media        60     1   -8629    4120    8817   -8622   -8624
'    ----Cold source
ellipsoid  8605  3.103880    4.8514245  3.103880  origin x=40.76188   y=6.10636   rotate a1=210 a2=90
ellipsoid  8606  3.403600    5.1528462  3.403600  origin x=40.83554   y=5.97877   rotate a1=210 a2=90
sphere     8607  3.97764                          origin x=40.76188   y=6.10636   rotate a1=210 a2=90
sphere     8608  4.27736                          origin x=40.83554   y=5.97877   rotate a1=210 a2=90
plane      8626          zpl=1.0                  origin x=40.76188   y=6.10636   rotate a1=210 a2=90
media        60     1            8626    8605    8607
media        24     1            8626    8606    8608   -8605    8607
media        24     1            8626    8606    8608           -8607
media       560     1            8626    8606   -8608    8603
'
ecylinder  8611  3.103880    4.8514245  1.  -99.0 origin x=40.76188   y=6.10636   rotate a1=210 a2=90
ecylinder  8612  3.403600    5.1528462  1.  -99.0 origin x=40.83554   y=5.97877   rotate a1=210 a2=90
cylinder   8609  3.97764                1.  -99.0 origin x=40.76188   y=6.10636   rotate a1=210 a2=90
cylinder   8610  4.27736                1.  -99.0 origin x=40.83554   y=5.97877   rotate a1=210 a2=90
cylinder   8627  2.2225               99.0 -99.0 origin x=42.51829   y=3.06416   rotate a1=120 a2=90
cylinder  86271  7.12216              99.0 -99.0 origin x=29.56403   y=17.06880  rotate a1=210 a2=90
cylinder  86272  7.12216              99.0 -99.0 origin x=36.86705   y=21.28520  rotate a1=210 a2=90
plane      8553          zpl=1.0                  origin x=44.64554   y=-0.62034  rotate a1=210 a2=90
plane      8615  xpl=0.5 zpl=0.8660254  con=-11.97937 origin x=33.21554  y=19.177 rotate a1=300
plane      8616  xpl=0.5 zpl=0.8660254  con=-12.27909 origin x=33.21554  y=19.177 rotate a1=300
plane      8617  xpl=0.5 zpl=-0.8660254 con=-11.97937 origin x=33.21554  y=19.177 rotate a1=300
plane      8618  xpl=0.5 zpl=-0.8660254 con=-12.27909 origin x=33.21554  y=19.177 rotate a1=300
plane      8629          zpl=1.0                  origin x=45.91554   y=-2.82005  rotate a1=210 a2=90
cylinder   8621  0.635                99.0 -99.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
cylinder   8622  0.71501              99.0 -99.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
cone      86221  1.0807   3.5       0.70456 -0.1 origin x=49.41307   y=-0.80075  rotate a1=210 a2=90
cylinder   8623  0.635                99.0 -99.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
cylinder   8624  0.71501              99.0 -99.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
cone      86241  1.0807   3.5       0.70456 -0.1 origin x=42.41801   y=-4.83935  rotate a1=210 a2=90
media        60     1    8553   -8626    8611    8609   -8627
media        60     1    8553   -8626    8611    8609    8627   86271   86272
media        20     1    8553   -8626           -8616           -8618    8612    8610   -8611    8609
media        60     1    8553   -8626            8616                    8612    8610   -8611    8609
media        60     1    8553   -8626                             8618    8612    8610   -8611    8609
media        20     1    8553   -8626           -8616           -8618    8612    8610           -8609
media        60     1    8553   -8626            8616                    8612    8610           -8609
media        60     1    8553   -8626                             8618    8612    8610           -8609
```

```
media       560     1    8553   -8626   -8615          -8617           8612   -8610    8603
media        24     1    8553   -8626    8615   -8616                  8612   -8610    8603
media        24     1    8553   -8626                    8617   -8618   8612   -8610    8603
media        60     1    8553   -8626            8616                   8612   -8610    8603
media        60     1    8553   -8626                             8618   8612   -8610    8603
media        24     1                    8611    8627  -86271
media        24     1                    8611    8627  -86272
'
media        24     1   -8553    8629    8604   86221   -8611   -8621
media        60     1   -8553    8629    8604   86221    8611   -8621
media        24     1   -8629    4120    8622   -8621
media       560     1   -8553    4120    8621
media        24     1   -8553    8629    8604   86241   -8611   -8623
media        60     1   -8553    8629    8604   86241    8611   -8623
media        24     1   -8629    4120    8624   -8623
media       560     1   -8553    4120    8623
'      ------------------------------------
'      Engineering Facilities (Slant tubes)
'      ------------------------------------
plane       101          zpl=1.0    con=-30.48
plane       201          zpl=1.0    con=30.48
'    -------------EF-1
cylinder   8210  4.1834            99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8211  4.8819            99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8212  5.08              99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8213  5.3975            99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8214  5.87375           99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
media         7     1    4120    -101     201    8210
media        24     1    4120    -101     201    8211   -8210
media         5     1    4120    -101     201    8212   -8211
media        24     1    4120    -101     201    8213   -8212
media         7     1    4120    -101     201    8214   -8213
'    -------------EF-2
cylinder   8230  4.1834            99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8231  4.8819            99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8232  5.08              99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8233  5.3975            99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8234  5.87375           99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
media         7     1    4120    -101     201    8230
media        24     1    4120    -101     201    8231   -8230
media         5     1    4120    -101     201    8232   -8231
media        24     1    4120    -101     201    8233   -8232
media         7     1    4120    -101     201    8234   -8233
'    First ring of permanent reflector
cylinder   9001 36.3375     30.48     -30.48
media       105     1    9001   -4092
                        -8861   -8862   -8864
                                -7915
                        -8006   -8015
                        -8822   -8830   -8800
'    Second ring of permanent reflector
cylinder   9002 39.3375     30.48     -30.48
media       106     1    9002   -9001
                        -8861   -8862   -8864
                                -7915
                        -8006   -8015
                        -8822   -8830   -8800
                        -4200   -4400   -4600   -4800   -5000   -5200   -5400   -5600   -5900
                        -6100   -6250
'    Third ring of permanent reflector
cylinder   9003 42.3375     30.48     -30.48
media       107     1    9003   -9002
                        -8861   -8862   -8864
                                -7915
                        -8005   -8006   -8015
                        -8822   -8830   -8800
                        -4200   -4400   -4600   -4800   -5000   -5200   -5400   -5600   -5900
                        -6100   -6250   -4300   -4500   -4900   -5100   -5300
'    Fourth ring of permanent reflector
cylinder   9004 45.3375     30.48     -30.48
media       108     1    9004   -9003
                        -8861   -8862   -8864
                        -7906   -7915
                        -8005   -8006   -8015
                        -8822   -8830   -8800
                        -4300   -4500   -4900   -5100   -5300   -4700   -5500   -5700   -5800
                        -6000   -6200
'    Fifth ring of permanent reflector
cylinder   9005 48.3375     30.48     -30.48
media       109     1    9005   -9004
                        -8861   -8862   -8864
```

```
                        -7905   -7906
                        -8005   -8006
                        -8822   -8830   -8800
                        -4300   -4500   -4900   -5100   -5300   -4700   -5500   -5700   -5800
                        -6000   -6200
'    Sixth ring of permanent reflector
 cylinder   9006 51.3375     30.48     -30.48
 media       110     1    9006   -9005
                        -8861   -8862
                        -7905   -7906
                        -8005   -8006
                        -8822   -8830   -8800
                        -4700   -5500   -5700   -5800   -6000   -6200
                        -8214   -8234
'    Seventh ring of permanent reflector
 cylinder   9007 54.61       30.48     -30.48
 media       111     1    9007   -9006
                        -8861
                        -7905
                        -8005
                        -8822   -8800
                        -8214   -8234
'    water region--above core region
 cylinder   4104 54.61      149.9907   -30.48
 media         6     1    4104   -9007   -4092   -4800
'    water region--below core region
 cylinder   4105 54.61      149.9907  -149.9907
 media         4     1    4105   -4104   -4092
'    Bit of water
 cylinder   4110 55.245     149.9907  -149.9907
 media         7     1    4110   -4105
                        -8861
                        -7905
                        -8005
                        -8800
                        -8214   -8234
'    Reflector Container
 cylinder   4120 56.8325    149.9907  -149.9907
 media        24     1    4120   -4110    -101     201
                        -8861
                        -7905
                        -8005
                        -8800
                        -8214   -8234
 media        24     1    4120   -4110     101
 media        24     1    4120   -4110    -201
 boundary   4120
' end unit 4100
'
unit 4160
'     water just outside outer reflector container
 cylinder   4130 119.38     149.9908   -149.9908
 hole       4100
'    HB-1
 cylinder   8875  6.35        0.0     -193.04      origin x=27.05350   y=29.84997  rotate a1=30  a2=90
 cylinder   8870  5.08        0.0     -193.04      origin x=27.19193   y=29.61020  rotate a1=30  a2=90
 media        24     1    4160    8875   -8870
 media        60     1    4160    8870
'    HB-2 (Radial Tube)
 cylinder   7903 10.795       0.0      -22.22774   origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 cylinder   7900  8.95604     0.0      -22.22774   origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4160    7903   -7900
 media        60     1    4160    7900
 cone       7934 10.795     -22.22774   13.96365  -34.0533    origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 cone       7933  8.95604   -22.22774   11.49350  -34.0533    origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4160    7934   -7933
 media        60     1    4160    7933
 cylinder   7936 13.96365   -34.0533  -193.04      origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 cylinder   7935 11.49350   -34.0533  -193.04      origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4160    7936   -7935
 media        60     1    4160    7935
 cone       7937 15.062       0.0       17.872     20.0       origin x=-138.43    y=0.0       rotate a1=90  a2=90
 media         7     1   -4130    7937   -7936
 cylinder   7939 33.17875     0.0       17.87      origin x=-138.43    y=0.0       rotate a1=90  a2=90
 media        50     1    4160   -4150    7939   -7937
'    HB-3
 cylinder   8003  6.35        0.0     -293.04      origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 cylinder   8000  5.08        0.0     -293.04      origin x=9.06086    y=-37.64613 rotate a1=150 a2=90
 media        24     1    4160    8003   -8000
 media        60     1    4160    8000
'    HB-4 (Cold Source)
```

```
cylinder   8800  8.89       29.0      -99.0       origin x=59.88554   y=-27.01680 rotate a1=210 a2=90
cylinder   8814  7.62       29.0      -99.0       origin x=59.88554   y=-27.01680 rotate a1=210 a2=90
cylinder   8817  5.63245    29.0      -99.0       origin x=59.88554   y=-27.01680 rotate a1=210 a2=90
plane      8845          zpl=1.0                  origin x=59.88554   y=-27.01680 rotate a1=210 a2=90
cone       8807  7.6183      7.63       8.9067    -0.1 origin x=63.69554   y=-33.61591 rotate a1=210 a2=90
cone       8810  5.6310      7.63       6.7325    -0.1 origin x=63.69554   y=-33.61591 rotate a1=210 a2=90
plane      8846          zpl=1.0                  origin x=63.69554   y=-33.61591 rotate a1=210 a2=90
cylinder   8803  6.71830    29.0      -99.0       origin x=63.69554   y=-33.61591 rotate a1=210 a2=90
media        5     1            8845    8800   -8814
media       24     1            8845    8814   -8817
media       60     1            8845    8817   -8622   -8624
media        5     1   -8845    8846    8800   -8807
media       24     1   -8845    8846    8800    8807   -8810
media       60     1   -8845    8846    8810   -8622   -8624
media       24     1   -8846    4160    8800   -8803
media       60     1   -8846    4160    8803   -8622   -8624
'
cylinder   8621  0.635                0.0 -199.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
cylinder   8622  0.71501              0.0 -199.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
cylinder   8623  0.635                0.0 -199.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
cylinder   8624  0.71501              0.0 -199.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
media       24     1    4160            8622   -8621
media      560     1    4160            8621
media       24     1    4160            8624   -8623
media      560     1    4160            8623
'      ------------------------------------
'      Engineering Facilities (Slant tubes)
'      ------------------------------------
plane      101          zpl=1.0    con=-30.48
plane      201          zpl=1.0    con=30.48
'    --------------EF-1
cylinder   8210  4.1834             99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8211  4.8819             99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8212  5.08               99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8213  5.3975             99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8214  5.87375            99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
cylinder   8215  6.50875            99.0  -99.0   origin x=46.110552  y=30.427406 rotate a1=33.42 a2=-49 a3=90
media        7     1    4130    -101     201    8210
media       24     1    4130    -101     201    8211   -8210
media        5     1    4130    -101     201    8212   -8211
media       24     1    4130    -101     201    8213   -8212
media        7     1    4130    -101     201    8214   -8213
media       24     1    4130    -101     201    8215   -8214
'    --------------EF-2
cylinder   8230  4.1834             99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8231  4.8819             99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8232  5.08               99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8233  5.3975             99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8234  5.87375            99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
cylinder   8235  6.50875            99.0  -99.0   origin x=-11.410619  y=54.053749 rotate a1=101.92 a2=-49 a3=90
media        7     1    4130    -101     201    8230
media       24     1    4130    -101     201    8231   -8230
media        5     1    4130    -101     201    8232   -8231
media       24     1    4130    -101     201    8233   -8232
media        7     1    4130    -101     201    8234   -8233
media       24     1    4130    -101     201    8235   -8234
'
media        7     1    4130    -101     201
                       -8875
                       -7903   -7934   -7936
                       -8003
                       -8800
                       -8215   -8235
media        7     1    4130     101
media        7     1    4130    -201
'    --------------Pressure vessel
cylinder   4140 119.6975   149.9908   -149.9908
media       40     1    4140   -4130
                       -8875
                       -7937
                       -8003
                       -8800
cylinder   4150 127.0      149.9908   -149.9908
media       50     1    4150   -4140
                       -8875
                       -7937
                       -8003
                       -8800
cylinder   4160 127.254    149.9908   -149.9908
media       40     1    4160   -4150
                       -8875
```

```
                      -7939
                      -8003
                      -8800
 boundary   4160
' end unit 4160
'
unit 4170
'     water just outside pressure vessel
 cylinder   4170 274.32     149.9909   -149.9909
 hole       4160
'    HB-1
 cylinder   8875  6.35        0.0     -293.04      origin x=27.05350   y=29.84997  rotate a1=30  a2=90
 cylinder   8870  5.08        0.0     -293.04      origin x=27.19193   y=29.61020  rotate a1=30  a2=90
 media        24     1    4170    8875   -8870
 media        60     1    4170    8870
'    HB-2 (Radial Tube)
 cylinder   7936 13.96365   -34.0533  -293.04      origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 cylinder   7935 11.49350   -34.0533  -293.04      origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4170    7936   -7935
 media        60     1    4170    7935
 cone       7937 15.062       0.0       17.872     20.0       origin x=-138.43    y=0.0       rotate a1=90  a2=90
 media         7     1    7937    7939   -7936
 cylinder   7939 33.17875     0.0       17.87      origin x=-138.43    y=0.0       rotate a1=90  a2=90
 media        50     1    7939   -7937   -7936
'    HB-3
 cylinder   8003  6.35        0.0     -293.04      origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 cylinder   8000  5.08        0.0     -293.04      origin x=9.06086    y=-37.64613 rotate a1=150 a2=90
 media        24     1    4170    8003   -8000
 media        60     1    4170    8000
'    HB-4 (Cold Source)
 cylinder   8800  8.89       99.0        0.0       origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8803  6.71830    99.0        0.0       origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8910 13.97        5.3975   -99.0       origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8911 13.335       0.0      -99.0       origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8912 12.7         0.0       -2.54      origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8902  6.71830     0.0       -2.54      origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8903  6.71830     0.0       -0.3175    origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 media        24     1            8800   -8803
 media        60     1            8803   -8622   -8624
 media        24     1            8910   -8800   -8911
 media        60     1            8911   -8912
 media        24     1            8912   -8902
 media        60     1            8902   -8903
 media        24     1            8903
'
 cylinder   8621  0.635                0.0 -299.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
 cylinder   8622  0.71501              0.0 -299.0 origin x=36.71307   y=21.19630  rotate a1=210 a2=90
 cylinder   8623  0.635                0.0 -299.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
 cylinder   8624  0.71501              0.0 -299.0 origin x=29.71801   y=17.15770  rotate a1=210 a2=90
 media        24     1            8803    8622   -8621
 media       560     1            8803    8621
 media        24     1            8803    8624   -8623
 media       560     1            8803    8623
'
 media         8     1    4170
                      -8875
                      -7936   -7939
                      -8003
                      -8800   -8910
 boundary   4170
' end unit 4170
'
unit 9997
'     biological shielding
 cylinder   4018 720.0      149.991    -149.991
 hole       4170
'    HB-1
 cylinder   8875  6.35        0.0     -750.0       origin x=27.05350   y=29.84997  rotate a1=30  a2=90
 cylinder   8870  5.08        0.0     -750.0       origin x=27.19193   y=29.61020  rotate a1=30  a2=90
 media        24     1    4018    8875   -8870
 media        60     1    4018    8870
'    HB-2 (Radial Tube)
 cylinder   7936 13.96365     0.0     -750.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 cylinder   7935 11.49350     0.0     -750.0       origin x=-43.57606  y=0.0       rotate a1=90  a2=90
 media        24     1    4018    7936   -7935
 media        60     1    4018    7935
'    HB-3
 cylinder   8003  6.35        0.0     -750.0       origin x=8.92243    y=-37.88590 rotate a1=150 a2=90
 cylinder   8000  5.08        0.0     -750.0       origin x=9.06086    y=-37.64613 rotate a1=150 a2=90
 media        24     1    4018    8003   -8000
 media        60     1    4018    8000
```

```
'    HB-4 (Cold Source)
 cylinder   8910 13.97        0.0     -211.7725    origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8911 13.335       0.0     -211.455     origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 cylinder   8912 13.97        0.0     -750.0       origin x=132.27554  y=-152.39995 rotate a1=210 a2=90
 media        60     1    4018    8911
 media        24     1    4018    8910   -8911
 media        60     1    4018    8912   -8910
'
 media        62     1    4018
                         -8875
                         -7936
                         -8003
                         -8912
 boundary   4018
' end unit 9997
'

global unit 9999
 cylinder   9999 721.0      150.0      -150.0
 hole       9997
 media         0     1    9999
 boundary   9999

end geometry

read boun all=vacuum end boun

read plot
ttl='-003.Core Cross Section at z=0 cm (Full Model)'
  TYP=XY
  XUL=-750.0 YUL=750.0  ZUL=0.
  XLR=750.0  YLR=-750.0 ZLR=0.
  NAX=1280 end
ttl='Target Basket Cross Section at z=0 cm'
  TYP=XY
  XUL=-8.0 YUL=8.0  ZUL=0.
  XLR=8.0  YLR=-8.0 ZLR=0.
  NAX=1280 end
ttl='Core Cross Section at z=+50 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=+50.
  XLR=80.0  YLR=-80.0 ZLR=+50.
  NAX=1280 end
ttl='Core Cross Section at z=+35 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=+35.
  XLR=80.0  YLR=-80.0 ZLR=+35.
  NAX=1280 end
ttl='Core Cross Section at z=+5 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=+5.
  XLR=80.0  YLR=-80.0 ZLR=+5.
  NAX=1280 end
ttl='Core Cross Section at z=0 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=0.
  XLR=80.0  YLR=-80.0 ZLR=0.
  NAX=1280 end
ttl='HB-1 Tip Cross Section at z=0 cm'
  TYP=XY
  XUL=19.0 YUL=38.0   ZUL=0.
  XLR=35.0  YLR=22.0 ZLR=0.
  NAX=1280 end
ttl='HB-2 Tip Cross Section at z=0 cm'
  TYP=XY
  XUL=-59.5 YUL=14.5   ZUL=0.
  XLR=-30.5  YLR=-14.5 ZLR=0.
  NAX=1280 end
ttl='HB-3 Tip Cross Section at z=0 cm'
  TYP=XY
  XUL=0.5 YUL=-29.5   ZUL=0.
  XLR=16.5  YLR=-45.5 ZLR=0.
  NAX=1280 end
ttl='HB-4 Tip Cross Section at z=0 cm'
  TYP=XY
  XUL=29.0 YUL=18.0   ZUL=0.
  XLR=53.0  YLR=-6.0  ZLR=0.
  NAX=1280 end
ttl='Core Cross Section at z=0 cm'
  TYP=XY
  XUL=-200.0 YUL=200.0  ZUL=0.
```

```
  XLR=200.0  YLR=-200.0 ZLR=0.
  NAX=1280 end
ttl='Core Cross Section at z=-5 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=-5.
  XLR=80.0  YLR=-80.0 ZLR=-5.
  NAX=1280 end
ttl='Core Cross Section at z=-35 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=-35.
  XLR=80.0  YLR=-80.0 ZLR=-35.
  NAX=1280 end
ttl='Core Cross Section at z=-50 cm'
  TYP=XY
  XUL=-80.0 YUL=80.0  ZUL=-50.
  XLR=80.0  YLR=-80.0 ZLR=-50.
  NAX=1280 end
ttl='Vertical View of the HFIR Core, y=0 cm'
  TYP=XZ
  XUL=-80.0 YUL=0.  ZUL=151.
  XLR=80.0  YLR=0. ZLR=-151.
  UAX=1.0 WDN=-1.0 NAX=1280 end
ttl='Vertical View of the HFIR Core, y=7.296944 cm'
  TYP=XZ
  XUL=-80.0 YUL=7.296944  ZUL=151.
  XLR=80.0  YLR=7.296944 ZLR=-151.
  UAX=1.0 WDN=-1.0 NAX=1280 end
ttl='Vertical View of the HFIR Core, y=13.445625 cm'
  TYP=XZ
  XUL=-80.0 YUL=13.445625  ZUL=151.
  XLR=80.0  YLR=13.445625 ZLR=-151.
  UAX=1.0 WDN=-1.0 NAX=1280 end
ttl='Vertical View of the HFIR Core, y=23.765063 cm'
  TYP=XZ
  XUL=-80.0 YUL=23.765063  ZUL=151.
  XLR=80.0  YLR=23.765063 ZLR=-151.
  UAX=1.0 WDN=-1.0 NAX=1280 end
ttl='Vertical View of the HFIR Core, y=26.311930 cm'
  TYP=XZ
  XUL=-80.0 YUL=26.311930  ZUL=151.
  XLR=80.0  YLR=26.311930 ZLR=-151.
  UAX=1.0 WDN=-1.0 NAX=1280 end
end plot

end data
end
```

INTERNAL DISTRIBUTION

1. B. J. Ade (*adebj@ornl.gov*)
2. J. L. Binder (*binderjl@ornl.gov*)
3. S. M. Bowman (*bowmansm@ornl.gov*)
4. B. L. Broadhead (*broadheadbl@ornl.gov*)
5. C. Bryan (*bryancd@ornl.gov*)
6. D. Chandler (*chandlerd@ornl.gov*)
7. D.H. Cook (*cookdh@ornl.gov*)
8. R.A. Crone (*cronera@ornl.gov*)
9. M.E. Dunn (*dunnme@ornl.gov*)
10. R.J. Ellis (*ellisrj@ornl.gov*)
11. J.D. Freels (*freelsjd@ornl.gov*)
12. I.C. Gauld (*gauldi@ornl.gov*)
13. J.C. Gehin (*gehinjc@ornl.gov*)
14. R.E. Grove (*grovere@ornl.gov*)
15. G.J. Hirtz (*hirtzgj@ornl.gov*)
16. R.W. Hobbs (*hobbsrw@ornl.gov*)
17. A.S. Icenhour (*icenhouras@ornl.gov*)
18. D. Ilas (*ilasd@ornl.gov*)
19. G. Ilas (*ilasg@ornl.gov*)
20. M.A. Jessee (*jesseema@ornl.gov*)
21. G.I. Maldonado (*maldonadogi@ornl.gov*)
22. G.T. Mays (*maysgt@ornl.gov*)
23. J.L. McDuffee (*mcduffeej@ornl.gov*)
24. C.V. Parks (*parkscv@ornl.gov*)
25. J.L. Peterson (*petersonjl@ornl.gov*)
26. T. Powers (*powerstp@ornl.gov*)
27. B.T. Rearden (*reardenb@ornl.gov*)
28. I. Remec (*remeci@ornl.gov*)
29. J.M. Risner (*risnerjm@ornl.gov*)
30. K.A. Smith (*smithka@ornl.gov*)
31. T.E. Valentine (*valentinete@ornl.gov*)
32. J.C. Wagner (*wagnerjc@ornl.gov*)
33. M.L. Williams (*williamsml@ornl.gov*)
34. G.L. Yoder (*yodergljr@ornl.gov*)
35. S.J. Zinkle (*zinklesj@ornl.gov*)
36. ORNL Laboratory Records (*hamrindr@ornl.gov*)

EXTERNAL DISTRIBUTION

None