



# **Mixed Oxide Fuel Fabrication Facility**

## **Criticality Code Validation**

### **Part I**

Docket Number 070-03098

Prepared by  
Duke Cogema Stone & Webster

June 2001

Under  
U.S. Department of Energy  
Contract DE-AC02-99-CH10888

## TABLE OF CONTENTS

	Page
<b>EXECUTIVE SUMMARY .....</b>	<b>5</b>
<b>1. INTRODUCTION.....</b>	<b>6</b>
1.1 PURPOSE .....	6
1.2 SCOPE .....	6
1.3 APPLICABILITY .....	6
1.4 BACKGROUND.....	6
1.4.1 Overall MFFF Design .....	6
1.4.2 Regulatory Requirements, Guidance, and Industrial Standards.....	7
<b>2. CALCULATIONAL METHOD .....</b>	<b>8</b>
<b>3. CRITICALITY CODE VALIDATION METHODOLOGY .....</b>	<b>9</b>
3.1 DETERMINATION OF BIAS.....	10
3.2 USL METHOD 1: CONFIDENCE BAND WITH ADMINISTRATIVE MARGIN.....	12
3.3 USL METHOD 2: SINGLE-SIDED UNIFORM WIDTH CLOSED INTERVAL APPROACH .....	14
3.4 APPLICATION OF THE USL .....	16
<b>4. MFFF DESIGN APPLICATION CLASSIFICATION .....</b>	<b>19</b>
4.1 DESIGN APPLICATION (1) – PU-NITRATE SOLUTION.....	19
4.2 DESIGN APPLICATION (2) – MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES .....	19
<b>5. BENCHMARK EXPERIMENTS.....</b>	<b>22</b>
5.1 AOA (1) - PU-NITRATE SOLUTION.....	22
5.2 AOA (2) - MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES .....	22
<b>6. ANALYSIS OF VALIDATION RESULTS.....</b>	<b>27</b>
6.1 DESIGN APPLICATION (1) – AQUEOUS SOLUTIONS OF PU-NITRATE .....	27
6.1.1 USL with EALF and H/Pu Ratio.....	27
6.1.2 USL with <sup>240</sup> Pu Content in Plutonium .....	27
6.1.3 Effect of Reflectors .....	28
6.1.4 Summary of USL for AOA(1) Aqueous Solutions of Pu-Nitrate .....	28
6.2 DESIGN APPLICATION (2) – MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES .....	28
6.2.1 USL with EALF and $v^m/v^f$ Ratio.....	29
6.2.2 USL with PuO <sub>2</sub> Content in MOX.....	29
6.2.3 Summary of USL for AOA(2) MOX Pellets, Fuel Rods, and Fuel Assemblies .....	29
<b>7. CONCLUSIONS .....</b>	<b>38</b>

## 8. REFERENCES..... 39

ATTACHMENT 1 – CRITICAL CALCULATION RESULTS FOR AOA (1)

ATTACHMENT 2 – CRITICAL CALCULATION RESULTS FOR AOA (2)

ATTACHMENT 3 – BORATED CONCRETE REFLECTORS

ATTACHMENT 4 – CONCRETE AND CD/WATER REFLECTORS

ATTACHMENT 5 – SAMPLE STATISTICAL CALCULATION

ATTACHMENT 6 – INPUT FILES

### LIST OF TABLES

Table 3-1. Characteristics of the Five MFFF Application Areas *	17
Table 4-1. Anticipated Criticality Calculation Derived Characteristics for Design Applications Involving Pu-Nitrate Solutions	20
Table 4-2. Anticipated Criticality Calculation Derived Characteristics for Design Application MOX Pellets, Fuel Rods, and Fuel Assemblies	21
Table 5-1. Critical Experiments Selected for AOA(1)	23
Table 5-2. AOA (1) – Comparison of Key Parameters	24
Table 5-3. Critical Experiments Selected for AOA(2)	25
Table 5-4. AOA (2) – Comparison of Key Parameters	26
Table 6-1. Summary of USL Calculations for AOA(1)	31
Table 6-2. Summary of USL Calculations for AOA(2)	31

### LIST OF FIGURES

Figure 3-1. Overview of the Criticality Analysis Process of the MFFF	17
Figure 6-1. Group AOA(1) Experiments Histogram of $k_{eff}$ Occurrences	32
Figure 6-2. Design Application Area (1): Pu-Nitrate Solution; $k_{eff}$ as Function of EALF	32
Figure 6-3. Design Application Area (1): Pu-Nitrate Solution; $k_{eff}$ as Function of H/Pu	33
Figure 6-4. Design Application Area (1): Calculated $k_{eff}$ as Function of $^{240}\text{Pu}$ Content	33
Figure 6-5. Group AOA(2) Experiments Histogram of $k_{eff}$ Occurrences	34
Figure 6-6. Design Application (2) – MOX Pellets, Fuel Rods, and Fuel Assemblies: $k_{eff}$ as Function of EALF	35
Figure 6-7. Design Application (2) – MOX Pellets, Fuel Rods, and Fuel Assemblies: $k_{eff}$ as Function of $v^m/v^f$	36
Figure 6-8. Calculated $k_{eff}$ Values and Related USL as Function of $\text{PuO}_2$ Content	37

## LIST OF ACRONYMS

ANS	American Nuclear Society
ANSI	American National Standards Institute
AOA	area of applicability
CFR	Code of Federal Regulations
DCS	Duke Cogema Stone & Webster
DOE	U.S. Department of Energy
EALF	energy of average lethargy causing fission
FA	fuel assembly
LTB	lower tolerance band
MFFF	Mixed Oxide Fuel Fabrication Facility
MOX	mixed oxide
NRC	U.S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
RSICC	Radiation Safety Information Computational Center
USL	upper safety limit

## EXECUTIVE SUMMARY

The report documents the validation of the nuclear criticality safety codes to be used in the design of the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF), to be owned by the U.S. Department of Energy (DOE) and operated by the licensee, Duke Cogema Stone & Webster (DCS). This report is applicable to the validation of the SCALE 4.4 code package (Oak Ridge National Laboratory [ORNL] 1995) using the CSAS26 (KENOVI) sequence and the 238 energy group cross section library 238GROUPDF5.

Title 10 Code of Federal Regulations (CFR) §70.61(d) requires that all nuclear processes remain subcritical under all normal and credible abnormal conditions. In order to establish that a system or process will be subcritical under all normal and credible conditions, it is necessary to establish acceptable subcritical limits for the operation and then show that the proposed operation will not exceed those values. In order to comply with this requirement, the *American National Standard for Nuclear Criticality in Operations with Fissionable Material Outside Reactors* (American National Standards Institute/American Nuclear Society [ANSI/ANS 1983]) and the U.S. Nuclear Regulatory Commission (NRC) *Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility* (NRC 2000), require that a validation be performed that will (1) demonstrate the adequacy of the margin of subcriticality for safety by assuring that the margin is large compared to the uncertainty in the calculated value of  $k_{\text{eff}}$  and (2) determine the area(s) of applicability (AOA) and use of the code within the AOA, including justification for extending the AOA by using trends in the bias.

Five design AOAs are established to cover the range of processes and fissile materials in the MFFF. The five AOAs are as follows: (1) Pu-nitrate aqueous solutions (homogeneous systems), (2) MOX pellets, fuel rods, and fuel assemblies (heterogeneous systems), (3) PuO<sub>2</sub> powders, (4) MOX powders, and (5) aqueous solutions of Pu compounds (Pu-oxalate solutions). This report addresses only the first two AOAs: (1) Pu-nitrate aqueous solutions (homogeneous systems), and (2) MOX pellets, fuel rods, and fuel assemblies (heterogeneous systems). The remaining three AOAs will be addressed in a separate report scheduled to be completed later in 2001.

The report concludes that the upper safety limit (USL) for the first design AOA (i.e., Pu-nitrate solutions) is 0.9399, and the USL for the second design AOA (i.e., MOX pellets, fuel rods, and fuel assemblies) is 0.9350. The USL accounts for the computational bias, uncertainties, and a 0.05 administrative margin.

## **1. INTRODUCTION**

### **1.1 PURPOSE**

The purpose of this report is to validate the criticality codes and determine the bias to be used for performing nuclear criticality safety calculations and analyses of the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF), to be owned by the U.S. Department of Energy (DOE) and operated by the licensee, Duke Cogema Stone & Webster (DCS).

### **1.2 SCOPE**

The scope of this report is limited to the validation of the SCALE 4.4 code package (Oak Ridge National Laboratory [ORNL] 1995) with the 238 energy group cross-section library 238GROUPNDF5 for nuclear criticality safety calculations of the MFFF.

### **1.3 APPLICABILITY**

Five design areas of applicability (AOAs) are established to cover the range of processes and fissile materials in the MFFF. The five AOAs are as follows:

- Pu-nitrate aqueous solutions (homogeneous systems)
- MOX pellets, fuel rods, and fuel assemblies (heterogeneous systems)
- PuO<sub>2</sub> powders
- MOX powders
- Aqueous solutions of Pu compounds (Pu-oxalate solutions).

This report addresses only the first two AOAs:

- Pu-nitrate aqueous solutions (homogeneous systems)
- MOX pellets, fuel rods, and fuel assemblies (heterogeneous systems).

The remaining three AOAs will be addressed in a separate report scheduled to be completed later in 2001.

## **1.4 BACKGROUND**

### **1.4.1 Overall MFFF Design**

The MFFF is designed to produce MOX fuel assemblies on an industrial scale from a mixture of uranium and plutonium oxides for use in mission light-water reactors. The MFFF will be constructed on a DOE site and will be licensed by the U.S. Nuclear Regulatory Commission (NRC) under Title 10 Code of Federal Regulations (CFR) Part 70. The facility is designed to applicable U.S. codes and standards and operated by DCS, a private consortium under contract to DOE. The goal of the contract is to design, construct, and operate a facility to fabricate MOX

fuel based on existing technology from the COGEMA MELOX and La Hague plants in France. To maximize the benefit of the existing technology, process and equipment designs from the MELOX and La Hague plants are duplicated, to the maximum extent possible, in the design of the new plant.

The feed material is depleted uranium dioxide and surplus plutonium dioxide (from the Pit Disassembly and Conversion Facility) supplied by DOE. The impurities in the plutonium dioxide feed are extracted by the Aqueous Polishing Process. The MOX fuel fabrication process blends this “polished” plutonium dioxide with depleted uranium dioxide to form mixed oxide pellets. These pellets are loaded into the fuel rods, which are integrated into fuel assemblies. The nuclear fuel assemblies are transported for use in specific U.S. commercial reactors as nuclear fuel. The MFFF is designed to process 3.5 metric tons annually, for a total disposition of 33 metric tons of plutonium (as dioxide).

#### 1.4.2 Regulatory Requirements, Guidance, and Industrial Standards

Title 10 CFR §70.61(d) requires that “*under normal and credible abnormal conditions, all nuclear processes are subcritical, including use of an approved safety margin of subcriticality for safety.*” In order to comply with this requirement, NUREG 1718 (NRC 2000) and ANSI/ANS-8.1 (American National Standards Institute/American Nuclear Society [ANSI/ANS 1983]) require a validation report that will (1) demonstrate the adequacy of the margin of subcriticality for safety by assuring that the margin is large compared to the uncertainty in the calculated value of  $k_{\text{eff}}$  and (2) determine the AOA and use of the code within the AOA, including justification for extending the AOA by using trends in the bias.

NUREG 1718 further states that the validation report should contain “*a description of the AOA that identifies the range of values for which valid results have been obtained for the parameters used in the methodology. As defined in ANSI/ANS 8.1-1983, the AOA is the range of material compositions and geometric arrangements within which the bias of a calculational method is established. Other variables that may affect the neutronic behavior of the calculational method should also be specified in the definition of the AOA. Particular attention should be given to validating the code for calculations involving mixed oxides of differing isotopics and defining the isotopic ranges covered by the available benchmark experiments. In accordance with the provisions in ANSI/ANS-8.1-1983 (applicable section is Section 4.3.2), any extrapolation of the AOA beyond the physical range of the data should be supported by an established mathematical methodology.*”

## **2. CALCULATIONAL METHOD**

The SCALE 4.4 code package is the computational system used for MFFF criticality analyses. The SCALE 4.4 code package is available from the Radiation Safety Information Computational Center (RSICC). The SCALE 4.4 code package is installed and verified on the SGN SUN hardware platform.

SCALE 4.4 is a collection of modules designed to perform criticality, shielding, and thermal calculations. The criticality modules are validated in this report. Functional modules may be run individually or sequentially in a designated as a criticality safety control sequence (CSAS). A control sequence is also referred to as a control module. The CSAS26 and CSAS26X (KENO VI) sequences are used for MFFF criticality analyses using the using the 238 energy group cross-section library 238GROUPNDF5 based on the ENDF/B-V data file. The CSAS sequences process the cross sections via the BONAMI and NITAWL-II modules within SCALE. The calculation of  $k_{\text{eff}}$  is performed with the Monte Carlo code KENO VI.



### 3. CRITICALITY CODE VALIDATION METHODOLOGY

In order to establish that a system or process will be subcritical under all normal and credible conditions, it is necessary to establish acceptable subcritical limits for the operation and then show that the proposed operation will not exceed those values.

Figure 3-1 shows how the validation process fits within the overall MFFF nuclear criticality analysis process. The first step involves the procurement, installation, and verification of the criticality software on computer platform. For the MFFF, the SCALE 4.4 code package system was procured, installed, and verified on the SGN SUN hardware platform. This step is followed by the validation of the criticality software, which is the purpose of this report. The final step involves the criticality safety design analysis calculations, which are performed and presented in separate reports.

The criticality code validation methodology can be divided into four steps:

- Identify general MFFF design applications
- Select applicable benchmark experiments and group into AOAs
- Model and calculate  $k_{\text{eff}}$  values of selected critical benchmark experiments
- Perform statistical analysis of results to determine computational bias and upper safety limit (USL).

The first step is to identify the MFFF design applications and key parameters associated with the normal and upset design conditions. Table 3-1 lists some key parameters for the MFFF.

The second step involves several substeps. First, based on the key parameters, the AOA and expected range of the key parameter are identified. ANSI/ANS-8.1 (ANSI/ANS 1998) defines the AOA as “*the limiting ranges of material composition, geometric arrangements, neutron energy spectra, and other relevant parameters (such as heterogeneity, leakage, interaction, absorption, etc.) within which the bias of a computational method is established.*” Five AOAs are established for the MFFF: (1) Pu-nitrate solutions; (2) MOX pellets, fuel rods, and fuel assemblies; (3) PuO<sub>2</sub> powders; (4) MOX powders; and (5) aqueous solutions of Pu compounds. These AOAs are defined and presented in Section 4. After identifying the AOAs, a set of critical benchmark experiments is selected. Benchmark experiments for the five AOAs are selected from the references listed in the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (Nuclear Energy Agency 1999), the *Guide to Verification and Validation of the SCALE-4 Criticality Safety Software* (Emmett and Jordan 1996), and the *Critical Experiments: Benchmarks (Pu-U systems)* (Bierman 1974). A description of all relevant experiments used for an AOA is provided in Section 5.

The third step involves modeling the critical experiments and calculating the  $k_{\text{eff}}$  values of the selected critical benchmark experiments.<sup>1</sup> Attachments 1 and 2 present calculated results.

---

<sup>1</sup> The design application calculations and validation calculations are performed with the SCALE 4.4 sequences CSAS26 and CSAS26X (KENO VI) using the 238 energy group cross-section library 238GROUPNDF5 on the same hardware platform.

The final step involves the statistical analysis of the results in order to calculate the computational bias and USL. Section 6 presents the computational bias and USL results.

### 3.1 DETERMINATION OF BIAS

ANSI/ANS-8.1 (ANSI/ANS 1983) requires a determination of the calculational bias by *“correlating the results of criticality experiments with results obtained for these same systems by the method being validated.”* The analyst shall use *“sufficient correlation to determine if major changes in the bias can occur over the range of variables in the operation being analyzed. Where the extrapolation is large, supplement the method with other calculation methods to provide a better estimate of the bias in the extended area.”*

Calculational bias is the systematic difference between experimental data and calculated results. The simplest technique is to find the difference between the average value of the calculated results of critical benchmark experiments and 1.0. This technique gives a constant bias over a defined range of applicability.

Another technique is to find the difference between a regression fit of the calculated results of critical benchmark experiments and 1.0, as a function of an independent variable (e.g., enrichment, moderator-to-fuel ratio, etc.). As a rule, the bias is not a constant, but is dependent upon an independent variable, usually the degree of moderation of the neutrons. For example, the bias for an unmoderated system in which fissioning occurs with fast neutrons would not be expected to be the same as for a moderated system in which fissioning occurs with slow neutrons.

The recommended approach for establishing subcriticality based on numerical calculations of the neutron multiplication factor is prescribed in Section 5.1 of ANSI/ANS-8.17 (ANSI/ANS 1984). The criteria to establish subcriticality requires that for a design application (system) to be considered as subcritical, the calculated multiplication factor for the system,  $k_s$ , must be less than or equal to an established maximum allowed multiplication factor based on benchmark calculations and uncertainty terms that is:

$$k_s \leq k_c - \Delta k_s - \Delta k_c - \Delta k_m \quad (\text{Eq. 3.1})$$

where:

- $k_s$  = the calculated allowable maximum multiplication factor ( $k_{\text{eff}}$ ) of the design application (system)
- $k_c$  = the mean  $k_{\text{eff}}$  value resulting from the calculation of benchmark critical experiments using a specific calculation method and data
- $\Delta k_s$  = the uncertainty in the value of  $k_s$
- $\Delta k_c$  = the uncertainty in the value of  $k_c$
- $\Delta k_m$  = the administrative margin to ensure subcriticality.

Sources of uncertainty that determine  $\Delta k_s$  include:

- Statistical and/or convergence uncertainties
- Material and fabrication tolerances
- Limitations in the geometric and/or material representations used.

Sources of uncertainty that determine  $\Delta k_c$  include:

- Uncertainties in critical experiments
- Statistical and/or convergence uncertainties in the computation
- Extrapolation outside of the range of experimental data
- Limitations in the geometric and/or material representations used.

An assurance of subcriticality requires the determination of an acceptable margin based on known biases and uncertainties. The USL is defined as the upper bound for an acceptable calculation.

Critical benchmark experiments used to determine calculational bias ( $\beta$ ) should be similar in composition, configuration, and nuclear characteristics to the system under examination. The range of applicability may be extended beyond the range of conditions represented by the benchmark experiments by extrapolating the trends established for the bias.  $\beta$  is related to  $k_c$  as follows:

$$\beta = k_c - 1 \quad (\text{Eq. 3.2})$$

$$\Delta\beta = \Delta k_c \quad (\text{Eq. 3.3})$$

Using this definition of bias, the condition for subcriticality in Eq. 3.1 is rewritten as:

$$k_s + \Delta k_s \leq 1 - \Delta k_m + \beta - \Delta\beta \quad (\text{Eq. 3.4})$$

A system is acceptably subcritical if a calculated  $k_{\text{eff}}$  plus calculational uncertainties lies at or below the USL.

$$k_s + \Delta k_s \leq \text{USL} \quad (\text{Eq. 3.5})$$

The USL can be written as:

$$\text{USL} = 1 - \Delta k_m + \beta - \Delta\beta \quad (\text{Eq. 3.6})$$

Bias is negative if  $k_c < 1$  and positive if  $k_c > 1$ . For conservatism, a positive bias is set equal to zero for the purpose of defining the USL.  $\Delta\beta$  is typically determined at the 95% confidence level.

The USL takes into account bias, uncertainties, and administrative and/or statistical margins such that the calculated configuration will be subcritical with a high degree of confidence.

$\beta$  is related to system parameters and may not be constant over the range of a parameter of interest. If  $k_{\text{eff}}$  values for benchmark experiments vary as a function of a system parameter, such as enrichment or degree of moderation, then  $\beta$  can be determined from a best fit as a function of the parameter upon which it is dependent. Extrapolation outside the range of validation must take into account trends in the bias.

Both  $\Delta\beta$  and  $\beta$  can vary with a given parameter, and the USL is typically expressed as a function of the parameter. Normally, the most important system parameter that affects bias is the degree of moderation of the neutrons. This parameter can be expressed in several different ways, such as the energy of average lethargy causing fission (EALF), fuel/moderator volume ratio ( $v^m/v^f$ ), or moderator-to-fuel atomic ratio (H/Pu ratio).

In general, the “bias” can be broken down into components caused by system modeling error, code modeling inaccuracies, cross-sectional inaccuracies, etc. Biases associated with individual inaccuracies are usually combined into a total bias to represent the combined effect from all sources that prevent code and cross-sections from calculating the exact critical value of  $k_{\text{eff}}$ .

One or two calculations are insufficient to determine calculational bias. In practice, it is necessary to determine the “average bias” for a group of experiments. A statistical analysis of the variation of biases around this average value is used to establish an uncertainty associated with the bias value when it is applied to a future calculation of a similar critical system. The lower limit of this band of uncertainty establishes an upper bound for which a future calculation of  $k_{\text{eff}}$  for a similar critical system can be considered subcritical with a high degree of confidence.

NUREG/CR-6361 (Lichtenwalter et al. 1997) describes two statistical methods for the determination of an USL from the bias and uncertainty terms associated with the calculation of criticality. The first method applies a statistical calculation of the bias and its uncertainty, plus an administrative margin to a linear fit of critical experimental benchmark data. The second method applies a statistical calculation to determine a combined lower confidence band and subcritical margin. Both methods assume that the distribution of data points is normal. The following discussion of each method is taken from NUREG/CR-6361 and is based on equations and techniques described in Dyer, Jordan, and Cain (1991); Easter (1985); Bowden and Graybill (1966); Johnson (1968); and Cain (1995).

### **3.2 USL METHOD 1: CONFIDENCE BAND WITH ADMINISTRATIVE MARGIN**

This method applies a statistical calculation of the bias ( $\beta$ ) and its uncertainty ( $\Delta\beta$ ) plus an administrative safety margin ( $\Delta k_m$ ) to a linear fit of calculated results for a selected set of critical experiments. A confidence band ( $W$ ) is determined statistically based on the existing data and a specified level of confidence; the greater the standard deviation in the data or the larger the confidence desired, the larger the band width will be. This confidence band,  $W$ , accounts for uncertainties in the experiments, the calculational approach, and calculational data (e.g., cross sections) and is therefore a statistical basis for  $\Delta\beta$ , the uncertainty in the value of  $\beta$ .  $W$  is defined for a confidence level of  $(1-\gamma_1)$  using the relationship:

$$W = \max \{w(x) \big|_{x_{\min}, x_{\max}}\}, \quad (\text{Eq. 3.7})$$

where:

$$w(x) = t_{1-\gamma_I} s_p \left[ I + \frac{I}{n} + \frac{(x - \bar{x})^2}{\sum_{i=1,n} (x_i - \bar{x})^2} \right]^{\frac{1}{2}}, \quad (\text{Eq. 3.8})$$

and

- $n$  = the number of critical calculations used in establishing  $k_c(x)$
- $t_{1-\gamma_I}$  = the Student - t distribution for  $1 - \gamma_I$  and  $n - 2$  degrees of freedom
- $\bar{x}$  = the mean value of parameter  $x$  in the set of calculations
- $s_p$  = the pooled standard deviation for the set of criticality calculations.

The function  $w(x)$  is a curvilinear function. For simplicity, it is desirable to obtain a constant width margin. Therefore, for conservatism, the confidence band,  $W$ , is defined as the maximum of  $(w(x_{\min}), w(x_{\max}))$ , where  $x_{\min}$  and  $x_{\max}$  are the minimum and maximum values of the independent parameter  $x$ , respectively. Typically,  $W$  is determined at a 95% confidence level.

The pooled standard deviation is obtained from the pooled variance  $(s_p = \sqrt{s_p^2})$ , where  $s_p$  is given as:

$$s_p^2 = s_{k(x)}^2 + s_w^2 \quad (\text{Eq. 3.9})$$

where  $s_{k(x)}^2$  is the variance (or mean square error) of the regression fit, and is given by:

$$s_{k(x)}^2 = \frac{I}{(n-2)} \left[ \sum_{i=1,n} (k_i - \bar{k})^2 - \frac{\left\{ \sum_{i=1,n} (x_i - \bar{x})(k_i - \bar{k}) \right\}^2}{\sum_{i=1,n} (x_i - \bar{x})^2} \right] \quad (\text{Eq. 3.10})$$

and  $s_w^2$  is the within-variance of the data:

$$s_w^2 = \frac{1}{n} \sum_{i=1,n} \sigma_i^2, \quad (\text{Eq. 3.11})$$

where  $\sigma_i$  is the standard deviation associated with  $k_i$  for a Monte Carlo calculation. It is recommended that the individual standard deviations for Monte Carlo calculations be roughly uniform in value for the best results. For deterministic codes that do not have a standard deviation associated with a computed value of  $k$ , the standard deviation is zero. However, this term can also be used as a mechanism to include known uncertainties in experimental data.

In USL Method 1,  $\Delta k_m$  is given an arbitrary administrative value. NUREG-1718 (NRC 2000) states that a “minimum subcritical margin ( $\Delta k_m$ ) of 0.05 is generally considered acceptable without additional justification when both the bias and its uncertainty are determined to be negligible.” The MFFF uses a value of 0.05. Section 6 provides further justification of the 0.05 administrative margin.

Having determined the constant  $W$  and substituting for  $\Delta\beta$  in equation 3.6, the expression for the USL may be written as:

$$\text{USL}_1(x) = 1.0 - \Delta k_m - W + \beta(x). \quad (\text{Eq. 3.12})$$

### 3.3 USL METHOD 2: SINGLE-SIDED UNIFORM WIDTH CLOSED INTERVAL APPROACH

In USL Method 2, sometimes referred to as a lower tolerance band (LTB) approach, statistical techniques are applied to determine a combined lower confidence band plus subcritical margin. In USL Method 1,  $\Delta k_m$  and  $\Delta\beta$  are determined independently, and in USL Method 2 (LTB method), a combined statistical lower bound is determined.

The purpose of this method is to determine a uniform tolerance band over a specified closed interval for a linear least-squares model. The level of confidence in the limit being calculated is  $\alpha$  and is typically in the range of 0.90 to 0.999.

The USL Method 2 is defined as:

$$\text{USL}_2(x) = 1.0 - (C_{\alpha/P} \cdot s_p) + \beta(x) \quad (\text{Eq. 3.13})$$

where  $s_p$  is the pooled variance of  $k_c$  described earlier. The term  $C_{\alpha/P} \cdot s_p$  provides a band for which there is a probability  $P$  with a confidence  $\alpha$  that an additional calculation of  $k_{\text{eff}}$  for a critical system will lie within the band. For example, a  $C_{95/99.5}$  multiplier produces a USL for which there is a 95% confidence that 995 out of 1,000 future calculations of critical systems will yield a value of  $k_{\text{eff}}$  above the USL.

The analysis is over the closed interval from  $x = a$  to  $x = b$ .  $C_{\alpha/P}$  is calculated according to the following equations:

$$g = \sqrt{\frac{1}{n} + \frac{(a - \bar{x})^2}{\sum_{i=1}^n (x_i - \bar{x})^2}} \quad (\text{Eq. 3.14})$$

$$h = \sqrt{\frac{1}{n} + \frac{(b - \bar{x})^2}{\sum_{i=1}^n (x_i - \bar{x})^2}} \quad (\text{Eq. 3.15})$$

$$\rho = \frac{1}{gh} \cdot \left\{ \frac{1}{n} + \frac{(a - \bar{x})(b - \bar{x})}{\sum_{i=1}^n (x_i - \bar{x})^2} \right\} \quad (\text{Eq. 3.16})$$

$$A = \frac{g}{h} \quad (\text{Eq. 3.17})$$

$A$ ,  $\rho$ , and  $(n-2)$  are used to determine the value of  $D$  from Table 3 in Bowden (Bowden and Graybill 1966), which covers values of  $0.5 \leq A \leq 1.5$ . The procedure to follow when  $A$  is in this range is:

$$C^* = D \cdot g. \quad (\text{Eq. 3.18})$$

When  $A$  is outside the above range,  $A$  is replaced by  $1/A$  for the determination of  $D$ , and  $C^*$  is given by:

$$C^* = D \cdot h. \quad (\text{Eq. 3.19})$$

Next,

$$C_{\alpha/P} = C^* + z_p \cdot \sqrt{\frac{n-2}{\chi^2}}, \quad (\text{Eq. 3.20})$$

where:

- $z_p$  = the Student t statistic depending on  $n$  and  $P$
- $\chi^2$  = the chi square distribution, a function of  $n-2$  and  $\alpha$ .

This approach provides a statistically based subcritical margin,  $\Delta k_m$ , which can be determined as the difference  $(C_{\alpha/P} \cdot S_p)$ -W. In criticality safety applications, such a statistically determined

approach generally, but not necessarily, yields a margin of less than 0.05, which serves to illustrate the adequacy of the administrative margin. The recommended purpose of USL Method 2 is to apply it in tandem with USL Method 1 to verify that the administrative margin is conservative relative to a purely statistical basis. This concurrent application of USL Method 2 is especially important when a limited number of data points are used in determination of  $k_c(x)$ , or when the calculated values have a large standard deviation. In these cases, the statistically based subcritical margin may indicate the need for a larger administrative margin.

### 3.4 APPLICATION OF THE USL

The equations for USL Methods 1 and 2 (equations 3.12 and 3.13) represent an upper bound to assure subcriticality for a given configuration when the calculated  $k_{eff}$  plus uncertainty for the configuration is less than the USL. USLs may be calculated for a number of independent parameters for a given system. The subcritical limit is the minimum of all USLs computed for the specific parameters of the system.

Another advantage of the USL is that it may also be used to establish guidelines for quantitatively determining the applicability of the bias (or validation) to specific applications. For a given parameter, the USL is valid over the range of that parameter in the set of calculations used to determine the USL. However, ANSI/ANS-8.1 (ANSI/ANS 1983) allows the range of applicability to be extended beyond this range by extrapolating the trends established for the bias. No precise guidelines are specified for the limits of extrapolation. Thus, engineering judgment should be applied when extrapolating beyond the range of the parameter bounds.

Appendix C in NUREG/CR-6361 (Lichtenwalter et al. 1997) documents a computer program called USLSTATS that was developed to perform the required statistical analysis and calculate USLs based on USL Methods 1 and 2.

USLSTATS is used to trend the following parameters:

- Moderator-to fuel atomic ratio (H/Pu)
- Energy of Average Lethargy Causing Fission (EALF)
- Moderator to fuel volume ratio ( $v^m/v^f$ ).
- $^{240}\text{Pu}$  and  $\text{PuO}_2$  content

The H/Pu ratio is a parameter that describes the moderation of the neutrons in the fissile medium. The  $v^m/v^f$  ratio has a similar meaning for fuel rod lattices. The EALF parameter is a measure for the energy depending fission efficiency of the fissile medium.

The administrative margin,  $\Delta k_m$ , is fixed in order to have a sufficient confidence that the calculated results are subcritical.



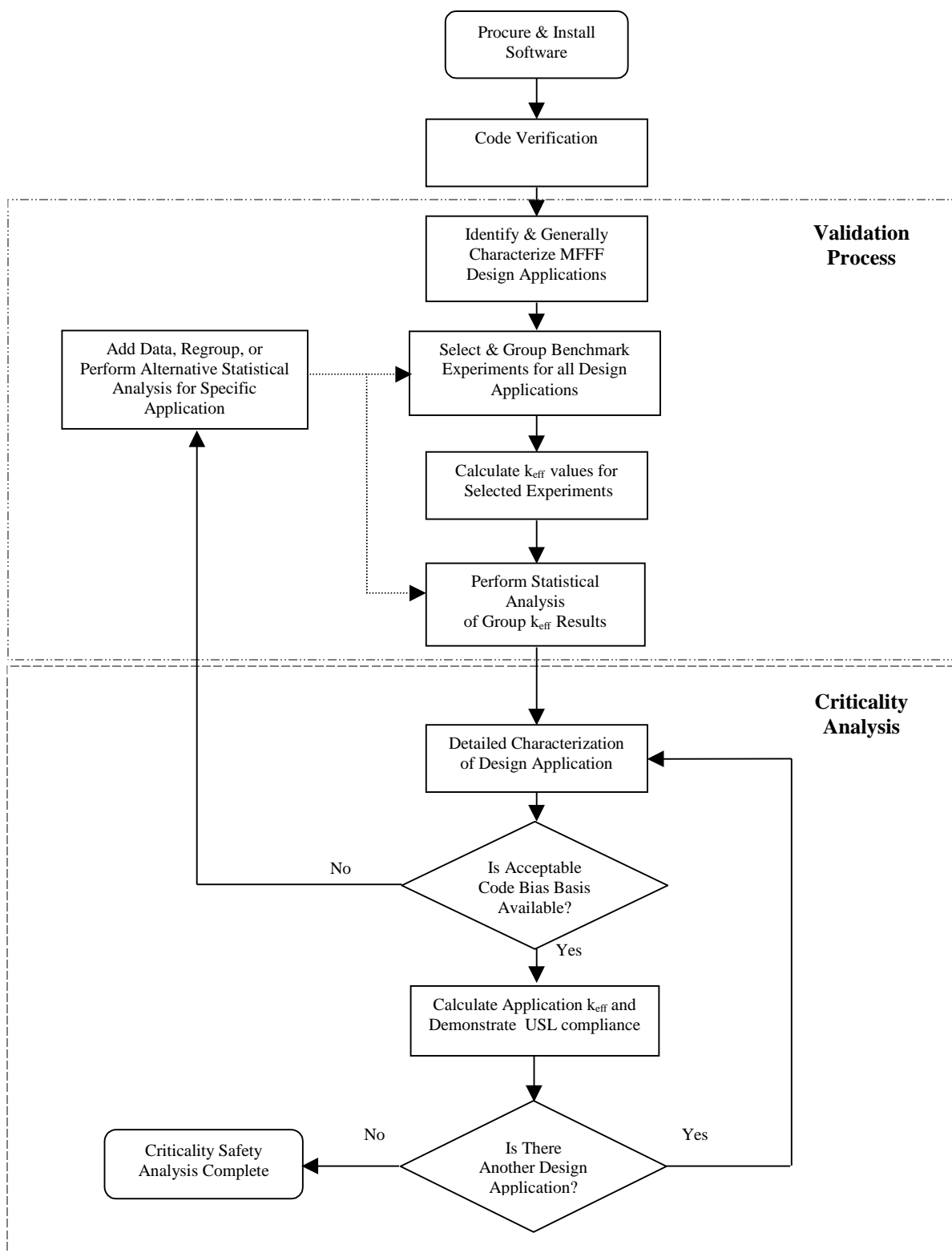


Table 3-1. Characteristics of the Five MFFF Application Areas \*

Figure 3-1. Overview of the Criticality Analysis Process of the MFFF

Parameter	Pu-nitrate solution	MOX pellets, MOX fuel rods, MOX FAs	PuO <sub>2</sub> powder/water mixtures	MOX powder/water mixtures	Aqueous solutions of Pu-compounds
Fissile Material Physical/Chemical Form	Pu-nitrate	MOX green and sintered pellets, MOX Rods and FAs	PuO <sub>2</sub> powder	MOX powder	(a) Pu-oxalate (b) PuO <sub>2</sub> F <sub>2</sub>
Design Isotopic composition of fissile material**	96% <sup>239</sup> Pu 4% <sup>240</sup> Pu	96% <sup>239</sup> Pu 4% <sup>240</sup> Pu depleted U	96% <sup>239</sup> Pu 4% <sup>240</sup> Pu	96% <sup>239</sup> Pu 4% <sup>240</sup> Pu depleted U	96% <sup>239</sup> Pu 4% <sup>240</sup> Pu
Pu/(U+Pu)	100 %	6.3 %, 6.0 %	100 %	6.3% - 22%	100 %
Oxide density [g/cm <sup>3</sup> ]	–	7.0 – 11.0	3.5 – 7.0	3.5 – 5.5	–
Pu concentration [g/liter]	125-237	–	–	–	(a) 242 (b) 696
Type of moderation	Homogeneous	Heterogeneous	Homogeneous	Homogeneous	Homogeneous
Optimum moderation***	H/Pu=100-200	$v^m/v^f = 1.9 - 9$	H/Pu= 6 - 1.7	H/Pu=20 H/Pu=50	(a) H/Pu=100 (b) H/Pu=30
Low density moderation [wt.% H <sub>2</sub> O]	–	$\leq 5$ ****	$\leq 5$	$\leq 5$	–
Anticipated Absorber/ Reflector Materials	Water Cd/water Concrete Borated concrete	Water Concrete Borated Shield	Water Borated Concrete	Water	Water Cd/water Concrete
Typical Geometry	Annular cylinders Cylinders Slabs	Cylinders Arrays Cuboids	Various configurations	Various configurations	Annular cylinders Cylinders Slabs

\* Characteristics presented typically refer to optimal or bounding values or ranges associated with respective AOAs.

\*\* Bounding design isotopic composition from Aqueous Polishing System basis of design.

\*\*\* Per calculation.

\*\*\*\* Green Pellets (i.e., unsintered pellets) < 5; sintered pellets < 1.

## **4. MFFF DESIGN APPLICATION CLASSIFICATION**

This section describes the characteristics of the established AOAs based on the various fuel configurations encountered in the MFFF. Five AOAs are established for the MFFF (see Table 3-1):

- Pu-nitrate aqueous solution
- MOX pellets, fuel rods, and fuel assemblies (FA)
- PuO<sub>2</sub> powders
- MOX powders
- Aqueous solutions of Pu compounds (Pu-oxalate solution, PuO<sub>2</sub>F<sub>2</sub>-“standard” solution).

### **4.1 DESIGN APPLICATION (1) – PU-NITRATE SOLUTION**

Table 4-1 summarizes the anticipated criticality calculations to be performed for the design of the Aqueous Polishing process of the MFFF in which Pu-nitrate will be processed. The table provides the relevant parameters (i.e., chemical form, isotopic vector, moderator to fuel atomic ratio(H/Pu), and EALF) for each criticality design application.

Since geometry control is expected to be used for all the equipment listed in Table 4-1, the calculations are performed at optimum moderation taking into account full water reflection. In some applications (e.g., mixer settler, tanks), the reflector is modified by cadmium/water materials and borated concrete materials.

### **4.2 DESIGN APPLICATION (2) – MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES**

Table 4-2 summarizes the anticipated criticality calculations to be performed for the design of the MOX pellet, fuel rod, and fuel assembly lines. In addition, the table provides the relevant parameters (i.e., chemical form, fuel concentration C(Pu), isotopic vector, moderator to fuel volume ratio ( $v^m/v^f$ ), and EALF) for each criticality design application.

In the pellet and fuel rod area, a conservative value of 6.3% Pu-content is used to bound the design limit of 6.0%. The maximum average Pu-content in the fuel assembly area is expected to be less than 6.0%. The specific value depends on the FA-type that is specified by the MFFF customers (i.e., utility reactors) and will be incorporated into the criticality design application calculations.

**Table 4-1. Anticipated Criticality Calculation Derived Characteristics for Design Applications Involving Pu-Nitrate Solutions**

<b>Fuel Configuration</b>	<b>Reflector Conditions</b>	<b>Chemical Form</b>	<b>Pu/ (U+Pu)</b>	<b>Pu-Isotopic composition</b>	<b>H/Pu</b>	<b>C(Pu)</b>	<b>EALF [eV]</b>
<b>Purification</b>							
Mixer settler in cell	Slab with Cd/water reflector	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	100	237	0.20
Active Gallery in cell	Array of interacting cylinders	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	150	164	0.14
Pulsed columns in cell	Cylinder with water reflector	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	150	194	0.14
Tanks in various cells	Annular cylinder with concrete reflector, Slab with Cd/water reflector	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	200	125	0.18
<b>Oxalic Precipitation Oxidation</b>							
Tanks in cell	Annular cylinder with water reflector	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	200	125	0.18
Dosing wheel	Rectangular solid with steel water reflector	Pu(NO <sub>3</sub> ) <sub>3</sub>	100%	4% <sup>240</sup> Pu	150	164	0.25
<b>Expected Range of Design Applications</b>	<b>Various configurations</b>	<b>Pu(NO<sub>3</sub>)<sub>3</sub></b>	<b>100%</b>	<b>4% <sup>240</sup>Pu</b>	<b>100-200</b>	<b>125-237</b>	<b>0.14-0.25</b>

**Table 4-2. Anticipated Criticality Calculation Derived Characteristics for Design Application MOX Pellets, Fuel Rods, and Fuel Assemblies**

<b>Fuel Configuration</b>	<b>Reflector Condition</b>	<b>Chemical Form</b>	<b>Pu/ (U+Pu)</b>	<b>Pu-Isotopic Composition</b>	<b>V<sup>m</sup>/V<sup>f</sup></b>	<b>EALF [eV]</b>
<b>Pellet area</b>						
Sintering furnace, Heterogeneous Array*	Water and concrete	MOX	6.3%	4% <sup>240</sup> Pu	2 – 10	0.1 - 1
Pellets boats in the return glove box of the sintering furnace, Heterogeneous Array	Water	MOX	6.3%	4% <sup>240</sup> Pu	2 – 10	0.1 - 1
Glove boxes, Heterogeneous Array	Water	MOX	6.3%	4% <sup>240</sup> Pu	2 – 10	0.1 - 1
Pellets boats and boxes store, Heterogeneous Array	Water	MOX	6.3%	4% <sup>240</sup> Pu	2 – 10	0.1 - 1
Pellets stored in tray baskets, Heterogeneous Array	Water	MOX	6.3 %	4% <sup>240</sup> Pu	2 – 10	0.1 - 1
<b>Rod area</b>						
Rod store, rectangular array	Water	MOX	6.3%	4% <sup>240</sup> Pu	2 – 5	0.1 – 0.5
<b>Fuel Assembly area</b>						
MOX FA store, rectangular array	Water, Concrete	MOX	2.0% -6.3%	4% <sup>240</sup> Pu	~1.9	0.1 – 0.5
<b>Expected Range of Design Applications</b>	<b>Various</b>	<b>MOX</b>	<b>2.0% -6.3%</b>	<b>4% <sup>240</sup>Pu</b>	<b>1.9 - 10</b>	<b>0.1 – 1</b>

\* Random orientation of pellets modeled as regular arrays with hexagonal or rectangular pitch.

## **5. BENCHMARK EXPERIMENTS**

### **5.1 AOA (1) - PU-NITRATE SOLUTION**

Thirteen sets of Pu-nitrate solution benchmark experiments were selected from the ICSBEP-Handbook (Nuclear Energy Agency 1999) to cover the AOA for Pu-nitrate solutions. These experiments cover a range of H/Pu ratios, EALFs, geometries, and reflectors. Table 5-1 lists the experiments, along with a description and key parameters. Table 5-2 provides a comparison of the AOA key parameters for the critical experiments and design applications.

### **5.2 AOA (2) - MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES**

Five sets of mixed U/Pu benchmark experiments were selected from the ICSBEP-Handbook (Nuclear Energy Agency 1999) to cover the AOA for MOX pellets, fuel rods, and fuel assemblies. These experiments include 36 critical experiments performed with lattices of MOX fuel rods in water with various Pu-contents and moderating ratios ( $v^m/v^f$ ). Table 5-3 lists the experiments, along with a description and key parameters. Table 5-4 provides a comparison of the AOA key parameters for the critical experiments and design applications.

Table 5-1. Critical Experiments Selected for AOA(1)

Experiment *	H/Pu	EALF	Reflector/ Geometric form	<sup>240</sup> Pu [wt.%]	Description
PU-SOL-THERM-001	87 - 354	0.35 – 0.09	Water reflected sphere	4.67	11.5" Diameter sphere
PU-SOL-THERM-002	309 - 524	0.10 – 0.07	Water reflected sphere	3.12	12" Diameter sphere
PU-SOL-THERM-003	562 - 788	0.07 – 0.06	Water reflected sphere	1.76, 3.12	13" Diameter sphere
PU-SOL-THERM-004	592 - 987	0.06 – 0.05	Water reflected sphere	0.54 to 3.43	14" Diameter sphere
PU-SOL-THERM-005	581 - 903	0.07 – 0.06	Water reflected sphere	4.05 4.40	14" Diameter sphere
PU-SOL-THERM-006	940 –1061	0.06 – 0.05	Water reflected sphere	3.12	15" Diameter sphere
PU-SOL-THERM-008	78-858	0.55 – 0.05	Concrete reflected and concrete/Cd reflected sphere	4.67	14" Diameter sphere
PU-SOL-THERM-011	574 –1208	0.08 – 0.05	Bare sphere	4.2	Bare 16" and 18" diameter spheres
PU-SOL-THERM-014	211	0.17-0.14	Unreflected array of cylinders	4.23	Interacting cylinders in air (115.1gPu/l)
PU-SOL-THERM-015	156	0.24	Unreflected array of cylinders	4.23	Interacting cylinders in air (152.5gPu/l)
PU-SOL-THERM-016	156 - 211	0.24 – 0.17	Unreflected array of cylinders	4.23	Interacting cylinders in air with (152.5 and 115.1gPu/l)
PU-SOL-THERM-017	211	0.17	Unreflected array of cylinders	4.23	Interacting cylinders in air (115.1gPu/l)
PU-SOL-THERM-020	453 - 756	0.08 – 0.06	Water reflected, Water/Cd reflected sphere	4.67	14" Diameter sphere

\* From (Nuclear Energy Agency 1999).

**Table 5-2. AOA (1) – Comparison of Key Parameters**

<b>Parameter</b>	<b>Design application (cf. Table 4-1)</b>	<b>Benchmark (cf. Table 5-1)</b>
Geometric shape	Cylinder Slab Annular cylinder Array of cylinders	Homogeneous Medium: Single Unit and Interacting Cylinders
Absorber/Reflector <sup>*</sup>	Full water Cd/water Borated concrete	Full water Cd/water Concrete
Chemical form	Pu-nitrate solution	Pu-nitrate solution
Isotopic composition	4% <sup>240</sup> Pu	0.54% – 4.67% <sup>240</sup> Pu
H/Pu	100 – 200	78 – 1208
C(Pu) [g/l]	125 – 237	22-269
EALF [eV]	0.14 – 0.20 <sup>**</sup>	0.01 – 0.55

<sup>\*</sup> Attachments 3 and 4 discuss systems with borated concrete and Cd.

<sup>\*\*</sup> At the optimum moderation.



**Table 5-3. Critical Experiments Selected for AOA(2)**

Experiment	$v^m/v^f$	EALF	Reflector/ geometric form	PuO <sub>2</sub> wt. %	<sup>240</sup> Pu wt. %	Description
MIX-COMP-THERM-002	0.91 to 3.36	0.14 to 0.77	Water	2.0	8.0	Rectangular Arrays of Water-moderated UO <sub>2</sub> - PuO <sub>2</sub> Fuel Rods
MIX-COMP-THERM-003	1.7 to 10.75	0.10 to 0.91	Water radial	6.6	8.6	Rectangular Arrays of Water-moderated UO <sub>2</sub> - PuO <sub>2</sub> Fuel Rods
MIX-COMP-THERM-004	2.4 to 5.6	0.08 to 0.15	Water radial	3.0	22	Rectangular Array of PuO <sub>2</sub> -UO <sub>2</sub> Fuel Rods in Water
MIX-COMP-THERM-005	1.9 to 10.1	0.09 to 0.39	Water	4.0	18	Water-moderated Mixed PuO <sub>2</sub> -UO <sub>2</sub> Pins in hexagonal lattice
MIX-COMP-THERM-009	1.1 to 5.6	0.09 to 0.55	Water	1.5	8	Mixed Oxide Fuel Pin hexagonal Lattice, Depleted Uranium

**Table 5-4. AOA (2) – Comparison of Key Parameters**

<b>Parameter</b>	<b>Design application (cf. Table 4-2)</b>	<b>Benchmark (cf. Table 5-3)</b>
Geometrical shape	Heterogeneous Array, Rectangular array	Rectangular arrays
Absorber/Reflector	Water Concrete Borated Shield	Water – -
Chemical form	Mixed oxide	Mixed oxide
PuO <sub>2</sub> composition	2.0% - 6.3%	1.5% - 6.6%
Isotopic Composition	4% <sup>240</sup> Pu	8-22% <sup>240</sup> Pu
$v^m/v^f$	1.4 – 10	0.91 – 10.75
EALF [eV]	0.1 – 1	0.08 – 0.91

## 6. ANALYSIS OF VALIDATION RESULTS

### 6.1 DESIGN APPLICATION (1) – AQUEOUS SOLUTIONS OF PU-NITRATE

One hundred eighty-two critical experiments are modeled with CSAS26/KENO VI using the 238group library 238GROUPNDF5. These experiments include:

- Bare spheres
- Water reflected spheres
- Concrete reflected spheres
- Cadmium/concrete reflected spheres
- Cadmium/water reflected spheres.

The calculated  $k_{\text{eff}}$  values are presented in Attachment 1. The distribution of the calculated  $k_{\text{eff}}$  values for the design application (Group AOA(1) – Pu-Nitrate Solutions) is shown in Figure 6-1. The results are analyzed statistically using the USLSTATS computer code.<sup>2</sup> The experiments are analyzed as a full set and as selected subgroups to highlight the effect of concrete and cadmium as reflectors and the effect of the  $^{240}\text{Pu}$  content in the plutonium. Figures 6-2 through 6-6 show the results graphically, and Table 6-1 summarizes the statistical results. All positive biases are conservatively set to zero.

#### 6.1.1 USL with EALF and H/Pu Ratio

Figure 6-2 and Figure 6-3 show the calculated  $k_{\text{eff}}$  and the values of USL-1 and USL-2, versus the trending parameters EALF and H/Pu, respectively. Table 6-1 shows that for the range of applicability (EALF from 0.05 to 0.35 and H/Pu ratio from 78 to 1208), the minimum USL-1 with a 0.05 administrative margin is 0.9399. The minimum USL-2 is 0.9680. This indicates that the administrative margin ( $\Delta k_m=0.05$ ) applied to the USL-1 value is adequate for the AOA(1) application as long as the EALF and H/Pu ratio fall within the applicable range.<sup>3</sup> This is further substantiated by a  $\Delta k_m=0.0220$  and 0.0205, calculated using the USL 2 method. Thus an administrative margin of 0.05 plus bias and uncertainties to provide a USL of 0.9399 is justified.

#### 6.1.2 USL with $^{240}\text{Pu}$ Content in Plutonium

Forty-six experiments were selected from PU\_SOL\_THERM\_001, \_002, \_003, \_004, \_005, and \_006 to evaluate the effect of the  $^{240}\text{Pu}$ /Pu ratio on the calculational bias. The  $^{240}\text{Pu}$  content in the fissile solutions of Pu-nitrate used in the experiments varied from 0.54 wt.% to 4.67 wt.%.

<sup>2</sup> Many of the benchmark experiments in the International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999) are considered to be critical (i.e.,  $k_{\text{eff}}=1.000$ ), while other experiments are not considered critical (i.e.,  $k_{\text{eff}}\neq 1.000$ ) due to simplified modeling by the Handbook evaluator. Therefore, all calculated  $k_{\text{eff}}$  values are normalized to the handbook values.

<sup>3</sup> ANSI/ANS-8.1-1983 allows the range of applicability to be extended beyond this range by extrapolating the trends established for the bias; however, no precise guidelines are specified for the limits of extrapolation. Therefore, engineering judgment must be applied when extrapolating beyond the range of the parameter bounds. If extrapolation is necessary, it will be discussed on a case-by-case basis in the individual criticality calculations.

The experiments have similar characteristics:

- Pu-nitrate solution
- Spherical geometry, water reflected.

Figure 6-4 shows the calculated  $k_{\text{eff}}$  values and the parameters for the determination of USL-1 and USL-2 based on trending with  $^{240}\text{Pu}$  content. The figure shows that the bias ( $k_{\text{eff}}-1.0$ ) is positive and increases slightly with an increase in  $^{240}\text{Pu}$  content. The maximum considered  $^{240}\text{Pu}$  content (4.7%) in the experiments is bounding for the MFFF design value of 4%. Table 6-1 shows that the minimum USL-1 with a 0.05 administrative margin is 0.9449. The minimum USL-2 for this set of experiments is 0.9867. This indicates that the administrative margin ( $\Delta k_m=0.05$ ) applied to the USL-1 value is adequate for the AOA(1) application. This is further substantiated by a  $\Delta k_m=0.0082$ , calculated using the USL 2 method. Thus, an administrative margin of 0.05 plus bias and uncertainties to provide a USL of 0.9449 is justified.

### 6.1.3 Effect of Reflectors

Cadmium absorbers and borated concrete materials are used for some AOA(1) design applications to reduce reflector effectiveness and neutron interaction between adjacent fission zones. These materials are considered when establishing the USL and computational bias for the AOA(1) design applications. Attachment 3 and 4 present a brief discussion on these materials.

### 6.1.4 Summary of USL for AOA(1) Aqueous Solutions of Pu-Nitrate

The minimum USL for the AOA(1) systems is 0.9399. This value includes a 0.05 administrative margin and 0.0101 calculational bias and allowance for uncertainties. The 0.05 administrative margin is more than adequate since an adequate number of representative benchmark experiments cover the range of applicability for the design conditions. This administrative margin is further justified by comparison of the USL-1 and USL-2 values, which indicates that the 0.05 administrative margin is justified.

## 6.2 DESIGN APPLICATION (2) – MOX PELLETS, FUEL RODS, AND FUEL ASSEMBLIES

Thirty-six experiments were evaluated for this design application. The calculated  $k_{\text{eff}}$  values are presented in Attachment 2. The distribution of the calculated  $k_{\text{eff}}$  values for the set of experiments used for this design application (Group AOA(2) – MOX pellets, fuel rods, and fuel assemblies) is shown in Figure 6-5. The results are analyzed statistically using the USLSTATS computer code. The experiments are analyzed as a full set for trends. Figures 6-6 through 6-8 show the results graphically, and Table 6-2 summarizes the statistical results. All positive biases are conservatively set to zero.

### 6.2.1 USL with EALF and $v^m/v^f$ Ratio

Figure 6-6 and Figure 6-7 show the calculated  $k_{eff}$  and the values of USL-1 and USL-2, versus the trending parameters EALF and  $v^m/v^f$ , respectively. Table 6-2 shows that the minimum USL-1 with a 0.05 administrative margin is 0.9350 for trending with EALF and  $v^m/v^f$  (EALF from 0.08 to 0.91 and  $v^m/v^f$  ratio from 0.91 to 10.75). The minimum USL-2 for the experiments is 0.9711. This indicates that the administrative margin ( $\Delta k_m=0.05$ ) applied to the USL-1 value is adequate for the AOA(2) application as long as the EALF and  $v^m/v^f$  ratio fall within the applicable range.<sup>4</sup> This is further substantiated by a  $\Delta k_m=0.0139$  and 0.0139, calculated using the USL-2 method. Thus, an administrative margin of 0.05 plus bias and uncertainties to provide a USL of 0.9350 is justified.

### 6.2.2 USL with PuO<sub>2</sub> Content in MOX

The 36 experiments are also analyzed as a function of the PuO<sub>2</sub>/(UO<sub>2</sub>+PuO<sub>2</sub>) ratio to evaluate the effect of PuO<sub>2</sub> content on the calculational bias. These 36 experiments cover a range from 1.5 wt.% to 6.6 wt.% in PuO<sub>2</sub>/(UO<sub>2</sub>+PuO<sub>2</sub>). Figure 6-8 shows the calculated  $k_{eff}$  values and the parameters for the determination of USL-1 and USL-2 based on trending with PuO<sub>2</sub> content. The figure shows that the  $k_{eff}$ , USL-1, and USL-2 values increase with an increase in the MOX PuO<sub>2</sub> content.

Table 6-2 shows that the minimum USL-1 with a 0.05 administrative margin is 0.9386. The minimum USL-2 for this set of experiments is 0.9753. This indicates that the administrative margin ( $\Delta k_m=0.05$ ) applied to the USL-1 value is adequate for the AOA(1) application. This is further substantiated by a  $\Delta k_m=0.0134$ , calculated using the USL 2 method. Thus, an administrative margin of 0.05 plus bias and uncertainties to provide a USL of 0.9321 is justified.

### 6.2.3 Summary of USL for AOA(2) MOX Pellets, Fuel Rods, and Fuel Assemblies

The minimum USL for the AOA(2) systems is 0.9350. This value includes a 0.05 administrative margin and 0.0150 calculational bias and allowance for uncertainties. The 0.05 administrative margin is more than adequate since there is an adequate number of representative benchmark experiments that cover the range of applicability for the design conditions. This administrative margin is further justified by comparison of the USL-1 and USL-2 values, which indicates that the 0.05 administrative margin is justified.

Note that the benchmark experiments for clad fuel pellets are directly applicable to the production of fuel assemblies and configurations involving loose rods. The application calculations for these configurations are within the AOA as derived from the benchmark experiments. These benchmark experiments are also directly applicable to unclad fuel pellets or loose pellets since the cladding effects (neutronic absorption in the epithermal and thermal regions) are negligible. The cladding configuration (material, position and thickness) in these experiments changes the epithermal and thermal neutron flux distribution by less than 1% at the

<sup>4</sup> ANSI/ANS-8.1-1983 allows the range of applicability to be extended beyond this range by extrapolating the trends established for the bias. If extrapolation is necessary, it will be discussed on a case-by-case basis in the individual criticality calculations.

surface of the pellet (comparison of clad pellets as compared to unclad pellets). A 1% change in the epithermal and thermal flux distribution at the surface of the pellet leads to a significantly smaller change in the  $k_{\text{eff}}$  of the system since all neutrons transgressing the surface of the pellet do not lead to fission. The neutron flux difference would generally result in a  $\Delta k_{\text{eff}}$  (between clad and unclad pellets) of 0.005, which is on the order of the KENO variance. Based on this difference, the AOA for clad fuel pellets, fuel assemblies or loose rods is directly applicable to unclad pellets. Pellet configurations and application calculations within the AOA range established by benchmark experiments for clad rods are directly applicable to pellets and are therefore appropriately validated.

Table 6-1. Summary of USL Calculations for AOA(1)

Correlated Parameter (X)	No Exps.	Range of X	$k_c(x)$ Linear Regression	Average $k_c$	Min USL <sub>1</sub> ( $\Delta k_m = 0.05$ )	Min USL <sub>2</sub>	Min $\Delta k_m$ (USL <sub>2</sub> )
EALF	182	0.01 – 0.55	$1.0112 + (-1.209E-2) * X$	1.0097	0.9399	0.9680	0.0220
H/Pu	182	78 – 1208	$1.0099 + (-4.689E-7) * X$	1.0097	0.9403	0.9698	0.0205
<sup>240</sup> Pu	46	0.54 – 4.67	$1.0057 + (6.204E-4) * X$	1.0077	0.9449	0.9867	0.0082

Table 6-2. Summary of USL Calculations for AOA(2)

Correlated Parameter (X)	No Exps.	Range of X	$k_c(x)$ Linear Regression	Average $k_c$	Min USL <sub>1</sub> ( $\Delta k_m = 0.05$ )	Min USL <sub>2</sub>	Min $\Delta k_m$ (USL <sub>2</sub> )
EALF	36	0.08 – 0.91	$0.9990 + (-6.267E-3) * X$	0.9974	0.9350	0.9711	0.0139
$v^m/v^f$	36	0.91 – 10.75	$0.9974 + (-6.782E-4) * X$	0.9974	0.9373	0.9734	0.0139
PuO <sub>2</sub> /(UO <sub>2</sub> +PuO <sub>2</sub> )	36	1.5 – 6.6	$0.9961 + (3.764E-4) * X$	0.9974	0.9386	0.9753	0.0134

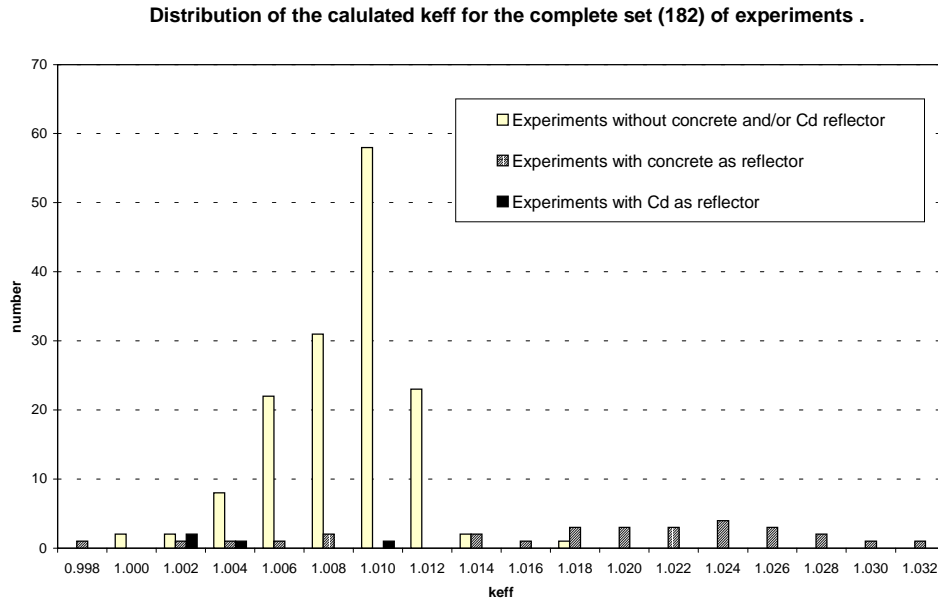


Figure 6-1. Group AOA(1) Experiments Histogram of  $k_{eff}$  Occurrences

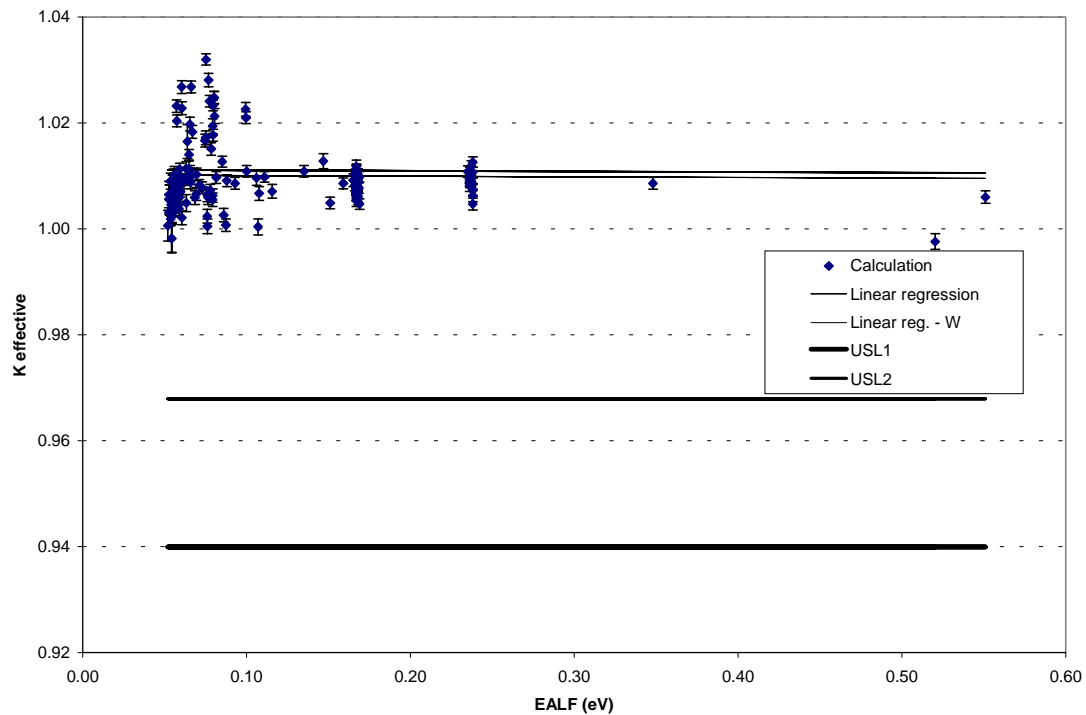


Figure 6-2. Design Application Area (1): Pu-Nitrate Solution;  $k_{eff}$  as Function of EALF



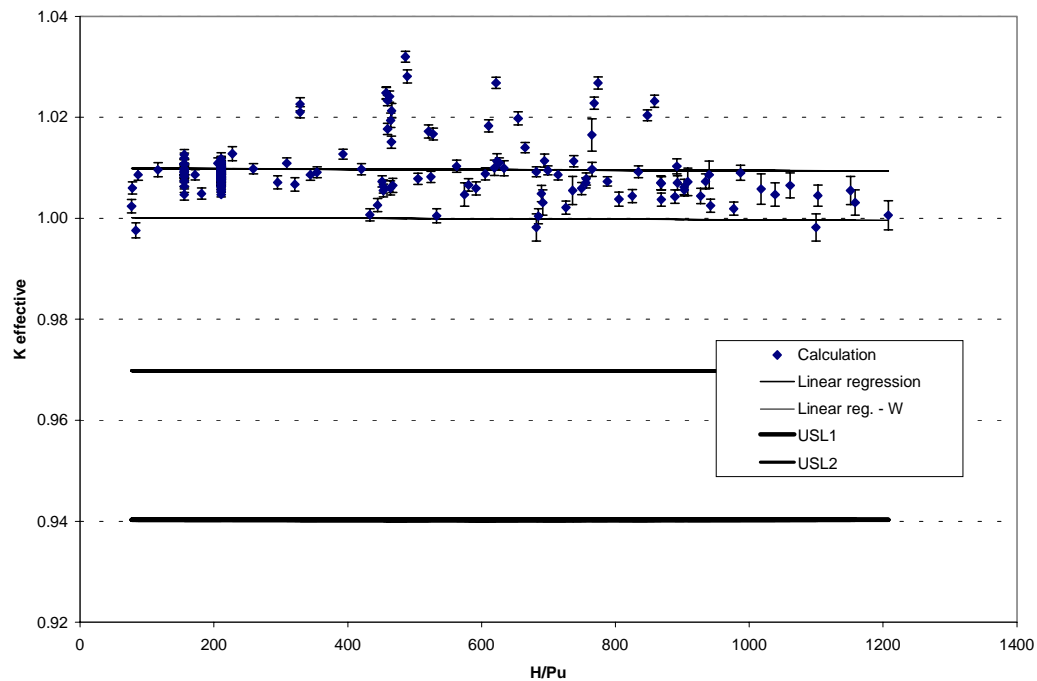


Figure 6-3. Design Application Area (1): Pu-Nitrate Solution;  $k_{\text{eff}}$  as Function of H/Pu

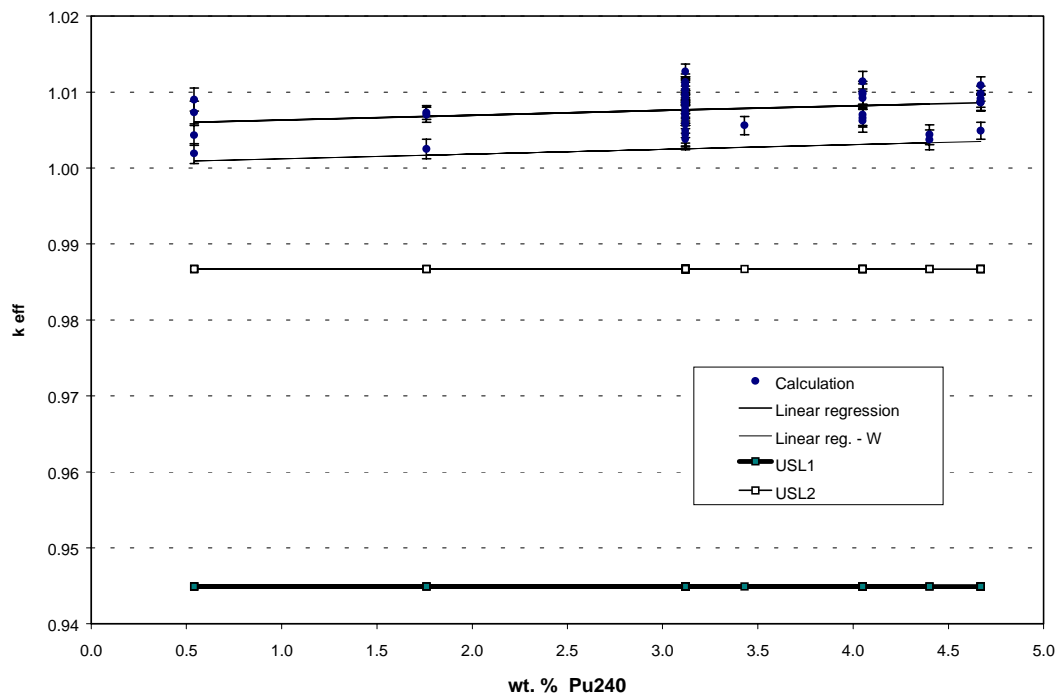
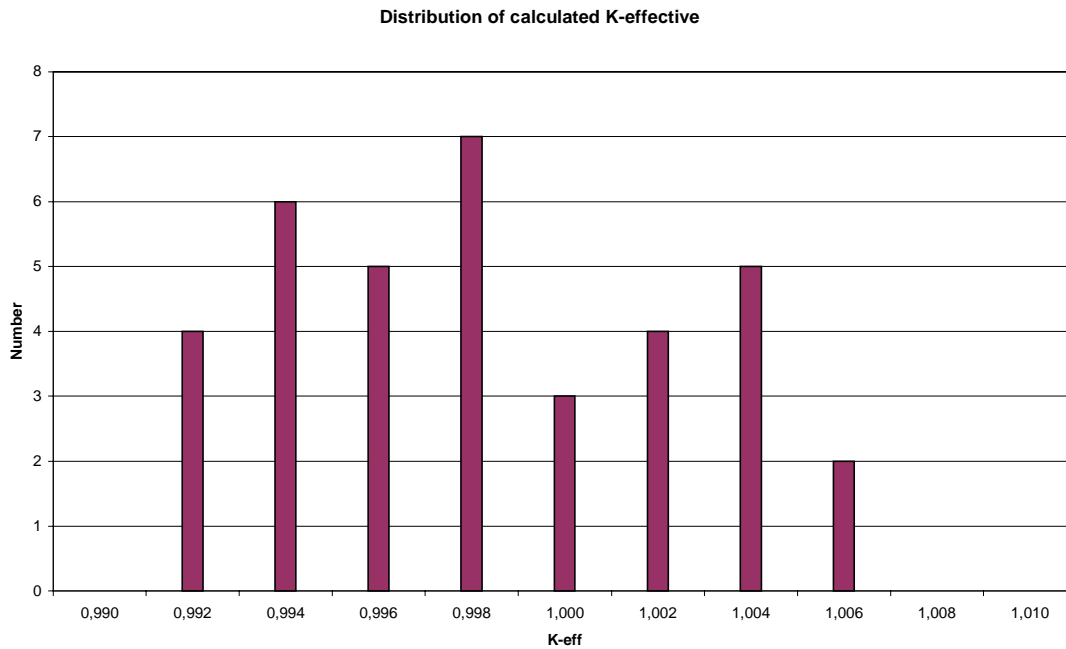
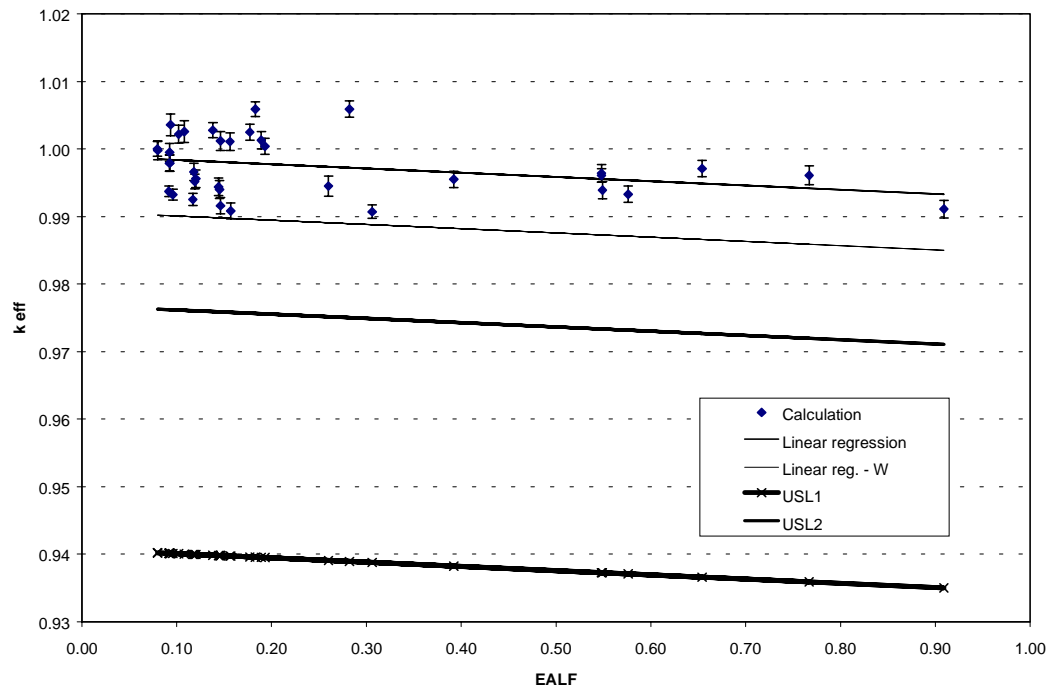


Figure 6-4. Design Application Area (1): Calculated  $k_{\text{eff}}$  as Function of  $^{240}\text{Pu}$  Content



**Figure 6-5. Group AOA(2) Experiments Histogram of  $k_{\text{eff}}$  Occurrences**



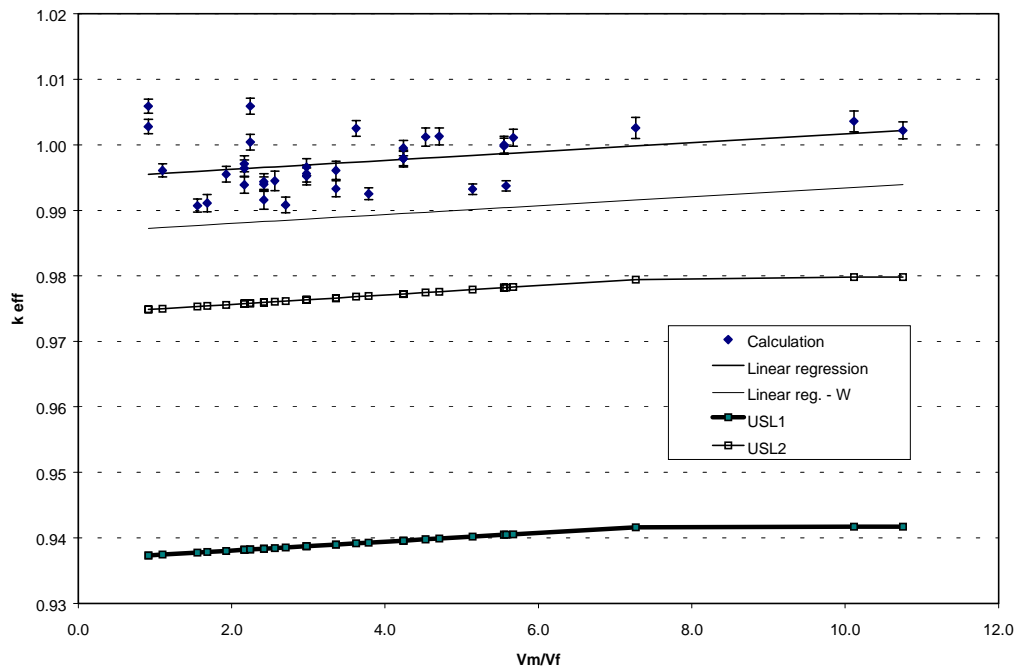
**Figure 6-6. Design Application (2) – MOX Pellets, Fuel Rods, and Fuel Assemblies:  
 $k_{eff}$  as Function of EALF**

$$USL-1 = 0.9407 - 6.2758E-3 * EALF$$

for  $0.08 < EALF < 0.91$  eV, and

$$USL-2 = 0.9768 - 6.2758E-3 * EALF$$

for  $0.08 < EALF < 0.91$  eV



**Figure 6-7. Design Application (2) – MOX Pellets, Fuel Rods, and Fuel Assemblies:**  
 $k_{eff}$  as Function of  $v^m/v^f$

$$\begin{aligned} \text{USL-1} &= 0.9367 - 6.7896\text{E-}3 * (v^m/v^f) \\ &= 0.9417 \end{aligned}$$

$$\begin{aligned} \text{USL-2} &= 0.9728 - 6.7896\text{E-}3 * (v^m/v^f) \\ &= 0.9779 \end{aligned}$$

$$\text{for } v^m/v^f < 7.477$$

$$\text{for } v^m/v^f > 7.477$$

$$\text{for } v^m/v^f < 7.477$$

$$\text{for } v^m/v^f > 7.477$$

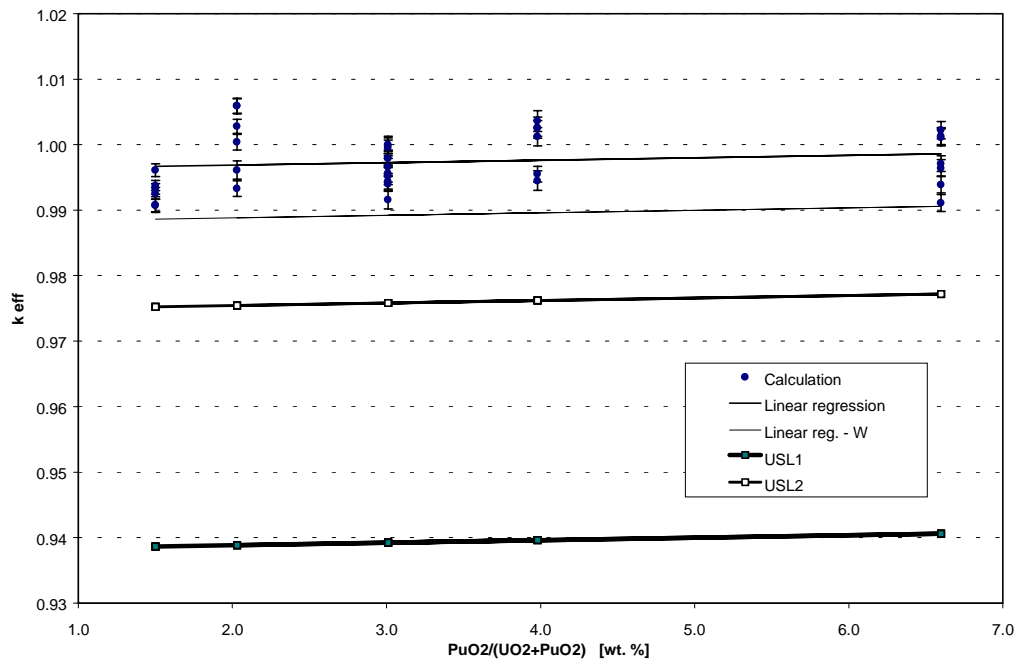


Figure 6-8. Calculated  $k_{eff}$  Values and Related USL as Function of  $PuO_2$  Content

## 7. CONCLUSIONS

The SCALE 4.4 code package using the CSAS26 (KENOVI) sequence and the 238 energy group cross section library 238GROUPDF5 has been validated to perform criticality calculations for the MFFF. It has been validated for two of the five facility design applications: (1) Pu-nitrate solutions, and (2) MOX pellets, fuel rods, and fuel assemblies.

The USL for the two design application areas is as follows:

- Design application (1) Pu-Nitrate solutions USL(AOA-1) = 0.9399
- Design application (2) MOX pellets, fuel rods, and fuel assemblies USL(AOA-2) = 0.9350

The USL accounts for the computational bias, uncertainties, and a 0.05 administrative margin. Historically, a 0.05 administrative margin has commonly been applied by the nuclear criticality safety community. NUREG-1718, *Standard Review Plan of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility* (NRC 2000), recommends an administrative margin of  $\Delta k_m = 0.05$  based on an adequate number of representative benchmark experiments covering the range of applicability of design conditions. The USLs for AOA(1) and AOA(2) are calculated using 182 and 36 critical benchmarks, respectively. Both sets of experiments are adequate to cover the range of the design application. The 0.05 administrative margin is further justified by comparison of the USL-1 and USL-2 values for each design application. The comparison indicates that the 0.05 administrative margin is more than adequate for these two design applications. No extrapolation outside the range of applicability is expected for the AOA(1) and AOA(2) USL values; however, ANSI/ANS-8.1 (ANSI/ANS 1983) does allow for extrapolation outside the AOA by extrapolating the trends established for the bias and USL. If extrapolation is necessary, it will be discussed on a case-by-case basis.

## 8. REFERENCES

- ANSI/ANS (American National Standards Institute/American Nuclear Society), 1983. *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, ANSI/ANS-8.1, La Grange Park, IL
- ANSI/ANS (American National Standards Institute/American Nuclear Society), 1998. *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, ANSI/ANS-8.1, La Grange Park, IL
- ANSI/ANS (American National Standards Institute/American Nuclear Society), 1984. *Criticality Safety Criteria for Handling Storage, and Transportation of LWR Fuel Outside Reactors*, ANSI/ANS-8.17, La Grange Park, IL
- DeHart M.D. and S.M. Bowman, 1994. *Validation of the SCALE Broad Structure 44-Group ENDF/B-V Cross-Section Library for Use in Criticality Safety Analyses*, NUREG/CR-6102.
- Bierman, S.R., 1974. *Critical experiments: benchmarks (Pu-U systems)*, Report No. BNWL-1862. Battelle Pacific Northwest Labs, Richland, WA.
- Bowden D.C. and F.A. Graybill, 1966. “Confidence Bands of Uniform and Proportional Width for Linear Models,” *Am. Stat. Assoc. J.* **61**, 182 (March 1966).
- Cain, V.R., 1995. *A Computer Code to Perform Analyses of Criticality Validation Results*, Y/DD-574, Martin Marietta Energy Systems, Inc., Oak Ridge Y-12 Plant, September 1995.
- Dyer, H.R., W.C. Jordan, and V.R. Cain, 1991. “A Technique for Code Validation for Criticality Safety Calculations,” *Trans. Am. Nucl. Soc.* **63**, 238 (June 1991).
- Easter, M.E., 1985. *Validation of KENO V.a and Two Cross-Section Libraries for Criticality Calculations of Low-Enriched Uranium Systems*, ORNL/CSD/TM-223, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., July 1985.
- Emmett, M.B., and W.C. Jordan, 1996, “Guide to Verification and Validation of the SCALE-4 Criticality Safety Software,” NUREG/CR-6483 (ORNL/TM-12834), Lockheed Martin Energy Research Corp., Oak Ridge National Laboratory, Oak Ridge, TN.
- Johnson, N.L., 1968. Ed., “Query,” *Technometrics* **10**, 207-209 (February 1968).
- Lichtenwalter, J.J., S.M. Bowman, M.D. DeHart, and C.M. Hopper, 1997. *Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages*, NUREG/CR-6361 (ORNL/TM-13211), Lockheed Martin Energy Research Corp., Oak Ridge National Laboratory, Oak Ridge, TN.

- NRC (U.S. Nuclear Regulatory Commission), 2000. Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility, NUREG-1718, U.S. Nuclear Regulatory Commission, Washington, DC.
- Nuclear Energy Agency, 1999. *International Handbook of Evaluated Criticality Safety Benchmark Experiments*, NEA/NSC/DOC(95)03, Nuclear Energy Agency, Organization for Economic Co-operation and Development.
- ORNL, 1995. *SCALE, A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation*, NUREG/CR-0200, Rev. 4 (ORNL/NUREG/CSD-2/R6), Vols. I–III (April 1995). Available from Radiation Shielding Information Center at Oak Ridge National Laboratory as CCC-545.



## ATTACHMENT 1

### CRITICALITY CALCULATION RESULTS FOR AOA(1)

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-001</b>											
Case 1	73.00	354.01	4.67%	1.0000	0.005	1.0091	0.0011	8.79E-02	600	1500	13
Case 2	96.00	258.85	4.67%	1.0000	0.005	1.0098	0.0010	1.11E-01	600	1500	15
Case 3	119.00	205.77	4.67%	1.0000	0.005	1.0109	0.0011	1.35E-01	600	1500	21
Case 4	132.00	181.53	4.67%	1.0000	0.005	1.0049	0.0011	1.51E-01	600	1500	20
Case 5	140.00	171.74	4.67%	1.0000	0.005	1.0086	0.0010	1.59E-01	600	1500	20
Case 6	268.70	86.93	4.67%	1.0000	0.005	1.0086	0.0011	3.48E-01	600	1500	23

<b>PU-SOL-THERM-002</b>											
Case 1	50.32	524.26	3.12%	1.0000	0.0047	1.0082	0.0011	7.12E-02	600	1500	16
Case 2	51.80	504.86	3.12%	1.0000	0.0047	1.0078	0.0011	7.29E-02	600	1500	19
Case 3	56.48	451.30	3.12%	1.0000	0.0047	1.0073	0.0011	7.78E-02	600	1500	11
Case 4	60.14	420.52	3.12%	1.0000	0.0047	1.0097	0.0011	8.15E-02	600	1500	14
Case 5	63.96	392.77	3.12%	1.0000	0.0047	1.0127	0.0010	8.51E-02	600	1500	16
Case 6	70.22	344.23	3.12%	1.0000	0.0047	1.0086	0.0011	9.29E-02	600	1500	85
Case 7	77.22	308.86	3.12%	1.0000	0.0047	1.0109	0.0011	1.00E-01	600	1500	25

<b>PU-SOL-THERM-003</b>											
Case 1	33.62	787.96	1.76%	1.0000	0.0047	1.0073	0.0009	5.84E-02	600	1500	12
Case 2	34.70	755.95	1.76%	1.0000	0.0047	1.0070	0.0010	5.96E-02	600	1500	75
Case 3	38.05	698.88	3.12%	1.0000	0.0047	1.0095	0.0009	6.18E-02	600	1500	25
Case 4	38.83	681.72	3.12%	1.0000	0.0047	1.0092	0.0010	6.27E-02	600	1500	17
Case 5	40.90	626.64	3.12%	1.0000	0.0047	1.0110	0.0010	6.54E-02	600	1500	22
Case 6	44.38	562.81	3.12%	1.0000	0.0047	1.0103	0.0012	6.94E-02	600	1500	12
Case 7	36.27	737.75	3.12%	1.0000	0.0047	1.0113	0.0011	5.91E-02	600	1500	11
Case 8	37.11	714.31	3.12%	1.0000	0.0047	1.0086	0.0010	6.01E-02	600	1500	38

GEN : = Number of generations

NPG : = Number of neutrons per generation

NSK : = Number of generations skipped prior to collecting data

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-004</b>											
Case 1	26.51	986.97	0.54%	1.0000	0.0047	1.0090	0.0015	5.34E-02	610	800	46
Case 2	26.50	976.88	0.54%	1.0000	0.0047	1.0019	0.0013	5.37E-02	610	800	25
Case 3	27.65	934.63	0.54%	1.0000	0.0047	1.0073	0.0015	5.48E-02	610	800	17
Case 4	28.57	888.90	0.54%	1.0000	0.0047	1.0043	0.0013	5.60E-02	610	800	56
Case 5	27.94	942.02	1.76%	1.0000	0.0047	1.0025	0.0013	5.46E-02	610	800	31
Case 6	28.78	927.39	3.12%	1.0000	0.0047	1.0044	0.0015	5.49E-02	610	800	21
Case 7	29.88	891.72	3.12%	1.0000	0.0047	1.0103	0.0015	5.59E-02	610	800	19
Case 8	30.33	868.97	3.12%	1.0000	0.0047	1.0069	0.0013	5.65E-02	610	800	23
Case 9	31.79	805.23	3.12%	1.0000	0.0047	1.0038	0.0014	5.87E-02	610	800	10
Case 10	35.68	689.40	3.12%	1.0000	0.0047	1.0049	0.0016	6.32E-02	610	800	47
Case 11	39.62	591.72	3.12%	1.0000	0.0047	1.0059	0.0013	6.85E-02	610	800	13
Case 12	29.74	892.74	3.12%	1.0000	0.0047	1.0070	0.0014	5.59E-02	610	800	19
Case 13	29.63	903.05	3.43%	1.0000	0.0047	1.0056	0.0012	5.56E-02	610	800	18

<b>PU-SOL-THERM-005</b>											
Case 1	29.94	902.77	4.05%	1.0000	0.0047	1.0062	0.0015	5.56E-02	610	800	13
Case 2	30.77	867.71	4.05%	1.0000	0.0047	1.0070	0.0014	5.66E-02	610	800	21
Case 3	31.72	834.36	4.05%	1.0000	0.0047	1.0092	0.0012	5.77E-02	610	800	17
Case 4	33.94	765.24	4.05%	1.0000	0.0047	1.0097	0.0014	6.01E-02	610	800	13
Case 5	36.38	694.07	4.05%	1.0000	0.0047	1.0114	0.0013	6.30E-02	610	800	21
Case 6	38.72	633.43	4.05%	1.0000	0.0047	1.0099	0.0015	6.61E-02	610	800	17
Case 7	41.16	580.59	4.05%	1.0000	0.0047	1.0066	0.0012	6.93E-02	610	800	55
Case 8	30.92	868.70	4.40%	1.0000	0.0047	1.0037	0.0013	5.66E-02	610	800	19
Case 9	32.41	825.10	4.40%	1.0000	0.0047	1.0044	0.0013	5.80E-02	610	800	11

<b>PU-SOL-THERM-006</b>											
Case 1	25.06	1061.1	3.12%	1.0000	0.0035	1.0065	0.0025	5.26E-02	210	500	18
Case 2	25.83	1017.8	3.12%	1.0000	0.0035	1.0058	0.0030	5.33E-02	210	500	13
Case 3	27.05	940.11	3.12%	1.0000	0.0035	1.0086	0.0027	5.53E-02	210	500	23

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-008</b>											
Case 1	35.5	665.0	4.67%	1.0000	0.0033	1.0140	0.0010	6.48E-02	810	800	13
Case 2	45.2	465.3	4.67%	1.0000	0.0040	1.0151	0.0012	7.85E-02	810	800	10
Case 3	46.4	459.6	4.67%	1.0000	0.0040	1.0233	0.0010	7.94E-02	810	800	20
Case 4	46.9	457.5	4.67%	1.0000	0.0040	1.0248	0.0011	8.02E-02	810	800	16
Case 5	32.8	774.0	4.67%	1.0000	0.0028	1.0268	0.0012	6.03E-02	810	800	85
Case 7	29.6	858.6	4.67%	1.0000	0.0028	1.0232	0.0012	5.71E-02	810	800	86
Case 8	50.9	433.0	4.67%	1.0000	0.0040	1.0007	0.0012	8.73E-02	810	800	15
Case 9	232	78.2	4.67%	1.0000	0.0061	1.0060	0.0012	5.51E-01	810	800	28
Case 10	43.4	486.4	4.67%	1.0000	0.0037	1.0320	0.0011	7.52E-02	810	800	48
Case 11	36.6	621.8	4.67%	1.0000	0.0031	1.0268	0.0011	6.62E-02	810	800	16
Case 12	67.9	328.9	4.67%	1.0000	0.0041	1.0226	0.0013	9.94E-02	810	800	31
Case 13	50.4	489.0	4.67%	1.0000	0.0041	1.0281	0.0013	7.68E-02	810	800	13
Case 14	75.0	321.1	4.67%	1.0000	0.0042	1.0067	0.0013	1.08E-01	810	800	65
Case 15	46.4	527.7	4.67%	1.0000	0.0041	1.0167	0.0012	7.46E-02	810	800	25
Case 16	36.5	654.8	4.67%	1.0000	0.0033	1.0198	0.0013	6.53E-02	810	800	22
Case 17	46.4	459.6	4.67%	1.0000	0.0040	1.0177	0.0011	7.95E-02	810	800	67
Case 18	46.9	457.5	4.67%	1.0000	0.0040	1.0248	0.0012	8.01E-02	810	800	35
Case 19	32.9	768.4	4.67%	1.0000	0.0028	1.0228	0.0012	6.05E-02	810	800	23
Case 20	30.0	848.0	4.67%	1.0000	0.0028	1.0204	0.0011	5.74E-02	810	800	10
Case 21	50.9	444.5	4.67%	1.0000	0.0040	1.0026	0.0013	8.60E-02	810	800	10
Case 22	232	83.4	4.67%	1.0000	0.0061	0.9976	0.0015	5.20E-01	810	800	93
Case 23	44.8	462.4	4.67%	1.0000	0.0037	1.0241	0.0011	7.73E-02	810	800	62
Case 24	36.8	610.5	4.67%	1.0000	0.0031	1.0183	0.0012	6.68E-02	810	800	21
Case 25	67.8	328.9	4.67%	1.0000	0.0042	1.0210	0.0011	9.96E-02	810	800	10
Case 26	52.1	464.3	4.67%	1.0000	0.0041	1.0194	0.0014	7.93E-02	810	800	29
Case 27	106	227.5	4.67%	1.0000	0.0042	1.0128	0.0014	1.47E-01	810	800	15
Case 28	81.7	295.1	4.67%	1.0000	0.0042	1.0071	0.0014	1.16E-01	810	800	51
Case 29	52.4	465.7	4.67%	1.0000	0.0041	1.0213	0.0013	8.03E-02	810	800	141
Case 30	47.0	520.9	4.67%	1.0000	0.0041	1.0172	0.0014	7.50E-02	810	800	46

<b>PU-SOL-THERM-011</b>											
Case 1-16	35.0	764.76	4.17%	1.0000	0.0052	1.0138	0.0013	0.0636	1003	1000	16
Case 1-18	22.4	1207.8	4.2%	1.0000	0.0052	0.9993	0.0010	0.0520	1003	1000	76
Case 2-16	36.2	736.02	4.17%	1.0000	0.0052	1.0201	0.0010	0.0647	1003	1000	9
Case 2-18	23.3	1151.3	4.2%	1.0000	0.0052	1.0051	0.0009	0.0529	1003	1000	14
Case 3-16	38.1	691.49	4.17%	1.0000	0.0052	1.0215	0.0010	0.0670	1003	1000	74
Case 3-18	23.1	1158.2	4.2%	1.0000	0.0052	1.0007	0.0010	0.0529	1003	1000	69
Case 4-16	38.2	681.73	4.17%	1.0000	0.0052	1.0157	0.0009	0.0678	1003	1000	36
Case 4-18	23.8	1099.7	4.2%	1.0000	0.0052	0.9990	0.0009	0.0541	1003	1000	6
Case 5-16	43.4	574.52	4.17%	1.0000	0.0052	1.0098	0.0010	0.0755	1003	1000	18
Case 5-18	25.2	1038.8	4.2%	1.0000	0.0052	1.0089	0.0010	0.0556	1003	1000	61
Case 6-18	27.5	908.37	4.2%	1.0000	0.0052	1.0056	0.0009	0.0593	1003	1000	3
Case 7-18	23.9	1102.5	4.2%	1.0000	0.0052	1.0045	0.0009	0.0540	1003	1000	13

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. Uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-014</b>											
Case 1	115.10	210.86	4.23%	0.9980	0.0032	1.0070	0.0010	1.68E-01	600	1800	15
Case 2	115.10	210.86	4.23%	0.9980	0.0032	1.0059	0.0011	1.67E-01	600	1800	21
Case 3	115.10	210.86	4.23%	0.9980	0.0032	1.0071	0.0011	1.67E-01	600	1800	65
Case 4	115.10	210.86	4.23%	0.9980	0.0032	1.0066	0.0010	1.67E-01	600	1800	37
Case 5	115.10	210.86	4.23%	0.9980	0.0032	1.0070	0.0011	1.67E-01	600	1800	12
Case 6	115.10	210.86	4.23%	0.9980	0.0032	1.0057	0.0011	1.67E-01	600	1800	11
Case 7	115.10	210.86	4.23%	0.9980	0.0032	1.0079	0.0012	1.68E-01	600	1800	42
Case 8	115.10	210.86	4.23%	0.9980	0.0032	1.0061	0.0011	1.67E-01	600	1800	26
Case 9	115.10	210.86	4.23%	0.9980	0.0032	1.0060	0.0009	1.68E-01	600	1800	10
Case 10	115.10	210.86	4.23%	0.9980	0.0032	1.0071	0.0011	1.67E-01	600	1800	49
Case 11	115.10	210.86	4.23%	0.9980	0.0032	1.0062	0.0011	1.67E-01	600	1800	44
Case 12	115.10	210.86	4.23%	0.9980	0.0032	1.0083	0.0009	1.66E-01	600	1800	12
Case 13	115.10	210.86	4.23%	0.9980	0.0043	1.0078	0.0010	1.69E-01	600	1800	12
Case 14	115.10	210.86	4.23%	0.9980	0.0043	1.0068	0.0010	1.68E-01	600	1800	26
Case 15	115.10	210.86	4.23%	0.9980	0.0043	1.0061	0.0010	1.67E-01	600	1800	16
Case 16	115.10	210.86	4.23%	0.9980	0.0043	1.0062	0.0010	1.66E-01	600	1800	29
Case 17	115.10	210.86	4.23%	0.9980	0.0043	1.0067	0.0012	1.67E-01	600	1800	25
Case 18	115.10	210.86	4.23%	0.9980	0.0043	1.0082	0.0009	1.68E-01	600	1800	55
Case 19	115.10	210.86	4.23%	0.9980	0.0043	1.0067	0.0010	1.68E-01	600	1800	24
Case 20	115.10	210.86	4.23%	0.9980	0.0043	1.0058	0.0010	1.67E-01	600	1800	29
Case 21	115.10	210.86	4.23%	0.9980	0.0043	1.0053	0.0010	1.67E-01	600	1800	25
Case 22	115.10	210.86	4.23%	0.9980	0.0043	1.0049	0.0011	1.67E-01	600	1800	60
Case 23	115.10	210.86	4.23%	0.9980	0.0043	1.0056	0.0011	1.67E-01	600	1800	17
Case 24	115.10	210.86	4.23%	0.9980	0.0043	1.0082	0.0012	1.68E-01	600	1800	17
Case 25	115.10	210.86	4.23%	0.9980	0.0043	1.0042	0.0011	1.68E-01	600	1800	25
Case 26	115.10	210.86	4.23%	0.9980	0.0043	1.0033	0.0011	1.67E-01	600	1800	40
Case 27	115.10	210.86	4.23%	0.9980	0.0043	1.0057	0.0010	1.67E-01	600	1800	10
Case 28	115.10	210.86	4.23%	0.9980	0.0043	1.0056	0.0010	1.67E-01	600	1800	27
Case 29	115.10	210.86	4.23%	0.9980	0.0043	1.0062	0.0012	1.67E-01	600	1800	22
Case 30	115.10	210.86	4.23%	0.9980	0.0043	1.0057	0.0010	1.69E-01	1300	1000	16
Case 31	115.10	210.86	4.23%	0.9980	0.0043	1.0027	0.0010	1.68E-01	1300	1000	30
Case 32	115.10	210.86	4.23%	0.9980	0.0043	1.0048	0.0010	1.68E-01	1300	1000	40
Case 33	115.10	210.86	4.23%	0.9980	0.0043	1.0036	0.0011	1.68E-01	1300	1000	23
Case 34	115.10	210.86	4.23%	0.9980	0.0043	1.0043	0.0009	1.67E-01	1300	1000	40
Case 35	115.10	210.86	4.23%	0.9980	0.0043	1.0042	0.0010	1.67E-01	1303	1000	15

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-015</b>											
Case 1	152.50	155.78	4.23%	0.9980	0.0038	1.0099	0.0010	2.37E-01	600	1800	18
Case 2	152.50	155.78	4.23%	0.9980	0.0038	1.0087	0.0010	2.37E-01	600	1800	17
Case 3	152.50	155.78	4.23%	0.9980	0.0038	1.0076	0.0010	2.36E-01	600	1800	10
Case 4	152.50	155.78	4.23%	0.9980	0.0038	1.0070	0.0012	2.36E-01	600	1800	23
Case 5	152.50	155.78	4.23%	0.9980	0.0038	1.0077	0.0010	2.36E-01	600	1800	19
Case 6	152.50	155.78	4.23%	0.9980	0.0038	1.0062	0.0011	2.36E-01	600	1800	18
Case 7	152.50	155.78	4.23%	0.9971	0.0047	1.0097	0.0010	2.38E-01	600	1800	16
Case 8	152.50	155.78	4.23%	0.9971	0.0047	1.0044	0.0011	2.38E-01	600	1800	10
Case 9	152.50	155.78	4.23%	0.9971	0.0047	1.0078	0.0010	2.36E-01	600	1800	13
Case 10	152.50	155.78	4.23%	0.9971	0.0047	1.0069	0.0011	2.36E-01	600	1800	128
Case 11	152.50	155.78	4.23%	0.9971	0.0047	1.0034	0.0012	2.38E-01	600	1800	11
Case 12	152.50	155.78	4.23%	0.9971	0.0047	1.0018	0.0011	2.38E-01	600	1800	21
Case 13	152.50	155.78	4.23%	0.9971	0.0047	1.0062	0.0010	2.37E-01	600	1800	11
Case 14	152.50	155.78	4.23%	0.9971	0.0047	1.0079	0.0011	2.35E-01	600	1800	49
Case 15	152.50	155.78	4.23%	0.9971	0.0047	1.0078	0.0010	2.38E-01	600	1800	22
Case 16	152.50	155.78	4.23%	0.9971	0.0047	1.0056	0.0011	2.38E-01	600	1800	35
Case 17	152.50	155.78	4.23%	0.9971	0.0047	1.0062	0.0013	2.37E-01	600	1800	18

<b>PU-SOL-THERM-016</b>											
Case 1	152.50	155.78	4.23%	0.9980	0.0043	1.0054	0.0011	2.38E-01	1000	1000	11
Case 2	152.50	155.78	4.23%	0.9980	0.0043	1.0077	0.0010	2.37E-01	1000	1000	10
Case 3	152.50	155.78	4.23%	0.9980	0.0043	1.0073	0.0012	2.36E-01	1000	1000	17
Case 4	152.50	155.78	4.23%	0.9980	0.0043	1.0077	0.0011	2.37E-01	1000	1000	75
Case 5	115.10	210.87	4.23%	0.9969	0.0038	1.0056	0.0012	1.68E-01	1000	1000	23
Case 6	115.10	210.87	4.23%	0.9969	0.0038	1.0056	0.0012	1.67E-01	1000	1000	18
Case 7	115.10	210.87	4.23%	0.9969	0.0038	1.0078	0.0011	1.67E-01	1000	1000	41
Case 8	115.10	210.87	4.23%	0.9969	0.0038	1.0072	0.0010	1.67E-01	1000	1000	10
Case 9	115.10	210.87	4.23%	0.9963	0.0033	1.0055	0.0012	1.65E-01	1000	1000	68
Case 10	115.10	210.87	4.23%	0.9963	0.0033	1.0056	0.0012	1.66E-01	1000	1000	32
Case 11	115.10	210.87	4.23%	0.9963	0.0033	1.0064	0.0012	1.67E-01	1000	1000	33

Experiment	C(Pu)	H/Pu	<sup>240</sup> Pu	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>PU-SOL-THERM-017</b>											
Case 1	115.10	210.86	4.23%	0.9969	0.0038	1.0052	0.0011	1.67E-01	1000	1000	14
Case 2	115.10	210.86	4.23%	0.9969	0.0038	1.0063	0.0012	1.67E-01	1000	1000	11
Case 3	115.10	210.86	4.23%	0.9969	0.0038	1.0045	0.0012	1.67E-01	1000	1000	21
Case 4	115.10	210.86	4.23%	0.9969	0.0038	1.0058	0.0011	1.67E-01	1000	1000	10
Case 5	115.10	210.86	4.23%	0.9969	0.0038	1.0058	0.0010	1.67E-01	1000	1000	47
Case 6	115.10	210.86	4.23%	0.9969	0.0038	1.0051	0.0011	1.67E-01	1000	1000	27
Case 7	115.10	210.86	4.23%	0.9969	0.0038	1.0057	0.0012	1.67E-01	1000	1000	43
Case 8	115.10	210.86	4.23%	0.9969	0.0038	1.0072	0.0011	1.67E-01	1000	1000	31
Case 9	115.10	210.86	4.23%	0.9969	0.0038	1.0065	0.0011	1.67E-01	1000	1000	13
Case 10	115.10	210.86	4.23%	0.9969	0.0038	1.0077	0.0013	1.67E-01	1000	1000	17
Case 11	115.10	210.86	4.23%	0.9969	0.0038	1.0045	0.0010	1.67E-01	1000	1000	11
Case 12	115.10	210.86	4.23%	0.9969	0.0038	1.0064	0.0011	1.67E-01	1000	1000	22
Case 13	115.10	210.86	4.23%	0.9969	0.0038	1.0052	0.0011	1.67E-01	1000	1000	35
Case 14	115.10	210.86	4.23%	0.9969	0.0038	1.0087	0.0012	1.67E-01	1000	1000	17
Case 15	115.10	210.86	4.23%	0.9969	0.0038	1.0054	0.0012	1.67E-01	1000	1000	33
Case 16	115.10	210.86	4.23%	0.9969	0.0038	1.0081	0.0011	1.67E-01	1000	1000	20
Case 17	115.10	210.86	4.23%	0.9969	0.0038	1.0037	0.0011	1.67E-01	1000	1000	34
Case 18	115.10	210.86	4.23%	0.9969	0.0038	1.0053	0.0011	1.67E-01	1000	1000	104

<b>PU-SOL-THERM-020</b>											
Case 1	39.20	605.49	4.67%	1.0000	0.0059	1.0088	0.0012	6.57E-02	610	800	15
Case 2	38.40	623.09	4.67%	1.0000	0.0059	1.0113	0.0015	6.47E-02	610	800	13
Case 3	33.50	749.56	4.67%	1.0000	0.0059	1.0059	0.0012	5.89E-02	610	800	10
Case 5	47.90	463.98	4.67%	1.0000	0.0059	1.0060	0.0014	7.63E-02	610	800	11
Case 6	49.50	453.29	4.67%	1.0000	0.0059	1.0063	0.0013	7.93E-02	610	800	15
Case 7	34.40	726.15	4.67%	1.0000	0.0059	1.0021	0.0013	6.04E-02	610	800	12
Case 8	69.40	344.07	4.67%	1.0000	0.0059	1.0096	0.0014	1.06E-01	610	800	76
Case 9	46.90	541.87	4.67%	1.0000	0.0059	1.0024	0.0013	7.58E-02	610	800	12
Case 10	38.60	619.20	4.67%	1.0000	0.0059	1.0100	0.0015	6.48E-02	610	800	10
Case 11	33.20	756.39	4.67%	1.0000	0.0059	1.0078	0.0012	5.85E-02	610	800	10
Case 12	47.50	467.28	4.67%	1.0000	0.0059	1.0065	0.0014	7.59E-02	610	800	55
Case 13	49.50	453.29	4.67%	1.0000	0.0059	1.0055	0.0013	7.92E-02	610	800	29
Case 14	46.90	541.87	4.67%	1.0000	0.0059	1.0005	0.0014	7.60E-02	610	800	11
Case 15	69.00	342.27	4.67%	1.0000	0.0059	1.0004	0.0015	1.07E-01	610	800	11

## **ATTACHMENT 2**

### **CRITICAL EXPERIMENTS FOR AOA(2) (MIXED U/Pu SYSTEMS – THERMAL COMPOUND SYSTEMS)**



Experiment No.	$v^m/v^f$	PuO <sub>2</sub> Content	Exp. $k_{eff}$	Exp. uncertainty	CSAS26 238GROUP $k_{eff}$	$\sigma$	EALF	GEN	NPG	NSK
<b>MIX-COMP-THERM_002</b>										
PNL-30	3.36	2.0%	1.00	0.0059	0.9933	0.0012	5.76E-01	600	700	12
PNL-31	3.36	2.0%	1.00	0.0045	0.9961	0.0014	7.67E-01	600	700	20
PNL-32	2.24	2.0%	1.00	0.0029	1.0004	0.0012	1.93E-01	600	700	45
PNL-33	2.24	2.0%	1.00	0.0021	1.0059	0.0012	2.82E-01	600	700	14
PNL-34	0.91	2.0%	1.00	0.0022	1.0028	0.0011	1.38E-01	600	700	16
PNL-35	0.91	2.0%	1.00	0.0024	1.0059	0.0011	1.83E-01	600	700	12

<b>MIX-COMP-THERM_003</b>										
Case 1	1.68	6.6%	1.00	0.00169	0.9911	0.0013	9.09E-01	905	600	24
Case 2-a	2.16	6.6%	1.00	0.00158	0.9939	0.0013	5.49E-01	905	600	7
Case 2-b	2.16	6.6%	1.00	0.00158	0.9964	0.0013	5.48E-01	905	600	21
Case 3	2.16	6.6%	1.00	0.00147	0.9971	0.0012	6.54E-01	905	600	86
Case 4	4.71	6.6%	1.00	0.00127	1.0013	0.0013	1.89E-01	905	600	15
Case 5	5.67	6.6%	1.00	0.00123	1.0011	0.0013	1.56E-01	905	600	24
Case 6	10.75	6.6%	1.00	0.00137	1.0022	0.0013	1.02E-01	905	600	8

<b>MIX-COMP-THERM_004</b>										
Case 1	2.42	3.01%	1.00	0.00460	0.9916	0.0012	1.46E-01	600	700	4
Case 2	2.42	3.01%	1.00	0.00460	0.9940	0.0013	1.45E-01	600	700	6
Case 3	2.42	3.01%	1.00	0.00460	0.9944	0.0013	1.44E-01	600	700	4
Case 4	2.98	3.01%	1.00	0.00390	0.9956	0.0013	1.20E-01	600	700	15
Case 5	2.98	3.01%	1.00	0.00390	0.9952	0.0011	1.19E-01	600	700	30
Case 6	2.98	3.01%	1.00	0.00390	0.9966	0.0013	1.18E-01	600	700	4
Case 7	4.24	3.01%	1.00	0.00400	0.9979	0.0012	9.24E-02	600	700	55
Case 8	4.24	3.01%	1.00	0.00400	0.9979	0.0012	9.24E-02	600	700	13
Case 9	4.24	3.01%	1.00	0.00400	0.9995	0.0013	9.23E-02	600	700	7
Case 10	5.55	3.01%	1.00	0.00550	0.9998	0.0014	7.99E-02	600	700	25
Case 11	5.55	3.01%	1.00	0.00550	1.0000	0.0011	7.95E-02	600	700	15

<b>MIX-COMP-THERM_005</b>										
Case 1	1.93	4.0%	1.0008	0.0022	0.9963	0.0012	3.92E-01	700	800	18
Case 2	2.56	4.0%	1.0011	0.0026	0.9956	0.0015	2.60E-01	700	800	74
Case 3	3.62	4.0%	1.0016	0.0029	1.0041	0.0012	1.77E-01	700	800	33
Case 4	4.53	4.0%	1.0021	0.0028	1.0033	0.0014	1.46E-01	700	800	10
Case 5	7.27	4.0%	1.0026	0.0036	1.0052	0.0016	1.08E-01	700	800	67
Case 6	10.11	4.0%	1.0033	0.0042	1.0069	0.0016	9.35E-02	700	800	17

MIX-COMP-THERM_009										
Case 1	1.10	1.5%	1.0003	0.0054	0.9964	0.0010	5.48E-01	800	800	50
Case 2	1.56	1.5%	1.0020	0.0049	0.9927	0.0010	3.06E-01	800	800	50
Case 3	2.71	1.5%	1.0035	0.0050	0.9943	0.0012	1.57E-01	800	800	22
Case 4	3.79	1.5%	1.0046	0.0062	0.9971	0.0009	1.17E-01	800	800	18
Case 5	5.14	1.5%	1.0059	0.0074	0.9991	0.0008	9.58E-02	800	800	20
Case 6	5.58	1.5%	1.0067	0.0080	1.0004	0.0008	9.16E-02	800	800	25

## **ATTACHMENT 3**

### **BORATED CONCRETE REFLECTORS**

### **ABSTRACT**

This attachment presents validation results for the SCALE 4.4 CSAS26 (KENO VI) criticality analysis sequence and the 238 energy group cross-section library (238GROUPNDF5) applicable to borated concrete fixed neutron absorber materials. As noted in Section 3.2, borated concrete is used in reflector regions of several MFFF plutonium nitrate aqueous solution design applications. However, the validation presented in the body of the report includes no benchmark experiment data or results for plutonium nitrate solution systems that include borated concrete neutron absorber materials. This attachment presents benchmark experiment data and validation results for high enrichment uranium nitrate aqueous solution systems that includes borated concrete supplemental absorber materials. The validation results presented for high enrichment uranium nitrate solution systems indicate that the CSAS26 criticality analysis sequence and the 238GROUPNDF5 cross-section library produce comparable results for systems with and without borated concrete neutron absorber materials present. This conclusion supports the use of the USL-1 for AOA-1 presented in Section 6.1 of this validation report (i.e.,  $USL-1=0.9399$ ) as an acceptance criterion for plutonium nitrate aqueous solution systems that include borated concrete supplemental neutron absorber materials.

## **INTRODUCTION**

Some design applications in the MFFF involving plutonium nitrate (Pu-nitrate) aqueous solutions include consideration of a full range of possible pure water reflection conditions. For those applications, the benchmarks selected in Section 4.1 are directly applicable. Other MFFF Pu-nitrate solution design applications incorporate borated concrete as a neutron absorber for criticality control purposes. A review of technical literature, including the International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999), did not identify any Pu-nitrate solution benchmark experiments that included borated concrete or other boron containing neutron absorber materials. However, a number of uranium nitrate (U-nitrate) solution fissile medium experiments that include borated concrete, borated plaster, and borated water neutron absorber materials were identified. These experiments are evaluated using the SCALE 4.4 CSAS26 (KENO VI) criticality analysis sequence and the 238 energy group cross-section library (238GROUPNDF5). The results of this evaluation are used to demonstrate the applicability of the USL-1 acceptance criterion for AOA-1 presented in Section 6.1 of this validation report (i.e.,  $USL-1=0.9399$ ) to Pu-nitrate systems incorporating borated concrete neutron absorber materials.

The appendix begins by providing a brief description of the high enrichment U-nitrate solution benchmark experiments and CSAS26/238GROUPNDF5 analyzed results. The results are then evaluated to accomplish the following:

1. Determine the bias, if any, between  $k_{eff}$  results obtained for experiments with borated concrete or borated plaster neutron absorbers and other similar experiments without these materials present,
2. Confirm the applicability of the U-nitrate experiment results to Pu-nitrate solution design applications, and
3. Determine the area(s) of applicability (AOA) encompassed by the borated concrete and borated plaster neutron absorber experiments evaluated and determine if any trends can be identified.

The approach taken to validate the CSAS26/238GROUPNDF5 criticality analysis methodology for application to Pu-nitrate systems incorporating borated concrete neutron absorber materials does not involve direct inclusion of the U-nitrate solution experiment data in the USL-1 determination. The approach involves a separate evaluation of the uranium-based data to demonstrate no significant method bias or uncertainty variations are observed when comparing results for systems that include borated concrete neutron absorber materials with results for systems that do not. The approach also demonstrates that the neutron absorption spectrum within the absorbing material is relatively insensitive to the source of the neutrons (e.g., U or Pu). This indirect approach is selected to avoid combining plutonium and uranium fissile medium benchmark experiment  $k_{eff}$  results in the USL-1 determination. Significant differences in method bias as a function of neutron energy spectra have been previously observed when comparing results for plutonium and uranium fissile systems (DeHart and Bowman 1994).

## **U-NITRATE SOLUTION EXPERIMENT DESCRIPTIONS AND ANALYZED RESULTS**

The critical experiments designated as HEU-SOL-THERM-033 in the International Handbook of Evaluated Criticality Safety Benchmark Experiments are used in order to validate the CSAS26/238GROUPNDF5 code system for use in Pu-nitrate solution design applications involving borated concrete supplemental neutron absorber materials. The HEU-SOL-THERM-033 experiments were performed at the Rocky Flats Critical Mass Laboratory and involved nested annular steel tanks containing fissile material solution with various materials inserted as a “plug” in the central annulus region formed by the innermost annular tank. The tank system was situated inside a concrete enclosure. Materials inserted in the central region included air, boron-free water, borated water, boron-free concrete, borated concrete, and borated plaster. Critical heights of the highly enriched solutions were measured. Thirty-seven critical configurations were attempted during 12 experiment sets. Nine of the configurations were subcritical. Of the 28 critical configurations, 26 were judged acceptable for benchmark applications by the experiment evaluator and reviewers (Nuclear Energy Agency 1999).

All 26 HEU-SOL-THERM-033 critical experiments judged acceptable by the benchmark handbook evaluator and reviewers were analyzed using CSAS25 (238-Group ENDF/B-IV cross section library) for verification purposes. Verification results are reported in the handbook. CSAS26 input files were prepared and calculations performed using the 238GROUPNDF5 cross section set as well. The calculated  $k_{\text{eff}}$  results for the complete set of all 26 of the benchmark experiments are presented in Table 1. Also presented in Table 1 are estimated values for measured  $k_{\text{eff}}$  and experiment uncertainties reported in the handbook and results of statistical analysis performed on the calculated data. Calculated  $k_{\text{eff}}$  results and similar grouped statistical analysis results are presented in Tables 2 through 5 for the following subsets of experiments: (a) 15 experiments with no borated concrete or borated plaster, (b) 18 experiments with no boron-free concrete, (c) 19 experiments with boron-free concrete, borated concrete, or borated plaster, and (d) 11 experiments with borated concrete or borated plaster. A summary of the statistical results for the five sets of experiment results evaluated is provided in Table 6.

A review of the Table 6 results summary indicates that no significant difference in bias results for systems that include borated concrete neutron absorbers as compared to systems that do not when using CSAS26 and the 238GROUPNDF5 cross section library. For example, the evaluated variation in CSAS26 method bias indicated for benchmark experiment sets with and without borated concrete (i.e., Table 2 and 5 method bias values) is 0.0015. This variation is small compared to the level of uncertainty in the method bias accounted for in the determination of USL-1 in Section 6.1 of the report (i.e., 0.01). The results also indicate that the criticality analysis methodology tends to predict higher  $k_{\text{eff}}$  results for systems containing borated concrete than for systems without any concrete, though slightly less than for systems containing boron-free concrete. This observation provides additional rationale supporting the acceptability of extrapolating Section 6.1 Pu-nitrate solution validation results to MFFF design applications containing borated concrete.

## **EXPERIMENT SET APPLICABILITY TO PU-NITRATE SYSTEMS**

The applicability of the HEU-SOL-THERM-033 critical experiment set to design applications containing Pu-nitrate solutions is addressed through an evaluation of the neutron energy spectra in the absorbing medium. The absorbed neutron energy spectrum for the borated concrete region of benchmark experiment configuration 8a is compared to the absorption spectrum for the same region of identical configurations with Pu-nitrate substituted for the U-nitrate in the fissile medium regions. This approach is selected to demonstrate that the neutron absorption spectrum within the absorbing material is insensitive to the source of the neutrons (i.e., Pu-nitrate versus U-nitrate solution systems).

Experiment configuration 8a is selected for the purposes of this applicability demonstration since it is the most heavily borated concrete experiment in the HEU-SOL-THERM-033 set. Experiment 8a incorporates 2.5 weight percent boron in the concrete plug placed in the central region of the annular tank system.

Calculations with Pu-nitrate substituted for U-nitrate fissile medium are created with all other attributes of the HEU-SOL-THERM-033 experiment 8a remaining unaltered. Two Pu-nitrate composition cases are evaluated. In the first case, the concentration of the Pu-nitrate was specified at a value comparable to the high enrichment uranium concentration used in the HEU-SOL-THERM-033 case (i.e., H/X=70). In the second case, a value which represents optimum moderation for the Pu-nitrate isotopic composition is specified (i.e., H/X=125). In both cases, the plutonium isotopic distribution assumed is 96 weight percent Pu-239, and 4 weight percent Pu-240.

Figure 1 presents the neutron absorption energy spectra results for the three fissile medium cases evaluated. The results indicate that the borated concrete absorption spectra are similar for the three fissile medium cases evaluated and that the absorption spectra are relatively insensitive to the fissile medium composition (i.e., high enrichment uranium versus plutonium). This favorable comparison of absorption spectra supports the use of U-nitrate based benchmark experiment data in the validation of the CSAS26/238GROUPNDF5 criticality analysis method for the limited purpose of extrapolating the AOA(1) USL result (i.e., USL-1=0.9399) to Pu-nitrate solution systems containing borated concrete as a supplemental neutron absorber.

## **AREA(S) OF APPLICABILITY DETERMINATION**

The general arrangement of the HEU-SOL-THERM-033 critical experiments supports a conclusion that the experiments evaluated encompass the entire AOA of any MFFF Pu-nitrate design application that incorporates borated concrete as a neutron absorber material. This conclusion is based on the experiment arrangement that places borated concrete plugs in the central cavity formed by annular steel tanks containing fissile aqueous solutions. In addition to being physically similar to MFFF design applications where annular tanks are utilized with borated concrete incorporated in the central cavity, the experiment arrangements place borated concrete in a position where the absorber acts to limit interaction between opposite sides of an annular tank. Thus, the experimental arrangements incorporate the neutron absorber in a high reactivity worth region of a fissile system relative to other typical design application arrangements. Other design application arrangements involving borated concrete supplemental

neutron absorber materials include reflectors external to cylindrical tank outer radial surfaces, or interaction control shields placed between physically separated fissile solution containing tanks or components.

Although the physical arrangement of the HEU-SOL-THERM-033 critical experiments supports a favorable AOA conclusion, additional analysis is necessary to fully establish the area of applicability encompassed by the borated concrete benchmark experiments included in the experiment set. Borated concrete supplemental neutron absorber materials are typically placed in a close proximity reflector region to reduce neutron reflection back into the source fissile unit, or at more remote locations between fissile units/regions to limit interaction. In any case, the borated concrete absorber will have only limited impact on the neutron spectrum characteristics of the fissile medium in aqueous solution fissile systems where the absorber is situated outside and separate from the fissile solution. Any impact on the neutron spectrum characteristics of the fissile medium is expected to be well within the fission spectrum encompassed by the AOA(1) bias basis benchmark experiment set (i.e., see Figure 6.2 of main report). Therefore, the most relevant trending parameter(s) would measure the effectiveness of the material as an absorber rather than its potential effect on a characteristic of the fissile medium, such as Energy of Average Lethargy Causing Fission (EALF). Both boron-10 (B-10) and hydrogen content are important characteristics of borated concrete absorber materials and are thus selected as additional AOA trending parameters.

Trending analysis on the B-10 and hydrogen content of materials placed in the central cavity of the annular tank experiments is performed to provide additional insights into the AOA encompassed by the HEU-SOL-THERM-033 critical experiment set. The calculated bias results presented in Table 1 and the HEU-SOL-THERM-033 critical experiment material atom density information provided in the International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999) are used to produce a trending analysis. Trending analysis results are presented in Figures 2 and 3 for B-10 and hydrogen content, respectively.

The trending analysis results do not indicate any strong trends exist within the AOA covered by the experiment set (i.e., 0 to  $5.4\text{E-}4$  atoms/barn-cm B-10, and 0 to  $6.6\text{E-}2$  atoms/barn-cm for hydrogen). Although the benchmark experiment AOA for B-10 content is limited to a maximum of  $5.4\text{E-}4$  atoms/barn-cm B-10, the trending analysis presented in Figure 2 supports the conclusion that extrapolation of benchmark evaluation results beyond the evaluated AOA is acceptable. The data presented for hydrogen content spans a wide range of conditions from dry air to full density pure water. Thus, the hydrogen content AOA encompasses the borated concrete absorber material used in design applications.

## **SUMMARY**

Results calculated by the CSAS26/238GROUPNDF5 criticality analysis methodology for U-nitrate aqueous solution benchmark experiments containing borated concrete, borated plaster, borated water, boron-free concrete, boron-free water, and void within the central cavity of an annular tank fissile configuration are presented. Comparisons of results for experiments containing borated materials against results for non-borated materials were performed. The comparisons did not indicate any significant bias exists between CSAS26/238GROUPNDF5



criticality analysis methodology calculated results for systems that contain borated neutron absorber materials relative to systems that are boron-free.

A comparison is also presented to demonstrate the applicability of the U-nitrate solution benchmark experiment conclusions to systems that contain Pu-nitrate aqueous solutions as a fissile medium (i.e., with respect to potential biases introduced by the presence of external borated neutron absorber materials). The absorbed neutron energy spectrum within the borated concrete medium is obtained from CSAS26 output for benchmark experiment configuration 8a (i.e., 2.5 weight percent boron case). Similar spectrum data are obtained for experiment 8a where the U-nitrate solution was replaced with Pu-nitrate with H/X ratios of 70 and 125. The absorbed neutron energy spectrum data for borated concrete was not significantly affected by substituting Pu-nitrate for the U-nitrate solution used in the actual experiment. This favorable comparison demonstrates that the neutron absorption characteristics of borated concrete incorporated separate and external to the fissile medium is not significantly affected by the fissile medium composition, and that the U-nitrate experiment derived borated concrete method bias conclusions are also applicable to Pu-nitrate aqueous solution systems.

Trending analyses are presented for borated concrete B-10 and hydrogen content for the purposes of establishing the AOA covered by the experiment set. Based on the results of this AOA trending analysis, it is concluded that the  $USL-1=0.9399$  acceptance criterion can be assumed applicable to Pu-nitrate aqueous solution systems incorporating borated concrete external to the fissile medium over a wide range of borated concrete hydrogen or B-10 content.

**Table 1. CSAS Results for All Experiments in HEU-SOL-THERM-033**

Experiment	Experiment/Case Description	OECD Result [1]		CSAS26; 238		Benchmark Model Bias & Uncertainty [2]			CSAS26; 238 Bias [5]
		k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	Bias	Uncertainty	
1	2a; None	1.0019	0.0011	0.9996	0.0012	0.9979	-0.0021	0.0112	0.0017
2	2b; None	0.9982	0.0012	0.9984	0.0012	1.0000	0.0000	0.0109	-0.0016
3	2c; None	0.9996	0.0010	0.9981	0.0010	0.9979	-0.0021	0.0067	0.0002
4	3a; Conc.	1.0015	0.0011	1.0014	0.0013	0.9942	-0.0058	0.0115	0.0072
5	3b; Conc.	1.0032	0.0010	1.0019	0.0013	0.9979	-0.0021	0.0112	0.0040
6	3c; Conc.	1.0110	0.0012	1.0125	0.0012	0.9979	-0.0021	0.0072	0.0146
7	4a; Conc. & Cd	0.9994	0.0011	1.0004	0.0013	0.9942	-0.0058	0.0115	0.0062
8	4b; Conc. & Cd	1.0078	0.0011	1.0060	0.0013	0.9979	-0.0021	0.0112	0.0081
9	5a; 1.2 w/o B-Conc.	1.0087	0.0011	1.0077	0.0012	0.9942	-0.0058	0.0112	0.0135
10	5b; 1.2 w/o B-Conc.	1.0077	0.0012	1.0085	0.0014	1.0000	0.0000	0.0109	0.0085
11	6a; 1.2 w/o B-Conc.	1.0031	0.0011	1.0022	0.0013	0.9942	-0.0058	0.0112	0.0080
12	6b; 1.2 w/o B-Conc.	1.0079	0.0011	1.0108	0.0012	1.0000	0.0000	0.0109	0.0108
13	7a; 1.1 w/o B-Plast.	0.9987	0.0011	0.9993	0.0012	0.9942	-0.0058	0.0112	0.0051
14	7b; 1.1 w/o B-Plast.	1.0053	0.0010	1.0058	0.0013	1.0000	0.0000	0.0109	0.0058
15	8a; 2.5 w/o B-Conc.	1.0026	0.0010	1.0034	0.0011	0.9942	-0.0058	0.0112	0.0092
16	8b; 2.5 w/o B-Conc.	1.0055	0.0011	1.0072	0.0013	1.0000	0.0000	0.0109	0.0072
17	9a; 1.1 w/o B-Plast.	0.9984	0.0011	0.9954	0.0012	0.9942	-0.0058	0.0112	0.0012
18	9b; 1.1 w/o B-Plast.	0.9961	0.0012	0.9971	0.0012	1.0000	0.0000	0.0109	-0.0029
19	9c; 1.1 w/o B-Plast.	0.9967	0.0012	0.9931	0.0012	0.9979	-0.0021	0.0105	-0.0048
20	10a; Conc.	1.0025	0.0011	1.0021	0.0011	0.9942	-0.0058	0.0115	0.0079
21	10c; Conc.	1.0027	0.0011	1.0016	0.0011	0.9979	-0.0021	0.0072	0.0036
22	10d; Conc.	0.9929	0.0011	0.9947	0.0013	0.9979	-0.0021	0.0106	-0.0032
23	11a; Water	1.0012	0.0012	1.0000	0.0012	0.9942	-0.0058	0.0112	0.0058
24	11b; Water	1.0013	0.0012	0.9982	0.0012	0.9979	-0.0021	0.0109	0.0003
25	12a; B-Water	0.9997	0.0011	0.9986	0.0011	0.9942	-0.0058	0.0112	0.0044
26	12b; B-Water	0.9996	0.0011	1.0019	0.0011	1.0000	0.0000	0.0109	0.0019
Mean		1.0020		1.0018		0.9970	-0.0030	0.0106	
Standard Deviation +/-		0.0043		0.0049					
Method Bias [3]		0.0050		0.0047					
Uncertainty in Bias [4] +/-		0.0115		0.0117					

**NOTES:**

[1] Table 49, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[2] Table 47, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[3] Method Bias = Mean - Mean Benchmark Model

[4] Uncertainty in Bias = (Standard Deviation<sup>2</sup> + Mean Benchmark Model Uncertainty<sup>2</sup>)<sup>0.5</sup>

[5] CSAS26 Bias = CSAS26; 238 k<sub>eff</sub> - Benchmark Model k<sub>eff</sub>.

**Table 2. CSAS Results for Experiments in HEU-SOL-THERM-033; No Borated Concrete or Plaster**

Experiment	Experiment/Case Description	OECD Result [1]		CSAS26; 238		Benchmark Model Bias & Uncertainty [2]			CSAS26; 238 Bias [5]
		k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	Bias	Uncertainty	
1	2a; None	1.0019	0.0011	0.9996	0.0012	0.9979	-0.0021	0.0112	0.0017
2	2b; None	0.9982	0.0012	0.9984	0.0012	1.0000	0.0000	0.0109	-0.0016
3	2c; None	0.9996	0.0010	0.9981	0.0010	0.9979	-0.0021	0.0067	0.0002
4	3a; Conc.	1.0015	0.0011	1.0014	0.0013	0.9942	-0.0058	0.0115	0.0072
5	3b; Conc.	1.0032	0.0010	1.0019	0.0013	0.9979	-0.0021	0.0112	0.0040
6	3c; Conc.	1.0110	0.0012	1.0125	0.0012	0.9979	-0.0021	0.0072	0.0146
7	4a; Conc. & Cd	0.9994	0.0011	1.0004	0.0013	0.9942	-0.0058	0.0115	0.0062
8	4b; Conc. & Cd	1.0078	0.0011	1.0060	0.0013	0.9979	-0.0021	0.0112	0.0081
9	10a; Conc.	1.0025	0.0011	1.0021	0.0011	0.9942	-0.0058	0.0115	0.0079
10	10c; Conc.	1.0027	0.0011	1.0016	0.0011	0.9979	-0.0021	0.0072	0.0036
11	10d; Conc.	0.9929	0.0011	0.9947	0.0013	0.9979	-0.0021	0.0106	-0.0032
12	11a; Water	1.0012	0.0012	1.0000	0.0012	0.9942	-0.0058	0.0112	0.0058
13	11b; Water	1.0013	0.0012	0.9982	0.0012	0.9979	-0.0021	0.0109	0.0003
14	12a; B-Water	0.9997	0.0011	0.9986	0.0011	0.9942	-0.0058	0.0112	0.0044
15	12b; B-Water	0.9996	0.0011	1.0019	0.0011	1.0000	0.0000	0.0109	0.0019
Mean		1.0015		1.0010		0.9969	-0.0031	0.0103	
Standard Deviation +/-		0.0041		0.0041					
Method Bias [3]		0.0046		0.0041					
Uncertainty in Bias [4] +/-		0.0111		0.0111					

**NOTES:**

[1] Table 49, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[2] Table 47, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[3] Method Bias = Mean - Mean Benchmark Model

[4] Uncertainty in Bias = (Standard Deviation<sup>2</sup> + Mean Benchmark Model Uncertainty<sup>2</sup>)<sup>0.5</sup>

[5] CSAS26 Bias = CSAS26; 238 k<sub>eff</sub> - Benchmark Model k<sub>eff</sub>.

**Table 3. CSAS Results for Experiments in HEU-SOL-THERM-033; No Boron-free Concrete**

Experiment	Experiment/Case Description	OECD Result [1]		CSAS26; 238		Benchmark Model Bias & Uncertainty [2]			CSAS26; 238 Bias [5]
		k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	Bias	Uncertainty	
1	2a; None	1.0019	0.0011	0.9996	0.0012	0.9979	-0.0021	0.0112	0.0017
2	2b; None	0.9982	0.0012	0.9984	0.0012	1.0000	0.0000	0.0109	-0.0016
3	2c; None	0.9996	0.0010	0.9981	0.0010	0.9979	-0.0021	0.0067	0.0002
4	5a; 1.2 w/o B-Conc.	1.0087	0.0011	1.0077	0.0012	0.9942	-0.0058	0.0112	0.0135
5	5b; 1.2 w/o B-Conc.	1.0077	0.0012	1.0085	0.0014	1.0000	0.0000	0.0109	0.0085
6	6a; 1.2 w/o B-Conc.	1.0031	0.0011	1.0022	0.0013	0.9942	-0.0058	0.0112	0.0080
7	6b; 1.2 w/o B-Conc.	1.0079	0.0011	1.0108	0.0012	1.0000	0.0000	0.0109	0.0108
8	7a; 1.1 w/o B-Plast.	0.9987	0.0011	0.9993	0.0012	0.9942	-0.0058	0.0112	0.0051
9	7b; 1.1 w/o B-Plast.	1.0053	0.0010	1.0058	0.0013	1.0000	0.0000	0.0109	0.0058
10	8a; 2.5 w/o B-Conc.	1.0026	0.0010	1.0034	0.0011	0.9942	-0.0058	0.0112	0.0092
11	8b; 2.5 w/o B-Conc.	1.0055	0.0011	1.0072	0.0013	1.0000	0.0000	0.0109	0.0072
12	9a; 1.1 w/o B-Plast.	0.9984	0.0011	0.9954	0.0012	0.9942	-0.0058	0.0112	0.0012
13	9b; 1.1 w/o B-Plast.	0.9961	0.0012	0.9971	0.0012	1.0000	0.0000	0.0109	-0.0029
14	9c; 1.1 w/o B-Plast.	0.9967	0.0012	0.9931	0.0012	0.9979	-0.0021	0.0105	-0.0048
15	11a; Water	1.0012	0.0012	1.0000	0.0012	0.9942	-0.0058	0.0112	0.0058
16	11b; Water	1.0013	0.0012	0.9982	0.0012	0.9979	-0.0021	0.0109	0.0003
17	12a; B-Water	0.9997	0.0011	0.9986	0.0011	0.9942	-0.0058	0.0112	0.0044
18	12b; B-Water	0.9996	0.0011	1.0019	0.0011	1.0000	0.0000	0.0109	0.0019
Mean		1.0018		1.0014		0.9973	-0.0027	0.0108	
Standard Deviation +/-		0.0039		0.0049					
Method Bias [3]		0.0045		0.0041					
Uncertainty in Bias [4] +/-		0.0115		0.0118					

**NOTES:**

[1] Table 49, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[2] Table 47, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[3] Method Bias = Mean - Mean Benchmark Model

[4] Uncertainty in Bias = (Standard Deviation<sup>2</sup> + Mean Benchmark Model Uncertainty<sup>2</sup>)<sup>0.5</sup>

[5] CSAS26 Bias = CSAS26; 238 k<sub>eff</sub> - Benchmark Model k<sub>eff</sub>.

**Table 4. CSAS Results for Experiments in HEU-SOL-THERM-033; All Concrete and Plaster Only**

Experiment	Experiment/Case Description	OECD Result [1]		CSAS26; 238		Benchmark Model Bias & Uncertainty [2]			CSAS26; 238
		k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	Bias	Uncertainty	Bias [5]
1	3a; Conc.	1.0015	0.0011	1.0014	0.0013	0.9942	-0.0058	0.0115	0.0072
2	3b; Conc.	1.0032	0.0010	1.0019	0.0013	0.9979	-0.0021	0.0112	0.0040
3	3c; Conc.	1.0110	0.0012	1.0125	0.0012	0.9979	-0.0021	0.0072	0.0146
4	4a; Conc. & Cd	0.9994	0.0011	1.0004	0.0013	0.9942	-0.0058	0.0115	0.0062
5	4b; Conc. & Cd	1.0078	0.0011	1.0060	0.0013	0.9979	-0.0021	0.0112	0.0081
6	5a; 1.2 w/o B-Conc.	1.0087	0.0011	1.0077	0.0012	0.9942	-0.0058	0.0112	0.0135
7	5b; 1.2 w/o B-Conc.	1.0077	0.0012	1.0085	0.0014	1.0000	0.0000	0.0109	0.0085
8	6a; 1.2 w/o B-Conc.	1.0031	0.0011	1.0022	0.0013	0.9942	-0.0058	0.0112	0.0080
9	6b; 1.2 w/o B-Conc.	1.0079	0.0011	1.0108	0.0012	1.0000	0.0000	0.0109	0.0108
10	7a; 1.1 w/o B-Plast.	0.9987	0.0011	0.9993	0.0012	0.9942	-0.0058	0.0112	0.0051
11	7b; 1.1 w/o B-Plast.	1.0053	0.0010	1.0058	0.0013	1.0000	0.0000	0.0109	0.0058
12	8a; 2.5 w/o B-Conc.	1.0026	0.0010	1.0034	0.0011	0.9942	-0.0058	0.0112	0.0092
13	8b; 2.5 w/o B-Conc.	1.0055	0.0011	1.0072	0.0013	1.0000	0.0000	0.0109	0.0072
14	9a; 1.1 w/o B-Plast.	0.9984	0.0011	0.9954	0.0012	0.9942	-0.0058	0.0112	0.0012
15	9b; 1.1 w/o B-Plast.	0.9961	0.0012	0.9971	0.0012	1.0000	0.0000	0.0109	-0.0029
16	9c; 1.1 w/o B-Plast.	0.9967	0.0012	0.9931	0.0012	0.9979	-0.0021	0.0105	-0.0048
17	10a; Conc.	1.0025	0.0011	1.0021	0.0011	0.9942	-0.0058	0.0115	0.0079
18	10c; Conc.	1.0027	0.0011	1.0016	0.0011	0.9979	-0.0021	0.0072	0.0036
19	10d; Conc.	0.9929	0.0011	0.9947	0.0013	0.9979	-0.0021	0.0106	-0.0032
Mean		1.0027		1.0027		0.9969	-0.0031	0.0107	
Standard Deviation +/-		0.0048		0.0054					
Method Bias [3]		0.0058		0.0058					
Uncertainty in Bias [4] +/-		0.0117		0.0120					

**NOTES:**

[1] Table 49, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[2] Table 47, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[3] Method Bias = Mean - Mean Benchmark Model

[4] Uncertainty in Bias = (Standard Deviation<sup>2</sup> + Mean Benchmark Model Uncertainty<sup>2</sup>)<sup>0.5</sup>

[5] CSAS26 Bias = CSAS26; 238 k<sub>eff</sub> - Benchmark Model k<sub>eff</sub>.

**Table 5. CSAS Results for Experiments in HEU-SOL-THERM-033; Borated Concrete and Plaster Only**

Experiment	Experiment/Case Description	OECD Result [1]		CSAS26; 238		Benchmark Model Bias & Uncertainty [2]			CSAS26; 238 Bias [5]
		k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	1-Sigma	k <sub>eff</sub>	Bias	Uncertainty	
1	5a; 1.2 w/o B-Conc.	1.0087	0.0011	1.0077	0.0012	0.9942	-0.0058	0.0112	0.0135
2	5b; 1.2 w/o B-Conc.	1.0077	0.0012	1.0085	0.0014	1.0000	0.0000	0.0109	0.0085
3	6a; 1.2 w/o B-Conc.	1.0031	0.0011	1.0022	0.0013	0.9942	-0.0058	0.0112	0.0080
4	6b; 1.2 w/o B-Conc.	1.0079	0.0011	1.0108	0.0012	1.0000	0.0000	0.0109	0.0108
5	7a; 1.1 w/o B-Plast.	0.9987	0.0011	0.9993	0.0012	0.9942	-0.0058	0.0112	0.0051
6	7b; 1.1 w/o B-Plast.	1.0053	0.0010	1.0058	0.0013	1.0000	0.0000	0.0109	0.0058
7	8a; 2.5 w/o B-Conc.	1.0026	0.0010	1.0034	0.0011	0.9942	-0.0058	0.0112	0.0092
8	8b; 2.5 w/o B-Conc.	1.0055	0.0011	1.0072	0.0013	1.0000	0.0000	0.0109	0.0072
9	9a; 1.1 w/o B-Plast.	0.9984	0.0011	0.9954	0.0012	0.9942	-0.0058	0.0112	0.0012
10	9b; 1.1 w/o B-Plast.	0.9961	0.0012	0.9971	0.0012	1.0000	0.0000	0.0109	-0.0029
11	9c; 1.1 w/o B-Plast.	0.9967	0.0012	0.9931	0.0012	0.9979	-0.0021	0.0105	-0.0048
Mean		1.0028		1.0028		0.9972	-0.0028	0.0110	
Standard Deviation +/-		0.0047		0.0059					
Method Bias [3]		0.0056		0.0056					
Uncertainty in Bias [4] +/-		0.0119		0.0125					

**NOTES:**

[1] Table 49, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[2] Table 47, International Handbook of Evaluated Criticality Safety Benchmark Experiments (Nuclear Energy Agency 1999).

[3] Method Bias = Mean - Mean Benchmark Model

[4] Uncertainty in Bias = (Standard Deviation<sup>2</sup> + Mean Benchmark Model Uncertainty<sup>2</sup>)<sup>0.5</sup>

[5] CSAS26 Bias = CSAS26; 238 k<sub>eff</sub> - Benchmark Model k<sub>eff</sub>.

**Table 6. Summary of Grouped Statistics Results**

Experiment Group	CSAS26/238GROUPNDF5			
	Mean	Standard Deviation (+/-)	Method Bias	Uncertainty in Bias (+/-)
All Experiments (Table 1)	1.0018	0.0049	0.0047	0.0117
No Borated Concrete or Plaster (Table 2)	1.0010	0.0041	0.0041 [1]	0.0111
No Boron-free Concrete (Table 3)	1.0014	0.0049	0.0041	0.0118
All Concrete and Plaster Only (Table 4)	1.0027	0.0054	0.0058	0.0120
Borated Concrete and Plaster Only (Table 5)	1.0028	0.0059	0.0056 [1]	0.0125

NOTE:

[1] Evaluated variation in CSAS26/238GROUPNDF method bias for systems "with" vs. "without" borated supplemental neutron absorber materials =  $0.0015 = 0.0056 - 0.0041$ .

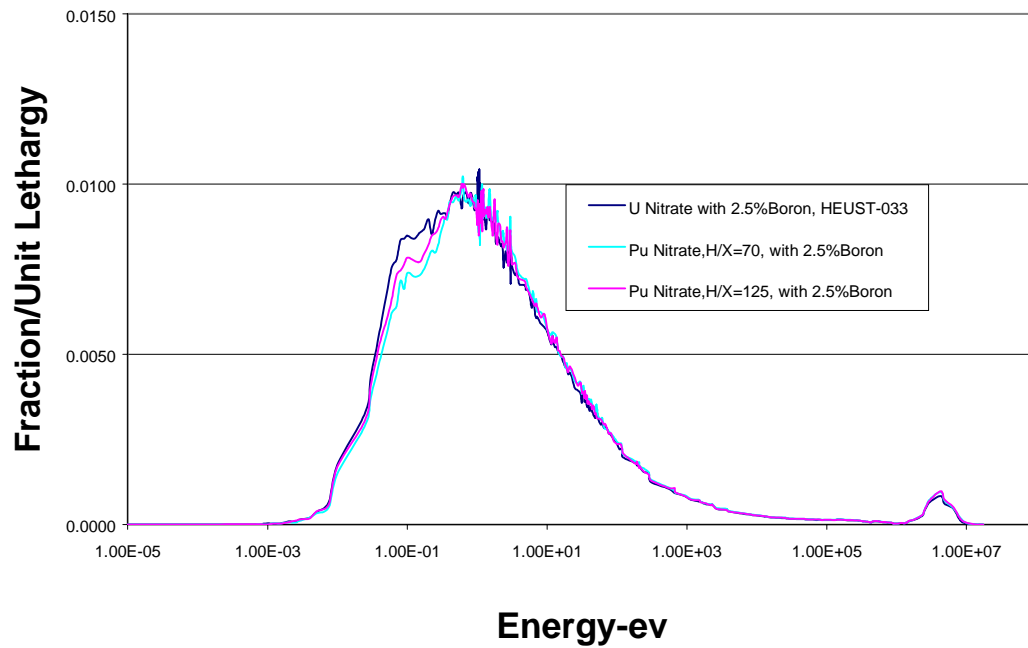


Figure 1. Borated Concrete Absorption Spectra

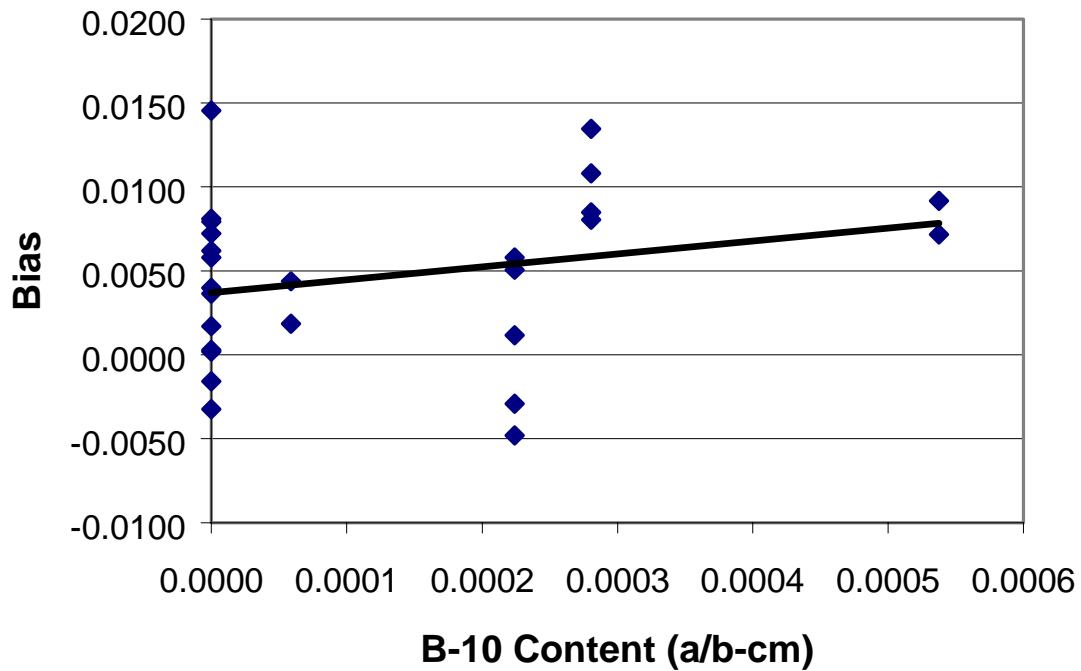
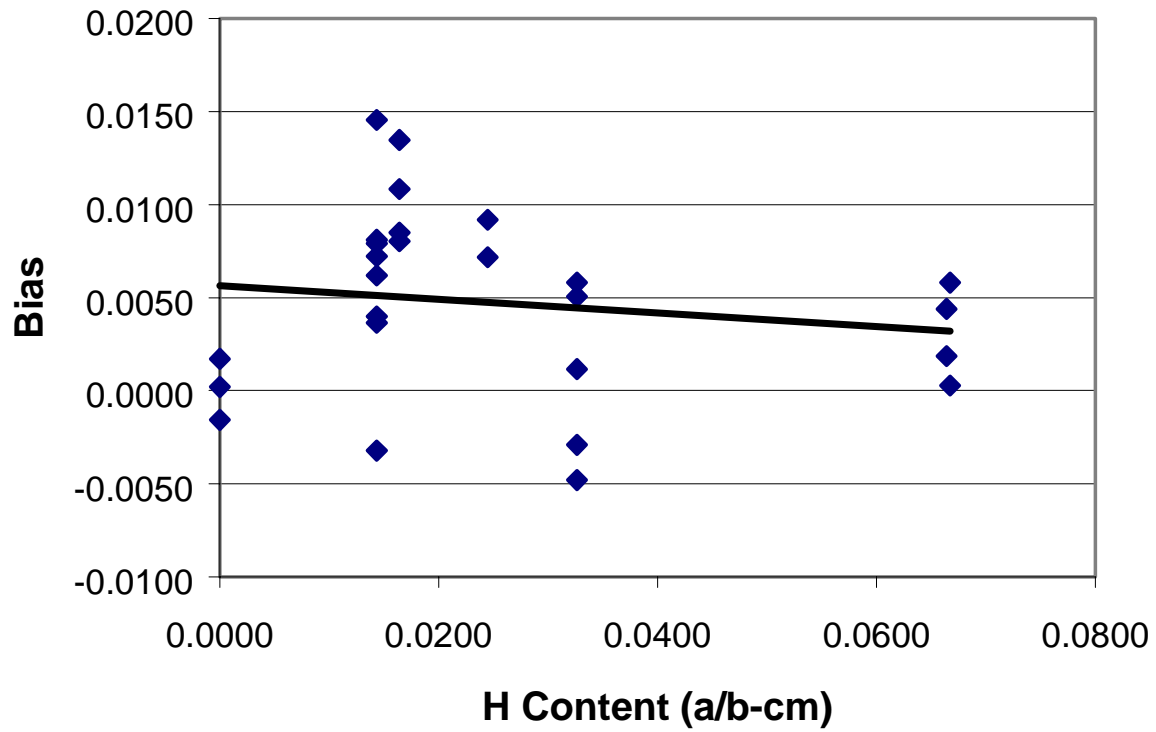


Figure 2. Bias versus B-10 Content





**Figure 3. Bias versus H Content**

## **ATTACHMENT 4**

### **CONCRETE AND CD/WATER REFLECTORS**

## **INTRODUCTION**

The 182 critical experiments modeled for AOA(1) (see Section 6.1) included bare spheres, water reflected spheres, concrete reflected spheres, cadmium/concrete reflected spheres, and cadmium/water reflected spheres. This attachment divides the set into three subgroups (i.e., concrete reflector, Cd/water reflector, and water reflector experiments) to evaluate whether the full group of 182 experiments adequately encompasses the subgroups.

## **USL FOR EXPERIMENTS WITH CONCRETE REFLECTORS**

Twenty-nine experiments were selected using the PU\_SOL\_THERM\_008 benchmark evaluations to evaluate the effect of concrete reflectors on the reactivity of the system.

These experiments have similar characteristics:

- Pu-nitrate solution (  $30 \text{ g/l} < C(\text{Pu}) < 100 \text{ g/l}$  ,  $4.1\% < \% {}^{240}\text{Pu} < 4.6\%$  )
- Spherical geometry
- Concrete reflector or cadmium/concrete reflector.

The evaluations include 24 experiments with a concrete reflector and five experiments with cadmium and concrete reflectors.

## **EXPERIMENTS WITH CADMIUM/WATER REFLECTOR**

Fourteen experiments were selected from the benchmark experiment PU-SOL-THERM-020 to evaluate the effect of water and cadmium/water reflectors on the reactivity of the system. These experiments were further divided to those experiments with and without Cd. The experiments have the following characteristics:

- Pu-nitrate solution (  $30 \text{ g/l} < C(\text{Pu}) < 70 \text{ g/l}$  ,  $4.67\% {}^{240}\text{Pu}$  )
- Spherical geometry.

Ten experiments are reflected by water and four are reflected by cadmium/water.

## **SUMMARY**

Table 1 provides a comparison of the mean  $k_{\text{eff}}$  of each subset with the mean  $k_{\text{eff}}$  from the full set. The table indicates that the bias is positive for all cases and that there is no significant difference in the bias results. Furthermore, the variation is small compared to the level of uncertainty in the computational bias accounted for in the determination of USL-1 in Section 6.1 of the report (i.e., 0.0101). Therefore, since the subsets are included in the calculation of the USL and computational bias established for AOA(1), the USL and range established for the AOA(1) is applicable to the subsets of concrete reflectors, Cd/water reflectors, and water reflectors.

**Table 1. Mean calculated Keff for full set and subsets of AOA(1) benchmarks.**

Description	No. Experiments	$k_{eff}$	$\sigma(k_{eff})$	Minimum	Maximum
Full set of experiments	182	1.0097	0.0058	0.9976	1.0320
Concrete Reflector	29	1.0177	0.0088	0.9976	1.0320
Cd/Water Reflector	4	1.0032	0.0050	1.0004	1.0096
Water Reflector	10	1.0070	0.0030	1.0021	1.0113

## **ATTACHMENT 5**

### **SAMPLE STATISTICAL CALCULATION**

uslstats: a utility to calculate upper subcritical  
limits for criticality safety applications

\*\*\*\*\*  
Version 1.3.7, May 18, 1999  
Oak Ridge National Laboratory  
\*\*\*\*\*

Input to statistical treatment from file:mixcompl.in

Title: Mix Comp Therm-Pellets, Rods, Assemblies

Proportion of the population = .999  
Confidence of fit = .950  
Confidence on proportion = .950  
Number of observations = 36  
Minimum value of closed band = 0.00  
Maximum value of closed band = 0.00  
Administrative margin = 0.05

independent variable - x	dependent variable - y	deviation in y	independent variable - x	dependent variable - y	deviation in y
5.76000E-01	9.93300E-01	1.20000E-03	1.18000E-01	9.96600E-01	1.30000E-03
7.67000E-01	9.96100E-01	1.40000E-03	9.24000E-02	9.97900E-01	1.20000E-03
1.93000E-01	1.00040E+00	1.20000E-03	9.24000E-02	9.97900E-01	1.20000E-03
2.82000E-01	1.00590E+00	1.20000E-03	9.23000E-02	9.99500E-01	1.30000E-03
1.38000E-01	1.00280E+00	1.10000E-03	7.99000E-02	9.99800E-01	1.40000E-03
1.83000E-01	1.00590E+00	1.10000E-03	7.95000E-02	1.00000E+00	1.10000E-03
9.09000E-01	9.91100E-01	1.30000E-03	3.92000E-01	9.95500E-01	1.20000E-03
5.49000E-01	9.93900E-01	1.30000E-03	2.60000E-01	9.94500E-01	1.50000E-03
5.48000E-01	9.96400E-01	1.30000E-03	1.77000E-01	1.00250E+00	1.20000E-03
6.54000E-01	9.97100E-01	1.20000E-03	1.46000E-01	1.00120E+00	1.40000E-03
1.89000E-01	1.00130E+00	1.30000E-03	1.08000E-01	1.00260E+00	1.60000E-03
1.56000E-01	1.00110E+00	1.30000E-03	9.35000E-02	1.00360E+00	1.60000E-03
1.02000E-01	1.00220E+00	1.30000E-03	5.48000E-01	9.96100E-01	1.00000E-03
1.46000E-01	9.91600E-01	1.20000E-03	3.06000E-01	9.90700E-01	1.00000E-03
1.45000E-01	9.94000E-01	1.30000E-03	1.57000E-01	9.90800E-01	1.20000E-03
1.44000E-01	9.94400E-01	1.30000E-03	1.17000E-01	9.92500E-01	9.00000E-04
1.20000E-01	9.95600E-01	1.30000E-03	9.58000E-02	9.93200E-01	8.00000E-04
1.19000E-01	9.95200E-01	1.10000E-03	9.16000E-02	9.93700E-01	8.00000E-04

WARNING \*\*\* the test for normal may be unreliable due to insufficient data.

chi = 3.7222 (upper bound = 9.49). The data tests normal.

Output from statistical treatment

Mix Comp Therm-Pellets, Rods, Assemblies

Number of data points (n)	36
Linear regression, k(X)	0.9990 + (-6.2669E-03)*X
Confidence on fit (1-gamma) [input]	95.0%
Confidence on proportion (alpha) [input]	95.0%
Proportion of population falling above lower tolerance interval (rho) [input]	99.9%
Minimum value of X	0.0795
Maximum value of X	0.9090
Average value of X	0.24907
Average value of k	0.99741
Minimum value of k	0.99070
Variance of fit, s(k,X)^2	1.7185E-05
Within variance, s(w)^2	1.5325E-06
Pooled variance, s(p)^2	1.8718E-05
Pooled std. deviation, s(p)	4.3264E-03
C(alpha,rho)*s(p)	2.2214E-02
student-t @ (n-2,1-gamma)	1.69180E+00
Confidence band width, W	8.3085E-03
Minimum margin of subcriticality, C*s(p)-W	1.3906E-02

Upper subcritical limits: ( 7.95000E-02 <= X <= 0.90900 )  
\*\*\*\*\*

USL Method 1 (Confidence Band with  
Administrative Margin)  $USL1 = 0.9407 + (-6.2669E-03)*X$

USL Method 2 (Single-Sided Uniform  
Width Closed Interval Approach)  $USL2 = 0.9768 + (-6.2669E-03)*X$

USLs Evaluated Over Range of Parameter X:  
\*\*\*\* \*\*\*\*\* \*\* \*\*\*\*\* \*\*

X:	7.95E-2	1.98E-1	3.17E-1	4.35E-1	5.54E-1	6.72E-1	7.91E-1	9.09E-1
USL-1:	0.9402	0.9394	0.9387	0.9379	0.9372	0.9365	0.9357	0.9350
USL-2:	0.9763	0.9755	0.9748	0.9740	0.9733	0.9725	0.9718	0.9711

\*\*\*\*\*  
Thus spake USLSTATS  
Finis.

## **ATTACHMENT 6**

### **INPUT FILES**



## INPUT FILES ON CD



# **Mixed Oxide Fuel Fabrication Facility**

## **Criticality Code Validation**

### **Part I**

Docket Number 070-03098

Prepared by  
Duke Cogema Stone & Webster

June 2001

Under  
U.S. Department of Energy  
Contract DE-AC02-99-CH10888

## **ATTACHMENT 6**

### **INPUT FILES**

## Case PU\_SOL\_TH\_001\_1\_T8A\_k6

```
#csas26      parm='size=00400000'
case 1,kvpusoln,238, 73gpu/1,4.6w/o240,h2oreflsph,red. dia
238group
infhommedium
'MTL1= 73GPU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 1.1080-08 298 end
pu-239 1 0.0 1.7472-04 298 end
pu-240 1 0.0 8.5486-06 298 end
pu-241 1 0.0 5.5623-07 298 end
pu-242 1 0.0 1.6345-08 298 end
n      1 0.0 8.5565-04 298 end
h      1 0.0 6.4883-02 298 end
o      1 0.0 3.4948-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe      2 0.0 5.9355-02 298 end
cr      2 0.0 1.7428-02 298 end
ni      2 0.0 7.7203-03 298 end
mn      2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
      1.451510E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 1 1 1
sphere 2
      1.463960E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 2 1 2 -1
sphere 3
      4.463960E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
end data
end
```

## Case PU\_SOL\_TH\_001\_2\_T8A\_k6

```
#csas26      parm='size=00400000'
case 2,kvpusoln,238,96gpu/1,4.6w/o240,h2oreflsph,red. dia
238group
infhommedium
'MTL1=96.0PU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 1.4571-08 298 end
pu-239 1 0.0 2.2977-04 298 end
pu-240 1 0.0 1.1242-05 298 end
pu-241 1 0.0 7.3148-07 298 end
pu-242 1 0.0 2.1495-08 298 end
n      1 0.0 1.9726-03 298 end
h      1 0.0 6.2392-02 298 end
o      1 0.0 3.6611-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe      2 0.0 5.9355-02 298 end
cr      2 0.0 1.7428-02 298 end
ni      2 0.0 7.7203-03 298 end
mn      2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
      1.453770E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
```

```
z= 0.000000E+00
media 1 1 1
sphere 2
      1.466220E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 2 1 2 -1
sphere 3
      4.466220E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
end data
end
```

## Case PU\_SOL\_TH\_001\_3\_T8A\_k6

```
#csas26      parm='size=00400000'
case 3,kvpusoln,238,119gpu/1,4.6w/o240,h2oreflsph,red. dia
238group
infhommedium
'MTL1=119GPU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 1.8063-08 298 end
pu-239 1 0.0 2.8482-04 298 end
pu-240 1 0.0 1.3935-05 298 end
pu-241 1 0.0 9.0672-07 298 end
pu-242 1 0.0 2.6645-08 298 end
n      1 0.0 2.4028-03 298 end
h      1 0.0 6.1481-02 298 end
o      1 0.0 3.7347-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe      2 0.0 5.9355-02 298 end
cr      2 0.0 1.7428-02 298 end
ni      2 0.0 7.7203-03 298 end
mn      2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
      1.451130E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 1 1 1
sphere 2
      1.463580E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 2 1 2 -1
sphere 3
      4.463580E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
end data
end
```

```
#csas26      parm='size=00400000'
case 4,kvpusoln,238,132gpu/1,4.6w/o240,h2oreflsph,red. dia
238group
infhommedium
'MTL1=132PU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 2.0036-08 298 end
pu-239 1 0.0 3.1594-04 298 end
pu-240 1 0.0 1.5458-05 298 end
pu-241 1 0.0 1.0058-06 298 end
pu-242 1 0.0 2.9556-08 298 end
n      1 0.0 2.7146-03 298 end
```

```
h      1 0.0 6.0164-02 298 end
o      1 0.0 3.7533-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe     2 0.0 5.9355-02 298 end
cr     2 0.0 1.7428-02 298 end
ni     2 0.0 7.7203-03 298 end
mn     2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
```

```
end comp
read param
tme=90 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
```

```
global
unit
sphere 1
      1.453020E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 1 1 1
sphere 2
      1.465470E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 2 1 2 -1
sphere 3
      4.465470E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 3 1 3 -2 -1
boundary 3
end geometry
```

```
end data
end
```

## Case PU\_SOL\_TH\_001\_5\_T8A\_k6

```
#csas26 parm='size=00400000'
case 5,kvpusoln,238,140gpu/1,4.6w/o240,h2oreflsph,red. dia
238group
infhommedium
'MTL1=140PU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 2.1250-08 298 end
pu-239 1 0.0 3.3509-04 298 end
pu-240 1 0.0 1.6395-05 298 end
pu-241 1 0.0 1.0667-06 298 end
pu-242 1 0.0 3.1347-08 298 end
n      1 0.0 2.7350-03 298 end
h      1 0.0 6.0371-02 298 end
o      1 0.0 3.7728-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe     2 0.0 5.9355-02 298 end
cr     2 0.0 1.7428-02 298 end
ni     2 0.0 7.7203-03 298 end
mn     2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
```

```
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
```

```
read geometry
global
unit
sphere 1
      1.453020E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 1 1 1
sphere 2
      1.465470E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 2 1 2 -1
sphere 3
      4.465470E+01
      origin
```

```
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
```

```
end data
end
```

## Case PU\_SOL\_TH\_001\_6\_T8A\_k6

```
#csas26 parm='size=00400000'
case 6,kvpusoln,238,268.7gpu/1,4.6w/o240,h2oreflsph,red.
dia
238group
infhommedium
'MTL1=268.7PU/L,4.6W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 4.0785-08 298 end
pu-239 1 0.0 6.4313-04 298 end
pu-240 1 0.0 3.1466-05 298 end
pu-241 1 0.0 2.0474-06 298 end
pu-242 1 0.0 6.0164-08 298 end
n      1 0.0 3.3692-03 298 end
h      1 0.0 5.8646-02 298 end
o      1 0.0 3.9099-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe     2 0.0 5.9355-02 298 end
cr     2 0.0 1.7428-02 298 end
ni     2 0.0 7.7203-03 298 end
mn     2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
```

```
end comp
read param
tme=90 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
```

```
global
unit
sphere 1
      1.451890E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 1 1 1
sphere 2
      1.464340E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 2 1 2 -1
sphere 3
      4.464340E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
```

```
media 3 1 3 -2 -1
boundary 3
end geometry
```

```
end data
end
```

## Case PU\_SOL\_TH\_002\_1\_k6

```
#csas26 parm='size=00500000'
case 1,kv238,p-11,49.84gpu/1, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=49.84GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.2164-04 300 end
pu-240 1 0.0 3.9010-06 300 end
n      1 0.0 1.3452-03 300 end
h      1 0.0 6.3772-02 300 end
o      1 0.0 3.5500-02 300 end
fe     1 0.0 2.0380-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
```

```
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
```

```

end param
read geometry
global
unit
sphere 1
    1.533990E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 1 1 1
sphere 2
    1.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 2 1 2 -1
sphere 3
    4.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_002_2_k6
#csas26 parm='size=00500000'
case 2,kv238,p-11,51.42gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=51.42GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.2549-04 300 end
pu-240 1 0.0 4.0246-06 300 end
n 1 0.0 1.5831-03 300 end
h 1 0.0 6.3356-02 300 end
o 1 0.0 3.5895-02 300 end
fe 1 0.0 2.9330-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
    1.533990E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 1 1 1
sphere 2
    1.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 2 1 2 -1
sphere 3
    4.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_002_3_k6
#csas26 parm='size=00500000'
case 3,kv238,p-11,56.09gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5

```

```

infhommedium
'MTL1=56.09GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.3689-04 300 end
pu-240 1 0.0 4.3902-06 300 end
n 1 0.0 2.0104-03 300 end
h 1 0.0 6.1779-02 300 end
o 1 0.0 3.6198-02 300 end
fe 1 0.0 2.6419-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
    1.533990E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 1 1 1
sphere 2
    1.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 2 1 2 -1
sphere 3
    4.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_002_4_k6
#csas26 parm='size=00500000'
case 4,kv238,p-11,59.64gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=59.64GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.4556-04 300 end
pu-240 1 0.0 4.6680-06 300 end
n 1 0.0 2.3018-03 300 end
h 1 0.0 6.1211-02 300 end
o 1 0.0 3.6660-02 300 end
fe 1 0.0 2.0704-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
    1.533990E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 1 1 1
sphere 2
    1.546690E+01
    origin
        x= 0.000000E+00
        y= 0.000000E+00
        z= 0.000000E+00
media 2 1 2 -1

```

```
sphere      3
            4.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      3 1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_002_5_k6
#csas26      parm='size=00500000'
case 5,kv238,p-11,63.33gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=63.33GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.5456-04 300 end
pu-240 1 0.0 4.9568-06 300 end
n      1 0.0 2.6223-03 300 end
h      1 0.0 6.0707-02 300 end
o      1 0.0 3.7228-02 300 end
fe      1 0.0 2.1243-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere      1
            1.533990E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      1 1
sphere      2
            1.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      2 1
sphere      3
            4.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      3 1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_002_6_k6
#csas26      parm='size=00500000'
case 6,kv238,p-11,70.11gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=70.11GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.7111-04 300 end
pu-240 1 0.0 5.4875-06 300 end
n      1 0.0 3.1274-03 300 end
h      1 0.0 5.8902-02 300 end
o      1 0.0 3.7623-02 300 end
fe      1 0.0 2.3507-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
```

```
end param
read geometry
global
unit
sphere      1
            1.533990E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      1 1
sphere      2
            1.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      2 1
sphere      3
            4.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      3 1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_002_7_k6
#csas26      parm='size=00500000'
case 7,kv238,p-11,77.09gpu/l, 3.12w/o240,h2oreflsph,12in
dia
238groupndf5
infhommedium
'MTL1=77.09GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.8814-04 300 end
pu-240 1 0.0 6.0338-06 300 end
n      1 0.0 3.4867-03 300 end
h      1 0.0 5.8109-02 300 end
o      1 0.0 3.8160-02 300 end
fe      1 0.0 2.5556-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere      1
            1.533990E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      1 1
sphere      2
            1.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      2 1
sphere      3
            4.546690E+01
            origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media      3 1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_003_1_k6
#csas26      parm='size=00400000'
case 1,kv27,p-11,33.32gpu/l, 1.76w/o240,h2oreflsph,13in
dia
238groupndf5
infhommedium
```

```
'MTL1=33.32GPU/L,1.76W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.2461-05 300 end
pu-240 1 0.0 1.4712-06 300 end
n 1 0.0 8.4206-04 300 end
h 1 0.0 6.4976-02 300 end
o 1 0.0 3.4761-02 300 end
fe 1 0.0 1.3371-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al 4 0.0 5.9881-02 300 end
si 4 0.0 3.7770-04 300 end
cu 4 0.0 5.1364-05 300 end
mn 4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.651560E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.664260E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.664260E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
end data
end
```

**Case PU\_SOL\_TH\_003\_2\_k6**  
#csas26 parm='size=00400000'  
case 2,kv27,p-11,34.32gpu/l, 1.76w/o240,h2oreflsph,13in dia  
238groupndf5  
infhommedium  
'MTL1=34.32GPU/L,1.76W/O240,NITRATE SOLN,C OF N CONSTANTS  
pu-239 1 0.0 8.4936-05 300 end  
pu-240 1 0.0 1.5153-06 300 end  
n 1 0.0 1.1315-03 300 end  
h 1 0.0 6.4208-02 300 end  
o 1 0.0 3.5106-02 300 end  
fe 1 0.0 1.2616-06 300 end  
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN  
fe 2 0.0 6.0386-02 300 end  
cr 2 0.0 1.6678-02 300 end  
ni 2 0.0 9.8504-03 300 end  
'MTL3=WATER AT 0.99651G/CC (27 C)  
h 3 0.0 6.6622-02 300 end  
o 3 0.0 3.3311-02 300 end  
'MATL4=2S ALUMINUM AT 2.71G/CC  
al 4 0.0 5.9881-02 300 end  
si 4 0.0 3.7770-04 300 end  
cu 4 0.0 5.1364-05 300 end  
mn 4 0.0 1.4853-05 300 end  
end comp  
read param  
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes  
end param  
read geometry  
global  
unit  
sphere 1  
1.651560E+01  
origin  
x= 0.000000E+00  
y= 0.000000E+00  
z= 0.000000E+00

```
media 1 1 1
sphere 2
1.664260E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.664260E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry
end data
end
```

**Case PU\_SOL\_TH\_003\_3\_k6**  
#csas26 parm='size=00400000'  
case 3,kv27,p-11,37.43gpu/l, 3.12w/o240,h2oreflsph,13in dia  
238groupndf5  
infhommedium  
'MTL1=37.43GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS  
pu-239 1 0.0 9.1350-05 300 end  
pu-240 1 0.0 2.9296-06 300 end  
n 1 0.0 1.2626-03 300 end  
h 1 0.0 6.3843-02 300 end  
o 1 0.0 3.5266-02 300 end  
fe 1 0.0 1.1107-06 300 end  
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN  
fe 2 0.0 6.0386-02 300 end  
cr 2 0.0 1.6678-02 300 end  
ni 2 0.0 9.8504-03 300 end  
'MTL3=WATER AT 0.99651G/CC (27 C)  
h 3 0.0 6.6622-02 300 end  
o 3 0.0 3.3311-02 300 end  
'MATL4=2S ALUMINUM AT 2.71G/CC  
al 4 0.0 5.9881-02 300 end  
si 4 0.0 3.7770-04 300 end  
cu 4 0.0 5.1364-05 300 end  
mn 4 0.0 1.4853-05 300 end  
end comp  
read param  
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes  
end param  
read geometry  
global  
unit  
sphere 1  
1.651560E+01  
origin  
x= 0.000000E+00  
y= 0.000000E+00  
z= 0.000000E+00  
media 1 1 1  
sphere 2  
1.664260E+01  
origin  
x= 0.000000E+00  
y= 0.000000E+00  
z= 0.000000E+00  
media 2 1 2 -1  
sphere 3  
4.664260E+01  
origin  
x= 0.000000E+00  
y= 0.000000E+00  
z= 0.000000E+00  
media 3 1 3 -2 -1  
boundary 3  
end geometry  
end data  
end

**Case PU\_SOL\_TH\_003\_4\_k6**  
#csas26 parm='size=00400000'  
case 4,kv27,p-11,38.12gpu/l, 3.12w/o240,h2oreflsph,13in dia  
238groupndf5  
infhommedium  
'MTL1=38.12GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS  
pu-239 1 0.0 9.3034-05 300 end  
pu-240 1 0.0 2.9836-06 300 end  
n 1 0.0 1.5151-03 300 end  
h 1 0.0 6.3424-02 300 end  
o 1 0.0 3.5692-02 300 end



```

fe      1 0.0 1.5204-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h       3 0.0 6.6622-02 300 end
o       3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al      4 0.0 5.9881-02 300 end
si      4 0.0 3.7770-04 300 end
cu      4 0.0 5.1364-05 300 end
mn      4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit    1
sphere  1
        1.651560E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    1 1 1
sphere   2
        1.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    2 1 2 -1
sphere   3
        4.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

## Case PU\_SOL\_TH\_003\_5\_k6

```

#csas26      parm='size=00400000'
case 5,kv27,p-11,40.65gpu/1, 3.12w/o240,h2oreflsph,13in dia
238groupndf5
infhommedium
'MTL1=40.65GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 9.9209-05 300 end
pu-240 1 0.0 3.1817-06 300 end
n       1 0.0 1.9910-03 300 end
h       1 0.0 6.2169-02 300 end
o       1 0.0 3.6267-02 300 end
fe      1 0.0 2.7713-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h       3 0.0 6.6622-02 300 end
o       3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al      4 0.0 5.9881-02 300 end
si      4 0.0 3.7770-04 300 end
cu      4 0.0 5.1364-05 300 end
mn      4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit    1
sphere  1
        1.651560E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    1 1 1
sphere   2
        1.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

z= 0.000000E+00
media    2 1 2 -1
sphere   3
        4.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

## Case PU\_SOL\_TH\_003\_6\_k6

```

#csas26      parm='size=00400000'
case 6,kv27,p-11,44.09gpu/1, 3.12w/o240,h2oreflsph,13in dia
238groupndf5
infhommedium
'MTL1=44.09GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 1.0760-04 300 end
pu-240 1 0.0 3.4509-06 300 end
n       1 0.0 2.6175-03 300 end
h       1 0.0 6.0559-02 300 end
o       1 0.0 3.7045-02 300 end
fe      1 0.0 2.8683-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h       3 0.0 6.6622-02 300 end
o       3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al      4 0.0 5.9881-02 300 end
si      4 0.0 3.7770-04 300 end
cu      4 0.0 5.1364-05 300 end
mn      4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit    1
sphere  1
        1.651560E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    1 1 1
sphere   2
        1.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    2 1 2 -1
sphere   3
        4.664260E+01
        origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media    3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

## Case PU\_SOL\_TH\_003\_7\_k6

```

#csas26      parm='size=00400000'
case 7,kv27,p-11,35.98gpu/1, 3.12w/o240,h2oreflsph,13in dia
238groupndf5
infhommedium
'MTL1=35.98GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.7811-05 300 end
pu-240 1 0.0 2.8161-06 300 end
n       1 0.0 9.0422-04 300 end
h       1 0.0 6.4783-02 300 end
o       1 0.0 3.4833-02 300 end
fe      1 0.0 1.2293-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe      2 0.0 6.0386-02 300 end
cr      2 0.0 1.6678-02 300 end
ni      2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)

```

```

h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al     4 0.0 5.9881-02 300 end
si     4 0.0 3.7770-04 300 end
cu     4 0.0 5.1364-05 300 end
mn     4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1
          1.624870E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1 1 1
sphere    2
          1.637770E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     4 1 2 -1
sphere    3
          4.637770E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3 1 3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_003_8_k6
#csas26      parm='size=00400000'
case 8,kv27,p-11,36.81gpu/L, 3.12w/o240,h2oreflsph,13in dia
238groupndf5
infhommedium
'MTL1=36.81GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.9837-05 300 end
pu-240 1 0.0 2.8811-06 300 end
n      1 0.0 1.2140-03 300 end
h      1 0.0 6.4172-02 300 end
o      1 0.0 3.5307-02 300 end
fe     1 0.0 1.3803-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
'MATL4=2S ALUMINUM AT 2.71G/CC
al     4 0.0 5.9881-02 300 end
si     4 0.0 3.7770-04 300 end
cu     4 0.0 5.1364-05 300 end
mn     4 0.0 1.4853-05 300 end
end comp
read param
tme=190 npg=1500 gen=600 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1
          1.624870E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1 1 1
sphere    2
          1.637770E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     4 1 2 -1
sphere    3
          4.637770E+01
          origin
            x= 0.000000E+00

```

```

y= 0.000000E+00
z= 0.000000E+00
media     3 1 3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_004_1_k6
#csas26      parm='size=00400000'
case 1,kv27,p-11,26.27gpu/L, 0.54w/o240, h2oreflsph,14in
dia,23.571
238group
infhommedium
'MTL1=26.27GPU/L,0.54W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 6.5821-05 300 end
pu-240 1 0.0 3.5587-07 300 end
n      1 0.0 7.5562-04 300 end
h      1 0.0 6.4964-02 300 end
o      1 0.0 3.4503-02 300 end
fe     1 0.0 1.5636-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1
          1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1 1 1
sphere    2
          1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2 1 2 -1
sphere    3
          4.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3 1 3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_004_10_k6
#csas26      parm='size=00400000'
case 10,kv27,p-11,35.36gpu/L, 3.12w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=35.36GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.6298-05 300 end
pu-240 1 0.0 2.7676-06 300 end
n      1 0.0 3.0060-03 300 end
h      1 0.0 5.9494-02 300 end
o      1 0.0 3.7440-02 300 end
fe     1 0.0 1.5636-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1

```

```
sphere      1      1.778650E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      1      1      1
sphere      2      1.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      2      1      2      -1
sphere      3      4.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      3      1      3      -2      -1
boundary    3
end geometry

end data
end

Case PU_SOL_TH_004_11_k6
#csas26      parm='size=00400000'
case 11,kv27,p-11,39.38gpu/1, 3.12w/o240,
h2oreflsph,14in,23.57l
238group
infhommedium
'MTL1=39.38GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 9.6109-05 300 end
pu-240 1 0.0 3.0823-06 300 end
n      1 0.0 3.9626-03 300 end
h      1 0.0 5.6870-02 300 end
o      1 0.0 3.8540-02 300 end
fe     1 0.0 1.5851-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     3      1      3      -2      -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_004_12_k6
#csas26      parm='size=00400000'
case 12,kv27,p-11,29.44gpu/1, 3.12w/o240,
h2oreflsph,14in,23.57l
238group
infhommedium
'MTL1=29.44GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.1850-05 300 end
pu-240 1 0.0 2.3043-06 300 end
```

```
n      1 0.0 1.1169-03 300 end
h      1 0.0 6.4144-02 300 end
o      1 0.0 3.5013-02 300 end
fe     1 0.0 1.2185-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes
run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     3      1      3      -2      -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_004_13_k6
#csas26      parm='size=00400000'
case 13,kv27,p-11,29.27gpu/1, 3.43w/o240,
h2oreflsph,14in,23.57l
238group
infhommedium
'MTL1=29.27GPU/L,3.43W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.1207-05 300 end
pu-240 1 0.0 2.5186-06 300 end
n      1 0.0 1.0810-03 300 end
h      1 0.0 6.4304-02 300 end
o      1 0.0 3.5002-02 300 end
fe     1 0.0 1.5096-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes
run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
              origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
```

```

origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_004_2_k6
#csas26 parm='size=00400000'
case 2,kv27,p-11,26.31gpu/1, 0.54w/o240, h2oreflsph,14in,
23.571
238group
infhommedium
'MTL1=26.31GPU/L,0.54W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 6.5921-05 300 end
pu-240 1 0.0 3.5641-07 300 end
n 1 0.0 1.0392-03 300 end
h 1 0.0 6.4397-02 300 end
o 1 0.0 3.4929-02 300 end
fe 1 0.0 1.6067-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_004_3_k6
#csas26 parm='size=00400000'
case 3,kv27,p-11,27.20gpu/1, 0.54w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=27.20GPU/L,0.54W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 6.8151-05 300 end
pu-240 1 0.0 3.6847-07 300 end
n 1 0.0 1.3354-03 300 end
h 1 0.0 6.3696-02 300 end
o 1 0.0 3.5324-02 300 end
fe 1 0.0 1.6822-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry

```

```

global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_004_4_k6
#csas26 parm='size=00400000'
case 4,kv27,p-11,28.09gpu/1, 0.54w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=28.09GPU/L,0.54W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.0381-05 300 end
pu-240 1 0.0 3.8053-07 300 end
n 1 0.0 1.8211-03 300 end
h 1 0.0 6.2562-02 300 end
o 1 0.0 3.5975-02 300 end
fe 1 0.0 1.7684-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_004_5_k6
#csas26 parm='size=00400000'
case 5,kv27,p-11,27.58gpu/1, 1.76w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=27.58GPU/L,1.76W/O240,NITRATE SOLN,C OF N CONSTANTS

```

```

pu-239 1 0.0 6.8256-05 300 end
pu-240 1 0.0 1.2177-06 300 end
n 1 0.0 1.0635-03 300 end
h 1 0.0 6.4299-02 300 end
o 1 0.0 3.4947-02 300 end
fe 1 0.0 1.0136-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_004_6_k6
#csas26 parm='size=00400000'
case 6,kv27,p-11,28.60gpu/1, 3.12w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=28.60GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 6.9800-05 300 end
pu-240 1 0.0 2.2385-06 300 end
n 1 0.0 8.4886-04 300 end
h 1 0.0 6.4732-02 300 end
o 1 0.0 3.4632-02 300 end
fe 1 0.0 1.1862-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01

```

```

origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_004_7_k6
#csas26 parm='size=00400000'
case 7,kv27,p-11,29.57gpu/1, 3.12w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=29.57GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.2167-05 300 end
pu-240 1 0.0 2.3144-06 300 end
n 1 0.0 1.0635-03 300 end
h 1 0.0 6.4353-02 300 end
o 1 0.0 3.4984-02 300 end
fe 1 0.0 1.3802-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_004_8_k6
#csas26 parm='size=00400000'
case 8,kv27,p-11,29.95gpu/1, 3.12w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=29.95GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.3095-05 300 end
pu-240 1 0.0 2.3442-06 300 end
n 1 0.0 1.3889-03 300 end
h 1 0.0 6.3518-02 300 end
o 1 0.0 3.5382-02 300 end
fe 1 0.0 1.2185-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry

```

```
global
unit      1
sphere    1      1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3      1      3      -2      -1
boundary  3
end geometry

end data
end
```

## Case PU\_SOL\_TH\_004\_9\_k6

```
#csas26      parm='size=00400000'
case 9,kv27,p-11,31.60gpu/1, 3.12w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=31.60GPU/L,3.12W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.7122-05 300 end
pu-240 1 0.0 2.4733-06 300 end
n      1 0.0 2.0202-03 300 end
h      1 0.0 6.2101-02 300 end
o      1 0.0 3.6260-02 300 end
fe     1 0.0 1.2940-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=150 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3      1      3      -2      -1
boundary  3
end geometry

end data
end
```

## Case PU\_SOL\_TH\_005\_1\_k6

```
#csas26      parm='size=00400000'
case 1,kv27,p-11,29.65gpu/1,4.05w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=29.65GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
```

```
pu-239 1 0.0 7.1668-05 300 end
pu-240 1 0.0 3.0124-06 300 end
n      1 0.0 8.4973-04 300 end
h      1 0.0 6.4700-02 300 end
o      1 0.0 3.4624-02 300 end
fe     1 0.0 1.3802-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3      1      3      -2      -1
boundary  3
end geometry

end data
end
```

## Case PU\_SOL\_TH\_005\_2\_k6

```
#csas26      parm='size=00400000'
case 2,kv27,p-11,30.54gpu/1, 4.05w/o240,
h2oreflsph,14in,23.571
238group
infhommedium
'MTL1=30.54GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.3819-05 300 end
pu-240 1 0.0 3.1029-06 300 end
n      1 0.0 1.1587-03 300 end
h      1 0.0 6.4054-02 300 end
o      1 0.0 3.5077-02 300 end
fe     1 0.0 8.5187-07 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit      1
sphere    1      1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1      1      1
sphere    2      1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2      1      2      -1
sphere    3      4.791350E+01
```

```

origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_005_3_k6
#csas26 parm='size=00400000'
case 3,kv27,p-11,31.43gpu/l, 4.05w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=31.43GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.5970-05 300 end
pu-240 1 0.0 3.1933-06 300 end
n 1 0.0 1.4258-03 300 end
h 1 0.0 6.3387-02 300 end
o 1 0.0 3.5416-02 300 end
fe 1 0.0 9.2736-07 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_005_4_k6
#csas26 parm='size=00400000'
case 4,kv27,p-11,33.54gpu/l, 4.05w/o240,
h2oreflsph,14in,23.57l
238group
infhommedium
'MTL1=33.54GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.1071-05 300 end
pu-240 1 0.0 3.4077-06 300 end
n 1 0.0 2.0464-03 300 end
h 1 0.0 6.2039-02 300 end
o 1 0.0 3.6305-02 300 end
fe 1 0.0 1.0460-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry

```

```

global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_005_5_k6
#csas26 parm='size=00400000'
case 5,kv27,p-11,36.04gpu/l, 4.05w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=36.04GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 8.7113-05 300 end
pu-240 1 0.0 3.6617-06 300 end
n 1 0.0 2.6456-03 300 end
h 1 0.0 6.0463-02 300 end
o 1 0.0 3.7027-02 300 end
fe 1 0.0 1.1215-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit 1
sphere 1 1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2 1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3 4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_005_6_k6
#csas26 parm='size=00400000'
case 6,kv27,p-11,38.49gpu/l, 4.05w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=38.49GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS

```

```

pu-239 1 0.0 9.3035-05 300 end
pu-240 1 0.0 3.9106-06 300 end
n 1 0.0 3.2556-03 300 end
h 1 0.0 5.8932-02 300 end
o 1 0.0 3.7799-02 300 end
fe 1 0.0 1.3587-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

## Case PU\_SOL\_TH\_005\_7\_k6

```

#csas26 parm='size=00400000'
case 7,kv27,p-11,40.91gpu/1, 4.05w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=40.91GPU/L,4.05W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 9.8885-05 300 end
pu-240 1 0.0 4.1565-06 300 end
n 1 0.0 3.7383-03 300 end
h 1 0.0 5.7412-02 300 end
o 1 0.0 3.8258-02 300 end
fe 1 0.0 1.3587-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01

```

```

origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

```

end data  
end

## Case PU\_SOL\_TH\_005\_8\_k6

```

#csas26 parm='size=00400000'
case 8,kv27,p-11,30.58gpu/1, 4.40w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=30.58GPU/L,4.40W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.3646-05 300 end
pu-240 1 0.0 3.3754-06 300 end
n 1 0.0 1.2286-03 300 end
h 1 0.0 6.3977-02 300 end
o 1 0.0 3.5214-02 300 end
fe 1 0.0 1.1646-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry
global
unit
sphere 1
1.778650E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
1.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.791350E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

## Case PU\_SOL\_TH\_005\_9\_k6

```

#csas26 parm='size=00400000'
case 9,kv27,p-11,31.85gpu/1, 4.40w/o240, h2oreflsph,14in
dia
238group
infhommedium
'MTL1=31.85GPU/L,4.40W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-239 1 0.0 7.6705-05 300 end
pu-240 1 0.0 3.5156-06 300 end
n 1 0.0 1.5345-03 300 end
h 1 0.0 6.3290-02 300 end
o 1 0.0 3.5642-02 300 end
fe 1 0.0 1.0999-06 300 end
'MATL2=347 STAINLESS STEEL, 8.0g/cc,CLARK COMPOSTN
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'MTL3=WATER AT 0.99651G/CC (27 C)
h 3 0.0 6.6622-02 300 end
o 3 0.0 3.3311-02 300 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
end param
read geometry

```



```

global
unit      1
sphere    1
          1.778650E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1  1  1
sphere    2
          1.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2  1  2 -1
sphere    3
          4.791350E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3  1  3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_006_CASE_1_k6
#csas26      parm='size=00500000'
case 1,15" sphere,2 kruesi samples averaged
238group
infhommedium
'239pu(.9688),240pu(.0312),24.80 gpu/l,1.60 M,Adj. Dens.
1.0898
pu-239 1 0.0 6.0526-05 300 end
pu-240 1 0.0 1.9411-06 300 end
n      1 0.0 1.1266-03 300 end
fe     1 0.0 9.4892-07 300 end
h      1 0.0 6.4226-02 300 end
o      1 0.0 3.5054-02 300 end
'ss347 sphere, Nom 15" dia, 8.0 g/cc
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'water reflector, 0.9965 g/cc. 27 C.
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param tme=150.0 npg=500 gen=210 nsk=10 fdn=yes
nub=yes
end param
read geometry
global
unit      1
com='k(exp) is 1.0000^
sphere    1
          1.904160E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1  1  1
sphere    2
          1.916860E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2  1  2 -1
sphere    3
          4.916860E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3  1  3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_006_CASE_2_k6
#csas26      parm='size=00500000'
case 2,15" sphere, 1 kruesi exp
238group
infhommedium

```

```

'239pu(.9688),240pu(.0312),25.56 gpu/l,2.08 M,Adj. Dens.
1.1067 g/cc
pu-239 1 0.0 6.2381-05 300 end
pu-240 1 0.0 2.0006-06 300 end
n      1 0.0 1.4277-03 300 end
fe     1 0.0 1.0136-06 300 end
h      1 0.0 6.3492-02 300 end
o      1 0.0 3.5444-02 300 end
'ss347 sphere, Nom 15" dia, 8.0 g/cc
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'water reflector, 0.9965 g/cc. 27 C.
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param tme=150.0 npg=500 gen=210 nsk=10 fdn=yes
nub=yes
end param
read geometry
global
unit      1
com='k(exp) is 1.0000^
sphere    1
          1.904160E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1  1  1
sphere    2
          1.916860E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     2  1  2 -1
sphere    3
          4.916860E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     3  1  3 -2 -1
boundary  3
end geometry

end data
end

Case PU_SOL_TH_006_CASE_3_k6
#csas26      parm='size=00500000'
case 3,15" sphere, 1 kruesi exp
238group
infhommedium
'239pu(.9688),240pu(.0312),26.97 gpu/l,3.07 M,Adj. Dens.
1.1408 g/cc
pu-239 1 0.0 6.5822-05 300 end
pu-240 1 0.0 2.1109-06 300 end
n      1 0.0 2.0590-03 300 end
fe     1 0.0 1.0352-06 300 end
h      1 0.0 6.1880-02 300 end
o      1 0.0 3.6223-02 300 end
'ss347, 8.0 g/cc
fe     2 0.0 6.0386-02 300 end
cr     2 0.0 1.6678-02 300 end
ni     2 0.0 9.8504-03 300 end
'water reflector, 0.9965 g/cc. 27 C.
h      3 0.0 6.6622-02 300 end
o      3 0.0 3.3311-02 300 end
end comp
read param tme=150.0 npg=500 gen=210 nsk=10 fdn=yes
nub=yes
end param
read geometry
global
unit      1
com='k(exp) is 1.0000^
sphere    1
          1.904160E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
media     1  1  1
sphere    2
          1.916860E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00

```

```

z= 0.000000E+00
media 2 1 2 -1
sphere 3
4.916860E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

```

```

Case PU_SOL_TH_008_case1_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 5.3884-09 300 end
pu-239 1 0.0 8.4958-05 300 end
pu-240 1 0.0 4.1563-06 300 end
pu-241 1 0.0 2.8291-07 300 end
pu-242 1 0.0 7.9487-09 300 end
n 1 0.0 2.0981-03 300 end
h 1 0.0 6.1146-02 300 end
o 1 0.0 3.5997-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -27.9673
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -27.9673
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 27.9673
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 27.9673
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

```

```

Case PU_SOL_TH_008_case10_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom

```

```

'pu'
pu-238 1 0.0 6.5875-09 300 end
pu-239 1 0.0 1.0388-04 300 end
pu-240 1 0.0 5.0823-06 300 end
pu-241 1 0.0 3.3286-07 300 end
pu-242 1 0.0 9.7176-09 300 end
n 1 0.0 4.2734-03 300 end
h 1 0.0 5.7000-02 300 end
o 1 0.0 3.9401-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 43.2073
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

```

```

Case PU_SOL_TH_008_case11_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 5.5554-09 300 end
pu-239 1 0.0 8.7600-05 300 end
pu-240 1 0.0 4.2860-06 300 end
pu-241 1 0.0 2.8070-07 300 end
pu-242 1 0.0 8.1950-09 300 end
n 1 0.0 3.0125-03 300 end
h 1 0.0 5.9994-02 300 end
o 1 0.0 3.7712-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end

```

```

fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

```

```

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

```

## Case PU\_SOL\_TH\_008\_case12\_k6

```

=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 1.0306-08 300 end
pu-239 1 0.0 1.6252-04 300 end
pu-240 1 0.0 7.9513-06 300 end
pu-241 1 0.0 5.2076-07 300 end
pu-242 1 0.0 1.5203-08 300 end
n      1 0.0 3.2675-03 300 end
h      1 0.0 5.8833-02 300 end
o      1 0.0 3.7927-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 0 1 7 -2 -4 -3 -5 -6
sphere 8 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 8 -7 -4 -3 -5 -6
boundary 8

```

```

cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 0 1 7 -2 -4 -3 -5 -6
sphere 8 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 8 -7 -4 -3 -5 -6
boundary 8
end geometry

```

```

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

```

## Case PU\_SOL\_TH\_008\_case13\_k6

```

=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.6500-09 300 end
pu-239 1 0.0 1.2063-04 300 end
pu-240 1 0.0 5.9020-06 300 end
pu-241 1 0.0 3.8654-07 300 end
pu-242 1 0.0 1.1285-08 300 end
n      1 0.0 1.8808-03 300 end
h      1 0.0 6.3459-02 300 end
o      1 0.0 3.6685-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 0 1 7 -2 -4 -3 -5 -6
sphere 8 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 8 -7 -4 -3 -5 -6
boundary 8

```

```

end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case14_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 1.1384-08 300 end
pu-239 1 0.0 1.7951-04 300 end
pu-240 1 0.0 8.7828-06 300 end
pu-241 1 0.0 5.7521-07 300 end
pu-242 1 0.0 1.6793-08 300 end
n 1 0.0 2.0203-03 300 end
h 1 0.0 6.1961-02 300 end
o 1 0.0 3.6409-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
plane 9 zpl=1
media 0 1 9 -7 -2 -4 -3 -5 -6
sphere 8 43.2073
origin x= 0 y= 0 z= 0
media 3 1 8 -9 -7 -4 -3 -5 -6
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -7 -4 -3 -5 -6 -2
boundary 10
end geometry

read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case15_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.0429-09 300 end
pu-239 1 0.0 1.1106-04 300 end
pu-240 1 0.0 5.4336-06 300 end
pu-241 1 0.0 3.5587-07 300 end
pu-242 1 0.0 1.0389-08 300 end
n 1 0.0 1.7020-03 300 end
h 1 0.0 6.2895-02 300 end
o 1 0.0 3.5936-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
plane 9 zpl=1
media 0 1 9 -7 -2 -4 -3 -5 -6
sphere 8 43.2073
origin x= 0 y= 0 z= 0
media 3 1 8 -9 -7 -4 -3 -5 -6
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -7 -4 -3 -5 -6 -2
boundary 10
end geometry

read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case16_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 5.5402-09 300 end
pu-239 1 0.0 8.7351-05 300 end
pu-240 1 0.0 4.2734-06 300 end
pu-241 1 0.0 2.9088-07 300 end
pu-242 1 0.0 8.1726-09 300 end
n 1 0.0 2.0418-03 300 end
h 1 0.0 6.1875-02 300 end
o 1 0.0 3.6226-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end

```

```

ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h        3 0 1.7376-02 300 end
o        3 0 4.5294-02 300 end
mg       3 0 7.6195-04 300 end
al       3 0 3.3533-03 300 end
ca       3 0 2.6095-03 300 end
fe       3 0 1.3417-03 300 end
na       3 0 1.1416-04 300 end
k        3 0 4.3569-04 300 end
mn       3 0 2.7673-05 300 end
si       3 0 1.2931-02 300 end
'cadmium'
cd       4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=15.2784
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
cylinder 3 2.86 -15.8073 -27.9673
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -27.9673
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 27.9673
        origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8
cylinder 6 3.025 15.8073 27.9673
        origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8
sphere 7 27.9673
        origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case17_k6
=cscas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.0249-09 300 end
pu-239 1 0.0 1.1104-04 300 end
pu-240 1 0.0 5.4324-06 300 end
pu-241 1 0.0 3.6977-07 300 end
pu-242 1 0.0 1.0389-08 300 end
n      1 0.0 3.8519-03 300 end
h      1 0.0 5.7092-02 300 end
o      1 0.0 3.6226-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h        3 0 1.7376-02 300 end
o        3 0 4.5294-02 300 end
mg       3 0 7.6195-04 300 end
al       3 0 3.3533-03 300 end
ca       3 0 2.6095-03 300 end
fe       3 0 1.3417-03 300 end
na       3 0 1.1416-04 300 end
k        3 0 4.3569-04 300 end
mn       3 0 2.7673-05 300 end
si       3 0 1.2931-02 300 end
'cadmium'
cd       4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=17.0923
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.9901
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8 -9 -5

tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=17.0923
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8987
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8 -9 -5
cylinder 3 2.86 -15.8073 -28.0587
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -28.0587
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 28.0587 chord -z=17.0923
        origin x=-3.811 y=0 z=0
media 1 1 5 -1 -8
cylinder 9 2.86 15.8073 28.0587
        origin x=-3.811 y=0 z=0
media 0 1 9 -1 -8 -5
cylinder 6 3.025 15.8073 28.0587
        origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8 -9
sphere 7 28.0587
        origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8 -9
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case18_k6
=cscas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.1188-09 300 end
pu-239 1 0.0 1.1224-04 300 end
pu-240 1 0.0 5.4910-06 300 end
pu-241 1 0.0 3.7376-07 300 end
pu-242 1 0.0 1.0501-08 300 end
n      1 0.0 3.8569-03 300 end
h      1 0.0 5.7425-02 300 end
o      1 0.0 3.8591-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h        3 0 1.7376-02 300 end
o        3 0 4.5294-02 300 end
mg       3 0 7.6195-04 300 end
al       3 0 3.3533-03 300 end
ca       3 0 2.6095-03 300 end
fe       3 0 1.3417-03 300 end
na       3 0 1.1416-04 300 end
k        3 0 4.3569-04 300 end
mn       3 0 2.7673-05 300 end
si       3 0 1.2931-02 300 end
'cadmium'
cd       4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=17.0923
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.9901
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8 -9 -5

```

```
cylinder 3 2.86 -15.8073 -28.1501
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -28.1501
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 28.1501 chord -z=17.0923
      origin x=-3.811 y=0 z=0
media 1 1 5 -1 -8
cylinder 9 2.86 15.8073 28.1501
      origin x=-3.811 y=0 z=0
media 0 1 9 -1 -8 -5
cylinder 6 3.025 15.8073 28.1501
      origin x=-3.811 y=0 z=0
media 2 1 6 -2 -5 -1 -8 -9
sphere 7 28.1501
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8 -9 -5
boundary 7
end geometry
```

```
read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end
```

```
Case PU_SOL_TH_008_case19_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group      infhom
'pu'
pu-238 1 0.0 4.9938-09 300 end
pu-239 1 0.0 7.8735-05 300 end
pu-240 1 0.0 3.8519-06 300 end
pu-241 1 0.0 2.6219-07 300 end
pu-242 1 0.0 7.3666-09 300 end
n      1 0.0 1.0360-03 300 end
h      1 0.0 6.4368-02 300 end
o      1 0.0 3.4940-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=15.2784
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
      origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
cylinder 3 2.86 -15.8073 -27.9673
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -27.9673
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8
cylinder 6 3.025 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8
boundary 7
```

end geometry

```
read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end
```

```
Case PU_SOL_TH_008_case2_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group      infhom
'pu'
pu-238 1 0.0 6.8607-09 300 end
pu-239 1 0.0 1.0817-04 300 end
pu-240 1 0.0 5.2920-06 300 end
pu-241 1 0.0 3.6021-07 300 end
pu-242 1 0.0 1.0121-08 300 end
n      1 0.0 3.9843-03 300 end
h      1 0.0 5.6456-02 300 end
o      1 0.0 3.8416-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -27.9673
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -27.9673
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry
```

```
read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end
```

```
Case PU_SOL_TH_008_case20_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group      infhom
'pu'
pu-238 1 0.0 4.5536-09 300 end
pu-239 1 0.0 7.1795-05 300 end
pu-240 1 0.0 3.5124-06 300 end
```

```

pu-241 1 0.0 2.3908-07 300 end
pu-242 1 0.0 6.7172-09 300 end
n      1 0.0 9.4656-04 300 end
h      1 0.0 6.4723-02 300 end
o      1 0.0 3.4879-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=15.2784
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
sphere 9 17.8835
        origin x= 0 y= 0 z= 0
media 4 1 9 -1 -8 -2
cylinder 3 2.86 -15.8073 -28.0435
media 0 1 3 -2 -1 -8 -9
cylinder 4 3.165 -15.8073 -28.0435
media 2 1 4 -3 -2 -1 -8 -9
cylinder 5 2.86 15.8073 28.0435
        origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8 -9
cylinder 6 3.025 15.8073 28.0435
        origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8 -9
sphere 7 43.2073
        origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8 -9
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case21_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.7259-09 300 end
pu-239 1 0.0 1.2181-04 300 end
pu-240 1 0.0 5.9593-06 300 end
pu-241 1 0.0 4.0564-07 300 end
pu-242 1 0.0 1.1397-08 300 end
n      1 0.0 2.8494-03 300 end
h      1 0.0 5.9352-02 300 end
o      1 0.0 3.7056-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=11.9997
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=14.2707
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
sphere 9 17.8835
        origin x= 0 y= 0 z= 0
media 4 1 9 -1 -8 -2
cylinder 3 2.86 -15.8073 -28.0435
media 0 1 3 -2 -1 -8 -9
cylinder 4 3.165 -15.8073 -28.0435
media 2 1 4 -3 -2 -1 -8 -9
cylinder 5 2.86 15.8073 28.0435
        origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8 -9
cylinder 6 3.025 15.8073 28.0435
        origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8 -9
sphere 7 28.0435
        origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8 -9
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

```

```

origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
sphere 9 17.8835
origin x= 0 y= 0 z= 0
media 4 1 9 -1 -8 -2
cylinder 3 2.86 -15.8073 -28.0435
media 0 1 3 -2 -1 -8 -9
cylinder 4 3.165 -15.8073 -28.0435
media 2 1 4 -3 -2 -1 -8 -9
cylinder 5 2.86 15.8073 28.0435
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8 -9
cylinder 6 3.025 15.8073 28.0435
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8 -9
sphere 7 28.0435
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8 -9
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case23_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 6.8000-09 300 end
pu-239 1 0.0 1.0724-04 300 end
pu-240 1 0.0 5.2462-06 300 end
pu-241 1 0.0 3.4359-07 300 end
pu-242 1 0.0 1.0031-08 300 end
n 1 0.0 4.3416-03 300 end
h 1 0.0 5.6083-02 300 end
o 1 0.0 3.9121-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=15.0488
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8
sphere 7 43.2073
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot

```

```

media 0 1 5 -2 -1 -8
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8
sphere 7 43.2073
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case24_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 5.5857-09 300 end
pu-239 1 0.0 8.8079-05 300 end
pu-240 1 0.0 4.3094-06 300 end
pu-241 1 0.0 2.8224-07 300 end
pu-242 1 0.0 8.2398-09 300 end
n 1 0.0 3.0325-03 300 end
h 1 0.0 5.9257-02 300 end
o 1 0.0 3.7395-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=15.5303
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1 -8
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1 -8
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -8
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8
sphere 7 43.2073
origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6 -8
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot

```



```

end data
end

Case PU_SOL_TH_008_case25_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group    infhom
'pu'
pu-238 1 0.0 1.0306-08 300 end
pu-239 1 0.0 1.6252-04 300 end
pu-240 1 0.0 7.9513-06 300 end
pu-241 1 0.0 5.2076-07 300 end
pu-242 1 0.0 1.5203-08 300 end
n      1 0.0 3.2675-03 300 end
h      1 0.0 5.8833-02 300 end
o      1 0.0 3.7927-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=17.0923
        origin x= 0 y= 0 z= 0
media 1 1 1
sphere 8 17.6955
        origin x= 0 y= 0 z= 0
media 0 1 8 -1
sphere 2 17.8073
        origin x= 0 y= 0 z= 0
media 2 1 2 -1 -8
sphere 9 27.9673
        origin x= 0 y= 0 z= 0
media 0 1 9 -1 -8 -2
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1 -8 -9
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1 -8 -9
cylinder 5 2.86 15.8073 43.2073
        origin x=-3.811 y=0 z=0
media 1 1 10 -2 -1 -9
cylinder 5 2.86 15.8073 43.2073
        origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1 -10 -9
cylinder 6 3.025 15.8073 43.2073
        origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1 -8 -10 -9
sphere 7 43.2073
        origin x= 0 y= 0 z= 0
media 3 1 7 -1 -2 -4 -6 -8 -9
boundary 7
end geometry

read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case26_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group    infhom
'pu'
pu-238 1 0.0 7.9081-09 300 end
pu-239 1 0.0 1.2470-04 300 end
pu-240 1 0.0 6.1011-06 300 end

pu-241 1 0.0 3.9958-07 300 end
pu-242 1 0.0 1.1666-08 300 end
n      1 0.0 1.9159-03 300 end
h      1 0.0 6.2317-02 300 end
o      1 0.0 3.6211-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end

```

```
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=13.4066
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 11 17.6955
      origin x= 0 y= 0 z= 0
media 0 1 11 -1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -11 -11
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -11
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -11
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 0 1 7 -2 -4 -3 -5 -6
plane 9 zpl=1
media 0 1 9 -7 -2 -4 -3 -5 -6
sphere 8 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 8 -9 -7 -4 -3 -5 -6
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -7 -4 -3 -5 -6 -2
boundary 10
end geometry
```

```
read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end
```

## Case PU\_SOL\_TH\_008\_case28\_k6

```
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 1.2401-08 300 end
pu-239 1 0.0 1.9554-04 300 end
pu-240 1 0.0 9.5674-06 300 end
pu-241 1 0.0 6.2660-07 300 end
pu-242 1 0.0 1.8293-08 300 end
n      1 0.0 2.0697-03 300 end
h      1 0.0 6.1959-02 300 end
o      1 0.0 3.6565-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
```

```
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=14.8363
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 11 17.6955
      origin x= 0 y= 0 z= 0
media 0 1 11 -1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -11 -11
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -11
cylinder 6 3.025 15.8073 43.2073
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -11
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 0 1 7 -2 -4 -3 -5 -6
plane 9 zpl=1
media 0 1 9 -7 -2 -4 -3 -5 -6
sphere 8 43.2073
      origin x= 0 y= 0 z= 0
media 3 1 8 -9 -7 -4 -3 -5 -6
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -7 -4 -3 -5 -6 -2
boundary 10
end geometry
```

```
read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end
```

## Case PU\_SOL\_TH\_008\_case29\_k6

```
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.9536-09 300 end
pu-239 1 0.0 1.2542-04 300 end
pu-240 1 0.0 6.1362-06 300 end
pu-241 1 0.0 4.0188-07 300 end
pu-242 1 0.0 1.1733-08 300 end
n      1 0.0 1.7744-03 300 end
h      1 0.0 6.2741-02 300 end
o      1 0.0 3.6071-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k       3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=12.9500
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 11 17.6955
```

```

origin x= 0 y= 0 z= 0
media 0 1 11 -1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1 -11
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1 -11
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1 -11
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -11
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -11
plane 9 zpl=1
media 0 1 9 -2 -4 -3 -5 -6 -11 -1
sphere 8 43.2073
origin x= 0 y= 0 z= 0
media 3 1 8 -9 -4 -3 -5 -6 -1 -11 -2
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -4 -3 -5 -6 -2
boundary 10
end geometry

read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data
end

```

```

Case PU_SOL_TH_008_case3_k6
=cscas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.0429-09 300 end
pu-239 1 0.0 1.1104-04 300 end
pu-240 1 0.0 5.4324-06 300 end
pu-241 1 0.0 3.6978-07 300 end
pu-242 1 0.0 1.0389-08 300 end
n 1 0.0 3.8519-03 300 end
h 1 0.0 5.7092-02 300 end
o 1 0.0 3.8410-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8987
origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8987 -28.0587
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8987 -28.0587
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8987 28.0587
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8987 28.0587
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 28.0587

```

```

origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case30_k6
=cscas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.1339-09 300 end
pu-239 1 0.0 1.1249-04 300 end
pu-240 1 0.0 5.5039-06 300 end
pu-241 1 0.0 3.6047-07 300 end
pu-242 1 0.0 1.0524-08 300 end
n 1 0.0 1.7080-03 300 end
h 1 0.0 6.2880-02 300 end
o 1 0.0 3.5947-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955 chord -z=16.1434
origin x= 0 y= 0 z= 0
media 1 1 1
sphere 11 17.6955
origin x= 0 y= 0 z= 0
media 0 1 11 -1
sphere 2 17.8073
origin x= 0 y= 0 z= 0
media 2 1 2 -1 -11
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1 -11
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1 -11
cylinder 5 2.86 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 0 1 5 -2 -11
cylinder 6 3.025 15.8073 43.2073
origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -11
plane 9 zpl=1
media 0 1 9 -2 -4 -3 -5 -6 -1 -11
sphere 8 43.2073
origin x= 0 y= 0 z= 0
media 3 1 8 -9 -4 -3 -5 -6 -2 -1 -11
cuboid 10 6p44.2073
media 0 1 10 -9 -8 -4 -3 -5 -6 -2
boundary 10
end geometry

read plot
ttl='graph'
xul=45 yul=0 zul=-45
xlr=-45 ylr=0 zlr=45
nax=400
uax=1 wdn=-1
end plot
end data

```

```

end

Case PU_SOL_TH_008_case4_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group    infhom
'pu'
pu-238 1 0.0 7.1188-09 300 end
pu-239 1 0.0 1.1224-04 300 end
pu-240 1 0.0 5.4910-06 300 end
pu-241 1 0.0 3.7376-07 300 end
pu-242 1 0.0 1.0501-08 300 end
n      1 0.0 3.8570-03 300 end
h      1 0.0 5.7425-02 300 end
o      1 0.0 3.8591-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -27.9673
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -27.9673
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 27.9673
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 27.9673
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case5_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group    infhom
'pu'
pu-238 1 0.0 4.9786-09 300 end
pu-239 1 0.0 7.8496-05 300 end
pu-240 1 0.0 3.8402-06 300 end
pu-241 1 0.0 2.6139-07 300 end
pu-242 1 0.0 7.3442-09 300 end
n      1 0.0 9.9289-04 300 end
h      1 0.0 6.4634-02 300 end
o      1 0.0 3.4964-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
      origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.9901
      origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.9901 -28.1501
media 0 1 3 -2 -1
cylinder 4 3.165 -15.9901 -28.1501
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.9901 28.1501
      origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.9901 28.1501
      origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 28.1501
      origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case7_k6
=csas26      parm=size=400000
PU_SOL_THERM_008_CASE1
238group    infhom
'pu'
pu-238 1 0.0 4.4929-09 300 end
pu-239 1 0.0 7.0838-05 300 end
pu-240 1 0.0 3.4655-06 300 end
pu-241 1 0.0 2.3589-07 300 end
pu-242 1 0.0 6.6277-09 300 end
n      1 0.0 9.4258-04 300 end
h      1 0.0 6.4643-02 300 end
o      1 0.0 3.4827-02 300 end
'stainless steel'
fe      2 0 5.9355-02 300 end
cr      2 0 1.7428-02 300 end
ni      2 0 7.7203-03 300 end
mn      2 0 1.7363-03 300 end
'concrete'
h      3 0 1.7376-02 300 end
o      3 0 4.5294-02 300 end
mg      3 0 7.6195-04 300 end
al      3 0 3.3533-03 300 end
ca      3 0 2.6095-03 300 end
fe      3 0 1.3417-03 300 end
na      3 0 1.1416-04 300 end
k      3 0 4.3569-04 300 end
mn      3 0 2.7673-05 300 end
si      3 0 1.2931-02 300 end
'cadmium'
cd      4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1

```

```

sphere 1 17.6955
  origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
  origin x= 0 y= 0 z= 0
media 2 1 2 -1
cylinder 3 2.86 -15.8073 -43.2073
media 0 1 3 -2 -1
cylinder 4 3.165 -15.8073 -43.2073
media 2 1 4 -3 -2 -1
cylinder 5 2.86 15.8073 43.2073
  origin x=-3.811 y=0 z=0
media 0 1 5 -2 -1
cylinder 6 3.025 15.8073 43.2073
  origin x=-3.811 y=0 z=0
media 2 1 6 -5 -2 -1
sphere 7 43.2073
  origin x= 0 y= 0 z= 0
media 3 1 7 -2 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_008_case8_k6
=csas26 parm=size=400000
PU_SOL_THERM_008_CASE1
238group infhom
'pu'
pu-238 1 0.0 7.7259-09 300 end
pu-239 1 0.0 1.2181-04 300 end
pu-240 1 0.0 5.9593-06 300 end
pu-241 1 0.0 4.0564-07 300 end
pu-242 1 0.0 1.1397-08 300 end
n 1 0.0 3.2649-03 300 end
h 1 0.0 5.8264-02 300 end
o 1 0.0 3.7551-02 300 end
'stainless steel'
fe 2 0 5.9355-02 300 end
cr 2 0 1.7428-02 300 end
ni 2 0 7.7203-03 300 end
mn 2 0 1.7363-03 300 end
'concrete'
h 3 0 1.7376-02 300 end
o 3 0 4.5294-02 300 end
mg 3 0 7.6195-04 300 end
al 3 0 3.3533-03 300 end
ca 3 0 2.6095-03 300 end
fe 3 0 1.3417-03 300 end
na 3 0 1.1416-04 300 end
k 3 0 4.3569-04 300 end
mn 3 0 2.7673-05 300 end
si 3 0 1.2931-02 300 end
'cadmium'
cd 4 0 4.6340-02 300 end
end comp
read param
tme=90 npg=800 gen=810 nsk=10 plt=no
end param
read geometry
global
unit 1
sphere 1 17.6955
  origin x= 0 y= 0 z= 0
media 1 1 1
sphere 2 17.8073
  origin x= 0 y= 0 z= 0
media 2 1 2 -1
sphere 8 17.8835
  origin x= 0 y= 0 z= 0
media 4 1 8 -2
cylinder 3 2.86 -15.8073 -28.0435
media 0 1 3 -8 -2 -1
cylinder 4 3.165 -15.8073 -28.0435
media 2 1 4 -8 -3 -2 -1
cylinder 5 2.86 15.8073 28.0435
  origin x=-3.811 y=0 z=0
media 0 1 5 -8 -2 -1
cylinder 6 3.025 15.8073 28.0435
  origin x=-3.811 y=0 z=0
media 2 1 6 -8 -5 -2 -1
sphere 7 28.0435
  origin x= 0 y= 0 z= 0
media 3 1 7 -8 -4 -6
boundary 7
end geometry

read plot
ttl='graph'
xul=30 yul=0 zul=-30
xlr=-30 ylr=0 zlr=30
nax=400
uax=1 wdn=-1
end plot
end data
end

Case PU_SOL_TH_011_C800_1_16_k6
#csas26 parm='size=00500000'

```

```

case 16-1, 16" bare sphere, 34.96 gPu/l 4.17 wt% pu240
238group
infhommedium
'4.17 wt% Pu-240 1.0961 Sol g/cc 34.96 gPu/l 1.12 M.
pu-239 1 0.0 8.4397-05 300 end
pu-240 1 0.0 3.6572-06 300 end
n 1 0.0 1.0140-03 300 end
h 1 0.0 6.4544-02 300 end
o 1 0.0 3.4983-02 300 end
fe 1 0.0 1.1215-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
end
read param tme=999.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='k(exp) is 1.0000^
sphere 1
2.012060E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.024760E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
boundary 2
end geometry

end data
end

Case PU_SOL_TH_011_C800_1_18_k6
#csas26 parm='size=00500000'
case 18-1, 18" bare sphere+.02" cad cover,22.35gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.0662 Sol g/cc 22.35 gPu/l 0.935 M.
pu-239 1 0.0 5.3938-05 300 end
pu-240 1 0.0 2.3549-06 300 end
n 1 0.0 7.3930-04 300 end
h 1 0.0 6.5147-02 300 end
o 1 0.0 3.4534-02 300 end
fe 1 0.0 1.2940-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd 3 0.0 4.6340-02 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='k(exp) is 1.0000^
sphere 1
2.269740E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.282440E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
2.287520E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

```

```

end data
end

Case PU_SOL_TH_011_C800_2_16_k6
#csas26 parm='size=00500000'
case 16-2, 16" bare sphere, 36.22 gPu/l 4.17 wt% pu240
238group
infhommedium
'4.17 wt% Pu-240 1.0991 Sol g/cc 36.22 gPu/l 1.31 M.
pu-239 1 0.0 8.7439-05 300 end
pu-240 1 0.0 3.7890-06 300 end
n 1 0.0 1.0625-03 300 end
h 1 0.0 6.4357-02 300 end
o 1 0.0 3.5017-02 300 end
fe 1 0.0 1.2940-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='k(exp) is 1.0000^
sphere 1
2.012060E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.024760E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
boundary 2
end geometry

end data
end

Case PU_SOL_TH_011_C800_2_18_k6
#csas26 parm='size=00500000'
case 18-2, 18" bare sphere+.02" cad cover,23.27gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.0788 Sol g/cc 23.27 gPu/l 1.431 M.
pu-239 1 0.0 5.6159-05 300 end
pu-240 1 0.0 2.4518-06 300 end
n 1 0.0 9.4957-04 300 end
h 1 0.0 6.4659-02 300 end
o 1 0.0 3.4820-02 300 end
fe 1 0.0 1.3587-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd 3 0.0 4.6340-02 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='k(exp) is 1.0000^
sphere 1
2.269740E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.282440E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
2.287520E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

```

```

x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_011_C800_3_16_k6
#csas26 parm='size=00500000'
case 16-3, 16" bare sphere, 38.13 gPu/l 4.17 wt% pu240
238group
infhommedium
'4.17 wt% Pu-240 1.1374 Sol g/cc 38.13 gPu/l 2.79 M.
pu-239 1 0.0 9.2050-05 300 end
pu-240 1 0.0 3.9888-06 300 end
n 1 0.0 1.5831-03 300 end
h 1 0.0 6.3652-02 300 end
o 1 0.0 3.5976-02 300 end
fe 1 0.0 1.3371-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='^k(exp) is 1.0000^
sphere 1
2.012060E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.024760E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
boundary 2
end geometry

end data
end

```

```

Case PU_SOL_TH_011_C800_3_18_k6
#csas26 parm='size=00500000'
case 18-3, 18" bare sphere+.02" cad cover, 23.10gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.0860 Sol g/cc 23.10 gPu/l 1.560 M.
pu-239 1 0.0 5.5748-05 300 end
pu-240 1 0.0 2.4339-06 300 end
n 1 0.0 1.0468-03 300 end
h 1 0.0 6.4569-02 300 end
o 1 0.0 3.5018-02 300 end
fe 1 0.0 1.4557-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd 3 0.0 4.6340-02 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='^k(exp) is 1.0000^
sphere 1
2.269740E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.282440E+01
origin
x= 0.000000E+00

```

```

y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
sphere 3
2.287520E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 3 -2 -1
boundary 3
end geometry

end data
end

Case PU_SOL_TH_011_C800_4_16_k6
#csas26 parm='size=00500000'
case 16-4, 16" bare sphere, 38.16 gPu/l 4.17 wt% pu240
238group
infhommedium
'4.17 wt% Pu-240 1.1396 Sol g/cc 38.16 gPu/l 2.58 M.
pu-239 1 0.0 9.2122-05 300 end
pu-240 1 0.0 3.9919-06 300 end
n 1 0.0 1.7482-03 300 end
h 1 0.0 6.2803-02 300 end
o 1 0.0 3.5964-02 300 end
fe 1 0.0 1.9194-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='^k(exp) is 1.0000^
sphere 1
2.012060E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 1 1 1
sphere 2
2.024760E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 2 -1
boundary 2
end geometry

end data
end

Case PU_SOL_TH_011_C800_4_18_k6
#csas26 parm='size=00500000'
case 18-4, 18" bare sphere+.02" cad cover, 23.82gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.1020 Sol g/cc 23.82 gPu/l 2.27 M.
pu-239 1 0.0 5.7486-05 300 end
pu-240 1 0.0 2.5097-06 300 end
n 1 0.0 1.4414-03 300 end
h 1 0.0 6.3220-02 300 end
o 1 0.0 3.5333-02 300 end
fe 1 0.0 1.3263-06 300 end
'ss347 8.0 g/cc
fe 2 0.0 6.0386-02 300 end
cr 2 0.0 1.6678-02 300 end
ni 2 0.0 9.8504-03 300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd 3 0.0 4.6340-02 300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit 1
com='^k(exp) is 1.0000^
sphere 1
2.269740E+01
origin
x= 0.000000E+00
y= 0.000000E+00

```

```

media      1      1      1      z= 0.000000E+00
sphere     2      2.282440E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      2      1      2      -1
sphere     3      2.287520E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      3      1      3      -2      -1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_011_C800_5_16_k6
#csas26      parm='size=00500000'
case 16-5, 16" bare sphere, 43.43 gPu/l 4.17 wt% pu240
238group
infhommedium
'4.17 wt% Pu-240 1.1958 Sol g/cc 43.43 gPu/l 4.18 M.
pu-239 1 0.0 1.0484-04      300 end
pu-240 1 0.0 4.5432-06      300 end
n      1 0.0 2.7369-03      300 end
h      1 0.0 6.0233-02      300 end
o      1 0.0 3.7177-02      300 end
fe     1 0.0 1.9302-06      300 end
'ss347 8.0 g/cc
fe      2 0.0 6.0386-02      300 end
cr      2 0.0 1.6678-02      300 end
ni      2 0.0 9.8504-03      300 end
end
read param tme=850.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit      1
com='^k(exp) is 1.0000^
sphere     1
          2.012060E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      1      1      1
sphere     2      2.024760E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      2      1      2      -1
boundary   2
end geometry

end data
end

Case PU_SOL_TH_011_C800_5_18_k6
#csas26      parm='size=00500000'
case 18-5, 18" bare sphere+.02" cad cover, 25.20gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.1472 Sol g/cc 25.20 gPu/l 3.49 M.
pu-239 1 0.0 6.0816-05      300 end
pu-240 1 0.0 2.6552-06      300 end
n      1 0.0 1.9343-03      300 end
h      1 0.0 6.3180-02      300 end
o      1 0.0 3.6553-02      300 end
fe     1 0.0 1.4773-06      300 end
'ss347 8.0 g/cc
fe      2 0.0 6.0386-02      300 end
cr      2 0.0 1.6678-02      300 end
ni      2 0.0 9.8504-03      300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd      3 0.0 4.6340-02      300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit      1

```

```

com='^k(exp) is 1.0000^
sphere     1
          2.269740E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      1      1      1
sphere     2      2.282440E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      2      1      2      -1
sphere     3      2.287520E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      3      1      3      -2      -1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_011_C800_6_18_k6
#csas26      parm='size=00500000'
case 18-6, 18" bare sphere+.02" cad cover, 27.49gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.1816 Sol g/cc 27.49 gPu/l 4.63 M.
pu-239 1 0.0 6.6343-05      300 end
pu-240 1 0.0 2.8964-06      300 end
n      1 0.0 2.7753-03      300 end
h      1 0.0 6.0264-02      300 end
o      1 0.0 3.7209-02      300 end
fe     1 0.0 1.5204-06      300 end
'ss347 8.0 g/cc
fe      2 0.0 6.0386-02      300 end
cr      2 0.0 1.6678-02      300 end
ni      2 0.0 9.8504-03      300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd      3 0.0 4.6340-02      300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit      1
com='^k(exp) is 1.0000^
sphere     1
          2.269740E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      1      1      1
sphere     2      2.282440E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      2      1      2      -1
sphere     3      2.287520E+01
          origin
                x= 0.000000E+00
                y= 0.000000E+00
                z= 0.000000E+00
media      3      1      3      -2      -1
boundary   3
end geometry

end data
end

Case PU_SOL_TH_011_C800_7_18_k6
#csas26      parm='size=00500000'
case 18-7, 18" bare sphere+.02" cad cover, 23.94gPu/l 4.2
wt% pu240
238group
infhommedium
'4.2 wt% Pu-240 1.0894 Sol g/cc 23.94 gPu/l 1.66 M.
pu-239 1 0.0 5.7776-05      300 end
pu-240 1 0.0 2.5224-06      300 end

```



```
n      1 0.0 1.2199-03      300 end
h      1 0.0 6.3701-02      300 end
o      1 0.0 3.5021-02      300 end
fe     1 0.0 4.1947-07      300 end
'ss347 8.0 g/cc
fe     2 0.0 6.0386-02      300 end
cr     2 0.0 1.6678-02      300 end
ni     2 0.0 9.8504-03      300 end
'Cadmium Cover 0.020 in, 8.65 g/cc
cd     3 0.0 4.6340-02      300 end
end
read param tme=950.0 npg=1000 gen=1003 fdn=yes nub=yes
end param
read geometry
global
unit      1
com='k(exp) is 1.0000^
sphere    1
          2.269740E+01
          origin
          x= 0.000000E+00
          y= 0.000000E+00
          z= 0.000000E+00
media     1 1 1
sphere    2
          2.282440E+01
          origin
          x= 0.000000E+00
          y= 0.000000E+00
          z= 0.000000E+00
media     2 1 2 -1
sphere    3
          2.287520E+01
          origin
          x= 0.000000E+00
          y= 0.000000E+00
          z= 0.000000E+00
media     3 1 3 -2 -1
boundary  3
end geometry

end data
end
```

```
Case PU_SOL_TH_014_1_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para
```

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit      1
com='cylinder + solution^
cylinder  1
```

```
          1.470000E+01 -2.004550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= -2.199995E+02 y= -2.000000E+01 z= -
3.440855E+02
hole     1 origin x= -2.500005E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry
```

read star

nst=1  
end star

end data

end

Case PU\_SOL\_TH\_014\_10\_k6

```
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
```

end comp  
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit      1
com='cylinder + solution^
cylinder  1
          1.470000E+01 -1.311550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
```

```

1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.350000E+02 y= 4.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -8.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_11_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.149550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00

```

```

media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.350000E+02 y= 7.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -1.100000E+02 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_12_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.055550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3

```

```

1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.350000E+02 y= 1.300000E+02 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.350000E+02 y= -1.700000E+02 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_13_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -2.746550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00

```

```

media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.436605E+02 y= -4.999500E+00 z= -
3.440855E+02
hole 1 origin x= -2.176790E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.436605E+02 y= -3.500050E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_14_k6
#csas26 parm='size=00500000'
238-grp keno5a xsection processing for pu sol in cea-r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.932550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global

```

```

unit          2
com='concrete building + array'
cuboid        1
              6.050000E+02 -6.050000E+02  4.400000E+02
              -4.400000E+02  5.000000E+02 -5.000000E+02
media         0 1 1
hole          1 origin x= -2.465470E+02 y=  0.000000E+00 z= -
3.440855E+02
hole          1 origin x= -2.119060E+02 y= -2.000000E+01 z= -
3.440855E+02
hole          1 origin x= -2.465470E+02 y= -4.000000E+01 z= -
3.440855E+02
cuboid        2
              7.500000E+02 -7.500000E+02  5.850000E+02
              -5.850000E+02  5.700000E+02 -5.400000E+02
media         3 1 2 -1
boundary      2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_15_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n       1 0.0 2.3837e-3 300.0 end
o       1 0.0 3.7011e-2 300.0 end
h       1 0.0 6.0930e-2 300.0 end
fe      1 0.0 2.5125e-6 300.0 end
ca      1 0.0 1.3839e-6 300.0 end
cr      1 0.0 6.6711e-7 300.0 end
ni      1 0.0 5.3151e-7 300.0 end
fe      2 0 5.8686e-2 300.0 end
cr      2 0 1.6469e-2 300.0 end
ni      2 0 8.1061e-3 300.0 end
mn      2 0 1.7319e-3 300.0 end
si      2 0 1.6939e-3 300.0 end
c       2 0 1.5857e-4 300.0 end
p       2 0 6.1439e-5 300.0 end
s       2 0 4.4518e-5 300.0 end
h       3 0 1.0350e-2 300.0 end
b-10    3 0 1.6020e-6 300.0 end
o       3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit          1
com='cylinder + solution'
cylinder      1
              1.470000E+01 -1.430550E+01 -5.058550E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         1 1 1
cylinder      2
              1.470000E+01  5.058550E+01 -5.058550E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         0 1 2 -1
cylinder      3
              1.500000E+01  5.178550E+01 -5.191450E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         2 1 3 -2 -1
boundary      3
global
unit          2
com='concrete building + array'
cuboid        1
              6.050000E+02 -6.050000E+02  4.400000E+02

```

```

cuboid        1
              6.050000E+02 -6.050000E+02  4.400000E+02
              -4.400000E+02  5.000000E+02 -5.000000E+02
media         0 1 1
hole          1 origin x= -2.523205E+02 y=  1.000000E+01 z= -
3.440855E+02
hole          1 origin x= -2.003590E+02 y= -2.000000E+01 z= -
3.440855E+02
hole          1 origin x= -2.523205E+02 y= -5.000000E+01 z= -
3.440855E+02
cuboid        2
              7.500000E+02 -7.500000E+02  5.850000E+02
              -5.850000E+02  5.700000E+02 -5.400000E+02
media         3 1 2 -1
boundary      2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_16_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n       1 0.0 2.3837e-3 300.0 end
o       1 0.0 3.7011e-2 300.0 end
h       1 0.0 6.0930e-2 300.0 end
fe      1 0.0 2.5125e-6 300.0 end
ca      1 0.0 1.3839e-6 300.0 end
cr      1 0.0 6.6711e-7 300.0 end
ni      1 0.0 5.3151e-7 300.0 end
fe      2 0 5.8686e-2 300.0 end
cr      2 0 1.6469e-2 300.0 end
ni      2 0 8.1061e-3 300.0 end
mn      2 0 1.7319e-3 300.0 end
si      2 0 1.6939e-3 300.0 end
c       2 0 1.5857e-4 300.0 end
p       2 0 6.1439e-5 300.0 end
s       2 0 4.4518e-5 300.0 end
h       3 0 1.0350e-2 300.0 end
b-10    3 0 1.6020e-6 300.0 end
o       3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit          1
com='cylinder + solution'
cylinder      1
              1.470000E+01 -1.205550E+01 -5.058550E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         1 1 1
cylinder      2
              1.470000E+01  5.058550E+01 -5.058550E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         0 1 2 -1
cylinder      3
              1.500000E+01  5.178550E+01 -5.191450E+01
              origin x=  0.000000E+00 y=  0.000000E+00
media         2 1 3 -2 -1
boundary      3
global
unit          2
com='concrete building + array'
cuboid        1
              6.050000E+02 -6.050000E+02  4.400000E+02

```

```

-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.609808E+02 y= 2.500000E+01 z= -
3.440855E+02
hole 1 origin x= -1.830385E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.609808E+02 y= -6.500000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_014\_17\_k6

```

#csas26 parm='size=00500000'
238-grp keno5a xsection processing for pu sol in cea-r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0.5868e-2 300.0 end
cr 2 0.1646e-2 300.0 end
ni 2 0.81061e-3 300.0 end
mn 2 0.17319e-3 300.0 end
si 2 0.16939e-3 300.0 end
c 2 0.15857e-4 300.0 end
p 2 0.61439e-5 300.0 end
s 2 0.4518e-5 300.0 end
h 3 0.10350e-2 300.0 end
b-10 3 0.16020e-6 300.0 end
o 3 0.43470e-2 300.0 end
al 3 0.15630e-3 300.0 end
si 3 0.14170e-2 300.0 end
ca 3 0.64240e-3 300.0 end
fe 3 0.76210e-4 300.0 end
end comp
read para

```

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.081550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1

```

```

hole 1 origin x= -2.783013E+02 y= 5.500000E+01 z= -
3.440855E+02
hole 1 origin x= -1.483975E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.783013E+02 y= -9.500000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_014\_18\_k6

```

#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0.5868e-2 300.0 end
cr 2 0.1646e-2 300.0 end
ni 2 0.81061e-3 300.0 end
mn 2 0.17319e-3 300.0 end
si 2 0.16939e-3 300.0 end
c 2 0.15857e-4 300.0 end
p 2 0.61439e-5 300.0 end
s 2 0.4518e-5 300.0 end
h 3 0.10350e-2 300.0 end
b-10 3 0.16020e-6 300.0 end
o 3 0.43470e-2 300.0 end
al 3 0.15630e-3 300.0 end
si 3 0.14170e-2 300.0 end
ca 3 0.64240e-3 300.0 end
fe 3 0.76210e-4 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -2.388550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.500005E+02 y= -4.999500E+00 z= -
3.440855E+02

```

```
hole 1 origin x= -2.199995E+02 y= -3.500050E+01 z= -
3.440855E+02
hole 1 origin x= -2.500005E+02 y= -3.500050E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

```
nst=1
end star
```

end data

end

## Case PU\_SOL\_TH\_014\_19\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para
```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.787550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.550000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole 1 origin x= -2.150000E+02 y= -4.000000E+01 z= -
3.440855E+02
```

```
hole 1 origin x= -2.550000E+02 y= -4.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

```
nst=1
end star
```

end data

end

## Case PU\_SOL\_TH\_014\_2\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para
```

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.678550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.175000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.525000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
```

```

-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_20_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution^'
cylinder 1
1.470000E+01 -1.368550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array^'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.650000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.050000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= -5.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1

```

```

boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_21_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0930e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
al 3 0 1.5630e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
fe 3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution^'
cylinder 1
1.470000E+01 -1.170550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array^'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.800000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole 1 origin x= -1.900000E+02 y= -6.500000E+01 z= -
3.440855E+02
hole 1 origin x= -2.800000E+02 y= -6.500000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

```

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_22_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.075550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -3.100000E+02 y= 5.500000E+01 z= -
3.440855E+02
hole      1 origin x= -1.600000E+02 y= -9.500000E+01 z= -
3.440855E+02
hole      1 origin x= -3.100000E+02 y= -9.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_23_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.072550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -3.225000E+02 y= 6.750000E+01 z= -
3.440855E+02
hole      1 origin x= -1.475000E+02 y= -1.075000E+02 z= -
3.440855E+02
hole      1 origin x= -3.225000E+02 y= -1.075000E+02 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```



```

nst=1
end star

end data

end

Case PU_SOL_TH_014_24_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600  npg=1800  nsk=10  tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -2.779550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.199995E+02 y= -4.999500E+00 z= -
3.440855E+02
hole      1 origin x= -2.500005E+02 y= -4.999500E+00 z= -
3.440855E+02
hole      1 origin x= -2.199995E+02 y= -3.500050E+01 z= -
3.440855E+02
hole      1 origin x= -2.500005E+02 y= -3.500050E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_25_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600  npg=1800  nsk=10  tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -2.083550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.150000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole      1 origin x= -2.550000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole      1 origin x= -2.150000E+02 y= -4.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.550000E+02 y= -4.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_26_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600  npg=1800  nsk=10  tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.527550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= -2.050000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.650000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.050000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.650000E+02 y= -5.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_27_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600  npg=1800  nsk=10  tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.268550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= -1.900000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.800000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -1.900000E+02 y= -6.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.800000E+02 y= -6.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_28_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.122550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -1.600000E+02 y= 5.500000E+01 z= -
3.440855E+02
hole      1 origin x= -3.100000E+02 y= 5.500000E+01 z= -
3.440855E+02
hole      1 origin x= -1.600000E+02 y= -9.500000E+01 z= -
3.440855E+02
hole      1 origin x= -3.100000E+02 y= -9.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_29_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.101550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -1.475000E+02 y= 6.750000E+01 z= -
3.440855E+02
hole      1 origin x= -3.225000E+02 y= 6.750000E+01 z= -
3.440855E+02
hole      1 origin x= -1.475000E+02 y= -1.075000E+02 z= -
3.440855E+02
hole      1 origin x= -3.225000E+02 y= -1.075000E+02 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

```

```

nst=1
end star

end data

end

Case PU_SOL_TH_014_3_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.391550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.125000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.575000E+02 y= -4.999500E+00 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -3.500050E+01 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -4.999500E+00 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_014_30_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=1300 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -2.375550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.575000E+02 y= -3.500050E+01 z= -
3.440855E+02
hole      1 origin x= -2.575000E+02 y= -4.999500E+00 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -3.500050E+01 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -4.999500E+00 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

```

end

## Case PU\_SOL\_TH\_014\_31\_k6

```
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para
```

tme=500.0 gen=1300 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -2.132550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.575000E+02 y= -3.750000E+01 z= -
3.440855E+02
hole      1 origin x= -2.575000E+02 y= -2.500000E+00 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -3.750000E+01 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -2.500000E+00 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry
```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_014\_32\_k6

```
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para
```

tme=500.0 gen=1300 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.882550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.575000E+02 y= -4.250000E+01 z= -
3.440855E+02
hole      1 origin x= -2.575000E+02 y= 2.500000E+00 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= -4.250000E+01 z= -
3.440855E+02
hole      1 origin x= -2.125000E+02 y= 2.500000E+00 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry
```

read star

nst=1  
end star

end data

```

end

Case PU_SOL_TH_014_33_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=1300 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.704550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= -2.575000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.575000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.125000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.125000E+02 y= 1.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_014_34_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-5 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=1300 npg=1000 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.556550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= -2.575000E+02 y= -6.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.575000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.125000E+02 y= -6.500000E+01 z= -
3.440855E+02
hole     1 1 origin x= -2.125000E+02 y= 2.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

```

end

## Case PU\_sol\_th\_014\_35\_k6

```
#csas26      parm='size=00500000'
pu-sol-therm-014-35, 2 x 2 cylinders, data processing for
pu sol in cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
```

```
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-5 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
```

```
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
```

```
read para tme=900 gen=1303 npg=1000 nsk=3 tba=5.0 plt=no
end para
```

```
read geometry
unit 1
com='cylinder + solution'
cylinder 10 14.7 -14.8055 -50.5855
cylinder 20 14.7 50.5855 -50.5855
cylinder 30 15.0 51.7855 -51.9145
media 1 1 10
media 0 1 20 -10
media 2 1 30 -20 -10
boundary 30
```

```
global unit 2
com='concrete building + array'
cuboid 40 605 -605 440 -440 500 -500
hole 1 origin x= -257.5 y= -65 z= -3.440855E+02
hole 1 origin x= -257.5 y= 85 z= -3.440855E+02
hole 1 origin x= -212.5 y= -65 z= -3.440855E+02
hole 1 origin x= -212.5 y= 85 z= -3.440855E+02
cuboid 50 750 -750 585 -585 570 -540
```

```
media 0 1 40
media 3 1 50 -40
boundary 50
end geometry
```

end data

end

## Case PU\_SOL\_TH\_014\_4\_k6

```
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
```

```
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-5 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para
```

```
tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0
```

```
run=yes amx=no flx=no fdn=no far=no plt=no
```

end para

```
read geometry
unit 1
com='cylinder + solution'
cylinder 1 1.470000E+01 -1.219550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2 1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3 1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1 6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.050000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2 7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

```
nst=1
end star
```

end data

end

## Case PU\_SOL\_TH\_014\_5\_k6

```
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
```

```

fe      2 0 5.8686e-2 300.0 end
cr      2 0 1.6469e-2 300.0 end
ni      2 0 8.1061e-3 300.0 end
mn      2 0 1.7319e-3 300.0 end
si      2 0 1.6939e-3 300.0 end
c       2 0 1.5857e-4 300.0 end
p       2 0 6.1439e-5 300.0 end
s       2 0 4.4518e-5 300.0 end
h       3 0 1.0350e-2 300.0 end
b-10    3 0 1.6020e-6 300.0 end
o       3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution^
cylinder  1
          1.470000E+01 -1.108550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -1.950000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.750000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_6_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end

```

```

si      2 0 1.6939e-3 300.0 end
c       2 0 1.5857e-4 300.0 end
p       2 0 6.1439e-5 300.0 end
s       2 0 4.4518e-5 300.0 end
h       3 0 1.0350e-2 300.0 end
b-10    3 0 1.6020e-6 300.0 end
o       3 0 4.3470e-2 300.0 end
al      3 0 1.5630e-3 300.0 end
si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution^
cylinder  1
          1.470000E+01 -1.021550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -1.475000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -3.225000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_7_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c       2 0 1.5857e-4 300.0 end
p       2 0 6.1439e-5 300.0 end
s       2 0 4.4518e-5 300.0 end

```



```

h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=5 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -2.228550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.350000E+02 y= 1.000050E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -5.000050E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_8_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end

```

```

o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
fe     3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.874550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.350000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -5.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_014_9_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.0317e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1013e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
al     3 0 1.5630e-3 300.0 end

```

```

si      3 0 1.4170e-2 300.0 end
ca      3 0 6.4240e-3 300.0 end
fe      3 0 7.6210e-4 300.0 end
end comp
read para

tme=500.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com=^cylinder + solution^
cylinder  1
          1.470000E+01 -1.539550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com=^concrete building + array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.350000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.350000E+02 y= -6.500000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_1_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238group infh
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
pu-241 1 0.0 1.2648e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7853e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0.58686e-2 300.0 end
cr     2 0.16469e-2 300.0 end
ni     2 0.81061e-3 300.0 end
mn     2 0.17319e-3 300.0 end
si     2 0.16939e-3 300.0 end
c      2 0.15857e-4 300.0 end
p      2 0.61439e-5 300.0 end
s      2 0.44518e-5 300.0 end
h      3 0.10350e-2 300.0 end
b-10   3 0.16020e-6 300.0 end
o      3 0.43470e-2 300.0 end
ca     3 0.64240e-3 300.0 end
si     3 0.14170e-2 300.0 end
fe     3 0.76210e-4 300.0 end

```

```

al      3 0 1.5630e-3 300.0 end
end comp
read para

tme=125. gen=600 npg=2000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com=^cylinder + solution^
cylinder  1
          1.470000E+01 -1.951550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      2
com=^concrete building + array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= -2.199995E+02 y= -2.000000E+01 z= -
3.440855E+02
hole      1 origin x= -2.500005E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02 5.850000E+02
          -5.850000E+02 5.700000E+02 -5.400000E+02
media     3 1 2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_10_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7853e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0.58686e-2 300.0 end
cr     2 0.16469e-2 300.0 end
ni     2 0.81061e-3 300.0 end
mn     2 0.17319e-3 300.0 end
si     2 0.16939e-3 300.0 end
c      2 0.15857e-4 300.0 end
p      2 0.61439e-5 300.0 end
s      2 0.44518e-5 300.0 end
h      3 0.10350e-2 300.0 end
b-10   3 0.16020e-6 300.0 end
o      3 0.43470e-2 300.0 end
ca     3 0.64240e-3 300.0 end
si     3 0.14170e-2 300.0 end
fe     3 0.76210e-4 300.0 end
al     3 0.15630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='cylinder + solution'
cylinder 1
    1.470000E+01 -1.068550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.609808E+02 y= 4.000000E+01 z= -
3.440855E+02
hole 1 origin x= -1.830385E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.609808E+02 y= -8.000000E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

nst=1  
end star

end data

end

Case PU\_SOL\_TH\_015\_11\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para
```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='cylinder + solution'
cylinder 1
    1.470000E+01 -2.400550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.500005E+02 y= -4.999500E+00 z= -
3.440855E+02
hole 1 origin x= -2.199995E+02 y= -3.500050E+01 z= -
3.440855E+02
hole 1 origin x= -2.500005E+02 y= -3.500050E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

nst=1  
end star

end data

end

Case PU\_SOL\_TH\_015\_12\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para
```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

```

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
    1.470000E+01 -1.741550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.550000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole 1 origin x= -2.150000E+02 y= -4.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.550000E+02 y= -4.000000E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_13_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0.5868e-2 300.0 end
cr 2 0.16469e-2 300.0 end
ni 2 0.81061e-3 300.0 end
mn 2 0.17319e-3 300.0 end
si 2 0.16939e-3 300.0 end
c 2 0.15857e-4 300.0 end
p 2 0.61439e-5 300.0 end
s 2 0.44518e-5 300.0 end
h 3 0.10350e-2 300.0 end
b-10 3 0.16020e-6 300.0 end
o 3 0.43470e-2 300.0 end
ca 3 0.64240e-3 300.0 end
si 3 0.14170e-2 300.0 end
fe 3 0.76210e-4 300.0 end
al 3 0.15630e-3 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

```

read geometry
unit 1
com='cylinder + solution'
cylinder 1
    1.470000E+01 -1.266550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.650000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.050000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= -5.000000E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_14_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0.5868e-2 300.0 end
cr 2 0.16469e-2 300.0 end
ni 2 0.81061e-3 300.0 end
mn 2 0.17319e-3 300.0 end
si 2 0.16939e-3 300.0 end
c 2 0.15857e-4 300.0 end
p 2 0.61439e-5 300.0 end
s 2 0.44518e-5 300.0 end
h 3 0.10350e-2 300.0 end
b-10 3 0.16020e-6 300.0 end
o 3 0.43470e-2 300.0 end
ca 3 0.64240e-3 300.0 end
si 3 0.14170e-2 300.0 end
fe 3 0.76210e-4 300.0 end
al 3 0.15630e-3 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1

```

```
com=^cylinder + solution^
cylinder 1
    1.470000E+01 -1.042550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com=^concrete building + array^
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.800000E+02 y= 2.500000E+01 z= -
3.440855E+02
hole 1 origin x= -1.900000E+02 y= -6.500000E+01 z= -
3.440855E+02
hole 1 origin x= -2.800000E+02 y= -6.500000E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_15\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para
```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com=^cylinder + solution^
cylinder 1
```

```
1.470000E+01 -2.762550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    1.470000E+01 5.058550E+01 -5.058550E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
    1.500000E+01 5.178550E+01 -5.191450E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com=^concrete building + array^
cuboid 1
    6.050000E+02 -6.050000E+02 4.400000E+02
    -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.199995E+02 y= -4.999500E+00 z= -
3.440855E+02
hole 1 origin x= -2.500005E+02 y= -4.999500E+00 z= -
3.440855E+02
hole 1 origin x= -2.199995E+02 y= -3.500050E+01 z= -
3.440855E+02
hole 1 origin x= -2.500005E+02 y= -3.500050E+01 z= -
3.440855E+02
cuboid 2
    7.500000E+02 -7.500000E+02 5.850000E+02
    -5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry
```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_16\_k6

```
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para
```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com=^cylinder + solution^
cylinder 1
```

```

1.470000E+01 -2.022550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com=^concrete building + array^
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.150000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole 1 origin x= -2.550000E+02 y= 0.000000E+00 z= -
3.440855E+02
hole 1 origin x= -2.150000E+02 y= -4.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.550000E+02 y= -4.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_17\_k6

```

#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com=^cylinder + solution^
cylinder 1

```

```

1.470000E+01 -1.433550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com=^concrete building + array^
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.050000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= 1.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.050000E+02 y= -5.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= -5.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_2\_k6

```

#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=160.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com=^cylinder + solution^
cylinder 1

```

```

1.470000E+01 -1.588550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.175000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.525000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_3_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.285550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3

```

```

1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.125000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.575000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_4_k6
#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -1.086550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3

```

```

1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -2.050000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.650000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_5\_k6

```

#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -9.725500E+00 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3

```

```

global
unit 2
com='concrete building + array'
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= -1.950000E+02 y= -2.000000E+01 z= -
3.440855E+02
hole 1 origin x= -2.750000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid 2
7.500000E+02 -7.500000E+02 5.850000E+02
-5.850000E+02 5.700000E+02 -5.400000E+02
media 3 1 2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_6\_k6

```

#csas26 parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n 1 0.0 2.9029e-3 300.0 end
o 1 0.0 3.7853e-2 300.0 end
h 1 0.0 5.9636e-2 300.0 end
fe 1 0.0 3.2134e-6 300.0 end
ca 1 0.0 1.8332e-6 300.0 end
cr 1 0.0 8.5358e-7 300.0 end
ni 1 0.0 6.8543e-7 300.0 end
fe 2 0 5.8686e-2 300.0 end
cr 2 0 1.6469e-2 300.0 end
ni 2 0 8.1061e-3 300.0 end
mn 2 0 1.7319e-3 300.0 end
si 2 0 1.6939e-3 300.0 end
c 2 0 1.5857e-4 300.0 end
p 2 0 6.1439e-5 300.0 end
s 2 0 4.4518e-5 300.0 end
h 3 0 1.0350e-2 300.0 end
b-10 3 0 1.6020e-6 300.0 end
o 3 0 4.3470e-2 300.0 end
ca 3 0 6.4240e-3 300.0 end
si 3 0 1.4170e-2 300.0 end
fe 3 0 7.6210e-4 300.0 end
al 3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit 1
com='cylinder + solution'
cylinder 1
1.470000E+01 -8.055500E+00 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 5.058550E+01 -5.058550E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 5.178550E+01 -5.191450E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 2
com='concrete building + array'
cuboid 1

```



```

        6.050000E+02 -6.050000E+02 4.400000E+02
        -4.400000E+02 5.000000E+02 -5.000000E+02
media    0      1      1
hole     1      origin x= -2.340000E+02 y= -2.000000E+01 z= -
3.440855E+02
cuboid   2
        7.500000E+02 -7.500000E+02 5.850000E+02
        -5.850000E+02 5.700000E+02 -5.400000E+02
media    3      1      2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_7\_k6

```

#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7853e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
fe     3 0 7.6210e-4 300.0 end
al     3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit      1
com='cylinder + solution^
cylinder  1
        1.470000E+01 -2.725550E+01 -5.058550E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    1      1      1
cylinder  2
        1.470000E+01 5.058550E+01 -5.058550E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    0      1      2 -1
cylinder  3
        1.500000E+01 5.178550E+01 -5.191450E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    2      1      3 -2 -1
boundary 3
global
unit      2
com='concrete building + array^
cuboid   1
        6.050000E+02 -6.050000E+02 4.400000E+02
        -4.400000E+02 5.000000E+02 -5.000000E+02
media    0      1      1
hole     1      origin x= -2.086605E+02 y= -1.499950E+01 z= -
3.448700E+02

```

```

hole     1      origin x= -1.826705E+02 y= -3.000000E+01 z= -
3.448700E+02
hole     1      origin x= -2.086605E+02 y= -4.500050E+01 z= -
3.448700E+02
cuboid   2
        7.500000E+02 -7.500000E+02 5.850000E+02
        -5.850000E+02 5.700000E+02 -5.400000E+02
media    3      1      2 -1
boundary 2
end geometry

```

read star

nst=1  
end star

end data

end

## Case PU\_SOL\_TH\_015\_8\_k6

```

#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in
cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7853e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
fe     3 0 7.6210e-4 300.0 end
al     3 0 1.5630e-3 300.0 end
end comp
read para

```

tme=200.0 gen=600 npg=1800 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```

read geometry
unit      1
com='cylinder + solution^
cylinder  1
        1.470000E+01 -1.868550E+01 -5.058550E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    1      1      1
cylinder  2
        1.470000E+01 5.058550E+01 -5.058550E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    0      1      2 -1
cylinder  3
        1.500000E+01 5.178550E+01 -5.191450E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media    2      1      3 -2 -1
boundary 3
global
unit      2
com='concrete building + array^
cuboid   1
        6.050000E+02 -6.050000E+02 4.400000E+02
        -4.400000E+02 5.000000E+02 -5.000000E+02
media    0      1      1
hole     1      origin x= -2.465470E+02 y= 0.000000E+00 z= -
3.440855E+02
hole     1      origin x= -2.119060E+02 y= -2.000000E+01 z= -
3.440855E+02

```

```

hole      1  origin x= -2.465470E+02  y= -4.000000E+01  z= -
3.440855E+02
cuboid    2
          7.500000E+02 -7.500000E+02  5.850000E+02
          -5.850000E+02  5.700000E+02 -5.400000E+02
media     3      1      2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_015_9_k6
#csas26      parm='size=00500000'
c5toc6 238-grp keno5a xsection processing for pu sol in cea-r-3946
238groupndf5 inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2161e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.2648e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7853e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
h      3 0 1.0350e-2 300.0 end
b-10   3 0 1.6020e-6 300.0 end
o      3 0 4.3470e-2 300.0 end
ca     3 0 6.4240e-3 300.0 end
si     3 0 1.4170e-2 300.0 end
fe     3 0 7.6210e-4 300.0 end
al     3 0 1.5630e-3 300.0 end
end comp
read para

tme=200.0 gen=600  npg=1800  nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='cylinder + solution'
cylinder  1
          1.470000E+01 -1.328550E+01 -5.058550E+01
          origin x= 0.000000E+00  y= 0.000000E+00
media     1      1      1
cylinder  2
          1.470000E+01  5.058550E+01 -5.058550E+01
          origin x= 0.000000E+00  y= 0.000000E+00
media     0      1      2 -1
cylinder  3
          1.500000E+01  5.178550E+01 -5.191450E+01
          origin x= 0.000000E+00  y= 0.000000E+00
media     2      1      3 -2 -1
boundary  3
global
unit      2
com='concrete building + array'
cuboid    1
          6.050000E+02 -6.050000E+02  4.400000E+02
          -4.400000E+02  5.000000E+02 -5.000000E+02
media     0      1      1
hole      1  origin x= -2.523205E+02  y= 1.000000E+01  z= -
3.440855E+02
hole      1  origin x= -2.003590E+02  y= -2.000000E+01  z= -
3.440855E+02
hole      1  origin x= -2.523205E+02  y= -5.000000E+01  z= -
3.440855E+02

```

```

cuboid    2
          7.500000E+02 -7.500000E+02  5.850000E+02
          -5.850000E+02  5.700000E+02 -5.400000E+02
media     3      1      2 -1
boundary  2
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_1_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6662e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9030e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000  nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='300 cylinder + critical solution'
cylinder  1
          1.470000E+01  3.618900E+01  1.329000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     1      1      1
cylinder  2
          1.470000E+01  1.025000E+02  1.329000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     0      1      2 -1
cylinder  3
          1.500000E+01  1.037000E+02  0.000000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     2      1      3 -2 -1
boundary  3
unit      2
com='256 cylinder + critical solution'
cylinder  1
          1.249000E+01  3.588900E+01  1.355000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     1      1      1
cylinder  2
          1.249000E+01  1.025000E+02  1.355000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     0      1      2 -1
cylinder  3
          1.279000E+01  1.037000E+02  0.000000E+00
          origin x= 0.000000E+00  y= 0.000000E+00
media     2      1      3 -2 -1
boundary  3
global
unit      3
com='space enclosing array'
cuboid    1
          6.050000E+02 -6.050000E+02  4.400000E+02
          -4.400000E+02  5.000000E+02 -5.000000E+02
media     0      1      1

```

```
hole 1 origin x= 0.000000E+00 y= -1.500010E+01 z= -
3.960000E+02
hole 2 origin x= 0.000000E+00 y= 1.279010E+01 z= -
3.957000E+02
boundary 1
end geometry
```

read star

```
nst=1
end star
```

end data

end

## Case PU\_SOL\_TH\_016\_10\_k6

```
#csas26 parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0931e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 6.0815e-2 300.0 end
cr 2 0 1.7531e-2 300.0 end
ni 2 0 7.6508e-3 300.0 end
h 3 0 6.3781e-2 300.0 end
n 3 0 1.2044e-3 300.0 end
o 3 0 3.4902e-2 300.0 end
end comp
read para
```

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='^300 cylinder + critical solution^
cylinder 1
1.470000E+01 4.169900E+01 1.329000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 1.025000E+02 1.329000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 1.037000E+02 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 2
com='^256 cylinder + 2n acid^
cylinder 1
1.249000E+01 4.235500E+01 1.355000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cylinder 2
1.249000E+01 1.025000E+02 1.355000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.279000E+01 1.037000E+02 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 3
com='^space enclosing array^
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= 0.000000E+00 y= -2.000000E+01 z= -
3.960000E+02
```

```
hole 2 origin x= 0.000000E+00 y= 1.779000E+01 z= -
3.957000E+02
boundary 1
end geometry
```

read star

```
nst=1
end star
```

end data

end

## Case PU\_SOL\_TH\_016\_11\_k6

```
#csas26 parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n 1 0.0 2.3837e-3 300.0 end
o 1 0.0 3.7011e-2 300.0 end
h 1 0.0 6.0931e-2 300.0 end
fe 1 0.0 2.5125e-6 300.0 end
ca 1 0.0 1.3839e-6 300.0 end
cr 1 0.0 6.6711e-7 300.0 end
ni 1 0.0 5.3151e-7 300.0 end
fe 2 0 6.0815e-2 300.0 end
cr 2 0 1.7531e-2 300.0 end
ni 2 0 7.6508e-3 300.0 end
h 3 0 6.3781e-2 300.0 end
n 3 0 1.2044e-3 300.0 end
o 3 0 3.4902e-2 300.0 end
end comp
read para
```

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

```
read geometry
unit 1
com='^300 cylinder + critical solution^
cylinder 1
1.470000E+01 4.221900E+01 1.329000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
1.470000E+01 1.025000E+02 1.329000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.500000E+01 1.037000E+02 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 2
com='^256 cylinder + 2n acid^
cylinder 1
1.249000E+01 4.235500E+01 1.355000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cylinder 2
1.249000E+01 1.025000E+02 1.355000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
1.279000E+01 1.037000E+02 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 3
com='^space enclosing array^
cuboid 1
6.050000E+02 -6.050000E+02 4.400000E+02
-4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
hole 2 origin x= 0.000000E+00 y= 2.779000E+01 z= -
3.957000E+02
```

```
boundary      1
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_2_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^
cylinder  1
          1.470000E+01 4.147900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^
cylinder  1
          1.249000E+01 4.117900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -2.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 1.779000E+01 z= -
3.957000E+02
```

```
boundary      1
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_3_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^
cylinder  1
          1.470000E+01 4.341900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^
cylinder  1
          1.249000E+01 4.311900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 2.779000E+01 z= -
3.957000E+02
```

```

boundary      1
end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_11_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0.0 6.0815e-2 300.0 end
cr     2 0.0 1.7531e-2 300.0 end
ni     2 0.0 7.6508e-3 300.0 end
h      3 0.0 6.3781e-2 300.0 end
n      3 0.0 1.2044e-3 300.0 end
o      3 0.0 3.4902e-2 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 4.221900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + 2n acid^'
cylinder  1
          1.249000E+01 4.235500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
hole      2 origin x= 0.000000E+00 y= 2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

```

```

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_2_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0.0 5.8686e-2 300.0 end
cr     2 0.0 1.6469e-2 300.0 end
ni     2 0.0 8.1061e-3 300.0 end
mn     2 0.0 1.7319e-3 300.0 end
si     2 0.0 1.6939e-3 300.0 end
c      2 0.0 1.5857e-4 300.0 end
p      2 0.0 6.1439e-5 300.0 end
s      2 0.0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 4.147900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^'
cylinder  1
          1.249000E+01 4.117900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= 0.000000E+00 y= -2.000000E+01 z= -
3.960000E+02
hole      2 origin x= 0.000000E+00 y= 1.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

```

```

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_3_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 4.341900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^'
cylinder  1
          1.249000E+01 4.311900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= 2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

```

```

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_4_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.7777e-8 300.0 end
pu-239 1 0.0 3.6661e-4 300.0 end
pu-240 1 0.0 1.6176e-5 300.0 end
pu-241 1 0.0 1.2068e-6 300.0 end
pu-242 1 0.0 6.0704e-8 300.0 end
am-241 1 0.0 1.3563e-7 300.0 end
n      1 0.0 2.9029e-3 300.0 end
o      1 0.0 3.7852e-2 300.0 end
h      1 0.0 5.9636e-2 300.0 end
fe     1 0.0 3.2134e-6 300.0 end
ca     1 0.0 1.8332e-6 300.0 end
cr     1 0.0 8.5358e-7 300.0 end
ni     1 0.0 6.8543e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 4.375900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^'
cylinder  1
          1.249000E+01 4.345900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= -4.500000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= 4.279000E+01 z= -
3.957000E+02
boundary  1
end geometry

```

```

end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_5_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7671e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 3.541900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^'
cylinder  1
          1.249000E+01 3.511900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -1.500010E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 1.279010E+01 z= -
3.957000E+02
boundary  1

```

```

end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_6_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3839e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 4.032900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^'
cylinder  1
          1.249000E+01 4.002900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -2.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 1.779000E+01 z= -
3.957000E+02
boundary  1

```

```

end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_7_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3839e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^
cylinder  1
          1.470000E+01 4.198900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^
cylinder  1
          1.249000E+01 4.168900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 2.779000E+01 z= -
3.957000E+02
boundary  1

```

```

end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_8_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3839e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^
cylinder  1
          1.470000E+01 4.222900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution^
cylinder  1
          1.249000E+01 4.192900E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -4.500000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 4.279000E+01 z= -
3.957000E+02
boundary  1

```



```

end geometry

read star

nst=1
end star

end data

end

Case PU_SOL_TH_016_9_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2209e-5 300.0 end
pu-241 1 0.0 9.1082e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.0237e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0931e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.3839e-6 300.0 end
cr     1 0.0 6.6711e-7 300.0 end
ni     1 0.0 5.3151e-7 300.0 end
fe     2 0 6.0815e-2 300.0 end
cr     2 0 1.7531e-2 300.0 end
ni     2 0 7.6508e-3 300.0 end
h      3 0 6.3781e-2 300.0 end
n      3 0 1.2044e-3 300.0 end
o      3 0 3.4902e-2 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution^'
cylinder  1
          1.470000E+01 3.992900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + 2n acid^'
cylinder  1
          1.249000E+01 4.235500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= -1.500010E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= 1.279010E+01 z= -
3.957000E+02
boundary  1
end geometry

```

```

read star

nst=1
end star

end data

end

Case PU_SOL_TH_017_1_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.66cm^'
cylinder  1
          1.470000E+01 4.198900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=0.0cm^'
cylinder  1
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 1
cylinder  2
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 2 -1
boundary  2
global
unit      3
com='^space enclosing array^'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1

```

```

end star

end data

end

Case PU_SOL_TH_017_10_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=39.43cm^
cylinder  1
          1.470000E+01 4.075900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=20.0cm^
cylinder  1
          1.249000E+01 2.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= 1.750000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= -1.529000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1

end star

```

```

end star

end data

end

Case PU_SOL_TH_017_11_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^1st 300 cylinder + critical solution height=40.64cm^
cylinder  1
          1.470000E+01 4.196900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^2nd 300 cylinder + critical solution height=0.0cm^
cylinder  1
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 1
cylinder  2
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 2 -1
boundary  2
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= -2.250000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1

end star

end data

```

```

end

Case PU_SOL_TH_017_12_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=40.70cm^
cylinder  1
          1.470000E+01 4.202900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=10.0cm^
cylinder  1
          1.470000E+01 1.132900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.250000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_13_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=40.43cm^
cylinder  1
          1.470000E+01 4.175900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=20.0cm^
cylinder  1
          1.249000E+01 2.132900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.250000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_14_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=39.57cm^
cylinder  1
      1.470000E+01 4.089900E+01 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
      1.470000E+01 1.025000E+02 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
      1.500000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=30.0cm^
cylinder  1
      1.470000E+01 3.132900E+01 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
      1.470000E+01 1.025000E+02 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
      1.500000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
      6.050000E+02 -6.050000E+02 4.400000E+02
      -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.250000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_15_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=40.87cm^
cylinder  1
      1.470000E+01 4.219900E+01 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
      1.470000E+01 1.025000E+02 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
      1.500000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=00.0cm^
cylinder  1
      1.470000E+01 1.132900E+01 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 1
cylinder  2
      1.470000E+01 1.025000E+02 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
      1.500000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
      6.050000E+02 -6.050000E+02 4.400000E+02
      -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_16_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=41.00cm^
cylinder  1
          1.470000E+01 4.232900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=10.0cm^
cylinder  1
          1.249000E+01 1.132900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_17_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=40.81cm^
cylinder  1
          1.470000E+01 4.213900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=20.0cm^
cylinder  1
          1.249000E+01 2.132900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_18_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='1st 300 cylinder + critical solution height=40.59cm^
cylinder  1
          1.470000E+01 4.191900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='2nd 300 cylinder + critical solution height=30.0cm^
cylinder  1
          1.249000E+01 3.132900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole      2 origin x= 0.000000E+00 y= -3.000000E+01 z= -
3.960000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_2_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='300 cylinder + critical solution height=40.54cm^
cylinder  1
          1.470000E+01 4.186900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='256 cylinder + critical solution height=20.0cm^
cylinder  1
          1.249000E+01 2.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole      1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole      2 origin x= 0.000000E+00 y= -2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_3_k6
#csas26      parm='size=00500000'
c5toc6 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.27cm'
cylinder  1
          1.470000E+01 4.159900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=40.0cm'
cylinder  1
          1.249000E+01 4.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= -2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_4_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.13cm'
cylinder  1
          1.470000E+01 4.145900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=60.0cm'
cylinder  1
          1.249000E+01 6.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array'
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 2 origin x= 0.000000E+00 y= -2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_5_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.12cm^
cylinder  1
          1.470000E+01 4.144900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=80.0cm^
cylinder  1
          1.249000E+01 8.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 3.000000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.779000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_6_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.34cm^
cylinder  1
          1.470000E+01 4.166900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=20.0cm^
cylinder  1
          1.249000E+01 2.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.029000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```



```

end

Case PU_SOL_TH_017_7_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=38.74cm^
cylinder  1
          1.470000E+01 4.006900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=80.0cm^
cylinder  1
          1.249000E+01 8.135500E+01 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 2.250000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -2.029000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_8_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit      1
com='^300 cylinder + critical solution height=40.45cm^
cylinder  1
          1.470000E+01 4.177900E+01 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.470000E+01 1.025000E+02 1.329000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.500000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
unit      2
com='^256 cylinder + critical solution height=6.0cm^
cylinder  1
          1.249000E+01 7.355000E+00 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1 1 1
cylinder  2
          1.249000E+01 1.025000E+02 1.355000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     0 1 2 -1
cylinder  3
          1.279000E+01 1.037000E+02 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2 1 3 -2 -1
boundary  3
global
unit      3
com='^space enclosing array^
cuboid    1
          6.050000E+02 -6.050000E+02 4.400000E+02
          -4.400000E+02 5.000000E+02 -5.000000E+02
media     0 1 1
hole     1 origin x= 0.000000E+00 y= 1.750000E+01 z= -
3.960000E+02
hole     2 origin x= 0.000000E+00 y= -1.529000E+01 z= -
3.957000E+02
boundary  1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_017_9_k6
#csas26      parm='size=00500000'
csas25 27-grp keno5a xsection processing for pu sol in cea-
r-3946
238group inf
pu-238 1 0.0 2.0965e-8 300.0 end
pu-239 1 0.0 2.7672e-4 300.0 end
pu-240 1 0.0 1.2210e-5 300.0 end
pu-241 1 0.0 8.9627e-7 300.0 end
pu-242 1 0.0 4.5817e-8 300.0 end
am-241 1 0.0 1.1646e-7 300.0 end
n      1 0.0 2.3837e-3 300.0 end
o      1 0.0 3.7011e-2 300.0 end
h      1 0.0 6.0930e-2 300.0 end
fe     1 0.0 2.5125e-6 300.0 end
ca     1 0.0 1.4004e-6 300.0 end
cr     1 0.0 6.7464e-7 300.0 end
ni     1 0.0 5.3790e-7 300.0 end
fe     2 0 5.8686e-2 300.0 end
cr     2 0 1.6469e-2 300.0 end
ni     2 0 8.1061e-3 300.0 end
mn     2 0 1.7319e-3 300.0 end
si     2 0 1.6939e-3 300.0 end
c      2 0 1.5857e-4 300.0 end
p      2 0 6.1439e-5 300.0 end
s      2 0 4.4518e-5 300.0 end
end comp
read para

tme=500.0 gen=1000 npg=1000 nsk=10 tba=5.0

run=yes amx=no flx=no fdn=no far=no plt=no

end para

read geometry
unit 1
com='^300 cylinder + critical solution height=40.17cm'
cylinder 1
      1.470000E+01 4.149900E+01 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      1.470000E+01 1.025000E+02 1.329000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      1.500000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 2
com='^256 cylinder + critical solution height=10.0cm'
cylinder 1
      1.249000E+01 1.135500E+01 1.355000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      1.249000E+01 1.025000E+02 1.355000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      1.279000E+01 1.037000E+02 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
global
unit 3
com='^space enclosing array'
cuboid 1
      6.050000E+02 -6.050000E+02 4.400000E+02
      -4.400000E+02 5.000000E+02 -5.000000E+02
media 0 1 1
hole 1 1 origin x= 0.000000E+00 y= 1.750000E+01 z= -
3.960000E+02
hole 2 2 origin x= 0.000000E+00 y= -1.529000E+01 z= -
3.957000E+02
boundary 1
end geometry

read star

nst=1
end star

end data

```

```

end

Case PU_SOL_TH_020_1_T8A_k6
#csas26      parm='size=00500000'
case20-
1,kvpusoln,27,39.2gpu/1,4.57w/o240,h2orefltruncsph,14in
238group
infhommedium
'MTL1=39.2GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.9500-09 298 end
pu-239 1 0.0 9.3820-05 298 end
pu-240 1 0.0 4.5895-06 298 end
pu-241 1 0.0 3.0456-07 298 end
pu-242 1 0.0 8.7772-09 298 end
n      1 0.0 2.9243-03 298 end
h      1 0.0 5.9590-02 298 end
o      1 0.0 3.7303-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe     2 0.0 5.9355-02 298 end
cr     2 0.0 1.7428-02 298 end
ni     2 0.0 7.7203-03 298 end
mn     2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=600 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit 1
sphere 1
      1.769550E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
      chord -z= 1.535960E+01
media 1 1 1
sphere 2
      1.769550E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 0 1 2 -1
sphere 3
      1.780730E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4
      4.780730E+01
      origin
      x= 0.000000E+00
      y= 0.000000E+00
      z= 0.000000E+00
media 3 1 4 -3 -2 -1
boundary 4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

Case PU_SOL_TH_020_10_T8B_k6
#csas26      parm='size=00500000'
case20-
10,kvpusoln,27,38.6gpu/1,4.57w/o240,h2orefl,.992ful,14in
238group
infhommedium
'MTL1=38.6GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.8589-09 298 end
pu-239 1 0.0 9.2385-05 298 end
pu-240 1 0.0 4.5192-06 298 end

```

```
pu-241 1 0.0 2.9990-07 298 end
pu-242 1 0.0 8.6429-09 298 end
n 1 0.0 2.8399-03 298 end
h 1 0.0 6.0007-02 298 end
o 1 0.0 3.7298-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
```

```
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
```

```
end param
read geometry
global
unit 1
sphere 1
```

```
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.583500E+01
```

```
media 1 1 1
sphere 2
```

```
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 0 1 2 -1
sphere 3
```

```
1.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 2 1 3 -2 -1
sphere 4
```

```
4.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 3 1 4 -3 -2 -1
boundary 4
end geometry
```

```
read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
```

```
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
```

```
end plot
end data
end
```

## Case PU\_SOL\_TH\_020\_11\_T8B\_k6

```
#csas26 parm='size=00500000'
case20-
11,kvpusoln,27,33.2gpu/L,4.57w/o240,h2orefl.992ful,14in
238group
infhommedium
'MTL1=33.2GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.0392-09 298 end
pu-239 1 0.0 7.9460-05 298 end
pu-240 1 0.0 3.8870-06 298 end
pu-241 1 0.0 2.5795-07 298 end
pu-242 1 0.0 7.4337-09 298 end
n 1 0.0 1.5871-03 298 end
h 1 0.0 6.3047-02 298 end
o 1 0.0 3.5659-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
```

```
o 3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
```

```
end param
read geometry
global
unit 1
sphere 1
```

```
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.583500E+01
```

```
media 1 1 1
sphere 2
```

```
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 0 1 2 -1
sphere 3
```

```
1.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 2 1 3 -2 -1
sphere 4
```

```
4.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
```

```
media 3 1 4 -3 -2 -1
boundary 4
end geometry
```

```
read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
```

```
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
```

```
end plot
end data
end
```

## Case PU\_SOL\_TH\_020\_12\_T8B\_k6

```
#csas26 parm='size=00500000'
case20-
12,kvpusoln,27,47.5gpu/L,4.57w/o240,h2orefl.992ful,14in
238group
infhommedium
'MTL1=47.5GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 7.2098-09 298 end
pu-239 1 0.0 1.1369-04 298 end
pu-240 1 0.0 5.5612-06 298 end
pu-241 1 0.0 3.6905-07 298 end
pu-242 1 0.0 1.0636-08 298 end
n 1 0.0 4.4892-03 298 end
h 1 0.0 5.5728-02 298 end
o 1 0.0 3.9326-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
```

```
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
```

```
end param
read geometry
global
unit 1
sphere 1
```

```
1.769550E+01
origin
```

```

x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.583500E+01
media 1 1 1
sphere 2
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 0 1 2 -1
sphere 3
1.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4
4.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 4 -3 -2 -1
boundary 4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

```

## Case PU\_SOL\_TH\_020\_13\_T8B\_k6

```

#csas26 parm='size=00500000'
case20-
13,kvpusoln,27,49.5gpu/1,4.57w/o240,h2oref1.992ful,14in
238group
infhommedium
'MTL1=49.5GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 7.5134-09 298 end
pu-239 1 0.0 1.1847-04 298 end
pu-240 1 0.0 5.7954-06 298 end
pu-241 1 0.0 3.8459-07 298 end
pu-242 1 0.0 1.1083-08 298 end
n 1 0.0 4.1179-03 298 end
h 1 0.0 5.6332-02 298 end
o 1 0.0 3.8710-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit
sphere 1
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.583500E+01
media 1 1 1
sphere 2
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 0 1 2 -1
sphere 3
1.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4
4.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00

```

```

sphere 3
1.799010E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4
4.799010E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 4 -3 -2 -1
boundary 4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

```

## Case PU\_SOL\_TH\_020\_2\_T8A\_k6

```

#csas26 parm='size=00500000'
case20-
2,kvpusoln,27,38.4gpu/1,4.57w/o240,h2oref1truncsph,14in
238group
infhommedium
'MTL1=38.4GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.8286-09 298 end
pu-239 1 0.0 9.1906-05 298 end
pu-240 1 0.0 4.4958-06 298 end
pu-241 1 0.0 2.9835-07 298 end
pu-242 1 0.0 8.5981-09 298 end
n 1 0.0 2.8318-03 298 end
h 1 0.0 6.0071-02 298 end
o 1 0.0 3.7308-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit
sphere 1
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.626960E+01
media 1 1 1
sphere 2
1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 0 1 2 -1
sphere 3
1.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4
4.780730E+01
origin
x= 0.000000E+00
y= 0.000000E+00

```

```

z= 0.000000E+00
media      3      1      4      -3      -2      -1
boundary   4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

```

```

Case PU_SOL_TH_020_3_T8A_k6
#csas26      parm='size=00500000'
case20-
3,kvpusoln,27,33.5gpu/l,4.57w/o240,h2orefltruncsph,14in
238group
infhommedium
'MTL1=33.5GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.0848-09 298 end
pu-239 1 0.0 8.0178-05 298 end
pu-240 1 0.0 3.9221-06 298 end
pu-241 1 0.0 2.6028-07 298 end
pu-242 1 0.0 7.5009-09 298 end
n      1 0.0 1.5841-03 298 end
h      1 0.0 6.3042-02 298 end
o      1 0.0 3.5650-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe      2 0.0 5.9355-02 298 end
cr      2 0.0 1.7428-02 298 end
ni      2 0.0 7.7203-03 298 end
mn      2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit
sphere    1
          1.769550E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.483630E+01
media     1 1 1
sphere    2
          1.769550E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.483630E+01
media     1 1 1
sphere    2
          1.769550E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.483630E+01
media     0 1 2 -1
sphere    3
          1.780730E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.483630E+01
media     2 1 3 -2 -1
sphere    4
          4.780730E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.483630E+01
media     3 1 4 -3 -2 -1
boundary   4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'

```

```

xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

Case PU_SOL_TH_020_5_T8A_k6
#csas26      parm='size=00500000'
case20-
5,kvpusoln,27,47.9gpu/l,4.57w/o240,h2orefltruncsph,14in
238group
infhommedium
'MTL1=47.9GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 7.2706-09 298 end
pu-239 1 0.0 1.1464-04 298 end
pu-240 1 0.0 5.6081-06 298 end
pu-241 1 0.0 3.7216-07 298 end
pu-242 1 0.0 1.0725-08 298 end
n      1 0.0 4.5174-03 298 end
h      1 0.0 5.5797-02 298 end
o      1 0.0 3.9433-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe      2 0.0 5.9355-02 298 end
cr      2 0.0 1.7428-02 298 end
ni      2 0.0 7.7203-03 298 end
mn      2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h      3 0.0 6.6655-02 298 end
o      3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit
sphere    1
          1.769550E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.544340E+01
media     1 1 1
sphere    2
          1.769550E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.544340E+01
media     0 1 2 -1
sphere    3
          1.780730E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.544340E+01
media     2 1 3 -2 -1
sphere    4
          4.780730E+01
          origin
            x= 0.000000E+00
            y= 0.000000E+00
            z= 0.000000E+00
          chord -z= 1.544340E+01
media     3 1 4 -3 -2 -1
boundary   4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +-0'
end
end plot
end data
end

Case PU_SOL_TH_020_6_T8A_k6
#csas26      parm='size=00500000'
case20-
6,kvpusoln,27,49.5gpu/l,4.57w/o240,h2orefltruncsph,14in

```

```

238group
infhommedium
'MTL1=49.5GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 7.5134-09 298 end
pu-239 1 0.0 1.1847-04 298 end
pu-240 1 0.0 5.7954-06 298 end
pu-241 1 0.0 3.8459-07 298 end
pu-242 1 0.0 1.1083-08 298 end
n 1 0.0 4.1179-03 298 end
h 1 0.0 5.6332-02 298 end
o 1 0.0 3.8710-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN
fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit 1
sphere 1 1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.571460E+01
media 1 1 1
sphere 2 1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 0 1 2 -1
sphere 3 1.799010E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4 4.799010E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 4 -3 -2 -1
boundary 4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +0'
end
end plot
end data
end

```

```

Case PU_SOL_TH_020_7_T8A_k6
#csas26 parm='size=00500000'
case20-
7,kvpusoln,27,34.4gpu/l,4.57w/o240,h2orefltruncsph,14in
238group
infhommedium
'MTL1=34.4GPU/L,4.57W/O240,NITRATE SOLN,C OF N CONSTANTS
pu-238 1 0.0 5.2214-09 298 end
pu-239 1 0.0 8.2332-05 298 end
pu-240 1 0.0 4.0275-06 298 end
pu-241 1 0.0 2.6727-07 298 end
pu-242 1 0.0 7.7024-09 298 end
n 1 0.0 1.6052-03 298 end
h 1 0.0 6.2714-02 298 end
o 1 0.0 3.5543-02 298 end
'MATL2=304L STAINLESS STEEL, 7.92g/cc,SCALE4 COMPOSTN

```

```

fe 2 0.0 5.9355-02 298 end
cr 2 0.0 1.7428-02 298 end
ni 2 0.0 7.7203-03 298 end
mn 2 0.0 1.7363-03 298 end
'MTL3=WATER AT 0.9970G/CC (25 C)
h 3 0.0 6.6655-02 298 end
o 3 0.0 3.3327-02 298 end
end comp
read param
tme=90 npg=800 gen=610 nsk=10 far=yes nub=yes run=yes
plt=no
end param
read geometry
global
unit 1
sphere 1 1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
chord -z= 1.494070E+01
media 1 1 1
sphere 2 1.769550E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 0 1 2 -1
sphere 3 1.789870E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 2 1 3 -2 -1
sphere 4 4.789870E+01
origin
x= 0.000000E+00
y= 0.000000E+00
z= 0.000000E+00
media 3 1 4 -3 -2 -1
boundary 4
end geometry

read plot
ttl='1/4 x-z elev view, y=0,vol=23.21 l'
xul=0 yul=0 zul=18 xlr=18 ylr=0 zlr=0
uax=1 wdn=-1 nax=130 ndn=87
nch=' +0'
end
ttl='x-z elev view of top void, delta z=5'
xul=0 yul=0 zul=18 xlr=5 ylr=0 zlr=13
uax=1 wdn=-1 nax=130 ndn=87
nch=' +0'
end
end plot
end data
end

```

## Case MIX COMP THERM 002 PNL30 k6

```

#csas26 parm='size=00500000'
mix_comp_therm_002_pnl30
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end
u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end

```

```

sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6706-02 293 end
o 4 0 3.3353-02 293 end
b-10 4 0 1.8706-08 293 end
b-11 4 0 7.5770-08 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end
al 5 0 5.8433-02 293 end
'lead shield'
pb 6 0 3.2174-02 293 end
end comp
squarepitch 1.778 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit 1
com='fuel pin (no fuel) in water'
cylinder 1
7.175500E-01 3.175000E+00 2.857500E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 3.175000E+00 2.857500E+00
media 4 1 2 -1
cuboid 3
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 3.175000E+00 0.000000E+00
media 5 1 3 -2 -1
boundary 3
unit 2
com='fuel pin (no fuel) in eggcrate'
cylinder 1
7.175500E-01 3.556000E+00 3.175000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
7.302500E-01 -7.302500E-01 7.302500E-01
-7.302500E-01 3.556000E+00 3.175000E+00
media 4 1 2 -1
cuboid 3
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 3.556000E+00 3.175000E+00
media 5 1 3 -2 -1
boundary 3
unit 3
com='fuel pin (uo2) in eggcrate'
cylinder 1
6.413500E-01 4.056000E+00 3.556000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
7.175500E-01 4.056000E+00 3.556000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
7.302500E-01 -7.302500E-01 7.302500E-01
-7.302500E-01 4.056000E+00 3.556000E+00
media 4 1 3 -2 -1
cuboid 4
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 4
com='fuel pin in eggcrate'
cylinder 1
6.413500E-01 5.715000E+00 4.056000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 5.715000E+00 4.056000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1

```

```

cuboid 3
7.302500E-01 -7.302500E-01 7.302500E-01
-7.302500E-01 5.715000E+00 4.056000E+00
media 4 1 3 -2 -1
cuboid 4
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 5.715000E+00 4.056000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 5
com='fuel pin in water'
cylinder 1
6.413500E-01 9.239250E+01 5.715000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 9.239250E+01 5.715000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 9.239250E+01 5.715000E+00
media 4 1 3 -2 -1
boundary 3
unit 6
com='fuel pin in eggcrate'
cylinder 1
6.413500E-01 9.493250E+01 9.239250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 9.493250E+01 9.239250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
7.302500E-01 -7.302500E-01 7.302500E-01
-7.302500E-01 9.493250E+01 9.239250E+01
media 4 1 3 -2 -1
cuboid 4
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 9.493250E+01 9.239250E+01
media 5 1 4 -3 -2 -1
boundary 4
unit 7
com='fuel pin in moderator'
cylinder 1
6.413500E-01 9.499600E+01 9.493250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 9.499600E+01 9.493250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 9.499600E+01 9.493250E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com='fuel pin (no fuel) in moderator'
cylinder 1
7.175500E-01 9.582150E+01 9.499600E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 9.582150E+01 9.499600E+01
media 4 1 2 -1
cuboid 3
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 9.677400E+01 9.499600E+01
media 6 1 3 -2 -1
boundary 3
unit 9
com='water'
cuboid 1
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 3.175000E+00 2.857500E+00
media 4 1 1
cuboid 2
8.890000E-01 -8.890000E-01 8.890000E-01
-8.890000E-01 3.175000E+00 0.000000E+00
media 5 1 2 -1
boundary 2
unit 10
com='eggcrate+water'
cuboid 1
7.302500E-01 -7.302500E-01 7.302500E-01
-7.302500E-01 3.556000E+00 3.175000E+00
media 4 1 1

```

```

cuboid      2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 3.556000E+00 3.175000E+00
media       5
boundary    2
unit        11
com='^eggcrate+water^'
cuboid      1
             7.302500E-01 -7.302500E-01 7.302500E-01
             -7.302500E-01 4.056000E+00 3.556000E+00
media       4
cuboid      2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 4.056000E+00 3.556000E+00
media       5
boundary    2
unit        12
com='^eggcrate+water^'
cuboid      1
             7.302500E-01 -7.302500E-01 7.302500E-01
             -7.302500E-01 5.715000E+00 4.056000E+00
media       4
cuboid      2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 5.715000E+00 4.056000E+00
media       5
boundary    2
unit        13
com='^water^'
cuboid      1
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 9.239250E+01 5.715000E+00
media       4
boundary    1
unit        14
com='^eggcrate+water^'
cuboid      1
             7.302500E-01 -7.302500E-01 7.302500E-01
             -7.302500E-01 9.493250E+01 9.239250E+01
media       4
cuboid      2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 9.493250E+01 9.239250E+01
media       5
boundary    2
unit        15
com='^water^'
cuboid      1
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 9.499600E+01 9.493250E+01
media       4
boundary    1
unit        16
com='^water+pb^'
cuboid      1
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 9.582150E+01 9.499600E+01
media       4
cuboid      2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 9.677400E+01 9.499600E+01
media       6
boundary    2
global
unit        17
cuboid      1
             4.089400E+01 0.000000E+00 4.089400E+01
             0.000000E+00 9.677400E+01 0.000000E+00
array       1
             1
             place 1 1 1 8.890000E-01 8.890000E-01
0.000000E+00
cuboid      2
             7.089400E+01 -3.000000E+01 7.089400E+01
             -3.000000E+01 1.120140E+02 -3.000000E+01
media       4
boundary    2
end geometry

read array
ara=1 nux=23 nuy=23 nuz=8
fill
5r9 13r1 5r9 4r9 15r1 4r9 3r9 17r1 3r9 2r9 19r1 2r9 9 21r1
9
299r1 299b115
5r10 13r2 9r10 15r2 7r10 17r2 5r10 19r2 3r10 21r2 10
299r2 299b115
5r11 13r3 9r11 15r3 7r11 17r3 5r11 19r3 3r11 21r3 11
299r3 299b115
5r12 13r4 9r12 15r4 7r12 17r4 5r12 19r4 3r12 21r4 12
299r4 299b115

```

```

5r13 13r5 9r13 15r5 7r13 17r5 5r13 19r5 3r13 21r5 13
299r5 299b115
5r14 13r6 9r14 15r6 7r14 17r6 5r14 19r6 3r14 21r6 14
299r6 299b115
5r15 13r7 9r15 15r7 7r15 17r7 5r15 19r7 3r15 21r7 15
299r7 299b115
5r16 13r8 9r16 15r8 7r16 17r8 5r16 19r8 3r16 21r8 16
299r8 299b115 t
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end

```

## Case Mix Comp Therm 002 PNL31 k6

```

#csas26      parm='size=00500000'
mix_comp_therm_002_pnl31
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end
u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end
sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6685-02 293 end
o 4 0 3.3400-02 293 end
b-10 4 0 7.5838-06 293 end
b-11 4 0 3.0718-05 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end
al 5 0 5.8433-02 293 end
'lead shield'
pb 6 0 3.2174-02 293 end
end comp
squarepitch 1.778 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit 1
com='^fuel pin (no fuel) in water^'
cylinder 1
             7.175500E-01 3.175000E+00 2.857500E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media 3
cuboid 2
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 3.175000E+00 2.857500E+00
media 4
cuboid 3
             8.890000E-01 -8.890000E-01 8.890000E-01
             -8.890000E-01 3.175000E+00 0.000000E+00
media 5
boundary 3
             1 3 -2 -1

```



```

unit      2
com=^fuel pin (no fuel) in eggcrate^
cylinder  1
          7.175500E-01  3.556000E+00  3.175000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    2
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  3.556000E+00  3.175000E+00
media     4
cuboid    3
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  3.556000E+00  3.175000E+00
media     5
boundary  3
unit      3
com=^fuel pin (uo2) in eggcrate^
cylinder  1
          6.413500E-01  4.056000E+00  3.556000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     2
cylinder  2
          7.175500E-01  4.056000E+00  3.556000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    3
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  4.056000E+00  3.556000E+00
media     4
cuboid    4
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  4.056000E+00  3.556000E+00
media     5
boundary  4
unit      4
com=^fuel pin in eggcrate^
cylinder  1
          6.413500E-01  5.715000E+00  4.056000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1
cylinder  2
          7.175500E-01  5.715000E+00  4.056000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    3
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  5.715000E+00  4.056000E+00
media     4
cuboid    4
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  5.715000E+00  4.056000E+00
media     5
boundary  4
unit      5
com=^fuel pin in water^
cylinder  1
          6.413500E-01  9.239250E+01  5.715000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     1
cylinder  2
          7.175500E-01  9.239250E+01  5.715000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    3
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.239250E+01  5.715000E+00
media     4
boundary  3
unit      6
com=^fuel pin in eggcrate^
cylinder  1
          6.413500E-01  9.493250E+01  9.239250E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1
cylinder  2
          7.175500E-01  9.493250E+01  9.239250E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    3
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  9.493250E+01  9.239250E+01
media     4
cuboid    4
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.493250E+01  9.239250E+01
media     5
boundary  4
unit      7
com=^fuel pin in moderator^
cylinder  1

```

```

          6.413500E-01  9.499600E+01  9.493250E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     1
cylinder  2
          7.175500E-01  9.499600E+01  9.493250E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    3
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.499600E+01  9.493250E+01
media     4
boundary  3
unit      8
com=^fuel pin (no fuel) in moderator^
cylinder  1
          7.175500E-01  9.582150E+01  9.499600E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media     3
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.582150E+01  9.499600E+01
media     4
cuboid    3
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.677400E+01  9.499600E+01
media     6
boundary  3
unit      9
com=^water^
cuboid    1
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  3.175000E+00  2.857500E+00
media     4
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  3.175000E+00  0.000000E+00
media     5
boundary  2
unit     10
com=^eggcrate+water^
cuboid    1
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  3.556000E+00  3.175000E+00
media     4
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  3.556000E+00  3.175000E+00
media     5
boundary  2
unit     11
com=^eggcrate+water^
cuboid    1
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  4.056000E+00  3.556000E+00
media     4
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  4.056000E+00  3.556000E+00
media     5
boundary  2
unit     12
com=^eggcrate+water^
cuboid    1
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  5.715000E+00  4.056000E+00
media     4
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  4.056000E+00  3.556000E+00
media     5
boundary  2
unit     13
com=^water^
cuboid    1
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.239250E+01  5.715000E+00
media     4
boundary  1
unit     14
com=^eggcrate+water^
cuboid    1
          7.302500E-01 -7.302500E-01  7.302500E-01
          -7.302500E-01  9.493250E+01  9.239250E+01
media     4
cuboid    2
          8.890000E-01 -8.890000E-01  8.890000E-01
          -8.890000E-01  9.493250E+01  9.239250E+01
media     5
boundary  2
unit     15

```

```
com='water'
cuboid 1
      8.890000E-01 -8.890000E-01 8.890000E-01
      -8.890000E-01 9.499600E+01 9.493250E+01
media 4 1 1
boundary 1
unit 16
com='water+pb'
cuboid 1
      8.890000E-01 -8.890000E-01 8.890000E-01
      -8.890000E-01 9.582150E+01 9.499600E+01
media 4 1 1
cuboid 2
      8.890000E-01 -8.890000E-01 8.890000E-01
      -8.890000E-01 9.677400E+01 9.499600E+01
media 6 1 2 -1
boundary 2
global
unit 17
cuboid 1
      5.511800E+01 0.000000E+00 5.511800E+01
      0.000000E+00 9.677400E+01 0.000000E+00
array 1 1
      place 1 1 1 8.890000E-01 8.890000E-01
0.000000E+00
cuboid 2
      8.511800E+01 -3.000000E+01 8.511800E+01
      -3.000000E+01 1.120140E+02 -3.000000E+01
media 4 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=31 nuy=31 nuz=8
fill
12r9 7r1 12r9 9r9 13r1 9r9 7r9 17r1 7r9 5r9 21r1 5r9 4r9
23r1 4r9
3r9 25r1 3r9 q31 2r9 27r1 2r9 q31 9 29r1 9 2q31 217r1
217b372
12r10 7r2 21r10 13r2 16r10 17r2 12r10 21r2 9r10 23r2 7r10
25r2 3r10 q31 2r10 27r2 2r10 q31 10 29r2 10 2q31 217r2
217b372
12r11 7r3 21r11 13r3 16r11 17r3 12r11 21r3 9r11 23r3 7r11
25r3 3r11 q31 2r11 27r3 2r11 q31 11 29r3 11 2q31 217r3
217b372
12r12 7r4 21r12 13r4 16r12 17r4 12r12 21r4 9r12 23r4 7r12
25r4 3r12 q31 2r12 27r4 2r12 q31 12 29r4 12 2q31 217r4
217b372
12r13 7r5 21r13 13r5 16r13 17r5 12r13 21r5 9r13 23r5 7r13
25r5 3r13 q31 2r13 27r5 2r13 q31 13 29r5 13 2q31 217r5
217b372
12r14 7r6 21r14 13r6 16r14 17r6 12r14 21r6 9r14 23r6 7r14
25r6 3r14 q31 2r14 27r6 2r14 q31 14 29r6 14 2q31 217r6
217b372
12r15 7r7 21r15 13r7 16r15 17r7 12r15 21r7 9r15 23r7 7r15
25r7 3r15 q31 2r15 27r7 2r15 q31 15 29r7 15 2q31 217r7
217b372
12r16 7r8 21r16 13r8 16r16 17r8 12r16 21r8 9r16 23r8 7r16
25r8 3r16 q31 2r16 27r8 2r16 q31 16 29r8 16 2q31 217r8
217b372
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end

Case MIX_COMP_THERM_002_PNL32_k6
#csas26 parm='size=00500000'
mix_comp_therm_002_pnl32
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end
u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
```

```
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end
sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6706-02 293 end
o 4 0 3.3353-02 293 end
b-10 4 0 9.9034-09 293 end
b-11 4 0 4.0114-08 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end
al 5 0 5.8433-02 293 end
'lead shield'
pb 6 0 3.2174-02 293 end
end comp
squarepitch 2.20914 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit 1
com='fuel pin (no fuel) in water'
cylinder 1
      7.175500E-01 3.175000E+00 2.857500E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
      1.104570E+00 -1.104570E+00 1.104570E+00
      -1.104570E+00 3.175000E+00 2.857500E+00
media 4 1 2 -1
cuboid 3
      1.104570E+00 -1.104570E+00 1.104570E+00
      -1.104570E+00 3.175000E+00 0.000000E+00
media 5 1 3 -2 -1
boundary 3
unit 2
com='fuel pin (no fuel) in eggcrate'
cylinder 1
      7.175500E-01 3.556000E+00 3.175000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
      1.047100E+00 -1.047100E+00 1.047100E+00
      -1.047100E+00 3.556000E+00 3.175000E+00
media 4 1 2 -1
cuboid 3
      1.104570E+00 -1.104570E+00 1.104570E+00
      -1.104570E+00 3.556000E+00 3.175000E+00
media 5 1 3 -2 -1
boundary 3
unit 3
com='fuel pin (uo2) in eggcrate'
cylinder 1
      6.413500E-01 4.056000E+00 3.556000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
      7.175500E-01 4.056000E+00 3.556000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.047100E+00 -1.047100E+00 1.047100E+00
      -1.047100E+00 4.056000E+00 3.556000E+00
media 4 1 3 -2 -1
cuboid 4
      1.104570E+00 -1.104570E+00 1.104570E+00
      -1.104570E+00 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 4
com='fuel pin in eggcrate'
cylinder 1
      6.413500E-01 5.715000E+00 4.056000E+00
```

[illegible]

```
7r10 3r2 12r10 6r2 10r10 9r2 7r10 11r2 5r10 13r2 3r10 15r2
10 q17 51r2 51b85 6r10 6r2 12r10 3r2 7r10
7r11 3r3 12r11 6r3 10r11 9r3 7r11 11r3 5r11 13r3 3r11 15r3
11 q17 51r3 51b85 6r11 6r3 12r11 3r3 7r11
7r12 3r4 12r12 6r4 10r12 9r4 7r12 11r4 5r12 13r4 3r12 15r4
12 q17 51r4 51b85 6r12 6r4 12r12 3r4 7r12
7r13 3r5 12r13 6r5 10r13 9r5 7r13 11r5 5r13 13r5 3r13 15r5
13 q17 51r5 51b85 6r13 6r5 12r13 3r5 7r13
7r14 3r6 12r14 6r6 10r14 9r6 7r14 11r6 5r14 13r6 3r14 15r6
14 q17 51r6 51b85 6r14 6r6 12r14 3r6 7r14
7r15 3r7 12r15 6r7 10r15 9r7 7r15 11r7 5r15 13r7 3r15 15r7
15 q17 51r7 51b85 6r15 6r7 12r15 3r7 7r15
7r16 3r8 12r16 6r8 10r16 9r8 7r16 11r8 5r16 13r8 3r16 15r8
16 q17 51r8 51b85 6r16 6r8 12r16 3r8 7r16
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end
```

## Case MIX\_COMP\_THERM\_002\_PNL33\_k6

```
#csas26      parm='size=00500000'
mix_comp_therm_002_pnl33
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end
u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end
sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6672-02 293 end
o 4 0 3.3427-02 293 end
b-10 4 0 1.2034-05 293 end
b-11 4 0 4.8746-05 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end
al 5 0 5.8433-02 293 end
'lead shield'
pb 6 0 3.2174-02 293 end
end comp
squarepitch 2.20914 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit 1
com='fuel pin (no fuel) in water'
cylinder 1
7.175500E-01 3.175000E+00 2.857500E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 3.175000E+00 2.857500E+00
```

```
media 4 1 2 -1
cuboid 3
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 3.175000E+00 0.000000E+00
media 5 1 3 -2 -1
boundary 3
unit 2
com='fuel pin (no fuel) in eggcrate'
cylinder 1
7.175500E-01 3.556000E+00 3.175000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
1.047100E+00 -1.047100E+00 1.047100E+00
-1.047100E+00 3.556000E+00 3.175000E+00
media 4 1 2 -1
cuboid 3
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 3.556000E+00 3.175000E+00
media 5 1 3 -2 -1
boundary 3
unit 3
com='fuel pin (uo2) in eggcrate'
cylinder 1
6.413500E-01 4.056000E+00 3.556000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
7.175500E-01 4.056000E+00 3.556000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
1.047100E+00 -1.047100E+00 1.047100E+00
-1.047100E+00 4.056000E+00 3.556000E+00
media 4 1 3 -2 -1
cuboid 4
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 4
com='fuel pin in eggcrate'
cylinder 1
6.413500E-01 5.715000E+00 4.056000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 5.715000E+00 4.056000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
1.047100E+00 -1.047100E+00 1.047100E+00
-1.047100E+00 5.715000E+00 4.056000E+00
media 4 1 3 -2 -1
cuboid 4
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 5.715000E+00 4.056000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 5
com='fuel pin in water'
cylinder 1
6.413500E-01 9.239250E+01 5.715000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 9.239250E+01 5.715000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
1.104570E+00 -1.104570E+00 1.104570E+00
-1.104570E+00 9.239250E+01 5.715000E+00
media 4 1 3 -2 -1
boundary 3
unit 6
com='fuel pin in eggcrate'
cylinder 1
6.413500E-01 9.493250E+01 9.239250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
7.175500E-01 9.493250E+01 9.239250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
1.047100E+00 -1.047100E+00 1.047100E+00
-1.047100E+00 9.493250E+01 9.239250E+01
media 4 1 3 -2 -1
cuboid 4
1.104570E+00 -1.104570E+00 1.104570E+00
```

```

-1.104570E+00  9.493250E+01  9.239250E+01
media 5 1 4 -3 -2 -1
boundary 4
unit 7
com='fuel pin in moderator'
cylinder 1
        6.413500E-01  9.499600E+01  9.493250E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
        7.175500E-01  9.499600E+01  9.493250E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.499600E+01  9.493250E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com='fuel pin (no fuel) in moderator'
cylinder 1
        7.175500E-01  9.582150E+01  9.499600E+01
        origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.582150E+01  9.499600E+01
media 4 1 2 -1
cuboid 3
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.677400E+01  9.499600E+01
media 6 1 3 -2 -1
boundary 3
unit 9
com='water'
cuboid 1
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  3.175000E+00  2.857500E+00
media 4 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  3.175000E+00  0.000000E+00
media 5 1 2 -1
boundary 2
unit 10
com='eggcrate+water'
cuboid 1
        1.047100E+00 -1.047100E+00 1.047100E+00
        -1.047100E+00  3.556000E+00  3.175000E+00
media 4 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  3.556000E+00  3.175000E+00
media 5 1 2 -1
boundary 2
unit 11
com='eggcrate+water'
cuboid 1
        1.047100E+00 -1.047100E+00 1.047100E+00
        -1.047100E+00  4.056000E+00  3.556000E+00
media 4 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  4.056000E+00  3.556000E+00
media 5 1 2 -1
boundary 2
unit 12
com='eggcrate+water'
cuboid 1
        1.047100E+00 -1.047100E+00 1.047100E+00
        -1.047100E+00  5.715000E+00  4.056000E+00
media 4 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  5.715000E+00  4.056000E+00
media 5 1 2 -1
boundary 2
unit 13
com='water'
cuboid 1
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.239250E+01  5.715000E+00
media 4 1 1
boundary 1
unit 14
com='eggcrate+water'
cuboid 1
        1.047100E+00 -1.047100E+00 1.047100E+00
        -1.047100E+00  9.493250E+01  9.239250E+01
media 4 1 1

```

```

cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.493250E+01  9.239250E+01
media 5 1 2 -1
boundary 2
unit 15
com='water'
cuboid 1
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.499600E+01  9.493250E+01
media 4 1 1
boundary 1
unit 16
com='water+pb'
cuboid 1
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.582150E+01  9.499600E+01
media 4 1 1
cuboid 2
        1.104570E+00 -1.104570E+00 1.104570E+00
        -1.104570E+00  9.677400E+01  9.499600E+01
media 6 1 2 -1
boundary 2
global
unit 17
cuboid 1
        6.848334E+01  0.000000E+00  6.848334E+01
        0.000000E+00  9.677400E+01  0.000000E+00
array 1 1
        place 1 1 1 1.104570E+00 1.104570E+00
0.000000E+00
cuboid 2
        9.848334E+01 -3.000000E+01  9.848334E+01
        -3.000000E+01  1.120140E+02 -3.000000E+01
media 4 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=31 nuy=31 nuz=8
fill
12r9 7r1 12r9 9r9 13r1 9r9 7r9 17r1 7r9 5r9 21r1 5r9 4r9
23r1 4r9
3r9 25r1 3r9 q31 2r9 27r1 2r9 q31 9 29r1 9 2q31 217r1
217b372
12r10 7r2 21r10 13r2 16r10 17r2 12r10 21r2 9r10 23r2 7r10
25r2 3r10 q31 2r10 27r2 2r10 q31 10 29r2 10 2q31 217r2
217b372
12r11 7r3 21r11 13r3 16r11 17r3 12r11 21r3 9r11 23r3 7r11
25r3 3r11 q31 2r11 27r3 2r11 q31 11 29r3 11 2q31 217r3
217b372
12r12 7r4 21r12 13r4 16r12 17r4 12r12 21r4 9r12 23r4 7r12
25r4 3r12 q31 2r12 27r4 2r12 q31 12 29r4 12 2q31 217r4
217b372
12r13 7r5 21r13 13r5 16r13 17r5 12r13 21r5 9r13 23r5 7r13
25r5 3r13 q31 2r13 27r5 2r13 q31 13 29r5 13 2q31 217r5
217b372
12r14 7r6 21r14 13r6 16r14 17r6 12r14 21r6 9r14 23r6 7r14
25r6 3r14 q31 2r14 27r6 2r14 q31 14 29r6 14 2q31 217r6
217b372
12r15 7r7 21r15 13r7 16r15 17r7 12r15 21r7 9r15 23r7 7r15
25r7 3r15 q31 2r15 27r7 2r15 q31 15 29r7 15 2q31 217r7
217b372
12r16 7r8 21r16 13r8 16r16 17r8 12r16 21r8 9r16 23r8 7r16
25r8 3r16 q31 2r16 27r8 2r16 q31 16 29r8 16 2q31 217r8
217b372
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end

1.1 CASE MIX_COMP_THERM_002_PNL34_K6

#csas26 parm='size=00500000'
mix_comp_therm_002_pnl30
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end

```

```

u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end
sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6706-02 293 end
o 4 0 3.3353-02 293 end
b-10 4 0 1.7606-08 293 end
b-11 4 0 7.1313-08 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end
al 5 0 5.8433-02 293 end
'lead shield'
pb 6 0 3.2174-02 293 end
end comp
squarepitch 2.51447 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit 1
com='^fuel pin (no fuel) in water^'
cylinder 1
    7.175500E-01 3.175000E+00 2.857500E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 3.175000E+00 2.857500E+00
media 4 1 2 -1
cuboid 3
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 3.175000E+00 0.000000E+00
media 5 1 3 -2 -1
boundary 3
unit 2
com='^fuel pin (no fuel) in eggcrate^'
cylinder 1
    7.175500E-01 3.556000E+00 3.175000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
    1.032730E+00 -1.032730E+00 1.032730E+00
    -1.032730E+00 3.556000E+00 3.175000E+00
media 4 1 2 -1
cuboid 3
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 3.556000E+00 3.175000E+00
media 5 1 3 -2 -1
boundary 3
unit 3
com='^fuel pin (uo2) in eggcrate^'
cylinder 1
    6.413500E-01 4.056000E+00 3.556000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
    7.175500E-01 4.056000E+00 3.556000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
    1.032730E+00 -1.032730E+00 1.032730E+00
    -1.032730E+00 4.056000E+00 3.556000E+00
media 4 1 3 -2 -1
cuboid 4
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 3
unit 9
com='^water^'
cuboid 1
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 5
com='^fuel pin in water^'
cylinder 1
    6.413500E-01 9.239250E+01 5.715000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    7.175500E-01 9.239250E+01 5.715000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 9.239250E+01 5.715000E+00
media 4 1 3 -2 -1
boundary 3
unit 6
com='^fuel pin in eggcrate^'
cylinder 1
    6.413500E-01 9.493250E+01 9.239250E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    7.175500E-01 9.493250E+01 9.239250E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
    1.032730E+00 -1.032730E+00 1.032730E+00
    -1.032730E+00 9.493250E+01 9.239250E+01
media 4 1 3 -2 -1
cuboid 4
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 9.493250E+01 9.239250E+01
media 5 1 4 -3 -2 -1
boundary 4
unit 7
com='^fuel pin in moderator^'
cylinder 1
    6.413500E-01 9.499600E+01 9.493250E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
    7.175500E-01 9.499600E+01 9.493250E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 9.499600E+01 9.493250E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com='^fuel pin (no fuel) in moderator^'
cylinder 1
    7.175500E-01 9.582150E+01 9.499600E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 9.582150E+01 9.499600E+01
media 4 1 2 -1
cuboid 3
    1.257235E+00 -1.257235E+00 1.257235E+00
    -1.257235E+00 9.677400E+01 9.499600E+01
media 6 1 3 -2 -1
boundary 3
unit 9
com='^water^'
cuboid 1

```

```

1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 3.175000E+00 2.857500E+00
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 3.175000E+00 0.000000E+00
media 5 1 2 -1
boundary 2
unit 10
com='eggcrate+water'
cuboid 1
1.032730E+00 -1.032730E+00 1.032730E+00
-1.032730E+00 3.556000E+00 3.175000E+00
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 3.556000E+00 3.175000E+00
media 5 1 2 -1
boundary 2
unit 11
com='eggcrate+water'
cuboid 1
1.032730E+00 -1.032730E+00 1.032730E+00
-1.032730E+00 4.056000E+00 3.556000E+00
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 2 -1
boundary 2
unit 12
com='eggcrate+water'
cuboid 1
1.032730E+00 -1.032730E+00 1.032730E+00
-1.032730E+00 5.715000E+00 4.056000E+00
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 5.715000E+00 4.056000E+00
media 5 1 2 -1
boundary 2
unit 13
com='water'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.239250E+01 5.715000E+00
media 4 1 1
boundary 1
unit 14
com='eggcrate+water'
cuboid 1
1.032730E+00 -1.032730E+00 1.032730E+00
-1.032730E+00 9.493250E+01 9.239250E+01
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.493250E+01 9.239250E+01
media 5 1 2 -1
boundary 2
unit 15
com='water'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.499600E+01 9.493250E+01
media 4 1 1
boundary 1
unit 16
com='water+pb'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.582150E+01 9.499600E+01
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.677400E+01 9.499600E+01
media 6 1 2 -1
boundary 2
global unit 17
cuboid 1
4.274599E+01 0.000000E+00 4.274599E+01
0.000000E+00 9.677400E+01 0.000000E+00
array 1 1
place 1 1 1 1.257235E+00 1.257235E+00
0.000000E+00
cuboid 2
7.274599E+01 -3.000000E+01 7.274599E+01
-3.000000E+01 9.906400E+01 -3.000000E+01
media 4 1 2 -1
boundary 2

```

```

end geometry
read array
ara=1 nux=17 nuy=17 nuz=8
fill
8r9 1 8r9 7r9 3r1 7r9 5r9 7r1 5r9 4r9 9r1 4r9 3r9 11r1 3r9
2r9 13r1 2r9 q17
9 15r1 9 17r1 17b136
8r10 2 15r10 3r2 12r10 7r2 9r10 9r2 7r10 11r2 5r10 13r2
2r10 q17
10 15r2 10 17r2 17b136
8r11 3 15r11 3r3 12r11 7r3 9r11 9r3 7r11 11r3 5r11 13r3
2r11 q17
11 15r3 11 17r3 17b136
8r12 4 15r12 3r4 12r12 7r4 9r12 9r4 7r12 11r4 5r12 13r4
2r12 q17
12 15r4 12 17r4 17b136
8r13 5 15r13 3r5 12r13 7r5 9r13 9r5 7r13 11r5 5r13 13r5
2r13 q17
13 15r5 13 17r5 17b136
8r14 6 15r14 3r6 12r14 7r6 9r14 9r6 7r14 11r6 5r14 13r6
2r14 q17
14 15r6 14 17r6 17b136
8r15 7 15r15 3r7 12r15 7r7 9r15 9r7 7r15 11r7 5r15 13r7
2r15 q17
15 15r7 15 17r7 17b136
8r16 8 15r16 3r8 12r16 7r8 9r16 9r8 7r16 11r8 5r16 13r8
2r16 q17
16 15r8 16 17r8 17b136
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end

```

## 1.2 CASE MIX\_COMP\_THERM\_002\_PNL35\_K6

```

#csas26      parm='size=00500000'
mix_comp_therm_002_pnl30
238group
latticecell
'UO2-PuO2 mixture'
pu-238 1 0 3.8836-08 293 end
pu-239 1 0 3.9462-04 293 end
pu-240 1 0 3.3206-05 293 end
pu-241 1 0 1.6081-06 293 end
pu-242 1 0 1.1882-07 293 end
am-241 1 0 1.4954-06 293 end
u-234 1 0 1.2458-06 293 end
u-235 1 0 1.4886-04 293 end
u-236 1 0 2.0936-09 293 end
u-238 1 0 2.0611-02 293 end
o 1 0 4.3779-02 293 end
'Natural UO2 layer'
u-234 2 0 1.2406-06 293 end
u-235 2 0 1.4824-04 293 end
u-236 2 0 2.0848-09 293 end
u-238 2 0 2.0525-02 293 end
o 2 0 4.1943-02 293 end
'Clad and plugs'
sn-112 3 0 4.6878-06 293 end
sn-114 3 0 3.1413-06 293 end
sn-115 3 0 1.7398-06 293 end
sn-116 3 0 7.0221-05 293 end
sn-117 3 0 3.7116-05 293 end
sn-118 3 0 1.1705-04 293 end
sn-119 3 0 4.1465-05 293 end
sn-120 3 0 1.5750-04 293 end
sn-122 3 0 2.2376-05 293 end
sn-124 3 0 2.7982-05 293 end
fe 3 0 9.5642-05 293 end
cr 3 0 7.6093-05 293 end
ni 3 0 3.0336-05 293 end
zr 3 0 4.2621-02 293 end
'water'
h 4 0 6.6682-02 293 end
o 4 0 3.3405-02 293 end
b-10 4 0 8.4597-06 293 end
b-11 4 0 3.4266-05 293 end
'eggcrate grid and fuel support plate'
si 5 0 3.4607-04 293 end
fe 5 0 1.0152-04 293 end
cu 5 0 6.3731-05 293 end
mn 5 0 2.2115-05 293 end
mg 5 0 6.6651-04 293 end
cr 5 0 6.2310-05 293 end
ti 5 0 2.5375-05 293 end

```

```

al      5 0 5.8433-02 293 end
'lead shield'
pb      6 0 3.2174-02 293 end
end comp
squarepitch 2.51447 1.2827 1 4 1.4351 3 end
read param tme=90 gen=600 npg=700 nsk=10 nub=yes run=yes
end param
read geometry
unit
1
com=^fuel pin (no fuel) in water^
cylinder 1
      7.175500E-01 3.175000E+00 2.857500E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 3.175000E+00 2.857500E+00
media 4 1 2 -1
cuboid 3
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 3.175000E+00 0.000000E+00
media 5 1 3 -2 -1
boundary 3
unit 2
com=^fuel pin (no fuel) in eggcrate^
cylinder 1
      7.175500E-01 3.556000E+00 3.175000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 3.556000E+00 3.175000E+00
media 4 1 2 -1
cuboid 3
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 3.556000E+00 3.175000E+00
media 5 1 3 -2 -1
boundary 3
unit 3
com=^fuel pin (uo2) in eggcrate^
cylinder 1
      6.413500E-01 4.056000E+00 3.556000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
      7.175500E-01 4.056000E+00 3.556000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 4.056000E+00 3.556000E+00
media 4 1 3 -2 -1
cuboid 4
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 4
com=^fuel pin in eggcrate^
cylinder 1
      6.413500E-01 5.715000E+00 4.056000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      7.175500E-01 5.715000E+00 4.056000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 5.715000E+00 4.056000E+00
media 4 1 3 -2 -1
cuboid 4
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 5.715000E+00 4.056000E+00
media 5 1 4 -3 -2 -1
boundary 4
unit 5
com=^fuel pin in water^
cylinder 1
      6.413500E-01 9.239250E+01 5.715000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      7.175500E-01 9.239250E+01 5.715000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 9.239250E+01 5.715000E+00
media 4 1 3 -2 -1

```

```

boundary 3
unit 6
com=^fuel pin in eggcrate^
cylinder 1
      6.413500E-01 9.493250E+01 9.239250E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      7.175500E-01 9.493250E+01 9.239250E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 9.493250E+01 9.239250E+01
media 4 1 3 -2 -1
cuboid 4
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 9.493250E+01 9.239250E+01
media 5 1 4 -3 -2 -1
boundary 4
unit 7
com=^fuel pin in moderator^
cylinder 1
      6.413500E-01 9.499600E+01 9.493250E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      7.175500E-01 9.499600E+01 9.493250E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 9.499600E+01 9.493250E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com=^fuel pin (no fuel) in moderator^
cylinder 1
      7.175500E-01 9.582150E+01 9.499600E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 1
cuboid 2
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 9.582150E+01 9.499600E+01
media 4 1 2 -1
cuboid 3
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 9.677400E+01 9.499600E+01
media 6 1 3 -2 -1
boundary 3
unit 9
com=^water^
cuboid 1
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 3.175000E+00 2.857500E+00
media 4 1 1
cuboid 2
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 3.175000E+00 0.000000E+00
media 5 1 2 -1
boundary 2
unit 10
com=^eggcrate+water^
cuboid 1
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 3.556000E+00 3.175000E+00
media 4 1 1
cuboid 2
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 2 -1
boundary 2
unit 11
com=^eggcrate+water^
cuboid 1
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 4.056000E+00 3.556000E+00
media 4 1 1
cuboid 2
      1.257235E+00 -1.257235E+00 1.257235E+00
      -1.257235E+00 4.056000E+00 3.556000E+00
media 5 1 2 -1
boundary 2
unit 12
com=^eggcrate+water^
cuboid 1
      1.032730E+00 -1.032730E+00 1.032730E+00
      -1.032730E+00 5.715000E+00 4.056000E+00
media 4 1 1
cuboid 2

```



```

1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 5.715000E+00 4.056000E+00
media 5 1 2 -1
boundary 2
unit 13
com='water'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.239250E+01 5.715000E+00
media 4 1 1
boundary 1
unit 14
com='eggcrate+water'
cuboid 1
1.032730E+00 -1.032730E+00 1.032730E+00
-1.032730E+00 9.493250E+01 9.239250E+01
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.493250E+01 9.239250E+01
media 5 1 2 -1
boundary 2
unit 15
com='water'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.499600E+01 9.493250E+01
media 4 1 1
boundary 1
unit 16
com='water+pb'
cuboid 1
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.582150E+01 9.499600E+01
media 4 1 1
cuboid 2
1.257235E+00 -1.257235E+00 1.257235E+00
-1.257235E+00 9.677400E+01 9.499600E+01
media 6 1 2 -1
boundary 2
global
unit 17
cuboid 1
7.291963E+01 0.000000E+00 7.291963E+01
0.000000E+00 9.677400E+01 0.000000E+00
array 1 1
place 1 1 1 1.257235E+00 1.257235E+00
0.000000E+00
cuboid 2
1.029196E+02 -3.000000E+01 1.029196E+02
-3.000000E+01 1.120140E+02 -3.000000E+01
media 4 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=29 nuy=29 nuz=8
fill
9r9 11r1 9r9 7r9 15r1 7r9 6r9 17r1 6r9 5r9 19r1 5r9 4r9
21r1 4r9 3r9
23r1 3r9 2r9 25r1 2r9 9 27r1 9 q29 31r1 319b261
9r10 11r2 16r10 15r2 13r10 17r2 11r10 19r2 9r10 21r2 7r10
23r2 5r10 25r2 3r10 27r2 10 q29 31r2 319b261
9r11 11r3 16r11 15r3 13r11 17r3 11r11 19r3 9r11 21r3 7r11
23r3 5r11 25r3 3r11 27r3 11 q29 31r3 319b261
9r12 11r4 16r12 15r4 13r12 17r4 11r12 19r4 9r12 21r4 7r12
23r4 5r12 25r4 3r12 27r4 12 q29 31r4 319b261
9r13 11r5 16r13 15r5 13r13 17r5 11r13 19r5 9r13 21r5 7r13
23r5 5r13 25r5 3r13 27r5 13 q29 31r5 319b261
9r14 11r6 16r14 15r6 13r14 17r6 11r14 19r6 9r14 21r6 7r14
23r6 5r14 25r6 3r14 27r6 14 q29 31r6 319b261
9r15 11r7 16r15 15r7 13r15 17r7 11r15 19r7 9r15 21r7 7r15
23r7 5r15 25r7 3r15 27r7 15 q29 31r7 319b261
9r16 11r8 16r16 15r8 13r16 17r8 11r16 19r8 9r16 21r8 7r16
23r8 5r16 25r8 3r16 27r8 16 q29 31r8 319b261
end fill
end array
read bnds +xb=vacuum -xb=vacuum +yb=vacuum -yb=vacuum
+zb=vacuum -zb=vacuum
end bnds
end data
end

1.3 CASE MIX_COMP_THERM_003_CAS1_K6

#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp .52 inch pitch (wcap-3385-54)
238group latticecell
'uo2-puo2 mixture'

```

```

pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6643-02 298 end
o 3 0 3.3322-02 298 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 1.3208 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.962045
end more
read parm gen=905 npg=600 nub=yes run=yes plt=no tme=120
nsk=10 nsk=10
end parm
read geometry
unit 1
com='fuel pin (no fuel) in bottom plate, 0 to .25 inches'
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
6.604000E-01 -6.604000E-01 6.604000E-01
-6.604000E-01 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com='fuel pin between lower plates, .25 to 18.75 inches'
cylinder 1
4.285000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
6.604000E-01 -6.604000E-01 6.604000E-01
-6.604000E-01 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com='fuel pin in middle plate, 18.75 to 19.0 inches'
cylinder 1
4.285000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.826000E+01 4.762500E+01

```

```

media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  0      1      2      -1
      4.966000E-01  4.826000E+01  4.762500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  2      1      3      -2      -1
      5.042000E-01  4.826000E+01  4.762500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    3      1      4      -3      -2      -1
      6.604000E-01  -6.604000E-01  6.604000E-01
      -6.604000E-01  4.826000E+01  4.762500E+01
media      4      1      5      -4      -3      -2      -1
boundary  unit
com=^fuel pin above middle plate, 19.0 to 33.29 inches^
cylinder  1
      4.285000E-01  8.480500E+01  4.826000E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  1      1
      4.375000E-01  8.480500E+01  4.826000E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  0      1      2      -1
      4.966000E-01  8.480500E+01  4.826000E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    2      1      3      -2      -1
      6.604000E-01  -6.604000E-01  6.604000E-01
      -6.604000E-01  8.480500E+01  4.826000E+01
media      3      1      4      -3      -2      -1
boundary  unit
com=^fuel pin above water, 33.29 to 37.35 inches^
cylinder  1
      4.285000E-01  9.486900E+01  8.480500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  5      1      1
      4.375000E-01  9.486900E+01  8.480500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  0      1      2      -1
      4.966000E-01  9.486900E+01  8.480500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    2      1      3      -2      -1
      6.604000E-01  -6.604000E-01  6.604000E-01
      -6.604000E-01  9.486900E+01  8.480500E+01
media      0      1      4      -3      -2      -1
boundary  unit
com=^top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder  1
      4.966000E-01  9.588500E+01  9.486900E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    2      1      1
      6.604000E-01  -6.604000E-01  6.604000E-01
      -6.604000E-01  9.588500E+01  9.486900E+01
media      0      1      2      -1
boundary  unit
com=^fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder  1
      4.966000E-01  9.715500E+01  9.588500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cylinder  2      1      1
      5.042000E-01  9.715500E+01  9.588500E+01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    0      1      2      -1
      6.604000E-01  -6.604000E-01  6.604000E-01
      -6.604000E-01  9.715500E+01  9.588500E+01
media      4      1      3      -2      -1
boundary  unit
com=^22 x 23 core (in water)^
cuboid    1
      2.905760E+01  0.000000E+00  3.037840E+01
      0.000000E+00  8.480500E+01  0.000000E+00
array      1
      place 1 1 1 1 6.604000E-01 6.604000E-01
0.000000E+00
cuboid    2
      3.205760E+01 -3.000000E+00 3.337840E+01
      -3.000000E+00 8.480500E+01 0.000000E+00

```

```

media      3      2      2      -1
cuboid    3
      3.505760E+01 -6.000000E+00 3.637840E+01
      -6.000000E+00 8.480500E+01 0.000000E+00
media      3      3      3      -2      -1
cuboid    4
      3.805760E+01 -9.000000E+00 3.937840E+01
      -9.000000E+00 8.480500E+01 0.000000E+00
media      3      4      4      -3      -2      -1
cuboid    5
      4.105760E+01 -1.200000E+01 4.237840E+01
      -1.200000E+01 8.480500E+01 0.000000E+00
media      3      5      5      -4      -3      -2      -1
cuboid    6
      4.405760E+01 -1.500000E+01 4.537840E+01
      -1.500000E+01 8.480500E+01 0.000000E+00
media      3      6      6      -5      -4      -3      -2      -1
cuboid    7
      4.705760E+01 -1.800000E+01 4.837840E+01
      -1.800000E+01 8.480500E+01 0.000000E+00
media      3      7      7      -6      -5      -4      -3      -2      -1
cuboid    8
      5.005760E+01 -2.100000E+01 5.137840E+01
      -2.100000E+01 8.480500E+01 0.000000E+00
media      3      8      8      -7      -6      -5      -4      -3      -2      -1
cuboid    9
      5.305760E+01 -2.400000E+01 5.437840E+01
      -2.400000E+01 8.480500E+01 0.000000E+00
media      3      9      9      -8      -7      -6      -5      -4      -3      -2      -1
cuboid    10
      5.605760E+01 -2.700000E+01 5.737840E+01
      -2.700000E+01 8.480500E+01 0.000000E+00
media      3      10     10     -9     -8     -7     -6     -5     -4     -3     -2     -1
cuboid    11
      5.905760E+01 -3.000000E+01 6.037840E+01
      -3.000000E+01 8.480500E+01 0.000000E+00
media      3      11     11     -10    -9     -8     -7     -6     -5     -4     -3     -2     -1
cuboid    12
      5.905760E+01 -3.000000E+01 6.037840E+01
      -3.000000E+01 8.480500E+01 -2.540000E+00
media      4      1      12     -11    -10    -9     -8     -7     -6     -5     -4     -3     -2     -1
cuboid    13
      5.905760E+01 -3.000000E+01 6.037840E+01
      -3.000000E+01 8.480500E+01 -8.889999E+00
media      3      1      13     -12    -11    -10    -9     -8     -7     -6     -5     -4     -3     -2     -1
cuboid    14
      5.905760E+01 -3.000000E+01 6.037840E+01
      -3.000000E+01 8.480500E+01 -1.397000E+01
media      4      1      14     -13    -12    -11    -10    -9     -8     -7     -6     -5     -4     -3     -2     -1
boundary  unit
com=^22 x 23 core (above water)^
cuboid    1
      2.905760E+01 0.000000E+00 3.037840E+01
      0.000000E+00 1.235000E+01 0.000000E+00
array      2
      place 1 1 1 1 6.604000E-01 6.604000E-01 -
8.480500E+01
cuboid    2
      5.905760E+01 -3.000000E+01 6.037840E+01
      -3.000000E+01 1.235000E+01 0.000000E+00
media      0      1      2      -1
boundary  unit
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder  1
      4.966000E-01 1.905000E+00 6.350000E-01
media      origin  x= 0.000000E+00  y= 0.000000E+00
cuboid    2      1      1
      6.604000E-01 -6.604000E-01 6.604000E-01
      -6.604000E-01 1.905000E+00 6.350000E-01
media      3      1      2      -1
boundary  unit
global unit
cuboid    1
      8.905760E+01 0.000000E+00 9.037840E+01
      0.000000E+00 1.111250E+02 0.000000E+00
array      3      1
      place 1 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

```

```
read array
ara=1 nux=22 nuy=23 nuz=5
com=!22 x 23 fuel pin array (in water)!
fill 506r1 506r20 506r2 506r3 506r4 end fill
ara=2 nux=22 nuy=23 nuz=3
com=!22 x 23 fuel pin array (above water)!
fill 506r5 506r6 506r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com=!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl=!x-y view of core!
plt=yes pic=mixture xul=29 yul=47 zul=62 xlr=47 ylr=29
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch=! 12 -
! end
ttl=!x-z view of core!
plt=yes pic=mixture xul=29 yul=45 zul=113 xlr=47 ylr=45
zlr=-1 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch=! 12./
! end
end plot
end data
end
```

## 1.4 CASE MIX\_COMP\_THERM\_003\_CAS2-1\_K6

```
#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp. 0.56 inch pitch (wcap-3385-
54)
238group latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6781-02 290.15 end
o 3 0 3.3390-02 290.15 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 1.4224 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.962045
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no tme=60
wrs=34 end parm
read geometry
unit 1
com=fuel pin (no fuel) in bottom plate, 0 to .25 inches^
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
```

```
media 2 origin x= 0.000000E+00 y= 0.000000E+00
cylinder 2 1 1
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com=fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.285000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com=fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
4.285000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
5.042000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1
boundary 5
unit 4
com=fuel pin above middle plate, 19.0 to 32.66 inches^
cylinder 1
4.285000E-01 8.270500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 8.270500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 8.270500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 8.270500E+01 4.826000E+01
media 3 1 4 -3 -2 -1
boundary 4
unit 5
com=fuel pin above water, 32.66 to 37.35 inches^
cylinder 1
4.285000E-01 9.486900E+01 8.270500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 5 1 1
cylinder 2
4.375000E-01 9.486900E+01 8.270500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 9.486900E+01 8.270500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 9.486900E+01 8.270500E+01
media 0 1 4 -3 -2 -1
```

```

boundary      4
unit          6
com=^top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder      1
              4.966000E-01 9.588500E+01 9.486900E+01
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        2
              7.112000E-01 -7.112000E-01 7.112000E-01
              -7.112000E-01 9.588500E+01 9.486900E+01
media         0
boundary      2
unit          7
com=^fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder      1
              4.966000E-01 9.715500E+01 9.588500E+01
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cylinder      2
              5.042000E-01 9.715500E+01 9.588500E+01
              origin x= 0.000000E+00 y= 0.000000E+00
media         0
cuboid        3
              7.112000E-01 -7.112000E-01 7.112000E-01
              -7.112000E-01 9.715500E+01 9.588500E+01
media         4
boundary      3
unit          8
com=^19 x 19 core (in water)^
cuboid        1
              2.702560E+01 0.000000E+00 2.702560E+01
              0.000000E+00 8.270500E+01 0.000000E+00
array         1
              place 1 1 1 7.112000E-01 7.112000E-01
0.000000E+00
cuboid        2
              3.002560E+01 -3.000000E+00 3.002560E+01
              -3.000000E+00 8.270500E+01 0.000000E+00
media         3
cuboid        3
              3.302560E+01 -6.000000E+00 3.302560E+01
              -6.000000E+00 8.270500E+01 0.000000E+00
media         3
cuboid        4
              3.602560E+01 -9.000000E+00 3.602560E+01
              -9.000000E+00 8.270500E+01 0.000000E+00
media         3
cuboid        5
              3.902560E+01 -1.200000E+01 3.902560E+01
              -1.200000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        6
              4.202560E+01 -1.500000E+01 4.202560E+01
              -1.500000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        7
              4.502560E+01 -1.800000E+01 4.502560E+01
              -1.800000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        8
              4.802560E+01 -2.100000E+01 4.802560E+01
              -2.100000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        9
              5.102560E+01 -2.400000E+01 5.102560E+01
              -2.400000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        10
              5.402560E+01 -2.700000E+01 5.402560E+01
              -2.700000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        11
              5.702560E+01 -3.000000E+01 5.702560E+01
              -3.000000E+01 8.270500E+01 0.000000E+00
media         3
cuboid        12
              5.702560E+01 -3.000000E+01 5.702560E+01
              -3.000000E+01 8.270500E+01 -2.540000E+00
media         4
cuboid        13
              5.702560E+01 -3.000000E+01 5.702560E+01
              -3.000000E+01 8.270500E+01 -8.889999E+00
media         4
cuboid        14
              5.702560E+01 -3.000000E+01 5.702560E+01

```

```

-3.000000E+01 8.270500E+01 -1.397000E+01
media         4
              14 -13 -12 -11 -10 -9 -8 -7 -6 -
5 -4 -3 -2
              -1
boundary      14
unit          9
com=^19 x 19 core (above water)^
cuboid        1
              2.702560E+01 0.000000E+00 2.702560E+01
              0.000000E+00 1.445000E+01 0.000000E+00
array         2
              place 1 1 1 7.112000E-01 7.112000E-01 -
8.270500E+01
cuboid        2
              5.702560E+01 -3.000000E+01 5.702560E+01
              -3.000000E+01 1.445000E+01 0.000000E+00
media         0
boundary      2
unit          20
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder      1
              4.966000E-01 1.905000E+00 6.350000E-01
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        2
              7.112000E-01 -7.112000E-01 7.112000E-01
              -7.112000E-01 1.905000E+00 6.350000E-01
media         3
boundary      2
global unit   21
cuboid        1
              8.702560E+01 0.000000E+00 8.702560E+01
              0.000000E+00 1.111250E+02 0.000000E+00
array         3
              place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary      1
end geometry

read array
ara=1 nux=19 nuy=19 nuz=5
com=!19 x 19 fuel pin array (in water)!
fill 361r1 361r20 361r2 361r3 361r4 end fill
ara=2 nux=19 nuy=19 nuz=3
com=!19 x 19 fuel pin array (above water)!
fill 361r5 361r6 361r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com=!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl=!x-y view of core!
plt=yes pic=mixture xul=28 yul=44 zul=62 xlr=44 ylr=28
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch=! 12.-
! end
ttl=!x-z view of core!
plt=yes pic=mixture xul=28 yul=35 zul=113 xlr=44 ylr=35
zlr=65 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch=! 12./
! end
end plot
end data
end

1.5 CASE MIX_COMP_THERM_003_CAS2-2_K6

#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp. 0.56 inch pitch (wcap-3385-
54)
238group latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end

```

```

sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6781-02 288.9 end
o 3 0 3.3390-02 288.9 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 1.4224 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.962045
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no tme=60
wrs=34 end parm
read geometry
unit 1
com='fuel pin (no fuel) in bottom plate, 0 to .25 inches^
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com='fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.285000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com='fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
4.285000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
5.042000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1

```

```

boundary 5
unit 4
com='fuel pin above middle plate, 19.0 to 32.66 inches^
cylinder 1
4.285000E-01 8.369500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 8.369500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 8.369500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 8.369500E+01 4.826000E+01
media 3 1 4 -3 -2 -1
boundary 4
unit 5
com='fuel pin above water, 32.66 to 37.35 inches^
cylinder 1
4.285000E-01 9.486900E+01 8.369500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 9.486900E+01 8.369500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 9.486900E+01 8.369500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 9.486900E+01 8.369500E+01
media 0 1 4 -3 -2 -1
boundary 4
unit 6
com='top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder 1
4.966000E-01 9.588500E+01 9.486900E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 9.588500E+01 9.486900E+01
media 0 1 2 -1
boundary 2
unit 7
com='fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder 1
4.966000E-01 9.715500E+01 9.588500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 9.715500E+01 9.588500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cuboid 3
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 9.715500E+01 9.588500E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com='19 x 19 core (in water)^
cuboid 1
2.702560E+01 0.000000E+00 2.702560E+01
0.000000E+00 8.369500E+01 0.000000E+00
array 1 1 1
place 1 1 1 7.112000E-01 7.112000E-01
0.000000E+00
cuboid 2
3.002560E+01 -3.000000E+00 3.002560E+01
-3.000000E+00 8.369500E+01 0.000000E+00
media 3 2 2 -1
cuboid 3
3.302560E+01 -6.000000E+00 3.302560E+01
-6.000000E+00 8.369500E+01 0.000000E+00
media 3 3 3 -2 -1
cuboid 4
3.602560E+01 -9.000000E+00 3.602560E+01
-9.000000E+00 8.369500E+01 0.000000E+00
media 3 4 4 -3 -2 -1
cuboid 5
3.902560E+01 -1.200000E+01 3.902560E+01
-1.200000E+01 8.369500E+01 0.000000E+00
media 3 5 5 -4 -3 -2 -1
cuboid 6

```

```

4.202560E+01 -1.500000E+01 4.202560E+01
-1.500000E+01 8.369500E+01 0.000000E+00
media 3 6 6 -5 -4 -3 -2 -1
cuboid 7
4.502560E+01 -1.800000E+01 4.502560E+01
-1.800000E+01 8.369500E+01 0.000000E+00
media 3 7 7 -6 -5 -4 -3 -2 -1
cuboid 8
4.802560E+01 -2.100000E+01 4.802560E+01
-2.100000E+01 8.369500E+01 0.000000E+00
media 3 8 8 -7 -6 -5 -4 -3 -2 -1
cuboid 9
5.102560E+01 -2.400000E+01 5.102560E+01
-2.400000E+01 8.369500E+01 0.000000E+00
media 3 9 9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 10
5.402560E+01 -2.700000E+01 5.402560E+01
-2.700000E+01 8.369500E+01 0.000000E+00
media 3 10 10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 11
5.702560E+01 -3.000000E+01 5.702560E+01
-3.000000E+01 8.369500E+01 0.000000E+00
media 3 11 11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 12
5.702560E+01 -3.000000E+01 5.702560E+01
-3.000000E+01 8.369500E+01 -2.540000E+00
media 4 1 12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 13
5.702560E+01 -3.000000E+01 5.702560E+01
-3.000000E+01 8.369500E+01 -8.889999E+00
media 3 1 13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 14
5.702560E+01 -3.000000E+01 5.702560E+01
-3.000000E+01 8.369500E+01 -1.397000E+01
media 4 1 14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
boundary 14
unit 9
com='^19 x 19 core (above water)'^
cuboid 1
2.702560E+01 0.000000E+00 2.702560E+01
0.000000E+00 1.346000E+01 0.000000E+00
array 2 1
place 1 1 1 7.112000E-01 7.112000E-01 -
8.369500E+01
cuboid 2
5.702560E+01 -3.000000E+01 5.702560E+01
-3.000000E+01 1.346000E+01 0.000000E+00
media 0 1 2 -1
boundary 2
unit 20
com='^fuel pin between lower plates, .25 to 18.75 inches'^
cylinder 1
4.966000E-01 1.905000E+00 6.350000E-01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 1.905000E+00 6.350000E-01
media 3 1 2 -1
boundary 2
global unit 21
cuboid 1
8.702560E+01 0.000000E+00 8.702560E+01
0.000000E+00 1.111250E+02 0.000000E+00
array 3 1
place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

read array
ara=1 nux=19 nuy=19 nuz=5
com='!19 x 19 fuel pin array (in water)!
fill 361r1 361r20 361r2 361r3 361r4 end fill
ara=2 nux=19 nuy=19 nuz=3
com='!19 x 19 fuel pin array (above water)!
fill 361r5 361r6 361r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com='!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot

```

```

ttl='!x-y view of core!
plt=yes pic=mixture xul=28 yul=44 zul=62 xlr=44 ylr=28
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch='! 12.-
! end
ttl='!x-z view of core!
plt=yes pic=mixture xul=28 yul=35 zul=113 xlr=44 ylr=35
zlr=65 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch='! 12./
! end
end plot
end data
end

```

## 1.6 CASE MIX\_COMP\_THERM\_003\_CAS3\_K6

```

#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp. 0.56 inch pitch with boron
(wcap-3385-54)
238group latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6751-02 298 end
o 3 0 3.3404-02 298 end
b-10 3 0 3.7338-06 298 end
b-11 3 0 1.5029-05 298 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 1.4224 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.962045
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no
wrs=34 end parm
read geometry
unit 1
com='^fuel pin (no fuel) in bottom plate, 0 to .25 inches'^
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2

```

```

com=fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
  4.285000E-01 4.762500E+01 1.905000E+00
  origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
  4.375000E-01 4.762500E+01 1.905000E+00
  origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
  4.966000E-01 4.762500E+01 1.905000E+00
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com=fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
  4.285000E-01 4.826000E+01 4.762500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
  4.375000E-01 4.826000E+01 4.762500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
  4.966000E-01 4.826000E+01 4.762500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
  5.042000E-01 4.826000E+01 4.762500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1
boundary 5
unit 4
com=fuel pin above middle plate, 19.0 to 35.31 inches^
cylinder 1
  4.285000E-01 8.996500E+01 4.826000E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
  4.375000E-01 8.996500E+01 4.826000E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
  4.966000E-01 8.996500E+01 4.826000E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 8.996500E+01 4.826000E+01
media 3 1 4 -3 -2 -1
boundary 4
unit 5
com=fuel pin above water, 35.31 to 37.35 inches^
cylinder 1
  4.285000E-01 9.486900E+01 8.996500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 5 1 1
cylinder 2
  4.375000E-01 9.486900E+01 8.996500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
  4.966000E-01 9.486900E+01 8.996500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 9.486900E+01 8.996500E+01
media 0 1 4 -3 -2 -1
boundary 4
unit 6
com=top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder 1
  4.966000E-01 9.588500E+01 9.486900E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 9.588500E+01 9.486900E+01
media 0 1 2 -1
boundary 2

```

```

unit 7
com=fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder 1
  4.966000E-01 9.715500E+01 9.588500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
  5.042000E-01 9.715500E+01 9.588500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cuboid 3
  7.112000E-01 -7.112000E-01 7.112000E-01
  -7.112000E-01 9.715500E+01 9.588500E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com=21 x 21 core (in water)^
cuboid 1
  2.987040E+01 0.000000E+00 2.987040E+01
  0.000000E+00 8.996500E+01 0.000000E+00
array 1 1
  place 1 1 1 7.112000E-01 7.112000E-01
0.000000E+00
cuboid 2
  3.287040E+01 -3.000000E+00 3.287040E+01
  -3.000000E+00 8.996500E+01 0.000000E+00
media 3 2 2 -1
cuboid 3
  3.587040E+01 -6.000000E+00 3.587040E+01
  -6.000000E+00 8.996500E+01 0.000000E+00
media 3 3 3 -2 -1
cuboid 4
  3.887040E+01 -9.000000E+00 3.887040E+01
  -9.000000E+00 8.996500E+01 0.000000E+00
media 3 4 4 -3 -2 -1
cuboid 5
  4.187040E+01 -1.200000E+01 4.187040E+01
  -1.200000E+01 8.996500E+01 0.000000E+00
media 3 5 5 -4 -3 -2 -1
cuboid 6
  4.487040E+01 -1.500000E+01 4.487040E+01
  -1.500000E+01 8.996500E+01 0.000000E+00
media 3 6 6 -5 -4 -3 -2 -1
cuboid 7
  4.787040E+01 -1.800000E+01 4.787040E+01
  -1.800000E+01 8.996500E+01 0.000000E+00
media 3 7 7 -6 -5 -4 -3 -2 -1
cuboid 8
  5.087040E+01 -2.100000E+01 5.087040E+01
  -2.100000E+01 8.996500E+01 0.000000E+00
media 3 8 8 -7 -6 -5 -4 -3 -2 -1
cuboid 9
  5.387040E+01 -2.400000E+01 5.387040E+01
  -2.400000E+01 8.996500E+01 0.000000E+00
media 3 9 9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 10
  5.687040E+01 -2.700000E+01 5.687040E+01
  -2.700000E+01 8.996500E+01 0.000000E+00
media 3 10 10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 11
  5.987040E+01 -3.000000E+01 5.987040E+01
  -3.000000E+01 8.996500E+01 0.000000E+00
media 3 11 11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 12
  5.987040E+01 -3.000000E+01 5.987040E+01
  -3.000000E+01 8.996500E+01 -2.540000E+00
media 4 1 12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 13
  5.987040E+01 -3.000000E+01 5.987040E+01
  -3.000000E+01 8.996500E+01 -8.889999E+00
media 3 1 13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 14
  5.987040E+01 -3.000000E+01 5.987040E+01
  -3.000000E+01 8.996500E+01 -1.397000E+01
media 4 1 14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2
boundary 14
unit 9
com=21 x 21 core (above water)^
cuboid 1
  2.987040E+01 0.000000E+00 2.987040E+01
  0.000000E+00 7.190000E+00 0.000000E+00
array 2 1

```

```

place 1 1 1 7.112000E-01 7.112000E-01 -
8.996500E+01
cuboid 2
5.987040E+01 -3.000000E+01 5.987040E+01
-3.000000E+01 7.190000E+00 0.000000E+00
media 0 1 2 -1
boundary 2
unit 20
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.966000E-01 1.905000E+00 6.350000E-01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
7.112000E-01 -7.112000E-01 7.112000E-01
-7.112000E-01 1.905000E+00 6.350000E-01
media 3 1 2 -1
boundary 2
global unit 21
cuboid 1
8.987040E+01 0.000000E+00 8.987040E+01
0.000000E+00 1.11250E+02 0.000000E+00
array 3 1
place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

read array
ara=1 nux=21 nuy=21 nuz=5
com=!21 x 21 fuel pin array (in water)!
fill 44lr1 44lr20 44lr2 44lr3 44lr4 end fill
ara=2 nux=21 nuy=21 nuz=3
com=!21 x 21 fuel pin array (above water)!
fill 44lr5 44lr6 44lr7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com=!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl=!x-y view of core!
plt=yes pic=mixture xul=28 yul=46 zul=62 xlr=46 ylr=28
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch=! 12.-
! end
ttl=!x-z view of core!
plt=yes pic=mixture xul=28 yul=35 zul=113 xlr=46 ylr=35
zlr=65 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch=! 12./
! end
end plot
end data
end

```

## 1.7 CASE MIX\_COMP\_THERM\_003\_CAS4\_K6

```

#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp. 0.735 inch pitch (wcap-3385-
54)
238group latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'

```

```

h 3 0 6.6673-02 298 end
o 3 0 3.3336-02 298 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 1.8669 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.97
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no tme=60
wrs=34 end parm
read geometry
unit 1
com=^fuel pin (no fuel) in bottom plate, 0 to .25 inches^
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
9.334500E-01 -9.334500E-01 9.334500E-01
-9.334500E-01 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.285000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
9.334500E-01 -9.334500E-01 9.334500E-01
-9.334500E-01 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com=^fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
4.285000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
5.042000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
9.334500E-01 -9.334500E-01 9.334500E-01
-9.334500E-01 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1
boundary 5
unit 4
com=^fuel pin above middle plate, 19.0 to 27.60 inches^
cylinder 1
4.285000E-01 7.031500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 7.031500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1

```



```

cylinder 3
  4.966000E-01 7.031500E+01 4.826000E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2
  1 3 -2 -1
cuboid 4
  9.334500E-01 -9.334500E-01 9.334500E-01
  -9.334500E-01 7.031500E+01 4.826000E+01
media 3
  1 4 -3 -2 -1
boundary 4
unit 5
com=fuel pin above water, 27.60 to 37.35 inches^
cylinder 1
  4.285000E-01 9.486900E+01 7.031500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 5
  1 1
cylinder 2
  4.375000E-01 9.486900E+01 7.031500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0
  1 2 -1
cylinder 3
  4.966000E-01 9.486900E+01 7.031500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2
  1 3 -2 -1
cuboid 4
  9.334500E-01 -9.334500E-01 9.334500E-01
  -9.334500E-01 9.486900E+01 7.031500E+01
media 0
  1 4 -3 -2 -1
boundary 4
unit 6
com=top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder 1
  4.966000E-01 9.588500E+01 9.486900E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2
  1 1
cuboid 2
  9.334500E-01 -9.334500E-01 9.334500E-01
  -9.334500E-01 9.588500E+01 9.486900E+01
media 0
  1 2 -1
boundary 2
unit 7
com=fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder 1
  4.966000E-01 9.715500E+01 9.588500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2
  1 1
cylinder 2
  5.042000E-01 9.715500E+01 9.588500E+01
  origin x= 0.000000E+00 y= 0.000000E+00
media 0
  1 2 -1
cuboid 3
  9.334500E-01 -9.334500E-01 9.334500E-01
  -9.334500E-01 9.715500E+01 9.588500E+01
media 4
  1 3 -2 -1
boundary 3
unit 8
com=13 x 13 core (in water)^
cuboid 1
  2.426970E+01 0.000000E+00 2.426970E+01
  0.000000E+00 7.031500E+01 0.000000E+00
array 1
  1 place 1 1 1 9.334500E-01 9.334500E-01
0.000000E+00
cuboid 2
  2.726970E+01 -3.000000E+00 2.726970E+01
  -3.000000E+00 7.031500E+01 0.000000E+00
media 3
  2 2 -1
cuboid 3
  3.026970E+01 -6.000000E+00 3.026970E+01
  -6.000000E+00 7.031500E+01 0.000000E+00
media 3
  3 3 -2 -1
cuboid 4
  3.326970E+01 -9.000000E+00 3.326970E+01
  -9.000000E+00 7.031500E+01 0.000000E+00
media 3
  4 4 -3 -2 -1
cuboid 5
  3.626970E+01 -1.200000E+01 3.626970E+01
  -1.200000E+01 7.031500E+01 0.000000E+00
media 3
  5 5 -4 -3 -2 -1
cuboid 6
  3.926970E+01 -1.500000E+01 3.926970E+01
  -1.500000E+01 7.031500E+01 0.000000E+00
media 3
  6 6 -5 -4 -3 -2 -1
cuboid 7
  4.226970E+01 -1.800000E+01 4.226970E+01
  -1.800000E+01 7.031500E+01 0.000000E+00
media 3
  7 7 -6 -5 -4 -3 -2 -1
cuboid 8
  4.526970E+01 -2.100000E+01 4.526970E+01
  -2.100000E+01 7.031500E+01 0.000000E+00
media 3
  8 8 -7 -6 -5 -4 -3 -2 -1

cuboid 9
  4.826970E+01 -2.400000E+01 4.826970E+01
  -2.400000E+01 7.031500E+01 0.000000E+00
media 3
  9 9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 10
  5.126970E+01 -2.700000E+01 5.126970E+01
  -2.700000E+01 7.031500E+01 0.000000E+00
media 3
  10 10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 11
  5.426970E+01 -3.000000E+01 5.426970E+01
  -3.000000E+01 7.031500E+01 0.000000E+00
media 3
  11 11 -10 -9 -8 -7 -6 -5 -4 -3 -1
cuboid 12
  5.426970E+01 -3.000000E+01 5.426970E+01
  -3.000000E+01 7.031500E+01 -2.540000E+00
media 4
  1 12 -11 -10 -9 -8 -7 -6 -5 -4 -1
cuboid 13
  5.426970E+01 -3.000000E+01 5.426970E+01
  -3.000000E+01 7.031500E+01 -8.889999E+00
media 3
  1 13 -12 -11 -10 -9 -8 -7 -6 -5 -1
cuboid 14
  5.426970E+01 -3.000000E+01 5.426970E+01
  -3.000000E+01 7.031500E+01 -1.397000E+01
media 4
  1 14 -13 -12 -11 -10 -9 -8 -7 -6 -1
boundary 14
unit 9
com=13 x 13 core (above water)^
cuboid 1
  2.426970E+01 0.000000E+00 2.426970E+01
  0.000000E+00 2.684000E+01 0.000000E+00
array 2
  1 place 1 1 1 9.334500E-01 9.334500E-01
7.031500E+01
cuboid 2
  5.426970E+01 -3.000000E+01 5.426970E+01
  -3.000000E+01 2.684000E+01 0.000000E+00
media 0
  1 2 -1
boundary 2
unit 20
com=fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
  4.966000E-01 1.905000E+00 6.350000E-01
  origin x= 0.000000E+00 y= 0.000000E+00
media 2
  1 1
cuboid 2
  9.334500E-01 -9.334500E-01 9.334500E-01
  -9.334500E-01 1.905000E+00 6.350000E-01
media 3
  1 2 -1
boundary 2
global unit 21
cuboid 1
  8.426970E+01 0.000000E+00 8.426970E+01
  0.000000E+00 1.111250E+02 0.000000E+00
array 3
  1 place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

read array
ara=1 nux=13 nuy=13 nuz=5
com=13 x 13 fuel pin array (in water)!
fill 169r1 169r20 169r2 169r3 169r4 end fill
ara=2 nux=13 nuy=13 nuz=3
com=13 x 13 fuel pin array (above water)!
fill 169r5 169r6 169r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com=complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl=x-y view of core!
plt=yes pic=mixture xul=28 yul=42 zul=62 xlr=42 ylr=28
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch=12.-
! end
ttl=x-z view of core!
plt=yes pic=mixture xul=28 yul=44 zul=113 xlr=42 ylr=44
zlr=0 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130

```

```
nch=1 12./
! end
end plot
end data
end
```

## 1.8 CASE MIX\_COMP\_THERM\_003\_CAS5\_K6

```
#csas26      parm='size=00500000'
saxton puo2-uo2 critical exp. 0.792 inch pitch (wcap-3385-
54)
238group      latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6783-02 298 end
o 3 0 3.3392-02 298 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end
o 5 0 4.5155-02 298 end
end comp
squarepitch 2.01168 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.97
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no tme=60
wrs=34 end parm
read geometry
unit 1
com='fuel pin (no fuel) in bottom plate, 0 to .25 inches^
cylinder 1
4.966000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com='fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.285000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.762500E+01 1.905000E+00
origin x= 0.000000E+00 y= 0.000000E+00
```

```
media 2 1 3 -2 -1
cuboid 4
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com='fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
4.285000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
5.042000E-01 4.826000E+01 4.762500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1
boundary 5
unit 4
com='fuel pin above middle plate, 19.0 to 30.88 inches^
cylinder 1
4.285000E-01 7.866500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
4.375000E-01 7.866500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 7.866500E+01 4.826000E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 7.866500E+01 4.826000E+01
media 3 1 4 -3 -2 -1
boundary 4
unit 5
com='fuel pin above water, 30.88 to 37.35 inches^
cylinder 1
4.285000E-01 9.486900E+01 7.866500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 5 1 1
cylinder 2
4.375000E-01 9.486900E+01 7.866500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
4.966000E-01 9.486900E+01 7.866500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 9.486900E+01 7.866500E+01
media 0 1 4 -3 -2 -1
boundary 4
unit 6
com='top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder 1
4.966000E-01 9.588500E+01 9.486900E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 9.588500E+01 9.486900E+01
media 0 1 2 -1
boundary 2
unit 7
com='fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder 1
4.966000E-01 9.715500E+01 9.588500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
5.042000E-01 9.715500E+01 9.588500E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cuboid 3
1.005840E+00 -1.005840E+00 1.005840E+00
```

```

-1.005840E+00  9.715500E+01  9.588500E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com=^12 x 12 core (in water)^
cuboid 1
2.414016E+01  0.000000E+00  2.414016E+01
0.000000E+00  7.866500E+01  0.000000E+00
array 1 1
place 1 1 1 1.005840E+00 1.005840E+00
0.000000E+00
cuboid 2
2.714016E+01 -3.000000E+00 2.714016E+01
-3.000000E+00 7.866500E+01 0.000000E+00
media 3 2 2 -1
cuboid 3
3.014016E+01 -6.000000E+00 3.014016E+01
-6.000000E+00 7.866500E+01 0.000000E+00
media 3 3 3 -2 -1
cuboid 4
3.314016E+01 -9.000000E+00 3.314016E+01
-9.000000E+00 7.866500E+01 0.000000E+00
media 3 4 4 -3 -2 -1
cuboid 5
3.614016E+01 -1.200000E+01 3.614016E+01
-1.200000E+01 7.866500E+01 0.000000E+00
media 3 5 5 -4 -3 -2 -1
cuboid 6
3.914016E+01 -1.500000E+01 3.914016E+01
-1.500000E+01 7.866500E+01 0.000000E+00
media 3 6 6 -5 -4 -3 -2 -1
cuboid 7
4.214016E+01 -1.800000E+01 4.214016E+01
-1.800000E+01 7.866500E+01 0.000000E+00
media 3 7 7 -6 -5 -4 -3 -2 -1
cuboid 8
4.514016E+01 -2.100000E+01 4.514016E+01
-2.100000E+01 7.866500E+01 0.000000E+00
media 3 8 8 -7 -6 -5 -4 -3 -2 -1
cuboid 9
4.814016E+01 -2.400000E+01 4.814016E+01
-2.400000E+01 7.866500E+01 0.000000E+00
media 3 9 9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 10
5.114016E+01 -2.700000E+01 5.114016E+01
-2.700000E+01 7.866500E+01 0.000000E+00
media 3 10 10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 11
5.414016E+01 -3.000000E+01 5.414016E+01
-3.000000E+01 7.866500E+01 0.000000E+00
media 3 11 11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 12
5.414016E+01 -3.000000E+01 5.414016E+01
-3.000000E+01 7.866500E+01 -2.540000E+00
media 4 1 12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 13
5.414016E+01 -3.000000E+01 5.414016E+01
-3.000000E+01 7.866500E+01 -8.889999E+00
media 3 1 13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 14
5.414016E+01 -3.000000E+01 5.414016E+01
-3.000000E+01 7.866500E+01 -1.397000E+01
media 4 1 14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1
boundary 14
unit 9
com=^12 x 12 core (above water)^
cuboid 1
2.414016E+01 0.000000E+00 2.414016E+01
0.000000E+00 1.849000E+01 0.000000E+00
array 2 1
place 1 1 1 1.005840E+00 1.005840E+00 -
7.866500E+01
cuboid 2
5.414016E+01 -3.000000E+01 5.414016E+01
-3.000000E+01 1.849000E+01 0.000000E+00
media 0 1 2 -1
boundary 2
unit 20
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
4.966000E-01 1.905000E+00 6.350000E-01
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1

```

```

cuboid 2
1.005840E+00 -1.005840E+00 1.005840E+00
-1.005840E+00 1.905000E+00 6.350000E-01
media 3 1 2 -1
boundary 2
global unit 21
cuboid 1
8.414016E+01 0.000000E+00 8.414016E+01
0.000000E+00 1.111250E+02 0.000000E+00
array 3 1
place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

read array
ara=1 nux=12 nuy=12 nuz=5
com=!12 x 12 fuel pin array (in water)!
fill 144r1 144r20 144r2 144r3 144r4 end fill
ara=2 nux=12 nuy=12 nuz=3
com=!12 x 12 fuel pin array (above water)!
fill 144r5 144r6 144r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com=!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl=!x-y view of core!
plt=yes pic=mixture xul=28 yul=42 zul=60 xlr=42 ylr=28
zlr=60 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch=! 12./
! end
ttl=!x-z view of core!
plt=yes pic=mixture xul=28 yul=31 zul=113 xlr=42 ylr=31
zlr=0 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch=! 12./
! end
end plot
end data
end

```

## 1.9 CASE MIX\_COMP\_THERM\_003\_CAS6\_K6

```

#csas26 parm='size=00500000'
saxton puo2-uo2 critical exp. 01.04 inch pitch (wcap-3385-
54)
238group latticecell
'uo2-puo2 mixture'
pu-239 1 0 1.3526-03 298 end
pu-240 1 0 1.2759-04 298 end
pu-241 1 0 1.1407-05 298 end
pu-242 1 0 6.0318-07 298 end
am-241 1 0 1.7783-06 298 end
u-234 1 0 1.1688-06 298 end
u-235 1 0 1.5301-04 298 end
u-238 1 0 2.1097-02 298 end
o 1 0 4.5155-02 298 end
'clad'
sn-112 2 0 4.5192-06 298 end
sn-114 2 0 3.0284-06 298 end
sn-115 2 0 1.6772-06 298 end
sn-116 2 0 2.0747-04 298 end
sn-117 2 0 3.5781-05 298 end
sn-118 2 0 1.1284-04 298 end
sn-119 2 0 3.9974-05 298 end
sn-120 2 0 1.5184-04 298 end
sn-122 2 0 2.1571-05 298 end
sn-124 2 0 2.6976-05 298 end
fe 2 0 1.4148-04 298 end
cr 2 0 7.5977-05 298 end
o 2 0 2.9630-04 298 end
zr 2 0 4.2517-02 298 end
'eau'
h 3 0 6.6737-02 298 end
o 3 0 3.3368-02 298 end
'aluminium'
al 4 0 6.0039-02 298 end
'uo2-puo2 mixture'
pu-239 5 0 1.3526-03 298 end
pu-240 5 0 1.2759-04 298 end
pu-241 5 0 1.1407-05 298 end
pu-242 5 0 6.0318-07 298 end
am-241 5 0 1.7783-06 298 end
u-234 5 0 1.1688-06 298 end
u-235 5 0 1.5301-04 298 end
u-238 5 0 2.1097-02 298 end

```

```

o      5 0 4.5155-02 298 end
end comp
squarepitch 2.6416 .856996 1 3 .99314 2 .87503 0 end
more data
res=5 cylinder 0.4285 dan(5)=0.98
end more
read parm gen=905 npg=600 nsk=5 res=205 nub=yes run=yes
plt=no tme=60
wrs=34 end parm
read geometry
unit
1
com=^fuel pin (no fuel) in bottom plate, 0 to .25 inches^
cylinder 1
      4.966000E-01 6.350000E-01 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
      5.042000E-01 6.350000E-01 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
cuboid 3
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 6.350000E-01 0.000000E+00
media 4 1 3 -2 -1
boundary 3
unit 2
com=^fuel pin between lower plates, .25 to 18.75 inches^
cylinder 1
      4.285000E-01 4.762500E+01 1.905000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      4.375000E-01 4.762500E+01 1.905000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      4.966000E-01 4.762500E+01 1.905000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 4.762500E+01 1.905000E+00
media 3 1 4 -3 -2 -1
boundary 4
unit 3
com=^fuel pin in middle plate, 18.75 to 19.0 inches^
cylinder 1
      4.285000E-01 4.826000E+01 4.762500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      4.375000E-01 4.826000E+01 4.762500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      4.966000E-01 4.826000E+01 4.762500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
      5.042000E-01 4.826000E+01 4.762500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 4 -3 -2 -1
cuboid 5
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 4.826000E+01 4.762500E+01
media 4 1 5 -4 -3 -2 -1
boundary 5
unit 4
com=^fuel pin above middle plate, 19.0 to 31.96 inches^
cylinder 1
      4.285000E-01 8.140500E+01 4.826000E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      4.375000E-01 8.140500E+01 4.826000E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      4.966000E-01 8.140500E+01 4.826000E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 8.140500E+01 4.826000E+01
media 3 1 4 -3 -2 -1
boundary 4
unit 5
com=^fuel pin above water, 31.96 to 37.35 inches^
cylinder 1
      4.285000E-01 9.486900E+01 8.140500E+01

```

```

      origin x= 0.000000E+00 y= 0.000000E+00
media 5 1 1
cylinder 2
      4.375000E-01 9.486900E+01 8.140500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cylinder 3
      4.966000E-01 9.486900E+01 8.140500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 3 -2 -1
cuboid 4
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 9.486900E+01 8.140500E+01
media 0 1 4 -3 -2 -1
boundary 4
unit 6
com=^top of fuel pin (no fuel), 37.35 to 37.75 inches^
cylinder 1
      4.966000E-01 9.588500E+01 9.486900E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cuboid 2
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 9.588500E+01 9.486900E+01
media 0 1 2 -1
boundary 2
unit 7
com=^fuel pin (no fuel) in top plate, 37.75 to 38.25 inch^
cylinder 1
      4.966000E-01 9.715500E+01 9.588500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 1
cylinder 2
      5.042000E-01 9.715500E+01 9.588500E+01
      origin x= 0.000000E+00 y= 0.000000E+00
media 0 1 2 -1
cuboid 3
      1.320800E+00 -1.320800E+00 1.320800E+00
      -1.320800E+00 9.715500E+01 9.588500E+01
media 4 1 3 -2 -1
boundary 3
unit 8
com=^11 x 11 core (in water)^
cuboid 1
      2.905760E+01 0.000000E+00 2.905760E+01
      0.000000E+00 8.140500E+01 0.000000E+00
array 1 1
      place 1 1 1 1.320800E+00 1.320800E+00
0.000000E+00
cuboid 2
      3.205760E+01 -3.000000E+00 3.205760E+01
      -3.000000E+00 8.140500E+01 0.000000E+00
media 3 2 2 -1
cuboid 3
      3.505760E+01 -6.000000E+00 3.505760E+01
      -6.000000E+00 8.140500E+01 0.000000E+00
media 3 3 3 -2 -1
cuboid 4
      3.805760E+01 -9.000000E+00 3.805760E+01
      -9.000000E+00 8.140500E+01 0.000000E+00
media 3 4 4 -3 -2 -1
cuboid 5
      4.105760E+01 -1.200000E+01 4.105760E+01
      -1.200000E+01 8.140500E+01 0.000000E+00
media 3 5 5 -4 -3 -2 -1
cuboid 6
      4.405760E+01 -1.500000E+01 4.405760E+01
      -1.500000E+01 8.140500E+01 0.000000E+00
media 3 6 6 -5 -4 -3 -2 -1
cuboid 7
      4.705760E+01 -1.800000E+01 4.705760E+01
      -1.800000E+01 8.140500E+01 0.000000E+00
media 3 7 7 -6 -5 -4 -3 -2 -1
cuboid 8
      5.005760E+01 -2.100000E+01 5.005760E+01
      -2.100000E+01 8.140500E+01 0.000000E+00
media 3 8 8 -7 -6 -5 -4 -3 -2 -1
cuboid 9
      5.305760E+01 -2.400000E+01 5.305760E+01
      -2.400000E+01 8.140500E+01 0.000000E+00
media 3 9 9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 10
      5.605760E+01 -2.700000E+01 5.605760E+01
      -2.700000E+01 8.140500E+01 0.000000E+00
media 3 10 10 -9 -8 -7 -6 -5 -4 -3 -2 -1
cuboid 11
      5.905760E+01 -3.000000E+01 5.905760E+01
      -3.000000E+01 8.140500E+01 0.000000E+00

```

```

media      3  11      11 -10 -9  -8  -7  -6  -5  -4  -3  -
2  -1
cuboid     12
          5.905760E+01 -3.000000E+01  5.905760E+01
          -3.000000E+01  8.140500E+01 -2.540000E+00
media      4  1      12 -11 -10 -9  -8  -7  -6  -5  -4  -
3  -2  -1
cuboid     13
          5.905760E+01 -3.000000E+01  5.905760E+01
          -3.000000E+01  8.140500E+01 -8.889999E+00
media      3  1      13 -12 -11 -10 -9  -8  -7  -6  -5  -
4  -3  -2  -1
cuboid     14
          5.905760E+01 -3.000000E+01  5.905760E+01
          -3.000000E+01  8.140500E+01 -1.397000E+01
media      4  1      14 -13 -12 -11 -10 -9  -8  -7  -6  -
5  -4  -3  -2
          -1
boundary    14
unit        9
com='^11 x 11 core (above water)'^
cuboid      1
          2.905760E+01  0.000000E+00  2.905760E+01
          0.000000E+00  1.575000E+01  0.000000E+00
array       2  1
          place 1 1 1 1.320800E+00 1.320800E+00 -
8.140500E+01
cuboid      2
          5.905760E+01 -3.000000E+01  5.905760E+01
          -3.000000E+01  1.575000E+01  0.000000E+00
media      0  1      2  -1
boundary    2
unit        20
com='^fuel pin between lower plates, .25 to 18.75 inches^
cylinder    1
          4.966000E-01  1.905000E+00  6.350000E-01
          origin x= 0.000000E+00 y= 0.000000E+00
media      2  1      1
cuboid      2
          1.320800E+00 -1.320800E+00  1.320800E+00
          -1.320800E+00  1.905000E+00  6.350000E-01
media      3  1      2  -1
boundary    2
global unit 21
cuboid 1
          8.905760E+01  0.000000E+00  8.905760E+01
          0.000000E+00  1.111250E+02  0.000000E+00
array       3  1
          place 1 1 1 3.000000E+01 3.000000E+01
1.397000E+01
boundary 1
end geometry

read array
ara=1 nux=11 nuy=11 nuz=5
com='!11 x 11 fuel pin array (in water)!
fill 121r1 121r20 121r2 121r3 121r4 end fill
ara=2 nux=11 nuy=11 nuz=3
com='!11 x 11 fuel pin array (above water)!
fill 121r5 121r6 121r7 end fill
ara=3 gbl=3 nux=1 nuy=1 nuz=2
com='!complete fuel core!
fill 8 9 end fill
end array
read bias id=500 2 11 end bias
read plot
ttl='!x-y view of core!
plt=yes pic=mixture xul=28 yul=45 zul=62 xlr=45 ylr=28
zlr=62 uax=1 vax=0
wax=0 udn=0 vdn=-1 wdn=0 nax=130
nch='! 12.-
! end
ttl='!x-z view of core!
plt=yes pic=mixture xul=28 yul=34 zul=113 xlr=44 ylr=34
zlr=0 uax=1 vax=0
wax=0 udn=0 vdn=0 wdn=-1 nax=130
nch='! 12./
! end
end plot
end data
end

1.10 CASE MIX_COMP_THERM_004_CAS1_K6

#csas26 parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.7923-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 1.3531-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 1.825 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.958294
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com='^concrete^
cuboid 1
          7.197500E+01 -3.000000E+01  7.197500E+01
          -3.000000E+01  3.700000E+01  0.000000E+00
media      6  1      1
boundary    1
unit        2
com='^lining of core tank^
cuboid 1
          7.197500E+01 -3.000000E+01  7.197500E+01
          -3.000000E+01  5.000000E-01  0.000000E+00
media      5  1      1
boundary    1
unit        3
com='^water^
cuboid 1
          7.197500E+01 -3.000000E+01  7.197500E+01
          -3.000000E+01  1.380000E+01  0.000000E+00

```

```

media      8      1      1
boundary   1
unit       4
com=^support plate (ss)^
cuboid     1
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 2.200000E+00 0.000000E+00
media      5      1
boundary   1
unit       5
com=^support plate (al)^
cuboid     1
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 1.270000E+00 0.000000E+00
media      4      1
boundary   1
unit       6
com=^end plug in water^
cylinder   1
          6.115000E-01 4.445000E+00 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      4      1
cuboid     2
          9.125000E-01 -9.125000E-01 9.125000E-01
          -9.125000E-01 4.445000E+00 0.000000E+00
media      3      1      2 -1
boundary   2
unit       7
com=^end plug and lower grid^
cuboid     1
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 6.000000E-01 0.000000E+00
media      4      1      1
boundary   1
unit       8
com=^end plug in water^
cylinder   1
          6.115000E-01 1.178500E+01 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      4      1      1
cuboid     2
          9.125000E-01 -9.125000E-01 9.125000E-01
          -9.125000E-01 1.178500E+01 0.000000E+00
media      3      1      2 -1
boundary   2
unit       9
com=^fuel rod in water^
cylinder   1
          5.325000E-01 5.955000E+01 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      1      1      1
cylinder   2
          6.115000E-01 5.955000E+01 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      2      1      2 -1
cuboid     3
          9.125000E-01 -9.125000E-01 9.125000E-01
          -9.125000E-01 5.955000E+01 0.000000E+00
media      3      1      3 -2 -1
boundary   3
unit       10
com=^fuel rod in air^
cylinder   1
          5.325000E-01 1.105000E+01 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      9      1      1
cylinder   2
          6.115000E-01 1.105000E+01 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      2      1      2 -1
cuboid     3
          9.125000E-01 -9.125000E-01 9.125000E-01
          -9.125000E-01 1.105000E+01 0.000000E+00
media      7      1      3 -2 -1
boundary   3
unit       11
com=^end plug in air^
cylinder   1
          6.115000E-01 9.970000E+00 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      4      1      1
cuboid     2
          9.125000E-01 -9.125000E-01 9.125000E-01
          -9.125000E-01 9.970000E+00 0.000000E+00
media      7      1      2 -1
boundary   2
unit       12
com=^lattice in water^
cuboid     1
          4.197500E+01 0.000000E+00 4.197500E+01

```

```

          0.000000E+00 4.445000E+00 0.000000E+00
array      1      1
          place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid     2
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 4.445000E+00 0.000000E+00
media      8      1      2 -1
boundary   2
unit       13
com=^end plug in water^
cuboid     1
          4.197500E+01 0.000000E+00 4.197500E+01
          0.000000E+00 1.178500E+01 0.000000E+00
array      2      1
          place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid     2
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 1.178500E+01 0.000000E+00
media      8      1      2 -1
boundary   2
unit       14
com=^fuel lattice in water^
cuboid     1
          4.197500E+01 0.000000E+00 4.197500E+01
          0.000000E+00 5.955000E+01 0.000000E+00
array      3      1
          place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid     2
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 5.955000E+01 0.000000E+00
media      8      1      2 -1
boundary   2
unit       15
com=^fuel lattice in air^
cuboid     1
          4.197500E+01 0.000000E+00 4.197500E+01
          0.000000E+00 1.105000E+01 0.000000E+00
array      4      1
          place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid     2
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 1.105000E+01 0.000000E+00
media      7      1      2 -1
boundary   2
unit       16
com=^end plug in air^
cuboid     1
          4.197500E+01 0.000000E+00 4.197500E+01
          0.000000E+00 9.970000E+00 0.000000E+00
array      5      1
          place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid     2
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 9.970000E+00 0.000000E+00
media      7      1      2 -1
boundary   2
unit       17
com=^middle grid plate^
cuboid     1
          7.197500E+01 -3.000000E+01 7.197500E+01
          -3.000000E+01 6.000000E-01 0.000000E+00
media      4      1      1
boundary   1
global unit 18
cuboid 1
          1.019750E+02 0.000000E+00 1.019750E+02
          0.000000E+00 1.527700E+02 0.000000E+00
array      6      1
          place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=23 nuy=23 nuz=1 fill 529*6 end fill
ara=2 nux=23 nuy=23 nuz=1 fill 529*8 end fill
ara=3 nux=23 nuy=23 nuz=1 fill 529*9 end fill
ara=4 nux=23 nuy=23 nuz=1 fill 529*10 end fill
ara=5 nux=23 nuy=23 nuz=1 fill 529*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

1.11 CASE MIX\_COMP\_THERM\_004\_CAS10\_K6

```
#csas26      parm='size=00500000'
experience   mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.8077-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 1.2053-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 2.474 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.970371
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com='concrete^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 3.700000E+01 0.000000E+00
media 6 1 1
boundary 1
unit 2
com='lining of core tank^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 5.000000E-01 0.000000E+00
media 5 1 1
```

```
boundary 1
unit 3
com='water^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 1.380000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 4
com='support plate (ss)^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 2.200000E+00 0.000000E+00
media 5 1 1
boundary 1
unit 5
com='support plate (al)^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 1.270000E+00 0.000000E+00
media 4 1 1
boundary 1
unit 6
com='end plug in water^'
cylinder 1
      6.115000E-01 4.445000E+00 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
      1.237000E+00 -1.237000E+00 1.237000E+00
      -1.237000E+00 4.445000E+00 0.000000E+00
media 3 1 2 -1
boundary 2
unit 7
com='end plug and lower grid^'
cuboid 1
      8.195400E+01 -3.000000E+01 8.195400E+01
      -3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
unit 8
com='end plug in water^'
cylinder 1
      6.115000E-01 1.178500E+01 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
      1.237000E+00 -1.237000E+00 1.237000E+00
      -1.237000E+00 1.178500E+01 0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com='fuel rod in water^'
cylinder 1
      5.325000E-01 6.205000E+01 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
      6.115000E-01 6.205000E+01 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
      1.237000E+00 -1.237000E+00 1.237000E+00
      -1.237000E+00 6.205000E+01 0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com='fuel rod in air^'
cylinder 1
      5.325000E-01 8.550000E+00 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
      6.115000E-01 8.550000E+00 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
      1.237000E+00 -1.237000E+00 1.237000E+00
      -1.237000E+00 8.550000E+00 0.000000E+00
media 7 1 3 -2 -1
boundary 3
unit 11
com='end plug in air^'
cylinder 1
      6.115000E-01 9.970000E+00 0.000000E+00
      origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
      1.237000E+00 -1.237000E+00 1.237000E+00
      -1.237000E+00 9.970000E+00 0.000000E+00
```

```

media      7      1      2      -1
boundary   2
unit       12
com='^lattice in water^'
cuboid     1
           5.195400E+01  0.000000E+00  5.195400E+01
           0.000000E+00  4.445000E+00  0.000000E+00

array      1
           1
           place 1 1 1 1.237000E+00 1.237000E+00

0.000000E+00
cuboid     2
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  4.445000E+00  0.000000E+00

media      8      1      2      -1
boundary   2
unit       13
com='^end plug in water^'
cuboid     1
           5.195400E+01  0.000000E+00  5.195400E+01
           0.000000E+00  1.178500E+01  0.000000E+00

array      2
           1
           place 1 1 1 1.237000E+00 1.237000E+00

0.000000E+00
cuboid     2
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  1.178500E+01  0.000000E+00

media      8      1      2      -1
boundary   2
unit       14
com='^fuel lattice in water^'
cuboid     1
           5.195400E+01  0.000000E+00  5.195400E+01
           0.000000E+00  6.205000E+01  0.000000E+00

array      3
           1
           place 1 1 1 1.237000E+00 1.237000E+00

0.000000E+00
cuboid     2
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  6.205000E+01  0.000000E+00

media      8      1      2      -1
boundary   2
unit       15
com='^fuel lattice in air^'
cuboid     1
           5.195400E+01  0.000000E+00  5.195400E+01
           0.000000E+00  8.550000E+00  0.000000E+00

array      4
           1
           place 1 1 1 1.237000E+00 1.237000E+00

0.000000E+00
cuboid     2
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  8.550000E+00  0.000000E+00

media      7      1      2      -1
boundary   2
unit       16
com='^end plug in air^'
cuboid     1
           5.195400E+01  0.000000E+00  5.195400E+01
           0.000000E+00  9.970000E+00  0.000000E+00

array      5
           1
           place 1 1 1 1.237000E+00 1.237000E+00

0.000000E+00
cuboid     2
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  9.970000E+00  0.000000E+00

media      7      1      2      -1
boundary   2
unit       17
com='^middle grid plate^'
cuboid     1
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  6.000000E+01  0.000000E+00

media      4      1      1
boundary   1
global unit
cuboid 1
           1.119540E+02  0.000000E+00  1.119540E+02
           0.000000E+00  1.527700E+02  0.000000E+00

array      6      1
           place 1 1 1 3.000000E+01 3.000000E+01

0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=21 nuy=21 nuz=1 fill 441*6 end fill
ara=2 nux=21 nuy=21 nuz=1 fill 441*8 end fill
ara=3 nux=21 nuy=21 nuz=1 fill 441*9 end fill
ara=4 nux=21 nuy=21 nuz=1 fill 441*10 end fill
ara=5 nux=21 nuy=21 nuz=1 fill 441*11 end fill

```

```

gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

## 1.12 CASE MIX\_COMP\_THERM\_004\_CAS11\_K6

```

#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.6617-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 2.6656-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 2.474 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.97
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com='^concrete^'
cuboid 1
           8.195400E+01 -3.000000E+01  8.195400E+01
           -3.000000E+01  3.700000E+01  0.000000E+00

media      6      1      1

```



```

boundary      1
unit          2
com='^lining of core tank^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 5.000000E-01 0.000000E+00
media         5
boundary      1
unit          3
com='^water^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 1.380000E+01 0.000000E+00
media         8
boundary      1
unit          4
com='^support plate (ss)^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 2.200000E+00 0.000000E+00
media         5
boundary      1
unit          5
com='^support plate (al)^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 1.270000E+00 0.000000E+00
media         4
boundary      1
unit          6
com='^end plug in water^
cylinder      1
              6.115000E-01 4.445000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         4
cuboid        2
              1.237000E+00 -1.237000E+00 1.237000E+00
              -1.237000E+00 4.445000E+00 0.000000E+00
media         3
boundary      2
unit          7
com='^end plug and lower grid^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 6.000000E-01 0.000000E+00
media         4
boundary      1
unit          8
com='^end plug in water^
cylinder      1
              6.115000E-01 1.178500E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         4
cuboid        2
              1.237000E+00 -1.237000E+00 1.237000E+00
              -1.237000E+00 1.178500E+01 0.000000E+00
media         3
boundary      2
unit          9
com='^fuel rod in water^
cylinder      1
              5.325000E-01 6.453000E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         1
cylinder      2
              6.115000E-01 6.453000E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        3
              1.237000E+00 -1.237000E+00 1.237000E+00
              -1.237000E+00 6.453000E+01 0.000000E+00
media         3
boundary      3
unit          10
com='^fuel rod in air^
cylinder      1
              5.325000E-01 6.070000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         9
cylinder      2
              6.115000E-01 6.070000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        3
              1.237000E+00 -1.237000E+00 1.237000E+00
              -1.237000E+00 6.070000E+00 0.000000E+00
media         7
boundary      3
unit          11
com='^end plug in air^

cylinder      1
              6.115000E-01 9.970000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         4
cuboid        2
              1.237000E+00 -1.237000E+00 1.237000E+00
              -1.237000E+00 9.970000E+00 0.000000E+00
media         7
boundary      2
unit          12
com='^lattice in water^
cuboid        1
              5.195400E+01 0.000000E+00 5.195400E+01
              0.000000E+00 4.445000E+00 0.000000E+00
array         1
              1
              place 1 1 1 1.237000E+00 1.237000E+00
0.000000E+00
cuboid        2
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 4.445000E+00 0.000000E+00
media         8
boundary      2
unit          13
com='^end plug in water^
cuboid        1
              5.195400E+01 0.000000E+00 5.195400E+01
              0.000000E+00 1.178500E+01 0.000000E+00
array         2
              1
              place 1 1 1 1.237000E+00 1.237000E+00
0.000000E+00
cuboid        2
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 1.178500E+01 0.000000E+00
media         8
boundary      2
unit          14
com='^fuel lattice in water^
cuboid        1
              5.195400E+01 0.000000E+00 5.195400E+01
              0.000000E+00 6.453000E+01 0.000000E+00
array         3
              1
              place 1 1 1 1.237000E+00 1.237000E+00
0.000000E+00
cuboid        2
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 6.453000E+01 0.000000E+00
media         8
boundary      2
unit          15
com='^fuel lattice in air^
cuboid        1
              5.195400E+01 0.000000E+00 5.195400E+01
              0.000000E+00 6.070000E+00 0.000000E+00
array         4
              1
              place 1 1 1 1.237000E+00 1.237000E+00
0.000000E+00
cuboid        2
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 6.070000E+00 0.000000E+00
media         7
boundary      2
unit          16
com='^end plug in air^
cuboid        1
              5.195400E+01 0.000000E+00 5.195400E+01
              0.000000E+00 9.970000E+00 0.000000E+00
array         5
              1
              place 1 1 1 1.237000E+00 1.237000E+00
0.000000E+00
cuboid        2
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 9.970000E+00 0.000000E+00
media         7
boundary      2
unit          17
com='^middle grid plate^
cuboid        1
              8.195400E+01 -3.000000E+01 8.195400E+01
              -3.000000E+01 6.000000E-01 0.000000E+00
media         4
boundary      1
global unit
cuboid 1
              1.119540E+02 0.000000E+00 1.119540E+02
              0.000000E+00 1.527700E+02 0.000000E+00
array         6
              1
              place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

```

```
read array
ara=1 nux=21 nuy=21 nuz=1 fill 441*6 end fill
ara=2 nux=21 nuy=21 nuz=1 fill 441*8 end fill
ara=3 nux=21 nuy=21 nuz=1 fill 441*9 end fill
ara=4 nux=21 nuy=21 nuz=1 fill 441*10 end fill
ara=5 nux=21 nuy=21 nuz=1 fill 441*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end
```

## 1.13 CASE MIX\_COMP\_THERM\_004\_CAS2\_K6

```
#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.6701-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 2.5812-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 1.825 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.958294
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
```

```
read geometry
unit 1
com='concrete^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 3.700000E+01 0.000000E+00
media 6 1 1
boundary 1
unit 2
com='lining of core tank^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 5.000000E-01 0.000000E+00
media 5 1 1
boundary 1
unit 3
com='water^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 1.380000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 4
com='support plate (ss)^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 2.200000E+00 0.000000E+00
media 5 1 1
boundary 1
unit 5
com='support plate (al)^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 1.270000E+00 0.000000E+00
media 4 1 1
boundary 1
unit 6
com='end plug in water^
cylinder 1
6.115000E-01 4.445000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 4.445000E+00 0.000000E+00
media 3 1 2 -1
boundary 2
unit 7
com='end plug and lower grid^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
unit 8
com='end plug in water^
cylinder 1
6.115000E-01 1.178500E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 1.178500E+01 0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com='fuel rod in water^
cylinder 1
5.325000E-01 6.190000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
6.115000E-01 6.190000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 6.190000E+01 0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com='fuel rod in air^
cylinder 1
5.325000E-01 8.700000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
6.115000E-01 8.700000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
```

```

cuboid      3
             9.125000E-01 -9.125000E-01 9.125000E-01
             -9.125000E-01 8.700000E+00 0.000000E+00
media        7      1      3      -2      -1
boundary     3
unit         11
com='^end plug in air^
cylinder     1
             6.115000E-01 9.970000E+00 0.000000E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media        4      1      1
cuboid       2
             9.125000E-01 -9.125000E-01 9.125000E-01
             -9.125000E-01 9.970000E+00 0.000000E+00
media        7      1      2      -1
boundary     2
unit         12
com='^lattice in water^
cuboid       1
             4.197500E+01 0.000000E+00 4.197500E+01
             0.000000E+00 4.445000E+00 0.000000E+00
array        1      1
             place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid       2
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 4.445000E+00 0.000000E+00
media        8      1      2      -1
boundary     2
unit         13
com='^end plug in water^
cuboid       1
             4.197500E+01 0.000000E+00 4.197500E+01
             0.000000E+00 1.178500E+01 0.000000E+00
array        2      1
             place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid       2
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 1.178500E+01 0.000000E+00
media        8      1      2      -1
boundary     2
unit         14
com='^fuel lattice in water^
cuboid       1
             4.197500E+01 0.000000E+00 4.197500E+01
             0.000000E+00 6.190000E+01 0.000000E+00
array        3      1
             place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid       2
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 6.190000E+01 0.000000E+00
media        8      1      2      -1
boundary     2
unit         15
com='^fuel lattice in air^
cuboid       1
             4.197500E+01 0.000000E+00 4.197500E+01
             0.000000E+00 8.700000E+00 0.000000E+00
array        4      1
             place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid       2
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 8.700000E+00 0.000000E+00
media        7      1      2      -1
boundary     2
unit         16
com='^end plug in air^
cuboid       1
             4.197500E+01 0.000000E+00 4.197500E+01
             0.000000E+00 9.970000E+00 0.000000E+00
array        5      1
             place 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid       2
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 9.970000E+00 0.000000E+00
media        7      1      2      -1
boundary     2
unit         17
com='^middle grid plate^
cuboid       1
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 6.000000E-01 0.000000E+00
media        4      1      1
boundary     1
global unit      18
cuboid 1

```

```

1.019750E+02 0.000000E+00 1.019750E+02
0.000000E+00 1.527700E+02 0.000000E+00
array        6      1
             place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=23 nuy=23 nuz=1 fill 529*6 end fill
ara=2 nux=23 nuy=23 nuz=1 fill 529*8 end fill
ara=3 nux=23 nuy=23 nuz=1 fill 529*9 end fill
ara=4 nux=23 nuy=23 nuz=1 fill 529*10 end fill
ara=5 nux=23 nuy=23 nuz=1 fill 529*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12
fill 1 2 3 4 5 12 7 13 14 15 16 17 end fill
end array
end data
end

```

## 1.14 CASE MIX\_COMP\_THERM\_004\_CAS3\_K6

```

#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.5447-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 3.8361-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end

```

```

end comp
squarepitch 1.825 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.958294
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit
com=^concrete^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 3.700000E+01 0.000000E+00
media 6 1 1
boundary 1
unit 2
com=^lining of core tank^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 5.000000E-01 0.000000E+00
media 5 1 1
boundary 1
unit 3
com=^water^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 1.380000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 4
com=^support plate (ss)^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 2.200000E+00 0.000000E+00
media 5 1 1
boundary 1
unit 5
com=^support plate (al)^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 1.270000E+00 0.000000E+00
media 4 1 1
boundary 1
unit 6
com=^end plug in water^
cylinder 1
6.115000E-01 4.445000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 4.445000E+00 0.000000E+00
media 3 1 2 -1
boundary 2
unit 7
com=^end plug and lower grid^
cuboid 1
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
unit 8
com=^end plug in water^
cylinder 1
6.115000E-01 1.178500E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 1.178500E+01 0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com=^fuel rod in water^
cylinder 1
5.325000E-01 6.406000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
6.115000E-01 6.406000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 6.406000E+01 0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com=^fuel rod in air^
cylinder 1
5.325000E-01 6.540000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
6.115000E-01 6.540000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 6.540000E+00 0.000000E+00
media 7 1 3 -2 -1
boundary 3
unit 11
com=^end plug in air^
cylinder 1
6.115000E-01 9.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.125000E-01 -9.125000E-01 9.125000E-01
-9.125000E-01 9.970000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 12
com=^lattice in water^
cuboid 1
4.197500E+01 0.000000E+00 4.197500E+01
0.000000E+00 4.445000E+00 0.000000E+00
array 1 1 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid 2
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 4.445000E+00 0.000000E+00
media 8 1 2 -1
boundary 2
unit 13
com=^end plug in water^
cuboid 1
4.197500E+01 0.000000E+00 4.197500E+01
0.000000E+00 1.178500E+01 0.000000E+00
array 2 1 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid 2
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 1.178500E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 14
com=^fuel lattice in water^
cuboid 1
4.197500E+01 0.000000E+00 4.197500E+01
0.000000E+00 6.406000E+01 0.000000E+00
array 3 1 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid 2
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 6.406000E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 15
com=^fuel lattice in air^
cuboid 1
4.197500E+01 0.000000E+00 4.197500E+01
0.000000E+00 6.540000E+00 0.000000E+00
array 4 1 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid 2
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 6.540000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 16
com=^end plug in air^
cuboid 1
4.197500E+01 0.000000E+00 4.197500E+01
0.000000E+00 9.970000E+00 0.000000E+00
array 5 1 1 1 1 9.125000E-01 9.125000E-01
0.000000E+00
cuboid 2
7.197500E+01 -3.000000E+01 7.197500E+01
-3.000000E+01 9.970000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 17
com=^middle grid plate^

```

```

cuboid      1
             7.197500E+01 -3.000000E+01 7.197500E+01
             -3.000000E+01 6.000000E-01 0.000000E+00
media       4      1      1
boundary    1
global unit      18
cuboid 1
             1.019750E+02 0.000000E+00 1.019750E+02
             0.000000E+00 1.527700E+02 0.000000E+00
array       6      1
             place 1 1 1      3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=23 nuy=23 nuz=1 fill 529*6 end fill
ara=2 nux=23 nuy=23 nuz=1 fill 529*8 end fill
ara=3 nux=23 nuy=23 nuz=1 fill 529*9 end fill
ara=4 nux=23 nuy=23 nuz=1 fill 529*10 end fill
ara=5 nux=23 nuy=23 nuz=1 fill 529*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

## 1.15 CASE MIX\_COMP\_THERM\_004\_CAS4\_K6

```

#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.8003-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 1.2793-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end

```

```

pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 1.956 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.933571
end more
read param tme=90 gen=600 npg=700 nub=yes nsk=10
end param
read geometry
unit      1
com='^concrete^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 3.700000E+01 0.000000E+00
media 6      1      1
boundary 1
unit      2
com='^lining of core tank^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 5.000000E-01 0.000000E+00
media 5      1      1
boundary 1
unit      3
com='^water^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 1.380000E+01 0.000000E+00
media 8      1      1
boundary 1
unit      4
com='^support plate (ss)^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 2.200000E+00 0.000000E+00
media 5      1      1
boundary 1
unit      5
com='^support plate (al)^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 1.270000E+00 0.000000E+00
media 4      1      1
boundary 1
unit      6
com='^end plug in water^'
cylinder 1
             6.115000E-01 4.445000E+00 0.000000E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media 4      1      1
cuboid 2
             9.780000E-01 -9.780000E-01 9.780000E-01
             -9.780000E-01 4.445000E+00 0.000000E+00
media 3      1      2 -1
boundary 2
unit      7
com='^end plug and lower grid^'
cuboid 1
             7.107600E+01 -3.000000E+01 7.107600E+01
             -3.000000E+01 6.000000E-01 0.000000E+00
media 4      1      1
boundary 1
unit      8
com='^end plug in water^'
cylinder 1
             6.115000E-01 1.178500E+01 0.000000E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media 4      1      1
cuboid 2
             9.780000E-01 -9.780000E-01 9.780000E-01
             -9.780000E-01 1.178500E+01 0.000000E+00
media 3      1      2 -1
boundary 2
unit      9
com='^fuel rod in water^'
cylinder 1
             5.325000E-01 6.150000E+01 0.000000E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media 1      1      1
cylinder 2
             6.115000E-01 6.150000E+01 0.000000E+00
             origin x= 0.000000E+00 y= 0.000000E+00
media 2      1      2 -1
cuboid 3

```

```

          9.780000E-01 -9.780000E-01 9.780000E-01
media      3      1      3      -2      -1
boundary   3
unit      10
com='^fuel rod in air^
cylinder   1
          5.325000E-01 9.100000E+00 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      9      1      1
cylinder   2
          6.115000E-01 9.100000E+00 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      2      1      2      -1
cuboid     3
          9.780000E-01 -9.780000E-01 9.780000E-01
          -9.780000E-01 9.100000E+00 0.000000E+00
media      7      1      3      -2      -1
boundary   3
unit      11
com='^end plug in air^
cylinder   1
          6.115000E-01 9.970000E+00 0.000000E+00
          origin x= 0.000000E+00 y= 0.000000E+00
media      4      1      1
cuboid     2
          9.780000E-01 -9.780000E-01 9.780000E-01
          -9.780000E-01 9.970000E+00 0.000000E+00
media      7      1      2      -1
boundary   2
unit      12
com='^lattice in water^
cuboid     1
          4.107600E+01 0.000000E+00 4.107600E+01
          0.000000E+00 4.445000E+00 0.000000E+00
array      1      1
          place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid     2
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 4.445000E+00 0.000000E+00
media      8      1      2      -1
boundary   2
unit      13
com='^end plug in water^
cuboid     1
          4.107600E+01 0.000000E+00 4.107600E+01
          0.000000E+00 1.178500E+01 0.000000E+00
array      2      1
          place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid     2
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 1.178500E+01 0.000000E+00
media      8      1      2      -1
boundary   2
unit      14
com='^fuel lattice in water^
cuboid     1
          4.107600E+01 0.000000E+00 4.107600E+01
          0.000000E+00 6.150000E+01 0.000000E+00
array      3      1
          place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid     2
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 6.150000E+01 0.000000E+00
media      8      1      2      -1
boundary   2
unit      15
com='^fuel lattice in air^
cuboid     1
          4.107600E+01 0.000000E+00 4.107600E+01
          0.000000E+00 9.100000E+00 0.000000E+00
array      4      1
          place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid     2
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 9.100000E+00 0.000000E+00
media      7      1      2      -1
boundary   2
unit      16
com='^end plug in air^
cuboid     1
          4.107600E+01 0.000000E+00 4.107600E+01
          0.000000E+00 9.970000E+00 0.000000E+00
array      5      1
          place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00

```

```

cuboid     2
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 9.970000E+00 0.000000E+00
media      7      1      2      -1
boundary   2
unit      17
com='^middle grid plate^
cuboid     1
          7.107600E+01 -3.000000E+01 7.107600E+01
          -3.000000E+01 6.000000E-01 0.000000E+00
media      4      1      1
boundary   1
global unit 18
cuboid     1
          1.010760E+02 0.000000E+00 1.010760E+02
          0.000000E+00 1.527700E+02 0.000000E+00
array      6      1
          place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=21 nuy=21 nuz=1 fill 441*6 end fill
ara=2 nux=21 nuy=21 nuz=1 fill 441*8 end fill
ara=3 nux=21 nuy=21 nuz=1 fill 441*9 end fill
ara=4 nux=21 nuy=21 nuz=1 fill 441*10 end fill
ara=5 nux=21 nuy=21 nuz=1 fill 441*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

## 1.16 CASE MIX\_COMP\_THERM\_004\_CAS5\_K6

```

#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.6670-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 2.6129-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end

```

```

h      8 0 6.6735-02 293.15 end
o      8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o      9 0 2.7837-02 293.15 end
b-10  9 0 6.0418-08 293.15 end
b-11  9 0 2.4319-07 293.15 end
end comp
squarepitch 1.956 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.93
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com=^concrete^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 3.700000E+01 0.000000E+00
media 6 1 1
boundary 1
unit 2
com=^lining of core tank^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 5.000000E-01 0.000000E+00
media 5 1 1
boundary 1
unit 3
com=^water^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 1.380000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 4
com=^support plate (ss)^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 2.200000E+00 0.000000E+00
media 5 1 1
boundary 1
unit 5
com=^support plate (al)^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 1.270000E+00 0.000000E+00
media 4 1 1
boundary 1
unit 6
com=^end plug in water^
cylinder 1
6.115000E-01 4.445000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.780000E-01 -9.780000E-01 9.780000E-01
-9.780000E-01 4.445000E+00 0.000000E+00
media 3 1 2 -1
boundary 2
unit 7
com=^end plug and lower grid^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
unit 8
com=^end plug in water^
cylinder 1
6.115000E-01 1.178500E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.780000E-01 -9.780000E-01 9.780000E-01
-9.780000E-01 1.178500E+01 0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com=^fuel rod in water^
cylinder 1
5.325000E-01 6.440000E+01 0.000000E+00
media 1 1 1
cylinder 2
6.115000E-01 6.440000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.780000E-01 -9.780000E-01 9.780000E-01
-9.780000E-01 6.440000E+01 0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com=^fuel rod in air^
cylinder 1
5.325000E-01 6.200000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
6.115000E-01 6.200000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.780000E-01 -9.780000E-01 9.780000E-01
-9.780000E-01 6.200000E+00 0.000000E+00
media 7 1 3 -2 -1
boundary 3
unit 11
com=^end plug in air^
cylinder 1
6.115000E-01 9.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.780000E-01 -9.780000E-01 9.780000E-01
-9.780000E-01 9.970000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 12
com=^lattice in water^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 4.445000E+00 0.000000E+00
array 1 1 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 4.445000E+00 0.000000E+00
media 8 1 2 -1
boundary 2
unit 13
com=^end plug in water^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 1.178500E+01 0.000000E+00
array 2 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 1.178500E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 14
com=^fuel lattice in water^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 6.440000E+01 0.000000E+00
array 3 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 6.440000E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 15
com=^fuel lattice in air^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 6.200000E+00 0.000000E+00
array 4 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 6.200000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 16

```

```
com=^end plug in air^
cuboid 1
    4.107600E+01 0.000000E+00 4.107600E+01
    0.000000E+00 9.970000E+00 0.000000E+00
array 5
    1
    place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 9.970000E+00 0.000000E+00
media 7
    1 2 -1
boundary 2
unit 17
com=^middle grid plate^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 6.000000E-01 0.000000E+00
media 4
    1 1
boundary 1
global unit 18
cuboid 1
    1.010760E+02 0.000000E+00 1.010760E+02
    0.000000E+00 1.527700E+02 0.000000E+00
array 6
    1
    place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=21 nuy=21 nuz=1 fill 441*6 end fill
ara=2 nux=21 nuy=21 nuz=1 fill 441*8 end fill
ara=3 nux=21 nuy=21 nuz=1 fill 441*9 end fill
ara=4 nux=21 nuy=21 nuz=1 fill 441*10 end fill
ara=5 nux=21 nuy=21 nuz=1 fill 441*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end
```

#### 1.17 CASE MIX\_COMP\_THERM\_004\_CAS6\_K6

```
#csas26 parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.4228-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 5.0543-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
```

```
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 1.956 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.93
end more
read param tme=90 gen=600 npg=700
end param
read geometry
unit 1
com=^concrete^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 3.700000E+01 0.000000E+00
media 6
    1 1
boundary 1
unit 2
com=^lining of core tank^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 5.000000E-01 0.000000E+00
media 5
    1 1
boundary 1
unit 3
com=^water^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 1.380000E+01 0.000000E+00
media 8
    1 1
boundary 1
unit 4
com=^support plate (ss)^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 2.200000E+00 0.000000E+00
media 5
    1 1
boundary 1
unit 5
com=^support plate (al)^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 1.270000E+00 0.000000E+00
media 4
    1 1
boundary 1
unit 6
com=^end plug in water^
cylinder 1
    6.115000E-01 4.445000E+00 0.000000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 4
    1 1
cuboid 2
    9.780000E-01 -9.780000E-01 9.780000E-01
    -9.780000E-01 4.445000E+00 0.000000E+00
media 3
    1 2 -1
boundary 2
unit 7
com=^end plug and lower grid^
cuboid 1
    7.107600E+01 -3.000000E+01 7.107600E+01
    -3.000000E+01 6.000000E-01 0.000000E+00
media 4
    1 1
boundary 1
unit 8
com=^end plug in water^
cylinder 1
    6.115000E-01 1.178500E+01 0.000000E+00
    origin x= 0.000000E+00 y= 0.000000E+00
media 4
    1 1
cuboid 2
    9.780000E-01 -9.780000E-01 9.780000E-01
```



```

-9.780000E-01  1.178500E+01  0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com=^fuel rod in water^
cylinder 1
5.325000E-01  6.940000E+01  0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
6.115000E-01  6.940000E+01  0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.780000E-01  -9.780000E-01  9.780000E-01
-9.780000E-01  6.940000E+01  0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com=^fuel rod in air^
cylinder 1
5.325000E-01  1.200000E+00  0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
6.115000E-01  1.200000E+00  0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
9.780000E-01  -9.780000E-01  9.780000E-01
-9.780000E-01  1.200000E+00  0.000000E+00
media 7 1 3 -2 -1
boundary 3
unit 11
com=^end plug in air^
cylinder 1
6.115000E-01  9.970000E+00  0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
9.780000E-01  -9.780000E-01  9.780000E-01
-9.780000E-01  9.970000E+00  0.000000E+00
media 7 1 2 -1
boundary 2
unit 12
com=^lattice in water^
cuboid 1
4.107600E+01  0.000000E+00  4.107600E+01
0.000000E+00  4.445000E+00  0.000000E+00
array 1 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 4.445000E+00 0.000000E+00
media 8 1 2 -1
boundary 2
unit 13
com=^end plug in water^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 1.178500E+01 0.000000E+00
array 2 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 1.178500E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 14
com=^fuel lattice in water^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 6.940000E+01 0.000000E+00
array 3 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 6.940000E+01 0.000000E+00
media 8 1 2 -1
boundary 2
unit 15
com=^fuel lattice in air^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 1.200000E+00 0.000000E+00
array 4 1

```

```

place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 1.200000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 16
com=^end plug in air^
cuboid 1
4.107600E+01 0.000000E+00 4.107600E+01
0.000000E+00 9.970000E+00 0.000000E+00
array 5 1
place 1 1 1 9.780000E-01 9.780000E-01
0.000000E+00
cuboid 2
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 9.970000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 17
com=^middle grid plate^
cuboid 1
7.107600E+01 -3.000000E+01 7.107600E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
global unit 18
cuboid 1
1.010760E+02 0.000000E+00 1.010760E+02
0.000000E+00 1.527700E+02 0.000000E+00
array 6 1
place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=21 nuy=21 nuz=1 fill 441*6 end fill
ara=2 nux=21 nuy=21 nuz=1 fill 441*8 end fill
ara=3 nux=21 nuy=21 nuz=1 fill 441*9 end fill
ara=4 nux=21 nuy=21 nuz=1 fill 441*10 end fill
ara=5 nux=21 nuy=21 nuz=1 fill 441*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

## 1.18 CASE MIX\_COMP\_THERM\_004\_CAS7\_K6

```

#csas26 parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.8133-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 1.1498-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end

```

```

ni      5 0 8.9506-03 293.15 end
cr      5 0 1.7450-02 293.15 end
fe      5 0 5.7202-02 293.15 end
h       6 0 1.3742-02 293.15 end
o       6 0 4.5919-02 293.15 end
c       6 0 1.1532-04 293.15 end
na      6 0 9.6395-04 293.15 end
mg      6 0 1.2388-04 293.15 end
al      6 0 1.7409-03 293.15 end
si      6 0 1.6617-02 293.15 end
k       6 0 4.6052-04 293.15 end
ca      6 0 1.5025-03 293.15 end
fe      6 0 3.4492-04 293.15 end
n       7 0 4.325-05 293.15 end
o       7 0 1.08-05 293.15 end
h       8 0 6.6735-02 293.15 end
o       8 0 3.3368-02 293.15 end
u-234   9 0 7.1749-07 293.15 end
u-235   9 0 9.3926-05 293.15 end
u-238   9 0 1.2951-02 293.15 end
pu-238  9 0 2.0003-06 293.15 end
pu-239  9 0 2.7491-04 293.15 end
pu-240  9 0 8.8417-05 293.15 end
pu-241  9 0 2.7923-05 293.15 end
pu-242  9 0 8.1234-06 293.15 end
am-241  9 0 1.3531-06 293.15 end
o       9 0 2.7837-02 293.15 end
b-10    9 0 6.0418-08 293.15 end
b-11    9 0 2.4319-07 293.15 end
end comp
squarepitch 2.225 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.966935
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com='concrete'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 3.700000E+01 0.000000E+00
media 6
boundary 1
unit 2
com='lining of core tank'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 5.000000E-01 0.000000E+00
media 5
boundary 1
unit 3
com='water'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.380000E+01 0.000000E+00
media 8
boundary 1
unit 4
com='support plate (ss)'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 2.200000E+00 0.000000E+00
media 5
boundary 1
unit 5
com='support plate (al)'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.270000E+00 0.000000E+00
media 4
boundary 1
unit 6
com='end plug in water'
cylinder 1
6.115000E-01 4.445000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 4.445000E+00 0.000000E+00
media 3
boundary 2
unit 7
com='end plug and lower grid'
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4
boundary 1

```

```

unit 8
com='end plug in water'
cylinder 1
6.115000E-01 1.178500E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 1.178500E+01 0.000000E+00
media 3
boundary 2
unit 9
com='fuel rod in water'
cylinder 1
5.325000E-01 6.032000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1
cylinder 2
6.115000E-01 6.032000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2
cuboid 3
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 6.032000E+01 0.000000E+00
media 3
boundary 3
unit 10
com='fuel rod in air'
cylinder 1
5.325000E-01 1.028000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9
cylinder 2
6.115000E-01 1.028000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2
cuboid 3
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 1.028000E+01 0.000000E+00
media 7
boundary 3
unit 11
com='end plug in air'
cylinder 1
6.115000E-01 9.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 9.970000E+00 0.000000E+00
media 7
boundary 2
unit 12
com='lattice in water'
cuboid 1
4.450000E+01 0.000000E+00 4.450000E+01
0.000000E+00 4.445000E+00 0.000000E+00
array 1
place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid 2
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 4.445000E+00 0.000000E+00
media 8
boundary 2
unit 13
com='end plug in water'
cuboid 1
4.450000E+01 0.000000E+00 4.450000E+01
0.000000E+00 1.178500E+01 0.000000E+00
array 2
place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid 2
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.178500E+01 0.000000E+00
media 8
boundary 2
unit 14
com='fuel lattice in water'
cuboid 1
4.450000E+01 0.000000E+00 4.450000E+01
0.000000E+00 6.032000E+01 0.000000E+00
array 3
place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid 2
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 6.032000E+01 0.000000E+00
media 8
boundary 2

```

```
boundary      2
unit          15
com='^fuel lattice in air^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 1.028000E+01 0.000000E+00
array         4
              1
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 1.028000E+01 0.000000E+00
media         7
              1      2 -1
boundary      2
unit          16
com='^end plug in air^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 9.970000E+00 0.000000E+00
array         5
              1
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 9.970000E+00 0.000000E+00
media         7
              1      2 -1
boundary      2
unit          17
com='^middle grid plate^
cuboid        1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 6.000000E+01 0.000000E+00
media         4
              1      1
boundary      1
global unit   18
cuboid 1
              1.045000E+02 0.000000E+00 1.045000E+02
              0.000000E+00 1.527700E+02 0.000000E+00
array         6
              1
              place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=20 nuy=20 nuz=1 fill 400*6 end fill
ara=2 nux=20 nuy=20 nuz=1 fill 400*8 end fill
ara=3 nux=20 nuy=20 nuz=1 fill 400*9 end fill
ara=4 nux=20 nuy=20 nuz=1 fill 400*10 end fill
ara=5 nux=20 nuy=20 nuz=1 fill 400*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end
```

## 1.19 CASE MIX\_COMP\_THERM\_004\_CAS8\_K6

```
#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.6649-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 2.6340-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end
sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
```

```
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 2.225 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.97
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com='^concrete^
cuboid 1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 3.700000E+01 0.000000E+00
media 6
              1      1
boundary 1
unit 2
com='^lining of core tank^
cuboid 1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 5.000000E+01 0.000000E+00
media 5
              1      1
boundary 1
unit 3
com='^water^
cuboid 1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 1.380000E+01 0.000000E+00
media 8
              1      1
boundary 1
unit 4
com='^support plate (ss)^
cuboid 1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 2.200000E+00 0.000000E+00
media 5
              1      1
boundary 1
unit 5
com='^support plate (al)^
cuboid 1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 1.270000E+00 0.000000E+00
media 4
              1      1
boundary 1
unit 6
com='^end plug in water^
cylinder 1
              6.115000E-01 4.445000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media 4
              1      1
cuboid 2
              1.112500E+00 -1.112500E+00 1.112500E+00
              -1.112500E+00 4.445000E+00 0.000000E+00
media 3
              1      2 -1
boundary 2
```

```

unit          7
com=^end plug and lower grid^
cuboid        1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 6.000000E-01 0.000000E+00
media         4
boundary      1
unit          8
com=^end plug in water^
cylinder      1
              6.115000E-01 1.178500E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         4
cuboid        2
              1.112500E+00 -1.112500E+00 1.112500E+00
              -1.112500E+00 1.178500E+01 0.000000E+00
media         3
boundary      2
unit          9
com=^fuel rod in water^
cylinder      1
              5.325000E-01 6.299000E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         1
cylinder      2
              6.115000E-01 6.299000E+01 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        3
              1.112500E+00 -1.112500E+00 1.112500E+00
              -1.112500E+00 6.299000E+01 0.000000E+00
media         3
boundary      3
unit          10
com=^fuel rod in air^
cylinder      1
              5.325000E-01 7.610000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         9
cylinder      2
              6.115000E-01 7.610000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         2
cuboid        3
              1.112500E+00 -1.112500E+00 1.112500E+00
              -1.112500E+00 7.610000E+00 0.000000E+00
media         7
boundary      3
unit          11
com=^end plug in air^
cylinder      1
              6.115000E-01 9.970000E+00 0.000000E+00
              origin x= 0.000000E+00 y= 0.000000E+00
media         4
cuboid        2
              1.112500E+00 -1.112500E+00 1.112500E+00
              -1.112500E+00 9.970000E+00 0.000000E+00
media         7
boundary      2
unit          12
com=^lattice in water^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 4.450000E+00 0.000000E+00
array         1
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 4.450000E+00 0.000000E+00
media         8
boundary      2
unit          13
com=^end plug in water^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 1.178500E+01 0.000000E+00
array         2
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 1.178500E+01 0.000000E+00
media         8
boundary      2
unit          14
com=^fuel lattice in water^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 6.299000E+01 0.000000E+00

```

```

array         3
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 6.299000E+01 0.000000E+00
media         8
boundary      2
unit          15
com=^fuel lattice in air^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 7.610000E+00 0.000000E+00
array         4
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 7.610000E+00 0.000000E+00
media         7
boundary      2
unit          16
com=^end plug in air^
cuboid        1
              4.450000E+01 0.000000E+00 4.450000E+01
              0.000000E+00 9.970000E+00 0.000000E+00
array         5
              place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid        2
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 9.970000E+00 0.000000E+00
media         7
boundary      2
unit          17
com=^middle grid plate^
cuboid        1
              7.450000E+01 -3.000000E+01 7.450000E+01
              -3.000000E+01 6.000000E-01 0.000000E+00
media         4
boundary      1
global unit   18
cuboid 1
              1.045000E+02 0.000000E+00 1.045000E+02
              0.000000E+00 1.527700E+02 0.000000E+00
array         6
              place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=20 nuy=20 nuz=1 fill 400*6 end fill
ara=2 nux=20 nuy=20 nuz=1 fill 400*8 end fill
ara=3 nux=20 nuy=20 nuz=1 fill 400*9 end fill
ara=4 nux=20 nuy=20 nuz=1 fill 400*10 end fill
ara=5 nux=20 nuy=20 nuz=1 fill 400*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end

```

#### 1.20 CASE MIX\_COMP\_THERM\_004\_CAS9\_K6

```

#csas26      parm='size=00500000'
experience mix_comp_therm_004 cas1
238group
latticecell
u-234 1 0 7.1749-07 293.15 end
u-235 1 0 9.3926-05 293.15 end
u-238 1 0 1.2951-02 293.15 end
pu-238 1 0 2.0003-06 293.15 end
pu-239 1 0 2.7491-04 293.15 end
pu-240 1 0 8.8417-05 293.15 end
pu-241 1 0 2.5373-05 293.15 end
pu-242 1 0 8.1234-06 293.15 end
am-241 1 0 3.9098-06 293.15 end
o 1 0 2.7837-02 293.15 end
b-10 1 0 6.0418-08 293.15 end
b-11 1 0 2.4319-07 293.15 end
zr 2 0 3.7772-02 293.15 end
sn-112 2 0 4.2425-06 293.15 end
sn-114 2 0 2.8429-06 293.15 end
sn-115 2 0 1.5745-06 293.15 end
sn-116 2 0 6.3550-05 293.15 end
sn-117 2 0 3.3590-05 293.15 end
sn-118 2 0 1.0593-04 293.15 end
sn-119 2 0 3.7526-05 293.15 end

```

```

sn-120 2 0 1.4254-04 293.15 end
sn-122 2 0 2.0250-05 293.15 end
sn-124 2 0 2.5324-05 293.15 end
fe 2 0 8.8570-05 293.15 end
cr 2 0 6.6119-05 293.15 end
ni 2 0 3.5864-05 293.15 end
h 3 0 6.6735-02 293.15 end
o 3 0 3.3368-02 293.15 end
al 4 0 6.0224-02 293.15 end
c 5 0 1.1928-04 293.15 end
si 5 0 1.7003-03 293.15 end
mn 5 0 1.7385-03 293.15 end
p 5 0 6.9381-05 293.15 end
s 5 0 4.4673-05 293.15 end
ni 5 0 8.9506-03 293.15 end
cr 5 0 1.7450-02 293.15 end
fe 5 0 5.7202-02 293.15 end
h 6 0 1.3742-02 293.15 end
o 6 0 4.5919-02 293.15 end
c 6 0 1.1532-04 293.15 end
na 6 0 9.6395-04 293.15 end
mg 6 0 1.2388-04 293.15 end
al 6 0 1.7409-03 293.15 end
si 6 0 1.6617-02 293.15 end
k 6 0 4.6052-04 293.15 end
ca 6 0 1.5025-03 293.15 end
fe 6 0 3.4492-04 293.15 end
n 7 0 4.325-05 293.15 end
o 7 0 1.08-05 293.15 end
h 8 0 6.6735-02 293.15 end
o 8 0 3.3368-02 293.15 end
u-234 9 0 7.1749-07 293.15 end
u-235 9 0 9.3926-05 293.15 end
u-238 9 0 1.2951-02 293.15 end
pu-238 9 0 2.0003-06 293.15 end
pu-239 9 0 2.7491-04 293.15 end
pu-240 9 0 8.8417-05 293.15 end
pu-241 9 0 2.7923-05 293.15 end
pu-242 9 0 8.1234-06 293.15 end
am-241 9 0 1.3531-06 293.15 end
o 9 0 2.7837-02 293.15 end
b-10 9 0 6.0418-08 293.15 end
b-11 9 0 2.4319-07 293.15 end
end comp
squarepitch 2.225 1.065 1 3 1.223 2 end
more data
res=9 cylinder 0.5325 dan(9)=0.97
end more
read param tme=90 gen=600 npg=700 nub=yes
end param
read geometry
unit 1
com=^concrete^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 3.700000E+01 0.000000E+00
media 6 1 1
boundary 1
unit 2
com=^lining of core tank^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 5.000000E-01 0.000000E+00
media 5 1 1
boundary 1
unit 3
com=^water^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.380000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 4
com=^support plate (ss)^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 2.200000E+00 0.000000E+00
media 5 1 1
boundary 1
unit 5
com=^support plate (al)^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.270000E+00 0.000000E+00
media 4 1 1
boundary 1
unit 6
com=^end plug in water^
cylinder 1
6.115000E-01 4.445000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 4.445000E+00 0.000000E+00
media 3 1 2 -1
boundary 2
unit 7
com=^end plug and lower grid^
cuboid 1
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 6.000000E-01 0.000000E+00
media 4 1 1
boundary 1
unit 8
com=^end plug in water^
cylinder 1
6.115000E-01 1.178500E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 1.178500E+01 0.000000E+00
media 3 1 2 -1
boundary 2
unit 9
com=^fuel rod in water^
cylinder 1
5.325000E-01 6.563000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 1 1 1
cylinder 2
6.115000E-01 6.563000E+01 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 6.563000E+01 0.000000E+00
media 3 1 3 -2 -1
boundary 3
unit 10
com=^fuel rod in air^
cylinder 1
5.325000E-01 4.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 9 1 1
cylinder 2
6.115000E-01 4.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 2 1 2 -1
cuboid 3
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 4.970000E+00 0.000000E+00
media 7 1 3 -2 -1
boundary 3
unit 11
com=^end plug in air^
cylinder 1
6.115000E-01 9.970000E+00 0.000000E+00
origin x= 0.000000E+00 y= 0.000000E+00
media 4 1 1
cuboid 2
1.112500E+00 -1.112500E+00 1.112500E+00
-1.112500E+00 9.970000E+00 0.000000E+00
media 7 1 2 -1
boundary 2
unit 12
com=^lattice in water^
cuboid 1
4.450000E+01 0.000000E+00 4.450000E+01
0.000000E+00 4.445000E+00 0.000000E+00
array 1 1
place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid 2
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 4.445000E+00 0.000000E+00
media 8 1 2 -1
boundary 2
unit 13
com=^end plug in water^
cuboid 1
4.450000E+01 0.000000E+00 4.450000E+01
0.000000E+00 1.178500E+01 0.000000E+00
array 2 1
place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid 2
7.450000E+01 -3.000000E+01 7.450000E+01
-3.000000E+01 1.178500E+01 0.000000E+00

```

```
media      8      1      2      -1
boundary   2
unit       14
com='fuel lattice in water'
cuboid     1
           4.450000E+01 0.000000E+00 4.450000E+01
           0.000000E+00 6.563000E+01 0.000000E+00
array      3      1
           place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid     2
           7.450000E+01 -3.000000E+01 7.450000E+01
           -3.000000E+01 6.563000E+01 0.000000E+00
media      8      1      2      -1
boundary   2
unit       15
com='fuel lattice in air'
cuboid     1
           4.450000E+01 0.000000E+00 4.450000E+01
           0.000000E+00 4.970000E+00 0.000000E+00
array      4      1
           place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid     2
           7.450000E+01 -3.000000E+01 7.450000E+01
           -3.000000E+01 4.970000E+00 0.000000E+00
media      7      1      2      -1
boundary   2
unit       16
com='end plug in air'
cuboid     1
           4.450000E+01 0.000000E+00 4.450000E+01
           0.000000E+00 9.970000E+00 0.000000E+00
array      5      1
           place 1 1 1 1.112500E+00 1.112500E+00
0.000000E+00
cuboid     2
           7.450000E+01 -3.000000E+01 7.450000E+01
           -3.000000E+01 9.970000E+00 0.000000E+00
media      7      1      2      -1
boundary   2
unit       17
com='middle grid plate'
cuboid     1
           7.450000E+01 -3.000000E+01 7.450000E+01
           -3.000000E+01 6.000000E-01 0.000000E+00
media      4      1      1
boundary   1
global unit 18
cuboid 1
           1.045000E+02 0.000000E+00 1.045000E+02
           0.000000E+00 1.527700E+02 0.000000E+00
array      6      1
           place 1 1 1 3.000000E+01 3.000000E+01
0.000000E+00
boundary 1
end geometry

read array
ara=1 nux=20 nuy=20 nuz=1 fill 400*6 end fill
ara=2 nux=20 nuy=20 nuz=1 fill 400*8 end fill
ara=3 nux=20 nuy=20 nuz=1 fill 400*9 end fill
ara=4 nux=20 nuy=20 nuz=1 fill 400*10 end fill
ara=5 nux=20 nuy=20 nuz=1 fill 400*11 end fill
gbl=6 ara=6 nux=1 nuy=1 nuz=12 fill 1 2 3 4 5 12 7 13 14 15
16 17 end fill
end array
end data
end
```

## 1.21 CASE MIXCT\_005\_CASE1\_K6

```
#csas26      parm='size=00100000'
4 wt 18 enrich puo2. lattice a. 253 pins. case new base
238group      latticecell
'FUEL
pu-238      1 0 2.3455e-06 298 end
pu-239      1 0 6.3144e-04 298 end
pu-240      1 0 1.5162e-04 298 end
pu-241      1 0 4.0198e-05 298 end
am-241      1 0 3.1834e-06 298 end
pu-242      1 0 9.6333e-06 298 end
u-234      1 0 1.1117e-06 298 end
u-235      1 0 1.4553e-04 298 end
u-238      1 0 2.0066e-02 298 end
o          1 0 4.2714e-02 298 end
'ZIRC-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
```

```
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112     2 0 4.6877e-06 298 end
sn-114     2 0 3.1413e-06 298 end
sn-115     2 0 1.7398e-06 298 end
sn-116     2 0 7.0219e-05 298 end
sn-117     2 0 3.7115e-05 298 end
sn-118     2 0 1.1705e-04 298 end
sn-119     2 0 4.1465e-05 298 end
sn-120     2 0 1.5750e-04 298 end
sn-122     2 0 2.2375e-05 298 end
sn-124     2 0 2.7981e-05 298 end
'WATER
h          3 0 6.6662e-02 298 end
o          3 0 3.3331e-02 298 end
'Lucite
c          4 0 3.5489e-02 298 end
h          4 0 5.6782e-02 298 end
o          4 0 1.4196e-02 298 end
' UO2 powder
u-234      5 0 1.1580e-06 298 end
u-235      5 0 1.5160e-04 298 end
u-238      5 0 2.0902e-02 298 end
o          5 0 4.2715e-02 298 end
end comp
triangpitch 2.1590 1.26366 1 3 1.43384 2 end
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=80
nub=yes end parm
read geometry
unit       1
com='fuel pin. top'
cylinder   1
           6.318300E-01 2.254250E+01 1.081300E+00
           origin x= 0.000000E+00 y=
0.000000E+00
           chord -y= 0.000000E+00
media      1      1      1
cylinder   2
           6.318300E-01 2.254250E+01 6.985000E-01
           origin x= 0.000000E+00 y=
0.000000E+00
           chord -y= 0.000000E+00
media      5      1      2      -1
cylinder   3
           7.169200E-01 2.254250E+01 6.985000E-01
           origin x= 0.000000E+00 y=
0.000000E+00
           chord -y= 0.000000E+00
media      2      1      3      -2      -1
cylinder   4
           7.169200E-01 2.254250E+01 0.000000E+00
           origin x= 0.000000E+00 y=
0.000000E+00
           chord -y= 0.000000E+00
media      2      1      4      -3      -2      -1
boundary   4
unit       2
com='fuel pin. bottom'
cylinder   1
           6.318300E-01 2.254250E+01 1.081300E+00
           origin x= 0.000000E+00 y=
0.000000E+00
           chord +y= 0.000000E+00
media      1      1      1
cylinder   2
           6.318300E-01 2.254250E+01 6.985000E-01
           origin x= 0.000000E+00 y=
0.000000E+00
           chord +y= 0.000000E+00
media      5      1      2      -1
cylinder   3
           7.169200E-01 2.254250E+01 6.985000E-01
           origin x= 0.000000E+00 y=
0.000000E+00
           chord +y= 0.000000E+00
media      2      1      3      -2      -1
cylinder   4
           7.169200E-01 2.254250E+01 0.000000E+00
           origin x= 0.000000E+00 y=
0.000000E+00
           chord +y= 0.000000E+00
media      2      1      4      -3      -2      -1
boundary   4
unit       3
com='fuel pin. left'
cylinder   1
           6.318300E-01 2.254250E+01 1.081300E+00
           origin x= 0.000000E+00 y=
0.000000E+00
           chord +x= 0.000000E+00
```

```

media 1 1 1
cylinder 2
    6.318300E-01 2.254250E+01 6.985000E-01
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 5 1 2 -1
cylinder 3
    7.169200E-01 2.254250E+01 6.985000E-01
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
    7.169200E-01 2.254250E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 4
com=^fuel pin. right^
cylinder 1
    6.318300E-01 2.254250E+01 1.081300E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    6.318300E-01 2.254250E+01 6.985000E-01
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 5 1 2 -1
cylinder 3
    7.169200E-01 2.254250E+01 6.985000E-01
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
    7.169200E-01 2.254250E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 5
com=^fuel pin. top^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 6
com=^fuel pin. bottom^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 7
com=^fuel pin. left^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00

```

```

media 2 1 2 -1
boundary 2
unit 8
com=^fuel pin. right^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 9
com=^fuel pin. top^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 10
com=^fuel pin. bottom^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 11
com=^fuel pin. left^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 12
com=^fuel pin. right^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=^fuel pin. top^
cylinder 1
    6.318300E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00

```

```

media      2      1      2      -1
cylinder   3
          7.169200E-01  2.279650E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -y= 0.000000E+00
media      2      1      3      -2      -1
boundary   3
unit       14
com='fuel pin. bottom'
cylinder   1
          6.318300E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      1      1      1
cylinder   2
          7.169200E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      2      1      2      -1
cylinder   3
          7.169200E-01  2.279650E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      2      1      3      -2      -1
boundary   3
unit       15
com='fuel pin. left'
cylinder   1
          6.318300E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      1      1      1
cylinder   2
          7.169200E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      2      1      2      -1
cylinder   3
          7.169200E-01  2.279650E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      2      1      3      -2      -1
boundary   3
unit       16
com='fuel pin. right'
cylinder   1
          6.318300E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      1      1      1
cylinder   2
          7.169200E-01  2.197100E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      2      1      2      -1
cylinder   3
          7.169200E-01  2.279650E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      2      1      3      -2      -1
boundary   3
unit       21
com='fuel pin. top'
cylinder   1
          7.169200E-01  2.254250E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -y= 0.000000E+00
media      3      1      1
boundary   1
unit       22
com='fuel pin. bottom'
cylinder   1
          7.169200E-01  2.254250E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      3      1      1
boundary   1
unit       23

```

```

com='fuel pin. left'
cylinder   1
          7.169200E-01  2.254250E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      3      1      1
boundary   1
unit       24
com='fuel pin. right'
cylinder   1
          7.169200E-01  2.254250E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      3      1      1
boundary   1
unit       25
com='fuel pin. top'
cylinder   1
          7.169200E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -y= 0.000000E+00
media      3      1      1
boundary   1
unit       26
com='fuel pin. bottom'
cylinder   1
          7.169200E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      3      1      1
boundary   1
unit       27
com='fuel pin. left'
cylinder   1
          7.169200E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      3      1      1
boundary   1
unit       28
com='fuel pin. right'
cylinder   1
          7.169200E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      3      1      1
boundary   1
unit       29
com='fuel pin. top'
cylinder   1
          7.169200E-01  4.381500E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -y= 0.000000E+00
media      3      1      1
boundary   1
unit       30
com='fuel pin. bottom'
cylinder   1
          7.169200E-01  4.381500E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +y= 0.000000E+00
media      3      1      1
boundary   1
unit       31
com='fuel pin. left'
cylinder   1
          7.169200E-01  4.381500E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord +x= 0.000000E+00
media      3      1      1
boundary   1
unit       32
com='fuel pin. right'
cylinder   1
          7.169200E-01  4.381500E+01  0.000000E+00
          origin x= 0.000000E+00      y=
0.000000E+00
          chord -x= 0.000000E+00
media      3      1      1
boundary   1
unit       33

```



```

com=^fuel pin. top^
cylinder 1
          7.169200E-01 2.279650E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 34
com=^fuel pin. bottom^
cylinder 1
          7.169200E-01 2.279650E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 35
com=^fuel pin. left^
cylinder 1
          7.169200E-01 2.279650E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 36
com=^fuel pin. right^
cylinder 1
          7.169200E-01 2.279650E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 41
com=^4 fuel^
cuboid 1
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 1.869700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -1.869700E+00 z=
1.905100E+00
hole 3 origin x= -1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.444770E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.635280E+01
hole 11 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 7.016790E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.016790E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.207300E+01
hole 15 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 43
com=^3 fuel. water bottom^
cuboid 1
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1

```

```

hole 1 origin x= 0.000000E+00 y= 1.869700E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -1.869700E+00 z=
1.905100E+00
hole 3 origin x= -1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 2.635271E+01 0.000000E+00
media 4
    1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.444770E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 7.016781E+01 0.000000E+00
media 3
    1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.635280E+01
hole 11 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 7.207291E+01 0.000000E+00
media 4
    1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.016790E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 1.156335E+02 0.000000E+00
media 3
    1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.207300E+01
hole 35 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 45
com=^3 fuel. water right^
cuboid 1
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 1.905000E+00 0.000000E+00
media 4
    1 1
cuboid 2
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 2.444761E+01 0.000000E+00
media 3
    1 2 -1
hole 1 origin x= 0.000000E+00 y= 1.869700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -1.869700E+00 z=
1.905100E+00
hole 3 origin x= -1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 2.635271E+01 0.000000E+00
media 4
    1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.444770E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 7.016781E+01 0.000000E+00
media 3
    1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.635280E+01
hole 11 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 7.207291E+01 0.000000E+00
media 4
    1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.016790E+01
hole 7 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
    1.079500E+00 -1.079500E+00 1.869700E+00
    -1.869700E+00 7.016781E+01 0.000000E+00

```

			-1.869700E+00	1.156335E+02	0.000000E+00	
media	3	1	6	-5 -4 -3	-2 -1	
hole	13	origin x=	0.000000E+00	y=	1.869700E+00	z=
7.207300E+01						
hole	14	origin x=	0.000000E+00	y=	-1.869700E+00	z=
7.207300E+01						
hole	15	origin x=	-1.079500E+00	y=	0.000000E+00	z=
7.207300E+01						
hole	36	origin x=	1.079500E+00	y=	0.000000E+00	z=
7.207300E+01						
boundary	6					
unit	46					
com=^2 fuel.		water right and top^				
cuboid	1					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	1.905000E+00	0.000000E+00	
media	4	1	1			
cuboid	2					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	2.444761E+01	0.000000E+00	
media	3	1	2	-1		
hole	21	origin x=	0.000000E+00	y=	1.869700E+00	z=
1.905100E+00						
hole	2	origin x=	0.000000E+00	y=	-1.869700E+00	z=
1.905100E+00						
hole	3	origin x=	-1.079500E+00	y=	0.000000E+00	z=
1.905100E+00						
hole	24	origin x=	1.079500E+00	y=	0.000000E+00	z=
1.905100E+00						
cuboid	3					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	2.635271E+01	0.000000E+00	
media	4	1	3	-2	-1	
hole	25	origin x=	0.000000E+00	y=	1.869700E+00	z=
2.444770E+01						
hole	6	origin x=	0.000000E+00	y=	-1.869700E+00	z=
2.444770E+01						
hole	7	origin x=	-1.079500E+00	y=	0.000000E+00	z=
2.444770E+01						
hole	28	origin x=	1.079500E+00	y=	0.000000E+00	z=
2.444770E+01						
cuboid	4					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	7.016781E+01	0.000000E+00	
media	3	1	4	-3	-2	-1
hole	29	origin x=	0.000000E+00	y=	1.869700E+00	z=
2.635280E+01						
hole	10	origin x=	0.000000E+00	y=	-1.869700E+00	z=
2.635280E+01						
hole	11	origin x=	-1.079500E+00	y=	0.000000E+00	z=
2.635280E+01						
hole	32	origin x=	1.079500E+00	y=	0.000000E+00	z=
2.635280E+01						
cuboid	5					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	7.207291E+01	0.000000E+00	
media	4	1	5	-4	-3	-2
hole	25	origin x=	0.000000E+00	y=	1.869700E+00	z=
7.016790E+01						
hole	6	origin x=	0.000000E+00	y=	-1.869700E+00	z=
7.016790E+01						
hole	7	origin x=	-1.079500E+00	y=	0.000000E+00	z=
7.016790E+01						
hole	28	origin x=	1.079500E+00	y=	0.000000E+00	z=
7.016790E+01						
cuboid	6					
			1.079500E+00	-1.079500E+00	1.869700E+00	
			-1.869700E+00	1.156335E+02	0.000000E+00	
media	3	1	6	-5 -4 -3	-2 -1	
hole	33	origin x=	0.000000E+00	y=	1.869700E+00	z=
7.207300E+01						
hole	14	origin x=	0.000000E+00	y=	-1.869700E+00	

```

hole      22 origin x=  0.000000E+00  y= -1.869700E+00  z=
1.905100E+00
hole      3 origin x= -1.079500E+00  y=  0.000000E+00  z=
1.905100E+00
hole     24 origin x=  1.079500E+00  y=  0.000000E+00  z=
1.905100E+00
cuboid    3
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  2.635271E+01  0.000000E+00
media     4      1      3 -2 -1
hole      5 origin x=  0.000000E+00  y=  1.869700E+00  z=
2.444770E+01
hole     26 origin x=  0.000000E+00  y= -1.869700E+00  z=
2.444770E+01
hole      7 origin x= -1.079500E+00  y=  0.000000E+00  z=
2.444770E+01
hole     28 origin x=  1.079500E+00  y=  0.000000E+00  z=
2.444770E+01
cuboid    4
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  7.016781E+01  0.000000E+00
media     3      1      4 -3 -2 -1
hole      9 origin x=  0.000000E+00  y=  1.869700E+00  z=
2.635280E+01
hole     30 origin x=  0.000000E+00  y= -1.869700E+00  z=
2.635280E+01
hole     11 origin x= -1.079500E+00  y=  0.000000E+00  z=
2.635280E+01
hole     32 origin x=  1.079500E+00  y=  0.000000E+00  z=
2.635280E+01
cuboid    5
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  7.207291E+01  0.000000E+00
media     4      1      5 -4 -3 -2 -1
hole      5 origin x=  0.000000E+00  y=  1.869700E+00  z=
7.016790E+01
hole     26 origin x=  0.000000E+00  y= -1.869700E+00  z=
7.016790E+01
hole      7 origin x= -1.079500E+00  y=  0.000000E+00  z=
7.016790E+01
hole     28 origin x=  1.079500E+00  y=  0.000000E+00  z=
7.016790E+01
cuboid    6
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  1.156335E+02  0.000000E+00
media     3      1      6 -5 -4 -3 -2 -1
hole     13 origin x=  0.000000E+00  y=  1.869700E+00  z=
7.207300E+01
hole     34 origin x=  0.000000E+00  y= -1.869700E+00  z=
7.207300E+01
hole     15 origin x= -1.079500E+00  y=  0.000000E+00  z=
7.207300E+01
hole     36 origin x=  1.079500E+00  y=  0.000000E+00  z=
7.207300E+01
boundary  6
unit      48
com=~2 fuel. water left and bottom^
cuboid    1
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  1.905000E+00  0.000000E+00
media     4      1      1
cuboid    2
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  2.444761E+01  0.000000E+00
media     3      1      2 -1
hole      1 origin x=  0.000000E+00  y=  1.869700E+00  z=
1.905100E+00
hole     22 origin x=  0.000000E+00  y= -1.869700E+00  z=
1.905100E+00
hole     23 origin x= -1.079500E+00  y=  0.000000E+00  z=
1.905100E+00
hole      4 origin x=  1.079500E+00  y=  0.000000E+00  z=
1.905100E+00
cuboid    3
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  2.635271E+01  0.000000E+00
media     4      1      3 -2 -1
hole      5 origin x=  0.000000E+00  y=  1.869700E+00  z=
2.444770E+01
hole     26 origin x=  0.000000E+00  y= -1.869700E+00  z=
2.444770E+01
hole     27 origin x= -1.079500E+00  y=  0.000000E+00  z=
2.444770E+01
hole      8 origin x=  1.079500E+00  y=  0.000000E+00  z=
2.444770E+01
cuboid    4
      1.079500E+00 -1.079500E+00  1.869700E+00
      -1.869700E+00  7.016781E+01  0.000000E+00
media     3      1      4 -3 -2 -1

```





```

media      3      1      6     -5  -4  -3  -2  -1
hole      33 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.207300E+01
hole      35 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
hole      16 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary   6
unit       54
com='^0 fuel^
cuboid     1
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 2.444761E+01 0.000000E+00
media      3      1      2     -1
hole      21 origin x= 0.000000E+00 y= 1.869700E+00 z=
1.905100E+00
hole      22 origin x= 0.000000E+00 y= -1.869700E+00 z=
1.905100E+00
hole      23 origin x= -1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
hole      24 origin x= 1.079500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid     3
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 2.635271E+01 0.000000E+00
media      4      1      3     -2     -1
hole      25 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.444770E+01
hole      26 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.444770E+01
hole      27 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
hole      28 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid     4
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 7.016781E+01 0.000000E+00
media      3      1      4     -3     -2     -1
hole      29 origin x= 0.000000E+00 y= 1.869700E+00 z=
2.635280E+01
hole      30 origin x= 0.000000E+00 y= -1.869700E+00 z=
2.635280E+01
hole      31 origin x= -1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
hole      32 origin x= 1.079500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid     5
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 7.207291E+01 0.000000E+00
media      4      1      5     -4     -3     -2     -1
hole      25 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.016790E+01
hole      26 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.016790E+01
hole      27 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
hole      28 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid     6
          1.079500E+00 -1.079500E+00 1.869700E+00
          -1.869700E+00 1.156335E+02 0.000000E+00
media      3      1      6     -5  -4  -3  -2  -1
hole      33 origin x= 0.000000E+00 y= 1.869700E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -1.869700E+00 z=
7.207300E+01
hole      35 origin x= -1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
hole      36 origin x= 1.079500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary   6
global
unit       55
com='^tank with al and core^
cuboid     1
          1.619300E+01 -2.051000E+01 1.495400E+01
          -2.244000E+01 1.156335E+02 0.000000E+00
array      1      1
          place 1 1 1 -1.943050E+01 -2.057030E+01
0.000000E+00
cylinder   2
          6.500000E+01 1.156335E+02 -1.492250E+01
          origin x= 0.000000E+00 y= 0.000000E+00
media      3      1      2     -1

```

```

boundary   2
end geometry

read array
ara=1 nux=17 nuy=10 nuz=1
com='!253 pins. fuel core array!
fill
54 54 54 54 51 48 43 43 43 43 43 47 51 54 54 54 54
54 54 48 43 41 41 41 41 41 41 41 41 41 43 47 54 54
54 48 41 41 41 41 41 41 41 41 41 41 41 41 41 47 54
48 41 41 41 41 41 41 41 41 41 41 41 41 41 41 47
44 41 41 41 41 41 41 41 41 41 41 41 41 41 41 45
44 41 41 41 41 41 41 41 41 41 41 41 41 41 41 45
49 41 41 41 41 41 41 41 41 41 41 41 41 41 41 46
54 49 41 41 41 41 41 41 41 41 41 41 41 41 41 46 54
54 54 49 42 41 41 41 41 41 41 41 41 41 42 46 54 54
54 54 54 54 50 49 42 42 42 42 42 46 50 54 54 54 54
end fill
end array
end data
end

```

## 1.22 CASE MIXCT\_005\_CASE2\_K6

```

#csas26      parm='size=00500000'
4 wt 18 enrich puo2, lattice a, 253 pins
238group      latticecell
'FUEL
pu-238      1 0 2.3455e-06 298 end
pu-239      1 0 6.3144e-04 298 end
pu-240      1 0 1.5162e-04 298 end
pu-241      1 0 4.0198e-05 298 end
am-241      1 0 3.1834e-06 298 end
pu-242      1 0 9.6333e-06 298 end
u-234      1 0 1.1117e-06 298 end
u-235      1 0 1.4553e-04 298 end
u-238      1 0 2.0066e-02 298 end
o          1 0 4.2714e-02 298 end
'ZIRC-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112      2 0 4.6877e-06 298 end
sn-114      2 0 3.1413e-06 298 end
sn-115      2 0 1.7398e-06 298 end
sn-116      2 0 7.0219e-05 298 end
sn-117      2 0 3.7115e-05 298 end
sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
'WATER
h          3 0 6.6662e-02 298 end
o          3 0 3.3331e-02 298 end
'Lucite
c          4 0 3.5489e-02 298 end
h          4 0 5.6782e-02 298 end
o          4 0 1.4196e-02 298 end
' UO2 powder
u-234      5 0 1.1580e-06 298 end
u-235      5 0 1.5160e-04 298 end
u-238      5 0 2.0902e-02 298 end
o          5 0 4.2715e-02 298 end
end comp
triangpitch 2.3622 1.26366 1 3 1.43384 2 end
more data DAB=300
end more
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=no
nub=yes
end parm
read geometry
unit       1
com='^fuel pin, top^
cylinder   1
          6.318300E-01 2.254250E+01 1.081300E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      1      1      1
cylinder   2
          6.318300E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      5      1      2     -1
cylinder   3
          7.169200E-01 2.254250E+01 6.985000E-01

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 2
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 3
com=^fuel pin, left^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 4
com=^fuel pin, right^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00

```

```

media 2 1 4 -3 -2 -1
boundary 4
unit 5
com=^fuel pin, top^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 6
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 7
com=^fuel pin, left^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 8
com=^fuel pin, right^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 9
com=^fuel pin, top^
cylinder 1
6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 10
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00

```

```

media      2      1      2      -1
boundary    2
unit       11
com='fuel pin, left^
cylinder    1
            6.318300E-01 4.381500E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 4.381500E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      2      1      2      -1
boundary    2
unit       12
com='fuel pin, right^
cylinder    1
            6.318300E-01 4.381500E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 4.381500E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      2      1      2      -1
boundary    2
unit       13
com='fuel pin, top^
cylinder    1
            6.318300E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      2      1      2      -1
boundary    2
unit       14
com='fuel pin, bottom^
cylinder    1
            6.318300E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      2      1      2      -1
boundary    3
unit       15
com='fuel pin, left^
cylinder    1
            6.318300E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      2      1      2      -1
boundary    3
unit       16
com='fuel pin, right^
cylinder    1
            6.318300E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      2      1      2      -1
boundary    3
unit       17
com='fuel pin, top^
cylinder    1
            6.318300E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      3      1      1
boundary    1
unit       22
com='fuel pin, bottom^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      3      1      1
boundary    1
unit       23
com='fuel pin, left^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      3      1      1
boundary    1
unit       24
com='fuel pin, right^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      3      1      1
boundary    1
unit       25
com='fuel pin, top^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      3      1      1
boundary    1
unit       26
com='fuel pin, bottom^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      3      1      1
boundary    1
unit       27
com='fuel pin, left^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      3      1      1
boundary    1
unit       28

```

```

            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      2      1      3      -2      -1
boundary    3
unit       16
com='fuel pin, right^
cylinder    1
            6.318300E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      1      1      1
cylinder    2
            7.169200E-01 2.197100E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      2      1      2      -1
cylinder    3
            7.169200E-01 2.279650E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      2      1      3      -2      -1
boundary    3
unit       21
com='fuel pin, top^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      3      1      1
boundary    1
unit       22
com='fuel pin, bottom^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      3      1      1
boundary    1
unit       23
com='fuel pin, left^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      3      1      1
boundary    1
unit       24
com='fuel pin, right^
cylinder    1
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media      3      1      1
boundary    1
unit       25
com='fuel pin, top^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media      3      1      1
boundary    1
unit       26
com='fuel pin, bottom^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media      3      1      1
boundary    1
unit       27
com='fuel pin, left^
cylinder    1
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media      3      1      1
boundary    1
unit       28

```



```

com=^fuel pin, right^
cylinder 1
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 29
com=^fuel pin, top^
cylinder 1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 30
com=^fuel pin, bottom^
cylinder 1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 31
com=^fuel pin, left^
cylinder 1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 32
com=^fuel pin, right^
cylinder 1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 33
com=^fuel pin, top^
cylinder 1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 34
com=^fuel pin, bottom^
cylinder 1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 35
com=^fuel pin, left^
cylinder 1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 36
com=^4 fuel^
cuboid 1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1

```

```

hole 1 origin x= 0.000000E+00 y= 2.045700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -2.045700E+00 z=
1.905100E+00
hole 3 origin x= -1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole 7 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole 11 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.016790E+01
hole 7 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.207300E+01
hole 15 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 42
com=^3 fuel, water top^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 2.045700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -2.045700E+00 z=
1.905100E+00
hole 3 origin x= -1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole 7 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 7.016781E+01 0.000000E+00

```

```

media      3      1      4      -3      -2      -1
hole      29      origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole      10      origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole      11      origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole      12      origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid      5
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      25      origin x= 0.000000E+00 y= 2.045700E+00 z=
7.016790E+01
hole      6      origin x= 0.000000E+00 y= -2.045700E+00 z=
7.016790E+01
hole      7      origin x= -1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
hole      8      origin x= 1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid      6
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      33      origin x= 0.000000E+00 y= 2.045700E+00 z=
7.207300E+01
hole      14      origin x= 0.000000E+00 y= -2.045700E+00 z=
7.207300E+01
hole      15      origin x= -1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
hole      16      origin x= 1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
boundary      6
unit      43
com=^3 fuel, water bottom^
cuboid      1
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      1      origin x= 0.000000E+00 y= 2.045700E+00 z=
1.905100E+00
hole      2      origin x= 0.000000E+00 y= -2.045700E+00 z=
1.905100E+00
hole      23      origin x= -1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
hole      4      origin x= 1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid      3
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      5      origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole      6      origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole      27      origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole      8      origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid      4
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      9      origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole      10      origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole      31      origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole      12      origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid      5
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      5      origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole      26      origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole      7      origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole      8      origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid      4
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      9      origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole      30      origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole      11      origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole      12      origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid      5
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      5      origin x= 0.000000E+00 y= 2.045700E+00 z=
7.016790E+01
hole      26      origin x= 0.000000E+00 y= -2.045700E+00 z=
7.016790E+01
hole      7      origin x= -1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
hole      8      origin x= 1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid      6
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      13      origin x= 0.000000E+00 y= 2.045700E+00 z=
7.207300E+01
hole      14      origin x= 0.000000E+00 y= -2.045700E+00 z=
7.207300E+01
hole      35      origin x= -1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
hole      16      origin x= 1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
boundary      6
unit      45
com=^3 fuel, water right^
cuboid      1
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
      1.181100E+00 -1.181100E+00 2.045700E+00
      -2.045700E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      1      origin x= 0.000000E+00 y= 2.045700E+00 z=
1.905100E+00

```







```

hole 22 origin x= 0.000000E+00 y= -2.045700E+00 z=
1.905100E+00
hole 23 origin x= -1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole 27 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole 31 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.016790E+01
hole 27 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.207300E+01
hole 35 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 54
com='^0 fuel^
cuboid 1
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 2.045700E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -2.045700E+00 z=
1.905100E+00
hole 23 origin x= -1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.181100E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.444770E+01
hole 27 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 2.045700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.045700E+00 z=
2.635280E+01
hole 31 origin x= -1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.181100E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.016790E+01
hole 27 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
    1.181100E+00 -1.181100E+00 2.045700E+00
    -2.045700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.045700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.045700E+00 z=
7.207300E+01
hole 35 origin x= -1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.181100E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
global
unit 55
com='^tank with core^
cuboid 1
    1.793740E+01 -2.222000E+01 1.636400E+01
    -2.455000E+01 1.156335E+02 0.000000E+00
array 1 1
    place 1 1 1 -2.103890E+01 -2.250430E+01
0.000000E+00
cylinder 2
    6.500000E+01 1.156335E+02 -1.492250E+01
    origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=17 nuy=10 nuz=1
com='!179 pins, fuel core array!
fill
54 54 54 54 54 54 54 54 51 54 54 54 54 54 54 54 54
54 54 54 54 48 43 43 43 41 43 43 43 47 54 54 54 54
54 54 51 48 41 41 41 41 41 41 41 41 41 41 43 47 54 54
54 54 44 41 41 41 41 41 41 41 41 41 41 41 41 41 52 54
54 48 41 41 41 41 41 41 41 41 41 41 41 41 41 41 47 54
54 49 41 41 41 41 41 41 41 41 41 41 41 41 41 41 46 54
54 54 44 41 41 41 41 41 41 41 41 41 41 41 41 41 45 54 54
54 54 50 49 41 41 41 41 41 41 41 41 41 41 46 50 54 54
54 54 54 54 49 42 42 41 41 41 41 42 42 46 54 54 54 54
54 54 54 54 54 54 54 50 50 50 54 54 54 54 54 54 54
end fill
end array
end data
end

1.23 CASE MIXCT_005_CASE3_K6

#csas26 parm='size=00500000'
4 wt 18 enrich puo2, lattice a, 253 pins, case new base
238group latticecell
'FUEL
pu-238 1 0 2.3455e-06 298 end
pu-239 1 0 6.3144e-04 298 end
pu-240 1 0 1.5162e-04 298 end
pu-241 1 0 4.0198e-05 298 end
am-241 1 0 3.1834e-06 298 end
pu-242 1 0 9.6333e-06 298 end
u-234 1 0 1.1117e-06 298 end
u-235 1 0 1.4553e-04 298 end
u-238 1 0 2.0066e-02 298 end
o 1 0 4.2714e-02 298 end
'ZIRC-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end

```

```

sn-112      2 0 4.6877e-06 298 end
sn-114      2 0 3.1413e-06 298 end
sn-115      2 0 1.7398e-06 298 end
sn-116      2 0 7.0219e-05 298 end
sn-117      2 0 3.7115e-05 298 end
sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
'WATER
h           3 0 6.6662e-02 298 end
o           3 0 3.3331e-02 298 end
'Lucite
c           4 0 3.5489e-02 298 end
h           4 0 5.6782e-02 298 end
o           4 0 1.4196e-02 298 end
' UO2 powder
u-234       5 0 1.1580e-06 298 end
u-235       5 0 1.5160e-04 298 end
u-238       5 0 2.0902e-02 298 end
o           5 0 4.2715e-02 298 end
end comp
triangpitch 2.6670 1.26366 1 3 1.43384 2 end
more data DAB=300 end more
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit        1
com='fuel pin, top^
cylinder    1
            6.318300E-01 2.254250E+01 1.081300E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        1 1 1
cylinder     2
            6.318300E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        5 1 2 -1
cylinder     3
            7.169200E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        2 1 3 -2 -1
cylinder     4
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        2 1 4 -3 -2 -1
boundary     4
unit         2
com='fuel pin, bottom^
cylinder     1
            6.318300E-01 2.254250E+01 1.081300E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        1 1 1
cylinder     2
            6.318300E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        5 1 2 -1
cylinder     3
            7.169200E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        2 1 3 -2 -1
cylinder     4
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        2 1 4 -3 -2 -1
boundary     4
unit         3
com='fuel pin, left^
cylinder     1
            6.318300E-01 2.254250E+01 1.081300E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        1 1 1

```

```

cylinder     2
            6.318300E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        5 1 2 -1
cylinder     3
            7.169200E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        2 1 3 -2 -1
cylinder     4
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        2 1 4 -3 -2 -1
boundary     4
unit         4
com='fuel pin, right^
cylinder     1
            6.318300E-01 2.254250E+01 1.081300E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media        1 1 1
cylinder     2
            6.318300E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media        5 1 2 -1
cylinder     3
            7.169200E-01 2.254250E+01 6.985000E-01
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media        2 1 3 -2 -1
cylinder     4
            7.169200E-01 2.254250E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media        2 1 4 -3 -2 -1
boundary     4
unit         5
com='fuel pin, top^
cylinder     1
            6.318300E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        1 1 1
cylinder     2
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media        2 1 2 -1
boundary     2
unit         6
com='fuel pin, bottom^
cylinder     1
            6.318300E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        1 1 1
cylinder     2
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media        2 1 2 -1
boundary     2
unit         7
com='fuel pin, left^
cylinder     1
            6.318300E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        1 1 1
cylinder     2
            7.169200E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media        2 1 2 -1

```

```

boundary      2
unit          8
com='fuel pin, right^
cylinder      1
              6.318300E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 2 -1
boundary      2
unit          9
com='fuel pin, top^
cylinder      1
              6.318300E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         2 1 2 -1
boundary      2
unit          10
com='fuel pin, bottom^
cylinder      1
              6.318300E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         2 1 2 -1
boundary      2
unit          11
com='fuel pin, left^
cylinder      1
              6.318300E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         2 1 2 -1
boundary      2
unit          12
com='fuel pin, right^
cylinder      1
              6.318300E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 2 -1
boundary      2
unit          13
com='fuel pin, top^
cylinder      1
              6.318300E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         2 1 2 -1
cylinder      3
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         2 1 3 -2 -1
boundary      3
unit          14
com='fuel pin, bottom^
cylinder      1
              6.318300E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         2 1 2 -1
cylinder      3
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         2 1 3 -2 -1
boundary      3
unit          15
com='fuel pin, left^
cylinder      1
              6.318300E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         2 1 2 -1
cylinder      3
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         2 1 3 -2 -1
boundary      3
unit          16
com='fuel pin, right^
cylinder      1
              6.318300E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 2 -1
cylinder      3
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 3 -2 -1
boundary      3
unit          21
com='fuel pin, top^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         3 1 1
boundary      1
unit          22
com='fuel pin, bottom^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         3 1 1
boundary      1
unit          23
com='fuel pin, left^

```



```

cylinder 1
  7.169200E-01 2.254250E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 24
com=^fuel pin, right^
cylinder 1
  7.169200E-01 2.254250E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 25
com=^fuel pin, top^
cylinder 1
  7.169200E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 26
com=^fuel pin, bottom^
cylinder 1
  7.169200E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 27
com=^fuel pin, left^
cylinder 1
  7.169200E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 28
com=^fuel pin, right^
cylinder 1
  7.169200E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 29
com=^fuel pin, top^
cylinder 1
  7.169200E-01 4.381500E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 30
com=^fuel pin, bottom^
cylinder 1
  7.169200E-01 4.381500E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 31
com=^fuel pin, left^
cylinder 1
  7.169200E-01 4.381500E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 32
com=^fuel pin, right^
cylinder 1
  7.169200E-01 4.381500E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 33
com=^fuel pin, top^

```

```

cylinder 1
  7.169200E-01 2.279650E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 34
com=^fuel pin, bottom^
cylinder 1
  7.169200E-01 2.279650E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 35
com=^fuel pin, left^
cylinder 1
  7.169200E-01 2.279650E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 36
com=^fuel pin, right^
cylinder 1
  7.169200E-01 2.279650E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 41
com=^4 fuel^
cuboid 1
  1.333500E+00 -1.333500E+00 2.309700E+00
  -2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
  1.333500E+00 -1.333500E+00 2.309700E+00
  -2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 3 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
  1.333500E+00 -1.333500E+00 2.309700E+00
  -2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
  1.333500E+00 -1.333500E+00 2.309700E+00
  -2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 11 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
  1.333500E+00 -1.333500E+00 2.309700E+00
  -2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
  1.333500E+00 -1.333500E+00 2.309700E+00

```

```

-2.309700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 15 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 42
com=^3 fuel, water top^
cuboid 1
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 3 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 11 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 15 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 44
com=^3 fuel, water left^
cuboid 1
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 23 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 1 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00

```

hole	9	origin x=	0.000000E+00	y=	2.309700E+00	z=
2.635280E+01						
hole	10	origin x=	0.000000E+00	y=	-2.309700E+00	z=
2.635280E+01						
hole	31	origin x=	-1.333500E+00	y=	0.000000E+00	z=
2.635280E+01						
hole	12	origin x=	1.333500E+00	y=	0.000000E+00	z=
2.635280E+01						
cuboid	5					
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	7.207291E+01	0.000000E+00	
media	4					
hole	1		5	-4	-3	-2
7.016790E+01						
hole	5	origin x=	0.000000E+00	y=	2.309700E+00	z=
7.016790E+01						
hole	6	origin x=	0.000000E+00	y=	-2.309700E+00	z=
7.016790E+01						
hole	27	origin x=	-1.333500E+00	y=	0.000000E+00	z=
7.016790E+01						
hole	8	origin x=	1.333500E+00	y=	0.000000E+00	z=
7.016790E+01						
cuboid	6					
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	1.156335E+02	0.000000E+00	
media	3					
hole	1		6	-5	-4	-3
7.207300E+01						
hole	13	origin x=	0.000000E+00	y=	2.309700E+00	z=
7.207300E+01						
hole	14	origin x=	0.000000E+00	y=	-2.309700E+00	z=
7.207300E+01						
hole	35	origin x=	-1.333500E+00	y=	0.000000E+00	z=
7.207300E+01						
hole	16	origin x=	1.333500E+00	y=	0.000000E+00	z=
7.207300E+01						
boundary	6					
unit	45					
com=^3 fuel, water right^						
cuboid	1					
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	1.905000E+00	0.000000E+00	
media	4					
cuboid	1		1			
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	2.444761E+01	0.000000E+00	
media	3					
hole	1		2	-1		
1.905100E+00		origin x=	0.000000E+00	y=	2.309700E+00	z=
1.905100E+00		2				
hole	2	origin x=	0.000000E+00	y=	-2.309700E+00	z=
1.905100E+00						
hole	3	origin x=	-1.333500E+00	y=	0.000000E+00	z=
1.905100E+00						
hole	24	origin x=	1.333500E+00	y=	0.000000E+00	z=
1.905100E+00						
cuboid	3					
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	2.635271E+01	0.000000E+00	
media	4					
hole	1		3	-2	-1	
2.444770E+01		origin x=	0.000000E+00	y=	2.309700E+00	z=
2.444770E+01						
hole	6	origin x=	0.000000E+00	y=	-2.309700E+00	z=
2.444770E+01						
hole	7	origin x=	-1.333500E+00	y=	0.000000E+00	z=
2.444770E+01						
hole	28	origin x=	1.333500E+00	y=	0.000000E+00	z=
2.444770E+01						
cuboid	4					
			1.333500E+00	-1.333500E+00	2.309700E+00	
			-2.309700E+00	7.016781E+01	0.000000E+00	
media	3					
hole	1		4	-3	-2	-1
2.635280E+01		origin x=				

```

media      3      1      6      -5      -4      -3      -2      -1
hole      13      origin x= 0.000000E+00      y= 2.309700E+00      z=
7.207300E+01
hole      14      origin x= 0.000000E+00      y= -2.309700E+00      z=
7.207300E+01
hole      15      origin x= -1.333500E+00      y= 0.000000E+00      z=
7.207300E+01
hole      36      origin x= 1.333500E+00      y= 0.000000E+00      z=
7.207300E+01
boundary   6
unit      46
com=^2 fuel, water right and top^
cuboid     1
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      21      origin x= 0.000000E+00      y= 2.309700E+00      z=
1.905100E+00
hole      2      origin x= 0.000000E+00      y= -2.309700E+00      z=
1.905100E+00
hole      3      origin x= -1.333500E+00      y= 0.000000E+00      z=
1.905100E+00
hole      24      origin x= 1.333500E+00      y= 0.000000E+00      z=
1.905100E+00
cuboid     3
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      25      origin x= 0.000000E+00      y= 2.309700E+00      z=
2.444770E+01
hole      6      origin x= 0.000000E+00      y= -2.309700E+00      z=
2.444770E+01
hole      7      origin x= -1.333500E+00      y= 0.000000E+00      z=
2.444770E+01
hole      28      origin x= 1.333500E+00      y= 0.000000E+00      z=
2.444770E+01
cuboid     4
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      29      origin x= 0.000000E+00      y= 2.309700E+00      z=
2.635280E+01
hole      10      origin x= 0.000000E+00      y= -2.309700E+00      z=
2.635280E+01
hole      11      origin x= -1.333500E+00      y= 0.000000E+00      z=
2.635280E+01
hole      32      origin x= 1.333500E+00      y= 0.000000E+00      z=
2.635280E+01
cuboid     5
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      25      origin x= 0.000000E+00      y= 2.309700E+00      z=
7.016790E+01
hole      6      origin x= 0.000000E+00      y= -2.309700E+00      z=
7.016790E+01
hole      7      origin x= -1.333500E+00      y= 0.000000E+00      z=
7.016790E+01
hole      28      origin x= 1.333500E+00      y= 0.000000E+00      z=
7.016790E+01
cuboid     6
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      33      origin x= 0.000000E+00      y= 2.309700E+00      z=
7.207300E+01
hole      14      origin x= 0.000000E+00      y= -2.309700E+00      z=
7.207300E+01
hole      15      origin x= -1.333500E+00      y= 0.000000E+00      z=
7.207300E+01
hole      36      origin x= 1.333500E+00      y= 0.000000E+00      z=
7.207300E+01
boundary   6
unit      47
com=^2 fuel, water right and bottom^
cuboid     1
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
              1.333500E+00 -1.333500E+00 2.309700E+00
            -2.309700E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      1      origin x= 0.000000E+00      y= 2.309700E+00      z=
1.905100E+00

```

```

hole 22 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 3 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 11 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 15 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 48
com=^2 fuel, water left and bottom^
cuboid 1
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 23 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1

```

```

hole          9 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole         30 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole         31 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole         12 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid        5
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 7.207291E+01 0.000000E+00
media          4
hole          5 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole         26 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole         27 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole          8 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid        6
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 1.156335E+02 0.000000E+00
media          3
hole         13 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole         34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole         35 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole         16 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary      6
unit          49
com=^2 fuel, water left and top^
cuboid        1
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 1.905000E+00 0.000000E+00
media          4
cuboid        2
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 2.444761E+01 0.000000E+00
media          3
hole         21 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole          2 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole         23 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole          4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid        3
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 2.635271E+01 0.000000E+00
media          4
hole         25 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole          6 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole         27 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole          8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid        4
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 7.016781E+01 0.000000E+00
media          3
hole         29 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole         10 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole         31 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole         12 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid        5
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 7.207291E+01 0.000000E+00
media          4
hole         25 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole          6 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole         27 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole          8 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid        6
                1.333500E+00 -1.333500E+00 2.309700E+00
                -2.309700E+00 1.156335E+02 0.000000E+00

```



```

hole 29 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 11 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 7 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 15 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 53
com=^1 fuel, fuel right^
cuboid 1
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 23 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 31 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.156335E+02 0.000000E+00

```

```

media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 35 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 54
com=^0 fuel^
cuboid 1
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 2.309700E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -2.309700E+00 z=
1.905100E+00
hole 23 origin x= -1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.333500E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.444770E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 2.309700E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.309700E+00 z=
2.635280E+01
hole 31 origin x= -1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.333500E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.016790E+01
hole 27 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.333500E+00 -1.333500E+00 2.309700E+00
-2.309700E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.309700E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.309700E+00 z=
7.207300E+01
hole 35 origin x= -1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.333500E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
global
unit 55
com=^tank with al and core^
cuboid 1
9.331000E+00 -2.534000E+01 9.235200E+00
-2.772000E+01 1.156335E+02 0.000000E+00
array 1 1
place 1 1 1 -2.400650E+01 -2.541030E+01
0.000000E+00
cylinder 2
6.500000E+01 1.156335E+02 -1.492250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1

```

```

boundary      2
end geometry

read array
ara=1 nux=13 nuy=8 nuz=1
com=!139 pins, fuel core array!
fill
54 54 54 51 51 48 43 47 51 51 54 54 54
54 51 48 41 41 41 41 41 41 41 47 51 54
53 41 41 41 41 41 41 41 41 41 41 41 52
48 41 41 41 41 41 41 41 41 41 41 41 47
49 41 41 41 41 41 41 41 41 41 41 41 46
53 41 41 41 41 41 41 41 41 41 41 41 52
54 50 49 41 41 41 41 41 41 41 46 50 54
54 54 54 50 50 49 42 46 50 50 54 54 54
end fill
end array
end data
end

1.24 CASE MIXCT_005_CASE4_K6

#csas26      parm='size=00500000'
4 wt 18 enrich puo2, lattice a, 253 pins, case new base
238group      latticecell
'FUEL
pu-238      1 0 2.3455e-06 298 end
pu-239      1 0 6.3144e-04 298 end
pu-240      1 0 1.5162e-04 298 end
pu-241      1 0 4.0198e-05 298 end
am-241      1 0 3.1834e-06 298 end
pu-242      1 0 9.6333e-06 298 end
u-234      1 0 1.1117e-06 298 end
u-235      1 0 1.4553e-04 298 end
u-238      1 0 2.0066e-02 298 end
o          1 0 4.2714e-02 298 end
'ZIRC-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112     2 0 4.6877e-06 298 end
sn-114     2 0 3.1413e-06 298 end
sn-115     2 0 1.7398e-06 298 end
sn-116     2 0 7.0219e-05 298 end
sn-117     2 0 3.7115e-05 298 end
sn-118     2 0 1.1705e-04 298 end
sn-119     2 0 4.1465e-05 298 end
sn-120     2 0 1.5750e-04 298 end
sn-122     2 0 2.2375e-05 298 end
sn-124     2 0 2.7981e-05 298 end
'WATER
h          3 0 6.6662e-02 298 end
o          3 0 3.3331e-02 298 end
'Lucite
c          4 0 3.5489e-02 298 end
h          4 0 5.6782e-02 298 end
o          4 0 1.4196e-02 298 end
' UO2 powder
u-234      5 0 1.1580e-06 298 end
u-235      5 0 1.5160e-04 298 end
u-238      5 0 2.0902e-02 298 end
o          5 0 4.2715e-02 298 end
end comp
triangpitch 2.90322 1.26366 1 3 1.43384 2 end
more data DAB=300 end more
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=40
nub=yes end parm
read geometry
unit      1
com='^fuel pin, top^'
cylinder  1
          6.318300E-01 2.254250E+01 1.081300E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      1 1 1
cylinder  2
          6.318300E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      5 1 2 -1
cylinder  3
          7.169200E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      2 1 4 -3 -2 -1
boundary    4
unit        5
com='^fuel pin, top^'

```

```

cylinder    4
          7.169200E-01 2.254250E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media      2 1 4 -3 -2 -1
boundary    4
unit        2
com='^fuel pin, bottom^'
cylinder    1
          6.318300E-01 2.254250E+01 1.081300E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media      1 1 1
cylinder    2
          6.318300E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media      5 1 2 -1
cylinder    3
          7.169200E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media      2 1 3 -2 -1
cylinder    4
          7.169200E-01 2.254250E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media      2 1 4 -3 -2 -1
boundary    4
unit        3
com='^fuel pin, left^'
cylinder    1
          6.318300E-01 2.254250E+01 1.081300E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media      1 1 1
cylinder    2
          6.318300E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media      5 1 2 -1
cylinder    3
          7.169200E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media      2 1 3 -2 -1
cylinder    4
          7.169200E-01 2.254250E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media      2 1 4 -3 -2 -1
boundary    4
unit        4
com='^fuel pin, right^'
cylinder    1
          6.318300E-01 2.254250E+01 1.081300E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media      1 1 1
cylinder    2
          6.318300E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media      5 1 2 -1
cylinder    3
          7.169200E-01 2.254250E+01 6.985000E-01
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media      2 1 3 -2 -1
cylinder    4
          7.169200E-01 2.254250E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media      2 1 4 -3 -2 -1
boundary    4
unit        5
com='^fuel pin, top^'

```

```

cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 6
com=^fuel pin, bottom^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 7
com=^fuel pin, left^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 8
com=^fuel pin, right^
cylinder 1
    6.318300E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 9
com=^fuel pin, top^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 10
com=^fuel pin, bottom^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 11
com=^fuel pin, left^

```

```

cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 12
com=^fuel pin, right^
cylinder 1
    6.318300E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=^fuel pin, top^
cylinder 1
    6.318300E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
cylinder 3
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 14
com=^fuel pin, bottom^
cylinder 1
    6.318300E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
cylinder 3
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 15
com=^fuel pin, left^
cylinder 1
    6.318300E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    7.169200E-01 2.197100E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
cylinder 3
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 3 -2 -1

```



```

boundary      3
unit          16
com=^fuel pin, right^
cylinder      1
              6.318300E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         1 1 1
cylinder      2
              7.169200E-01 2.197100E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 2 -1
cylinder      3
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2 1 3 -2 -1
boundary      3
unit          21
com=^fuel pin, top^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         3 1 1
boundary      1
unit          22
com=^fuel pin, bottom^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         3 1 1
boundary      1
unit          23
com=^fuel pin, left^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         3 1 1
boundary      1
unit          24
com=^fuel pin, right^
cylinder      1
              7.169200E-01 2.254250E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         3 1 1
boundary      1
unit          25
com=^fuel pin, top^
cylinder      1
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         3 1 1
boundary      1
unit          26
com=^fuel pin, bottom^
cylinder      1
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         3 1 1
boundary      1
unit          27
com=^fuel pin, left^
cylinder      1
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         3 1 1
boundary      1
unit          28
com=^fuel pin, right^
cylinder      1
              7.169200E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         3 1 1
boundary      1
unit          29
com=^fuel pin, top^
cylinder      1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         3 1 1
boundary      1
unit          30
com=^fuel pin, bottom^
cylinder      1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         3 1 1
boundary      1
unit          31
com=^fuel pin, left^
cylinder      1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         3 1 1
boundary      1
unit          32
com=^fuel pin, right^
cylinder      1
              7.169200E-01 4.381500E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         3 1 1
boundary      1
unit          33
com=^fuel pin, top^
cylinder      1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         3 1 1
boundary      1
unit          34
com=^fuel pin, bottom^
cylinder      1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         3 1 1
boundary      1
unit          35
com=^fuel pin, left^
cylinder      1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         3 1 1
boundary      1
unit          36
com=^fuel pin, right^
cylinder      1
              7.169200E-01 2.279650E+01 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         3 1 1
boundary      1
unit          41
com=^4 fuel^
cuboid        1
              1.451610E+00 -1.451610E+00 2.514300E+00
              -2.514300E+00 1.905000E+00 0.000000E+00
media         4 1 1
cuboid        2
              1.451610E+00 -1.451610E+00 2.514300E+00
              -2.514300E+00 2.444761E+01 0.000000E+00
media         3 1 2 -1
hole          1 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00

```



```

media      3      1      6    -5   -4   -3   -2   -1
hole      13 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole      15 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      16 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary   6
unit      44
com=^3 fuel, water left^
cuboid     1
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2   -1
hole      1 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00
hole      2 origin x= 0.000000E+00 y= -2.514300E+00 z=
1.905100E+00
hole      23 origin x= -1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
hole      4 origin x= 1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid     3
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 2.635271E+01 0.000000E+00
media      4      1      3   -2   -1
hole      5 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.444770E+01
hole      6 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.444770E+01
hole      27 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
hole      8 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid     4
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 7.016781E+01 0.000000E+00
media      3      1      4   -3   -2   -1
hole      9 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.635280E+01
hole      10 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.635280E+01
hole      31 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
hole      12 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid     5
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 7.207291E+01 0.000000E+00
media      4      1      5   -4   -3   -2   -1
hole      5 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.016790E+01
hole      6 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.016790E+01
hole      27 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
hole      8 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid     6
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 1.156335E+02 0.000000E+00
media      3      1      6    -5   -4   -3   -2   -1
hole      13 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole      14 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole      15 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      36 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary   6
unit      46
com=^2 fuel, water right and top^
cuboid     1
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2   -1
hole      21 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00
hole      2 origin x= 0.000000E+00 y= -2.514300E+00 z=
1.905100E+00
hole      3 origin x= -1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
hole      24 origin x= 1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid     3
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 2.635271E+01 0.000000E+00
media      4      1      3   -2   -1
hole      25 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.444770E+01
hole      6 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.444770E+01
hole      7 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
hole      28 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid     4
      1.451610E+00 -1.451610E+00 2.514300E+00
      -2.514300E+00 7.016781E+01 0.000000E+00
media      3      1      4   -3   -2   -1

```

hole	29	origin	x=	0.000000E+00	y=	2.514300E+00	z=
2.635280E+01							
hole	10	origin	x=	0.000000E+00	y=	-2.514300E+00	z=
2.635280E+01							
hole	11	origin	x=	-1.451610E+00	y=	0.000000E+00	z=
2.635280E+01							
hole	32	origin	x=	1.451610E+00	y=	0.000000E+00	z=
2.635280E+01							
cuboid	5						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	7.207291E+01	0.000000E+00	
media	4			1	5	-4	-3
hole	25	origin	x=	0.000000E+00	y=	2.514300E+00	z=
7.016790E+01							
hole	6	origin	x=	0.000000E+00	y=	-2.514300E+00	z=
7.016790E+01							
hole	7	origin	x=	-1.451610E+00	y=	0.000000E+00	z=
7.016790E+01							
hole	28	origin	x=	1.451610E+00	y=	0.000000E+00	z=
7.016790E+01							
cuboid	6						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	1.156335E+02	0.000000E+00	
media	3			1	6	-5	-4
hole	33	origin	x=	0.000000E+00	y=	2.514300E+00	z=
7.207300E+01							
hole	14	origin	x=	0.000000E+00	y=	-2.514300E+00	z=
7.207300E+01							
hole	15	origin	x=	-1.451610E+00	y=	0.000000E+00	z=
7.207300E+01							
hole	36	origin	x=	1.451610E+00	y=	0.000000E+00	z=
7.207300E+01							
boundary	6						
unit	47						
com=^2 fuel, water right and bottom^							
cuboid	1						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	1.905000E+00	0.000000E+00	
media	4			1	1		
cuboid	2						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	2.444761E+01	0.000000E+00	
media	3			1	2	-1	
hole	1	origin	x=	0.000000E+00	y=	2.514300E+00	z=
1.905100E+00							
hole	22	origin	x=	0.000000E+00	y=	-2.514300E+00	z=
1.905100E+00							
hole	3	origin	x=	-1.451610E+00	y=	0.000000E+00	z=
1.905100E+00							
hole	24	origin	x=	1.451610E+00	y=	0.000000E+00	z=
1.905100E+00							
cuboid	3						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	2.635271E+01	0.000000E+00	
media	4			1	3	-2	-1
hole	5	origin	x=	0.000000E+00	y=	2.514300E+00	z=
2.444770E+01							
hole	26	origin	x=	0.000000E+00	y=	-2.514300E+00	z=
2.444770E+01							
hole	7	origin	x=	-1.451610E+00	y=	0.000000E+00	z=
2.444770E+01							
hole	28	origin	x=	1.451610E+00	y=	0.000000E+00	z=
2.444770E+01							
cuboid	4						
				1.451610E+00	-1.451610E+00	2.514300E+00	
				-2.514300E+00	7.016781E+01	0.000000E+00	
media	3			1	4	-3	-2
hole	9	origin	x=	0.000000E+00			

```

media      3      1      6      -5      -4      -3      -2      -1
hole      13      origin x= 0.000000E+00      y= 2.514300E+00      z=
7.207300E+01
hole      34      origin x= 0.000000E+00      y= -2.514300E+00      z=
7.207300E+01
hole      15      origin x= -1.451610E+00      y= 0.000000E+00      z=
7.207300E+01
hole      36      origin x= 1.451610E+00      y= 0.000000E+00      z=
7.207300E+01
boundary   6
unit      48
com=^2 fuel, water left and bottom^
cuboid     1
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      1      origin x= 0.000000E+00      y= 2.514300E+00      z=
1.905100E+00
hole      22      origin x= 0.000000E+00      y= -2.514300E+00      z=
1.905100E+00
hole      23      origin x= -1.451610E+00      y= 0.000000E+00      z=
1.905100E+00
hole      4      origin x= 1.451610E+00      y= 0.000000E+00      z=
1.905100E+00
cuboid     3
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      5      origin x= 0.000000E+00      y= 2.514300E+00      z=
2.444770E+01
hole      26      origin x= 0.000000E+00      y= -2.514300E+00      z=
2.444770E+01
hole      27      origin x= -1.451610E+00      y= 0.000000E+00      z=
2.444770E+01
hole      8      origin x= 1.451610E+00      y= 0.000000E+00      z=
2.444770E+01
cuboid     4
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      9      origin x= 0.000000E+00      y= 2.514300E+00      z=
2.635280E+01
hole      30      origin x= 0.000000E+00      y= -2.514300E+00      z=
2.635280E+01
hole      31      origin x= -1.451610E+00      y= 0.000000E+00      z=
2.635280E+01
hole      12      origin x= 1.451610E+00      y= 0.000000E+00      z=
2.635280E+01
cuboid     5
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      5      origin x= 0.000000E+00      y= 2.514300E+00      z=
7.016790E+01
hole      26      origin x= 0.000000E+00      y= -2.514300E+00      z=
7.016790E+01
hole      27      origin x= -1.451610E+00      y= 0.000000E+00      z=
7.016790E+01
hole      8      origin x= 1.451610E+00      y= 0.000000E+00      z=
7.016790E+01
cuboid     6
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      13      origin x= 0.000000E+00      y= 2.514300E+00      z=
7.207300E+01
hole      34      origin x= 0.000000E+00      y= -2.514300E+00      z=
7.207300E+01
hole      35      origin x= -1.451610E+00      y= 0.000000E+00      z=
7.207300E+01
hole      16      origin x= 1.451610E+00      y= 0.000000E+00      z=
7.207300E+01
boundary   6
unit      49
com=^2 fuel, water left and top^
cuboid     1
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid     2
              1.451610E+00 -1.451610E+00 2.514300E+00
            -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      21      origin x= 0.000000E+00      y= 2.514300E+00      z=
1.905100E+00

```



```

media      3      1      6      -5      -4      -3      -2      -1
hole      13 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole      35 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      36 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary    6
unit        52
com='^1 fuel, fuel left^
cuboid      1
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      21 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00
hole      22 origin x= 0.000000E+00 y= -2.514300E+00 z=
1.905100E+00
hole      3 origin x= -1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
hole      24 origin x= 1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid      3
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      25 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.444770E+01
hole      26 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.444770E+01
hole      7 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
hole      28 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid      4
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      29 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.635280E+01
hole      30 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.635280E+01
hole      11 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
hole      32 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid      5
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      25 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.016790E+01
hole      26 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.016790E+01
hole      7 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
hole      28 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid      6
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      33 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole      35 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      16 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary    6
unit        54
com='^0 fuel^
cuboid      1
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      21 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00
hole      22 origin x= 0.000000E+00 y= -2.514300E+00 z=
1.905100E+00
hole      23 origin x= -1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
hole      24 origin x= 1.451610E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid      3
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      25 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.444770E+01
hole      26 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.444770E+01
hole      27 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
hole      28 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid      4
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      29 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.635280E+01
hole      30 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.635280E+01
hole      11 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
hole      32 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid      5
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      25 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.016790E+01
hole      26 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.016790E+01
hole      7 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
hole      28 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid      6
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      33 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole      34 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole      35 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      15 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole      36 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary    6
unit        53
com='^1 fuel, fuel right^
cuboid      1
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
          1.451610E+00 -1.451610E+00 2.514300E+00
          -2.514300E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      21 origin x= 0.000000E+00 y= 2.514300E+00 z=
1.905100E+00

```

```

hole 29 origin x= 0.000000E+00 y= 2.514300E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -2.514300E+00 z=
2.635280E+01
hole 31 origin x= -1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.451610E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.451610E+00 -1.451610E+00 2.514300E+00
-2.514300E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.016790E+01
hole 27 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.451610E+00 -1.451610E+00 2.514300E+00
-2.514300E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 2.514300E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -2.514300E+00 z=
7.207300E+01
hole 35 origin x= -1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.451610E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
global
unit 55
com='^tank with al and core^'
cuboid 1
1.016186E+01 -2.758000E+01 1.012880E+01
-3.010000E+01 1.156335E+02 0.000000E+00
array 1 1
place 1 1 1 -2.612839E+01 -2.758570E+01
0.000000E+00
cylinder 2
6.500000E+01 1.156335E+02 -1.492250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=13 nuy=8 nuz=1
com='!122 pins, fuel core array!'
fill
54 54 54 54 51 51 51 51 51 54 54 54 54
54 54 48 43 41 41 41 41 41 43 47 54 54
54 48 41 41 41 41 41 41 41 41 41 41 47 54
53 41 41 41 41 41 41 41 41 41 41 41 52
53 41 41 41 41 41 41 41 41 41 41 41 52
54 49 41 41 41 41 41 41 41 41 41 41 46 54
54 54 49 41 41 41 41 41 41 42 46 54 54
54 54 54 50 50 50 50 50 54 54 54 54
end fill
end array
end data
end

1.25 CASE MIXCT_005_CASE5_K6

#csas26 parm='size=00500000'
4 wt 18 enrich puo2, lattice a, 253 pins, case new base
238group latticecell
'FUEL
pu-238 1 0 2.3455e-06 298 end
pu-239 1 0 6.3144e-04 298 end
pu-240 1 0 1.5162e-04 298 end
pu-241 1 0 4.0198e-05 298 end
am-241 1 0 3.1834e-06 298 end
pu-242 1 0 9.6333e-06 298 end
u-234 1 0 1.1117e-06 298 end
u-235 1 0 1.4553e-04 298 end
u-238 1 0 2.0066e-02 298 end
o 1 0 4.2714e-02 298 end
'ZIRC-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end
sn-112 2 0 4.6877e-06 298 end
sn-114 2 0 3.1413e-06 298 end

sn-115 2 0 1.7398e-06 298 end
sn-116 2 0 7.0219e-05 298 end
sn-117 2 0 3.7115e-05 298 end
sn-118 2 0 1.1705e-04 298 end
sn-119 2 0 4.1465e-05 298 end
sn-120 2 0 1.5750e-04 298 end
sn-122 2 0 2.2375e-05 298 end
sn-124 2 0 2.7981e-05 298 end
'WATER
h 3 0 6.6662e-02 298 end
o 3 0 3.3331e-02 298 end
'Lucite
c 4 0 3.5489e-02 298 end
h 4 0 5.6782e-02 298 end
o 4 0 1.4196e-02 298 end
' UO2 powder
u-234 5 0 1.1580e-06 298 end
u-235 5 0 1.5160e-04 298 end
u-238 5 0 2.0902e-02 298 end
o 5 0 4.2715e-02 298 end
end comp
triangpitch 3.52044 1.26366 1 3 1.43384 2 end
more data DAB=300 end more
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit 1
com='^fuel pin, top^'
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 4 -3 -2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
boundary 4
unit 3
com='^fuel pin, left^'
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 2 -1
cylinder 3 7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4 7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 4
com=fuel pin, right^
cylinder 1 6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2 6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 2 -1
cylinder 3 7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4 7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 5
com=fuel pin, top^
cylinder 1 6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 6
com=fuel pin, bottom^
cylinder 1 6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 7
com=fuel pin, left^
cylinder 1 6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 8

com=fuel pin, right^
cylinder 1 6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 9
com=fuel pin, top^
cylinder 1 6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 10
com=fuel pin, bottom^
cylinder 1 6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 11
com=fuel pin, left^
cylinder 1 6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 12
com=fuel pin, right^
cylinder 1 6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=fuel pin, top^
cylinder 1 6.318300E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2 7.169200E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
cylinder 3 7.169200E-01 2.279650E+01 0.000000E+00

```



```

origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 14
com=fuel pin, bottom^
cylinder 1
6.318300E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
cylinder 3
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 15
com=fuel pin, left^
cylinder 1
6.318300E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
cylinder 3
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 16
com=fuel pin, right^
cylinder 1
6.318300E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 2.197100E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
cylinder 3
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 21
com=fuel pin, top^
cylinder 1
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 22
com=fuel pin, bottom^
cylinder 1
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 23
com=fuel pin, left^
cylinder 1
7.169200E-01 2.254250E+01 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 24
com=fuel pin, right^
cylinder 1
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 25
com=fuel pin, top^
cylinder 1
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 26
com=fuel pin, bottom^
cylinder 1
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 27
com=fuel pin, left^
cylinder 1
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 28
com=fuel pin, right^
cylinder 1
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 29
com=fuel pin, top^
cylinder 1
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 30
com=fuel pin, bottom^
cylinder 1
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 31
com=fuel pin, left^
cylinder 1
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 32
com=fuel pin, right^
cylinder 1
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 33
com=fuel pin, top^
cylinder 1
7.169200E-01 2.279650E+01 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 34
com=fuel pin, bottom^
cylinder 1
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 35
com=fuel pin, left^
cylinder 1
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 36
com=fuel pin, right^
cylinder 1
7.169200E-01 2.279650E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 41
com=fuel^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 3 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 11 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 11 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 12 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 43
com=fuel, water bottom^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 13 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 15 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 42
com=fuel, water top^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 3 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 11 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 15 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 43
com=fuel, water bottom^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00

```



```

hole 13 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 15 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 46
com=^2 fuel, water right and top^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3
hole 21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 3 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3
hole 29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 11 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 7 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3
hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 15 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 47
com=^2 fuel, water right and bottom^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3
hole 1 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00

```

```

hole      3      origin x= -1.760220E+00      y= 0.000000E+00      z=
1.905100E+00
hole      24      origin x= 1.760220E+00      y= 0.000000E+00      z=
1.905100E+00
cuboid      3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      5      origin x= 0.000000E+00      y= 3.048800E+00      z=
2.444770E+01
hole      26      origin x= 0.000000E+00      y= -3.048800E+00      z=
2.444770E+01
hole      7      origin x= -1.760220E+00      y= 0.000000E+00      z=
2.444770E+01
hole      28      origin x= 1.760220E+00      y= 0.000000E+00      z=
2.444770E+01
cuboid      4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      9      origin x= 0.000000E+00      y= 3.048800E+00      z=
2.635280E+01
hole      30      origin x= 0.000000E+00      y= -3.048800E+00      z=
2.635280E+01
hole      11      origin x= -1.760220E+00      y= 0.000000E+00      z=
2.635280E+01
hole      32      origin x= 1.760220E+00      y= 0.000000E+00      z=
2.635280E+01
cuboid      5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media      4      1      5      -4      -3      -2      -1
hole      5      origin x= 0.000000E+00      y= 3.048800E+00      z=
7.016790E+01
hole      26      origin x= 0.000000E+00      y= -3.048800E+00      z=
7.016790E+01
hole      7      origin x= -1.760220E+00      y= 0.000000E+00      z=
7.016790E+01
hole      28      origin x= 1.760220E+00      y= 0.000000E+00      z=
7.016790E+01
cuboid      6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media      3      1      6      -5      -4      -3      -2      -1
hole      13      origin x= 0.000000E+00      y= 3.048800E+00      z=
7.207300E+01
hole      34      origin x= 0.000000E+00      y= -3.048800E+00      z=
7.207300E+01
hole      15      origin x= -1.760220E+00      y= 0.000000E+00      z=
7.207300E+01
hole      36      origin x= 1.760220E+00      y= 0.000000E+00      z=
7.207300E+01
boundary      6
unit      48
com=^2 fuel, water left and bottom^
cuboid      1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media      4      1      1
cuboid      2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media      3      1      2      -1
hole      1      origin x= 0.000000E+00      y= 3.048800E+00      z=
1.905100E+00
hole      22      origin x= 0.000000E+00      y= -3.048800E+00      z=
1.905100E+00
hole      23      origin x= -1.760220E+00      y= 0.000000E+00      z=
1.905100E+00
hole      4      origin x= 1.760220E+00      y= 0.000000E+00      z=
1.905100E+00
cuboid      3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media      4      1      3      -2      -1
hole      5      origin x= 0.000000E+00      y= 3.048800E+00      z=
2.444770E+01
hole      26      origin x= 0.000000E+00      y= -3.048800E+00      z=
2.444770E+01
hole      27      origin x= -1.760220E+00      y= 0.000000E+00      z=
2.444770E+01
hole      8      origin x= 1.760220E+00      y= 0.000000E+00      z=
2.444770E+01
cuboid      4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media      3      1      4      -3      -2      -1
hole      9      origin x= 0.000000E+00      y= 3.048800E+00      z=
2.635280E+01

```

```

hole 30 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 31 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 49
com=^2 fuel, water left and top^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 23 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 31 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1

```

```

hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 50
com=^1 fuel, fuel bottom^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 23 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 31 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 51
com=^1 fuel, fuel top^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00

```

```

hole      23 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole      24 origin x=  1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid    3
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 2.635271E+01 0.000000E+00
media      4 1 3 -2 -1
hole      5 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole      26 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole      27 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole      28 origin x=  1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid    4
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 7.016781E+01 0.000000E+00
media      3 1 4 -3 -2 -1
hole      9 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole     30 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole     31 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole     32 origin x=  1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid    5
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 7.207291E+01 0.000000E+00
media      4 1 5 -4 -3 -2 -1
hole      5 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole     26 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole     27 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole     28 origin x=  1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid    6
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 1.156335E+02 0.000000E+00
media      3 1 6 -5 -4 -3 -2 -1
hole     13 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole     34 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole     35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole     36 origin x=  1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary   6
unit       52
coms=^l fuel, fuel left^
cuboid    1
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 1.905000E+00 0.000000E+00
media      4 1 1
cuboid    2
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 2.444761E+01 0.000000E+00
media      3 1 2 -1
hole     21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole     22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole     33 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole     24 origin x=  1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid    3
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 2.635271E+01 0.000000E+00
media      4 1 3 -2 -1
hole     25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole     26 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole     71 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole     28 origin x=  1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid    4
              1.760220E+00 -1.760220E+00 3.048800E+00
              -3.048800E+00 7.016781E+01 0.000000E+00
media      3 1 4 -3 -2 -1
hole     29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01

```

```

hole      30 origin x=  0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole      11 origin x= -1.760220E+00 y=  0.000000E+00 z=
2.635280E+01
hole      32 origin x=  1.760220E+00 y=  0.000000E+00 z=
2.635280E+01
cuboid    5
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  7.207291E+01  0.000000E+00
media     4
hole      25 origin x=  0.000000E+00 y=  3.048800E+00 z=
7.016790E+01
hole      26 origin x=  0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole      7 origin x= -1.760220E+00 y=  0.000000E+00 z=
7.016790E+01
hole      28 origin x=  1.760220E+00 y=  0.000000E+00 z=
7.016790E+01
cuboid    6
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  1.156335E+02  0.000000E+00
media     3
hole      33 origin x=  0.000000E+00 y=  3.048800E+00 z=
7.207300E+01
hole      34 origin x=  0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole      15 origin x= -1.760220E+00 y=  0.000000E+00 z=
7.207300E+01
hole      36 origin x=  1.760220E+00 y=  0.000000E+00 z=
7.207300E+01
boundary  6
unit      53
com=^1 fuel, fuel right^
cuboid    1
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  1.905000E+00  0.000000E+00
media     4
cuboid    2
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  2.444771E+01  0.000000E+00
media     3
hole      21 origin x=  0.000000E+00 y=  3.048800E+00 z=
1.905100E+00
hole      22 origin x=  0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole      23 origin x= -1.760220E+00 y=  0.000000E+00 z=
1.905100E+00
hole      4 origin x=  1.760220E+00 y=  0.000000E+00 z=
1.905100E+00
cuboid    3
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  2.635271E+01  0.000000E+00
media     4
hole      25 origin x=  0.000000E+00 y=  3.048800E+00 z=
2.444770E+01
hole      26 origin x=  0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole      27 origin x= -1.760220E+00 y=  0.000000E+00 z=
2.444770E+01
hole      8 origin x=  1.760220E+00 y=  0.000000E+00 z=
2.444770E+01
cuboid    4
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  7.016781E+01  0.000000E+00
media     3
hole      29 origin x=  0.000000E+00 y=  3.048800E+00 z=
2.635280E+01
hole      30 origin x=  0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole      31 origin x= -1.760220E+00 y=  0.000000E+00 z=
2.635280E+01
hole      12 origin x=  1.760220E+00 y=  0.000000E+00 z=
2.635280E+01
cuboid    5
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  7.207291E+01  0.000000E+00
media     4
hole      25 origin x=  0.000000E+00 y=  3.048800E+00 z=
7.016790E+01
hole      26 origin x=  0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole      27 origin x= -1.760220E+00 y=  0.000000E+00 z=
7.016790E+01
hole      8 origin x=  1.760220E+00 y=  0.000000E+00 z=
7.016790E+01
cuboid    6
          1.760220E+00 -1.760220E+00  3.048800E+00
          -3.048800E+00  1.156335E+02  0.000000E+00
media     3

```

```

hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 54
com='^0 fuel^
cuboid 1
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.048800E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.048800E+00 z=
1.905100E+00
hole 23 origin x= -1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 1.760220E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.444770E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.048800E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -3.048800E+00 z=
2.635280E+01
hole 31 origin x= -1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 1.760220E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.016790E+01
hole 27 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
1.760220E+00 -1.760220E+00 3.048800E+00
-3.048800E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.048800E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.048800E+00 z=
7.207300E+01
hole 35 origin x= -1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 1.760220E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
global
unit 55
com='^tank with al and core^
cuboid 1
1.232572E+01 -3.344000E+01 1.220080E+01
-3.658000E+01 1.156335E+02 0.000000E+00
array 1 1
place 1 1 1 -3.167978E+01 -3.353120E+01
0.000000E+00
cylinder 2
6.500000E+01 1.156335E+02 -1.492250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
boundary 2

```

end geometry

```

read array
ara=1 nux=13 nuy=8 nuz=1
com='!124 pins, fuel core array!
fill
54 54 54 54 51 51 51 51 51 51 54 54 54
54 54 48 43 41 41 41 41 41 41 47 54 54
54 48 41 41 41 41 41 41 41 41 41 47 54
48 41 41 41 41 41 41 41 41 41 41 41 52
49 41 41 41 41 41 41 41 41 41 41 41 52
54 49 41 41 41 41 41 41 41 41 41 46 54
54 54 49 42 41 41 41 41 41 41 46 54 54
54 54 54 54 50 50 50 50 50 50 54 54 54
end fill
end array
end data
end

```

## 1.26 CASE MIXCT\_005\_CASE6\_K6

```

#csas26 parm='size=00500000'
4 wt 18 enrich puo2, lattice a, 253 pins, case new base
238group latticecell
'FUEL
pu-238 1 0 2.3455e-06 298 end
pu-239 1 0 6.3144e-04 298 end
pu-240 1 0 1.5162e-04 298 end
pu-241 1 0 4.0198e-05 298 end
am-241 1 0 3.1834e-06 298 end
pu-242 1 0 9.6333e-06 298 end
u-234 1 0 1.1117e-06 298 end
u-235 1 0 1.4553e-04 298 end
u-238 1 0 2.0066e-02 298 end
o 1 0 4.2714e-02 298 end
'ZIRC-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end
sn-112 2 0 4.6877e-06 298 end
sn-114 2 0 3.1413e-06 298 end
sn-115 2 0 1.7398e-06 298 end
sn-116 2 0 7.0219e-05 298 end
sn-117 2 0 3.7115e-05 298 end
sn-118 2 0 1.1705e-04 298 end
sn-119 2 0 4.1465e-05 298 end
sn-120 2 0 1.5750e-04 298 end
sn-122 2 0 2.2375e-05 298 end
sn-124 2 0 2.7981e-05 298 end
'WATER
h 3 0 6.6662e-02 298 end
o 3 0 3.3331e-02 298 end
'Lucite
c 4 0 3.5489e-02 298 end
h 4 0 5.6782e-02 298 end
o 4 0 1.4196e-02 298 end
' UO2 powder
u-234 5 0 1.1580e-06 298 end
u-235 5 0 1.5160e-04 298 end
u-238 5 0 2.0902e-02 298 end
o 5 0 4.2715e-02 298 end
end comp
triangpitch 4.0640 1.26366 1 3 1.43384 2 end
more data DAB=300 end more
read parm tme=180 gen=700 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit 1
com='^fuel pin, top^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4

```

```

7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 2
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 3
com=^fuel pin, left^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 4
com=^fuel pin, right^
cylinder 1
6.318300E-01 2.254250E+01 1.081300E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
6.318300E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 2 -1
cylinder 3
7.169200E-01 2.254250E+01 6.985000E-01
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 3 -2 -1
cylinder 4
7.169200E-01 2.254250E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 4 -3 -2 -1
boundary 4
unit 5
com=^fuel pin, top^
cylinder 1

```

```

6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 6
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 7
com=^fuel pin, left^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 8
com=^fuel pin, right^
cylinder 1
6.318300E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 9
com=^fuel pin, top^
cylinder 1
6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 10
com=^fuel pin, bottom^
cylinder 1
6.318300E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
7.169200E-01 4.381500E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 11
com=^fuel pin, left^
cylinder 1

```



```

        6.318300E-01 4.381500E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 4.381500E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 12
com=^fuel pin, right^
cylinder 1
        6.318300E-01 4.381500E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 4.381500E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=^fuel pin, top^
cylinder 1
        6.318300E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 2 1 2 -1
cylinder 3
        7.169200E-01 2.279650E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 14
com=^fuel pin, bottom^
cylinder 1
        6.318300E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 2 1 2 -1
cylinder 3
        7.169200E-01 2.279650E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 15
com=^fuel pin, left^
cylinder 1
        6.318300E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 2 1 2 -1
cylinder 3
        7.169200E-01 2.279650E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 2 1 3 -2 -1
boundary 3

```

```

unit 16
com=^fuel pin, right^
cylinder 1
        6.318300E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 1 1 1
cylinder 2
        7.169200E-01 2.197100E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 2 1 2 -1
cylinder 3
        7.169200E-01 2.279650E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 2 1 3 -2 -1
boundary 3
unit 21
com=^fuel pin, top^
cylinder 1
        7.169200E-01 2.254250E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 22
com=^fuel pin, bottom^
cylinder 1
        7.169200E-01 2.254250E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 23
com=^fuel pin, left^
cylinder 1
        7.169200E-01 2.254250E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 24
com=^fuel pin, right^
cylinder 1
        7.169200E-01 2.254250E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 25
com=^fuel pin, top^
cylinder 1
        7.169200E-01 1.905000E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 26
com=^fuel pin, bottom^
cylinder 1
        7.169200E-01 1.905000E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 27
com=^fuel pin, left^
cylinder 1
        7.169200E-01 1.905000E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 28
com=^fuel pin, right^
cylinder 1
        7.169200E-01 1.905000E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 29
com=fuel pin, top^
cylinder 1
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 30
com=fuel pin, bottom^
cylinder 1
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 31
com=fuel pin, left^
cylinder 1
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 32
com=fuel pin, right^
cylinder 1
    7.169200E-01 4.381500E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 33
com=fuel pin, top^
cylinder 1
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 3 1 1
boundary 1
unit 34
com=fuel pin, bottom^
cylinder 1
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 3 1 1
boundary 1
unit 35
com=fuel pin, left^
cylinder 1
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 3 1 1
boundary 1
unit 36
com=fuel pin, right^
cylinder 1
    7.169200E-01 2.279650E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 3 1 1
boundary 1
unit 41
com=fuel pin, top^
cuboid 1
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 1
cuboid 2
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 2.444770E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 3 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 11 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 15 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 42
com=fuel pin, water top^
cuboid 1
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 2.444770E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
    2.032000E+00 -2.032000E+00 3.519500E+00
    -3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01

```

```

hole 10 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 11 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 15 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 43
com=^3 fuel, water bottom^
cuboid 1
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 3 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 11 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1

```

```

hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 15 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 44
com=^3 fuel, water left^
cuboid 1
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 31 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 45
com=^3 fuel, water right^
cuboid 1
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
      2.032000E+00 -2.032000E+00 3.519500E+00
      -3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00

```



```

hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 15 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 48
com=^2 fuel, water left and bottom^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 1 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 9 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 31 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 5 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 49
com=^2 fuel, water left and top^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00

```

```

hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 10 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 31 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 14 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 50
com=^1 fuel, fuel bottom^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 2 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 6 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01

```

hale	10	origin	x=	0.000000E+00	y=	-3.519500E+00	z=
2.635280E+01							
hole	31	origin	x=	-2.032000E+00	y=	0.000000E+00	z=
2.635280E+01							
hole	32	origin	x=	2.032000E+00	y=	0.000000E+00	z=
2.635280E+01							
cuboid	5						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	7.207291E+01	0.000000E+00	
media	4						
hole	1			5	-4	-3	-2
7.016790E+01		origin	x=	0.000000E+00	y=	3.519500E+00	z=
hole	6	origin	x=	0.000000E+00	y=	-3.519500E+00	z=
7.016790E+01							
hole	27	origin	x=	-2.032000E+00	y=	0.000000E+00	z=
7.016790E+01							
hole	28	origin	x=	2.032000E+00	y=	0.000000E+00	z=
7.016790E+01							
cuboid	6						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	1.156335E+02	0.000000E+00	
media	3						
hole	1			6	-5	-4	-3
7.207300E+01		origin	x=	0.000000E+00	y=	3.519500E+00	z=
hole	14	origin	x=	0.000000E+00	y=	-3.519500E+00	z=
7.207300E+01							
hole	35	origin	x=	-2.032000E+00	y=	0.000000E+00	z=
7.207300E+01							
hole	36	origin	x=	2.032000E+00	y=	0.000000E+00	z=
7.207300E+01							
boundary	6						
unit	51						
com=^1 fuel, fuel top^							
cuboid	1						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	1.905000E+00	0.000000E+00	
media	4						
cuboid	2						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	2.444761E+01	0.000000E+00	
media	3						
hole	1			2	-1		
1.905100E+00		origin	x=	0.000000E+00	y=	3.519500E+00	z=
hole	22	origin	x=	0.000000E+00	y=	-3.519500E+00	z=
1.905100E+00							
hole	23	origin	x=	-2.032000E+00	y=	0.000000E+00	z=
1.905100E+00							
hole	24	origin	x=	2.032000E+00	y=	0.000000E+00	z=
1.905100E+00							
cuboid	3						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	2.635271E+01	0.000000E+00	
media	4						
hole	1			3	-2	-1	
2.444770E+01		origin	x=	0.000000E+00	y=	3.519500E+00	z=
hole	26	origin	x=	0.000000E+00	y=	-3.519500E+00	z=
2.444770E+01							
hole	27	origin	x=	-2.032000E+00	y=	0.000000E+00	z=
2.444770E+01							
hole	28	origin	x=	2.032000E+00	y=	0.000000E+00	z=
2.444770E+01							
cuboid	4						
				2.032000E+00	-2.032000E+00	3.519500E+00	
				-3.519500E+00	7.016781E+01	0.000000E+00	
media	3						
hole	1			4	-3	-2	-1
2.635280E+01		origin	x=	0.000000E+00	y=	3.519500E+00	z=
hole	30	origin	x=	0.000000E+00	y=	-	

```

hole 13 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 52
com=^1 fuel, fuel left^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3
hole 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 3 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4
hole 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3
hole 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 11 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.207291E+01 0.000000E+00
media 4
hole 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 7 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.156335E+02 0.000000E+00
media 3
hole 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 15 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 53
com=^1 fuel, fuel right^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3
hole 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00

```

```

hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 4 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01
hole 30 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 31 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 12 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 8 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 16 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
unit 54
com='^0 fuel^
cuboid 1
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.905000E+00 0.000000E+00
media 4 1 1
cuboid 2
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.444761E+01 0.000000E+00
media 3 1 2 -1
hole 21 origin x= 0.000000E+00 y= 3.519500E+00 z=
1.905100E+00
hole 22 origin x= 0.000000E+00 y= -3.519500E+00 z=
1.905100E+00
hole 23 origin x= -2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
hole 24 origin x= 2.032000E+00 y= 0.000000E+00 z=
1.905100E+00
cuboid 3
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 2.635271E+01 0.000000E+00
media 4 1 3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.444770E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.444770E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.444770E+01
cuboid 4
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.016781E+01 0.000000E+00
media 3 1 4 -3 -2 -1
hole 29 origin x= 0.000000E+00 y= 3.519500E+00 z=
2.635280E+01

```

```

hole 30 origin x= 0.000000E+00 y= -3.519500E+00 z=
2.635280E+01
hole 31 origin x= -2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
hole 32 origin x= 2.032000E+00 y= 0.000000E+00 z=
2.635280E+01
cuboid 5
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 7.207291E+01 0.000000E+00
media 4 1 5 -4 -3 -2 -1
hole 25 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.016790E+01
hole 26 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.016790E+01
hole 27 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
hole 28 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.016790E+01
cuboid 6
2.032000E+00 -2.032000E+00 3.519500E+00
-3.519500E+00 1.156335E+02 0.000000E+00
media 3 1 6 -5 -4 -3 -2 -1
hole 33 origin x= 0.000000E+00 y= 3.519500E+00 z=
7.207300E+01
hole 34 origin x= 0.000000E+00 y= -3.519500E+00 z=
7.207300E+01
hole 35 origin x= -2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
hole 36 origin x= 2.032000E+00 y= 0.000000E+00 z=
7.207300E+01
boundary 6
global
unit 55
com='^tank with al and core^
cuboid 1
2.235000E+01 -3.861000E+01 1.408200E+01
-4.223000E+01 1.156335E+02 0.000000E+00
array 1 1
place 1 1 1 -3.657800E+01 -3.871050E+01
0.000000E+00
cylinder 2
6.500000E+01 1.156335E+02 -1.492250E+01
origin x= 0.000000E+00 y= 0.000000E+00
media 3 1 2 -1
boundary 2
end geometry

read array
ara=1 nux=15 nuy=8 nuz=1
com='!181 pins, fuel core array!
fill
54 54 54 48 43 43 43 43 43 43 43 47 54 54 54
54 48 43 41 41 41 41 41 41 41 41 41 43 47 54
53 41 41 41 41 41 41 41 41 41 41 41 41 41 52
48 41 41 41 41 41 41 41 41 41 41 41 41 41 47
49 41 41 41 41 41 41 41 41 41 41 41 41 41 46
53 41 41 41 41 41 41 41 41 41 41 41 41 41 52
54 49 42 41 41 41 41 41 41 41 41 41 41 42 46 54
54 54 54 49 42 42 42 42 42 42 42 46 54 54 54
end fill
end array
end data
end

1.27 CASE MIXCT_009_CASE1_K6

#csas26 parm='size=00500000'
1.5 wt % with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group latticecell
' Fuel Meat UO2 = 1.5 %
pu-239 1 0 2.9191e-04 298 end
pu-240 1 0 2.5004e-05 298 end
pu-241 1 0 2.1087e-06 298 end
am-241 1 0 2.2243e-07 298 end
pu-242 1 0 9.5801e-08 298 end
u-234 1 0 1.1580e-06 298 end
u-235 1 0 3.3688e-05 298 end
u-238 1 0 2.1020e-02 298 end
o 1 0 4.2749e-02 298 end
' Zirc-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end
sn-112 2 0 4.6877e-06 298 end
sn-114 2 0 3.1413e-06 298 end
sn-115 2 0 1.7398e-06 298 end
sn-116 2 0 7.0219e-05 298 end
sn-117 2 0 3.7115e-05 298 end

```

```

sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
' Water
h           3 0 6.6662e-02 298 end
o           3 0 3.3331e-02 298 end
' ZrO2
zr          4 0 2.0854e-02 298 end
o           4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe          5 0 5.5766e-03 298 end
cr          5 0 1.6386e-03 298 end
ni          5 0 7.6409e-04 298 end
mn          5 0 8.1627e-05 298 end
c           5 0 5.6004e-06 298 end
si          5 0 7.9836e-05 298 end
s           5 0 2.0978e-06 298 end
p           5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr          6 0 1.4231e-02 298 end
ni          6 0 1.0129e-05 298 end
cr          6 0 2.5407e-05 298 end
fe          6 0 3.1934e-05 298 end
sn-112      6 0 1.5652e-06 298 end
sn-114      6 0 1.0488e-06 298 end
sn-115      6 0 5.8090e-07 298 end
sn-116      6 0 2.3446e-05 298 end
sn-117      6 0 1.2392e-05 298 end
sn-118      6 0 3.9081e-05 298 end
sn-119      6 0 1.3845e-05 298 end
sn-120      6 0 5.2587e-05 298 end
sn-122      6 0 7.4710e-06 298 end
sn-124      6 0 9.3427e-06 298 end
h           6 0 4.4404e-02 298 end
o           6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr          7 0 1.3748e-02 298 end
ni          7 0 9.7854e-06 298 end
cr          7 0 2.4545e-05 298 end
fe          7 0 3.0851e-05 298 end
sn-112      7 0 1.5121e-06 298 end
sn-114      7 0 1.0133e-06 298 end
sn-115      7 0 5.6120e-07 298 end
sn-116      7 0 2.2651e-05 298 end
sn-117      7 0 1.1972e-05 298 end
sn-118      7 0 3.7757e-05 298 end
sn-119      7 0 1.3375e-05 298 end
sn-120      7 0 5.0805e-05 298 end
sn-122      7 0 7.2177e-06 298 end
sn-124      7 0 9.0260e-06 298 end
h           7 0 4.5159e-02 298 end
o           7 0 2.2580e-02 298 end
' Water
h           8 0 6.6662e-02 298 end
o           8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si          9 0 3.4607e-04 298 end
fe          9 0 1.0152e-04 298 end
cu          9 0 6.3731e-05 298 end
mn          9 0 2.2115e-05 298 end
mg          9 0 6.6651e-04 298 end
cr          9 0 6.2310e-05 298 end
ti          9 0 2.5375e-05 298 end
al          9 0 5.8433e-02 298 end
end comp
triangpitch 1.397 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit 5
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media 3 1 1
boundary 1
unit 10
com=^ top hemicylinder^
cylinder 1
        5.384800E-01 3.333800E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 7 1 1
cylinder 2
        5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 7 1 1
cylinder 2
        5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 7 1 1
cylinder 2
        5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +x= 0.000000E+00
media 7 1 1
cylinder 2
        5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=^ right hemicylinder^
cylinder 1
        5.384800E-01 3.333800E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 7 1 1
cylinder 2
        5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 15
com=^ complete layer^
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 11 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 12 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 16
com=^ top hemicylinder^
cylinder 1
        4.724400E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 1 1 1
cylinder 2
        5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 17
com=^ bottom hemicylinder^
cylinder 1
        4.724400E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
        chord +y= 0.000000E+00
media 1 1 1
cylinder 2
        5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00

```



```

chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 18
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 19
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 20
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 18 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 21
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 22
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 23
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 24
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 25
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 23 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 26
com=^ top hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 27
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 28
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 29
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 30
com=^ complete layer^
cuboid 1
    6.985000E-01 -6.985000E-01 1.209800E+00
    -1.209800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 28 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 31
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 33
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 34
com=^ right hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 35
com=^ complete layer^
cuboid 1
    6.985000E-01 -6.985000E-01 1.209800E+00
    -1.209800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 33 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

hole 34 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 36
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 4 1 1
cylinder 2
    5.384800E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 37
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 4 1 1
cylinder 2
    5.384800E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 38
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 4 1 1
cylinder 2
    5.384800E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 39
com=^ right hemicylinder^
cylinder 1
    4.724400E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 4 1 1
cylinder 2
    5.384800E-01 6.350000E-01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 40
com=^ complete layer^
cuboid 1
    6.985000E-01 -6.985000E-01 1.209800E+00
    -1.209800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 38 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 41
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 1.206480E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 5 1 1
cylinder 2
    5.384800E-01 1.206480E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 42
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 43
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 44
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 45
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 43 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 46
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 47
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord +y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 48
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 49
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 50
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 48 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 51
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 8 1 1
boundary 1
unit 52
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 8 1 1
boundary 1
unit 53
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 8 1 1
boundary 1
unit 54
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 8 1 1
boundary 1
unit 60
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 4.682500E+00 0.000000E+00
media 8 1 1

```

hole	11	origin x=	0.000000E+00	y=	-1.209800E+00	z=			6.985000E-01	-6.985000E-01	1.209800E+00
0.000000E+00									-1.209800E+00	2.141200E+00	0.000000E+00
hole	12	origin x=	-6.985000E-01	y=	0.000000E+00	z=		media	8	1	1
0.000000E+00								hole	47	origin x=	0.000000E+00 y= -1.209800E+00 z=
hole	13	origin x=	6.985000E-01	y=	0.000000E+00	z=		0.000000E+00			
0.000000E+00								hole	48	origin x=	-6.985000E-01 y= 0.000000E+00 z=
boundary	1							0.000000E+00			
unit	61							hole	49	origin x=	6.985000E-01 y= 0.000000E+00 z=
com=^ complete layer^								0.000000E+00			
cuboid	1							boundary	1		
			6.985000E-01	-6.985000E-01	1.209800E+00			unit	70		
			-1.209800E+00	3.087750E+01	0.000000E+00			com=^ complete layer^			
media	8	1	1					cuboid	1		
hole	17	origin x=	0.000000E+00	y=	-1.209800E+00	z=				6.985000E-01	-6.985000E-01 1.209800E+00
0.000000E+00										-1.209800E+00	4.682500E+00 0.000000E+00
hole	18	origin x=	-6.985000E-01	y=	0.000000E+00	z=		media	8	1	1
0.000000E+00								hole	10	origin x=	0.000000E+00 y= 1.209800E+00 z=
hole	19	origin x=	6.985000E-01	y=	0.000000E+00	z=		0.000000E+00			
0.000000E+00								hole	12	origin x=	-6.985000E-01 y= 0.000000E+00 z=
boundary	1							0.000000E+00			
unit	62							hole	13	origin x=	6.985000E-01 y= 0.000000E+00 z=
com=^ complete layer^								0.000000E+00			
cuboid	1							boundary	1		
			6.985000E-01	-6.985000E-01	1.209800E+00			unit	71		
			-1.209800E+00	1.905000E+00	0.000000E+00			com=^ complete layer^			
media	3	1	1					cuboid	1		
hole	51	origin x=	0.000000E+00	y=	1.209800E+00	z=				6.985000E-01	-6.985000E-01 1.209800E+00
0.000000E+00										-1.209800E+00	3.087750E+01 0.000000E+00
hole	22	origin x=	0.000000E+00	y=	-1.209800E+00	z=		media	8	1	1
0.000000E+00								hole	16	origin x=	0.000000E+00 y= 1.209800E+00 z=
hole	23	origin x=	-6.985000E-01	y=	0.000000E+00	z=		0.000000E+00			
0.000000E+00								hole	18	origin x=	-6.985000E-01 y= 0.000000E+00 z=
hole	24	origin x=	6.985000E-01	y=	0.000000E+00	z=		0.000000E+00			
0.000000E+00								hole	19	origin x=	6.985000E-01 y= 0.000000E+00 z=
boundary	1							0.000000E+00			
unit	63							boundary	1		
com=^ complete layer^								unit	72		
cuboid	1							com=^ complete layer^			
			6.985000E-01	-6.985000E-01	1.209800E+00			cuboid	1		
			-1.209800E+00	3.556000E+01	0.000000E+00					6.985000E-01	-6.985000E-01 1.209800E+00
media	8	1	1							-1.209800E+00	1.905000E+00 0.000000E+00
hole	27	origin x=	0.000000E+00	y=	-1.209800E+00	z=		media	3	1	1
0.000000E+00								hole	21	origin x=	0.000000E+00 y= 1.209800E+00 z



```

hole 26 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 28 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 94
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 33 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 95
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 38 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 96
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 43 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 97
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 48 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 101
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 10 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 102
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 11 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 103
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 12 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00

```

```

media 8 1 2 -1
boundary 2
unit 104
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 13 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 105
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 14 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 106
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 15 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 107
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 16 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 108
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 17 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 109
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 18 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 110
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 19 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 111
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.446185E+02 0.000000E+00
array 20 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2

```

```

unit      112
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.446185E+02 0.000000E+00
array     21
        1
        place 1 1 1 0. 0. 0.000000E+00
cuboid    2
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.450000E+02 0.000000E+00
media     8
        1 2 -1
boundary  2
unit      113
cuboid    1
        -6.985000E-01 -6.985000E-01 -1.209800E+00
        -1.209800E+00 0.000000E+00 0.000000E+00
array     22
        1
        place 1 1 1 0.000000E+00 0.000000E+00
0.000000E+00
cuboid    2
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.450000E+02 0.000000E+00
media     8
        1 2 -1
boundary  2
unit      114
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.446185E+02 0.000000E+00
array     23
        1
        place 1 1 1 0. 0. 0.000000E+00
cuboid    2
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.450000E+02 0.000000E+00
media     8
        1 2 -1
boundary  2
global
unit      115
cuboid    1
        6.007100E+01 0.000000E+00 6.049000E+01
        0.000000E+00 1.450000E+02 0.000000E+00
array     1
        1
        place 1 1 1 6.985000E-01 1.209800E+00
0.000000E+00
cuboid    2
        8.000000E+01 -2.000000E+01 8.000000E+01
        -2.000000E+01 1.499394E+02 -1.476380E+01
media     8
        1 2 -1
cuboid    3
        8.000000E+01 -2.000000E+01 8.000000E+01
        -2.000000E+01 1.499394E+02 -1.603380E+01
media     9
        1 3 -2 -1
boundary  3
unit      120
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 4.682500E+00 0.000000E+00
media     8
        1 1
hole     10 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     13 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      121
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.087750E+01 0.000000E+00
media     8
        1 1
hole     16 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     19 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      122
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media     3
        1 1
hole     21 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole     53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole     24 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      123
com=^ complete layer^

```

```

cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.556000E+01 0.000000E+00
media     8
        1 1
hole     26 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     29 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      124
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.547750E+01 0.000000E+00
media     8
        1 1
hole     31 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     34 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      125
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 6.350000E-01 0.000000E+00
media     8
        1 1
hole     36 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     39 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      126
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.206480E+01 0.000000E+00
media     8
        1 1
hole     41 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     44 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      127
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 2.141200E+00 0.000000E+00
media     8
        1 1
hole     46 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     49 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      130
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 4.682500E+00 0.000000E+00
media     8
        1 1
hole     10 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     12 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      131
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.087750E+01 0.000000E+00
media     8
        1 1
hole     16 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     18 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      132
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media     3
        1 1
hole     21 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole     23 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole     54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1

```

```

unit      133
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 3.556000E+01 0.000000E+00
media     8 1 1
hole      26 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      28 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      134
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.547750E+01 0.000000E+00
media     8 1 1
hole      31 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      33 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      135
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 6.350000E-01 0.000000E+00
media     8 1 1
hole      36 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      38 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      136
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.206480E+01 0.000000E+00
media     8 1 1
hole      41 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      43 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      137
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 2.141200E+00 0.000000E+00
media     8 1 1
hole      46 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      48 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      140
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 4.682500E+00 0.000000E+00
media     8 1 1
hole      11 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      12 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      141
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 3.087750E+01 0.000000E+00
media     8 1 1
hole      17 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      18 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      142
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.905000E+00 0.000000E+00
media     3 1 1
hole      51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      22 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      23 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

hole      54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      143
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 3.556000E+01 0.000000E+00
media     8 1 1
hole      27 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      28 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      144
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.547750E+01 0.000000E+00
media     8 1 1
hole      32 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      33 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      145
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 6.350000E-01 0.000000E+00
media     8 1 1
hole      37 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      38 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      146
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.206480E+01 0.000000E+00
media     8 1 1
hole      42 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      43 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      147
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 2.141200E+00 0.000000E+00
media     8 1 1
hole      47 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      48 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      150
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 4.682500E+00 0.000000E+00
media     8 1 1
hole      11 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      13 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      151
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 3.087750E+01 0.000000E+00
media     8 1 1
hole      17 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole      19 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      152
com=^ complete layer^
cuboid    1
          6.985000E-01 -6.985000E-01 1.209800E+00
          -1.209800E+00 1.905000E+00 0.000000E+00
media     3 1 1
hole      51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole      22 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00

```



```

hole 53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 153
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 29 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 34 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 39 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 44 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 49 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

hole 54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 164
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
boundary 1
unit 170
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary 1
unit 171
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary 1
unit 172
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 173
com=^ complete layer^
cuboid 1
6.985000E-01 -6.985000E-01 1.209800E+00
-1.209800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary 1

```

```

unit      174
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.547750E+01 0.000000E+00
media      8      1      1
hole     32 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary  1
unit      175
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 6.350000E-01 0.000000E+00
media      8      1      1
hole     37 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary  1
unit      176
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.206480E+01 0.000000E+00
media      8      1      1
hole     42 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary  1
unit      177
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 2.141200E+00 0.000000E+00
media      8      1      1
hole     47 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
boundary  1
unit      180
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole     12 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      181
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole     18 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      182
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole     51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole     23 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole     54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      183
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.556000E+01 0.000000E+00
media      8      1      1
hole     28 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      184
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.547750E+01 0.000000E+00
media      8      1      1
hole     33 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      185
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 6.350000E-01 0.000000E+00
media      8      1      1
hole     38 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      186
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.206480E+01 0.000000E+00
media      8      1      1
hole     43 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      187
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 2.141200E+00 0.000000E+00
media      8      1      1
hole     48 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      190
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole     13 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      191
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole     19 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      192
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole     51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole     53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole     24 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      193
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.556000E+01 0.000000E+00
media      8      1      1
hole     29 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      194
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.547750E+01 0.000000E+00
media      8      1      1
hole     34 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      195
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 6.350000E-01 0.000000E+00
media      8      1      1
hole     39 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      196
com=^ complete layer^
cuboid    1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.206480E+01 0.000000E+00
media      8      1      1

```

```

hole 44 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 197
com=^ complete layer^
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 49 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 202
com=^ complete layer^
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.209800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.209800E+00 z=
0.000000E+00
hole 53 origin x= -6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 6.985000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 203
com=^ complete layer^
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.556000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 204
com=^ complete layer^
cuboid 1
        6.985000E-01 -6.985000E-01 1.209800E+00
        -1.209800E+00 3.031850E+01 0.000000E+00
media 8 1 1
boundary 1
end geometry

read array
ara=1 nux=43 nuy=25 nuz=1 fill
19r114 6r110 18r114
13r114 106 5r103 6r101 4r103 107 13r114
10r114 110 106 103 17r101 103 107 110 10r114
8r114 106 103 23r101 103 107 8r114
6r114 106 103 27r101 103 107 6r114
5r114 106 31r101 107 5r114
4r114 106 33r101 107 4r114
3r114 106 35r101 107 3r114
2r114 106 37r101 107 2r114
2r114 104 37r101 105 2r114
114 106 39r101 107 114
114 104 39r101 105 114
114 104 39r101 105 114
114 104 39r101 105 114
114 109 39r101 108 114
2r114 104 38r101 112 114
2r114 109 37r101 108 2r114
3r114 109 35r101 108 3r114
4r114 109 33r101 108 4r114
5r114 109 31r101 108 5r114
6r114 109 102 27r101 102 108 6r114
8r114 109 25r101 108 8r114
9r114 109 102 102 19r101 102 102 108 9r114
12r114 111 109 5r102 6r101 4r102 108 111 12r114
19r114 6r111 18r114 t end fill
'----- Fuel Rod Layer Stacks
ara=10 nux=1 nuy=1 nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11 nux=1 nuy=1 nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12 nux=1 nuy=1 nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13 nux=1 nuy=1 nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14 nux=1 nuy=1 nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15 nux=1 nuy=1 nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16 nux=1 nuy=1 nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17 nux=1 nuy=1 nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18 nux=1 nuy=1 nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19 nux=1 nuy=1 nuz=12

```

```

fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20 nux=1 nuy=1 nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21 nux=1 nuy=1 nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22 nux=1 nuy=1 nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23 nux=1 nuy=1 nuz=8
fill 5 203 202 203 202 203 202 204 end fill
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end

```

## 1.28 CASE MIXCT\_009\_CASE2\_K6

```

#csas26      parm='size=00500000'
1.5 wt % with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group      latticecell
' Fuel Meat UO2 = 1.5 %
pu-239      1 0 2.9191e-04 298 end
pu-240      1 0 2.5004e-05 298 end
pu-241      1 0 2.1087e-06 298 end
am-241      1 0 2.2243e-07 298 end
pu-242      1 0 9.5801e-08 298 end
u-234      1 0 1.1580e-06 298 end
u-235      1 0 3.3688e-05 298 end
u-238      1 0 2.1020e-02 298 end
o          1 0 4.2749e-02 298 end
' Zirc-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112      2 0 4.6877e-06 298 end
sn-114      2 0 3.1413e-06 298 end
sn-115      2 0 1.7398e-06 298 end
sn-116      2 0 7.0219e-05 298 end
sn-117      2 0 3.7115e-05 298 end
sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
' Water
h          3 0 6.6662e-02 298 end
o          3 0 3.3331e-02 298 end
' ZrO2
zr          4 0 2.0854e-02 298 end
o          4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe          5 0 5.5766e-03 298 end
cr          5 0 1.6386e-03 298 end
ni          5 0 7.6409e-04 298 end
mn          5 0 8.1627e-05 298 end
c          5 0 5.6004e-06 298 end
si          5 0 7.9836e-05 298 end
s          5 0 2.0978e-06 298 end
p          5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr          6 0 1.4231e-02 298 end
ni          6 0 1.0129e-05 298 end
cr          6 0 2.5407e-05 298 end
fe          6 0 3.1934e-05 298 end
sn-112      6 0 1.5652e-06 298 end
sn-114      6 0 1.0488e-06 298 end
sn-115      6 0 5.8090e-07 298 end
sn-116      6 0 2.3446e-05 298 end
sn-117      6 0 1.2392e-05 298 end
sn-118      6 0 3.9081e-05 298 end
sn-119      6 0 1.3845e-05 298 end
sn-120      6 0 5.2587e-05 298 end
sn-122      6 0 7.4710e-06 298 end
sn-124      6 0 9.3427e-06 298 end
h          6 0 4.4404e-02 298 end
o          6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr          7 0 1.3748e-02 298 end
ni          7 0 9.7854e-06 298 end
cr          7 0 2.4545e-05 298 end
fe          7 0 3.0851e-05 298 end

```

```

sn-112      7 0 1.5121e-06 298 end
sn-114      7 0 1.0133e-06 298 end
sn-115      7 0 5.6120e-07 298 end
sn-116      7 0 2.2651e-05 298 end
sn-117      7 0 1.1972e-05 298 end
sn-118      7 0 3.7757e-05 298 end
sn-119      7 0 1.3375e-05 298 end
sn-120      7 0 5.0805e-05 298 end
sn-122      7 0 7.2177e-06 298 end
sn-124      7 0 9.0260e-06 298 end
h           7 0 4.5159e-02 298 end
o           7 0 2.2580e-02 298 end
' Water
h           8 0 6.6662e-02 298 end
o           8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si          9 0 3.4607e-04 298 end
fe          9 0 1.0152e-04 298 end
cu          9 0 6.3731e-05 298 end
mn          9 0 2.2115e-05 298 end
mg          9 0 6.6651e-04 298 end
cr          9 0 6.2310e-05 298 end
ti          9 0 2.5375e-05 298 end
al          9 0 5.8433e-02 298 end
end comp
triangpitch 1.5240 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=40
nub=yes end parm
read geometry
unit        5
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.905000E+00 0.000000E+00
media       3 1 1
boundary    1
unit        10
com=^ top hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        11
com=^ bottom hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        12
com=^ left hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        13
com=^ right hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        13
com=^ right hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        15
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 4.682500E+00 0.000000E+00
media       8 1 1
hole        10 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole        11 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole        12 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole        13 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        16
com=^ top hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        17
com=^ bottom hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        18
com=^ left hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        19
com=^ right hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        20
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 3.087750E+01 0.000000E+00
media       8 1 1
hole        16 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00

```

```

hole 17 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 18 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 21
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 22
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 23
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 24
com=^ right hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 25
com=^ complete layer^
cuboid 1
    7.620000E-01 -7.620000E-01 1.319800E+00
    -1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 23 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 26
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 28
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 29
com=^ right hemicylinder^
cylinder 1
    4.724400E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.556000E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 30
com=^ complete layer^
cuboid 1
    7.620000E-01 -7.620000E-01 1.319800E+00
    -1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 28 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 31
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 1.547750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
    chord +y= 0.000000E+00
media 1 1 1

```

```

cylinder 2
  5.384800E-01 1.547750E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 33
com=^ left hemicylinder^
cylinder 1
  4.724400E-01 1.547750E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 1 1 1
cylinder 2
  5.384800E-01 1.547750E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 34
com=^ right hemicylinder^
cylinder 1
  4.724400E-01 1.547750E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 1 1 1
cylinder 2
  5.384800E-01 1.547750E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 35
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 33 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 36
com=^ top hemicylinder^
cylinder 1
  4.724400E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 4 1 1
cylinder 2
  5.384800E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 37
com=^ bottom hemicylinder^
cylinder 1
  4.724400E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 4 1 1
cylinder 2
  5.384800E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 38
com=^ left hemicylinder^
cylinder 1
  4.724400E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 4 1 1

```

```

cylinder 2
  5.384800E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 39
com=^ right hemicylinder^
cylinder 1
  4.724400E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 4 1 1
cylinder 2
  5.384800E-01 6.350000E-01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 40
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 38 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 41
com=^ top hemicylinder^
cylinder 1
  4.724400E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 5 1 1
cylinder 2
  5.384800E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 42
com=^ bottom hemicylinder^
cylinder 1
  4.724400E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 5 1 1
cylinder 2
  5.384800E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 43
com=^ left hemicylinder^
cylinder 1
  4.724400E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 5 1 1
cylinder 2
  5.384800E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 44
com=^ right hemicylinder^
cylinder 1
  4.724400E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 5 1 1

```

```

cylinder 2
  5.384800E-01 1.206480E+01 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 45
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 43 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 46
com=^ top hemicylinder^
cylinder 1
  5.384800E-01 1.348700E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 2 1 1
cylinder 2
  5.384800E-01 2.141200E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 47
com=^ bottom hemicylinder^
cylinder 1
  5.384800E-01 1.348700E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 2 1 1
cylinder 2
  5.384800E-01 2.141200E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 48
com=^ left hemicylinder^
cylinder 1
  5.384800E-01 1.348700E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 2 1 1
cylinder 2
  5.384800E-01 2.141200E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 49
com=^ right hemicylinder^
cylinder 1
  5.384800E-01 1.348700E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 2 1 1
cylinder 2
  5.384800E-01 2.141200E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 50
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00

hole 47 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 48 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 51
com=^ top hemicylinder^
cylinder 1
  5.384800E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -y= 0.000000E+00
media 8 1 1
boundary 1
unit 52
com=^ bottom hemicylinder^
cylinder 1
  5.384800E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +y= 0.000000E+00
media 8 1 1
boundary 1
unit 53
com=^ left hemicylinder^
cylinder 1
  5.384800E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord +x= 0.000000E+00
media 8 1 1
boundary 1
unit 54
com=^ right hemicylinder^
cylinder 1
  5.384800E-01 1.905000E+00 0.000000E+00
  origin x= 0.000000E+00 y=
0.000000E+00
  chord -x= 0.000000E+00
media 8 1 1
boundary 1
unit 60
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 12 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 61
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 18 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 62
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 23 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 63
com=^ complete layer^
cuboid 1
  7.620000E-01 -7.620000E-01 1.319800E+00
  -1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1

```







```

hole 42 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 43 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 97
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8
1 1
hole 46 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 48 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 101
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 10
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 102
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 11
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 103
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 12
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 104
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 13
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 105
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 14
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 106
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 15
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 107
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 16
1
place 1 1 1 0. 0. 0.000000E+00

cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 108
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 17
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 109
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 18
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 110
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 19
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 111
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 20
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 112
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 21
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 113
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 22
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 114
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.446185E+02 0.000000E+00
array 23
1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.450000E+02 0.000000E+00
media 8
1 2 -1
boundary 2
unit 115
cuboid 1
5.029200E+01 0.000000E+00 5.015240E+01
0.000000E+00 1.450000E+02 0.000000E+00
array 1
1
place 1 1 1 7.620000E-01 1.319800E+00
0.000000E+00

```

```

cuboid      2
            8.000000E+01 -2.000000E+01 8.000000E+01
            -2.000000E+01 1.499394E+02 -1.476380E+01
media      8      1      2      -1
cuboid      3
            8.000000E+01 -2.000000E+01 8.000000E+01
            -2.000000E+01 1.499394E+02 -1.603380E+01
media      9      1      3      -2      -1
boundary    3
unit        120
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole      10 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      13 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        121
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole      16 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      19 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        122
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole      21 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole      53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole      24 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        123
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 3.556000E+01 0.000000E+00
media      8      1      1
hole      26 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      29 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        124
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.547750E+01 0.000000E+00
media      8      1      1
hole      31 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      34 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        125
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 6.350000E-01 0.000000E+00
media      8      1      1
hole      36 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      39 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        126
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.206480E+01 0.000000E+00
media      8      1      1
hole      41 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      44 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1

```

```

unit        127
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 2.141200E+00 0.000000E+00
media      8      1      1
hole      46 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      49 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        130
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole      10 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      12 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        131
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole      16 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      18 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        132
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole      21 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole      23 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole      54 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        133
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 3.556000E+01 0.000000E+00
media      8      1      1
hole      26 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      28 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        134
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.547750E+01 0.000000E+00
media      8      1      1
hole      31 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      33 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        135
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 6.350000E-01 0.000000E+00
media      8      1      1
hole      36 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole      38 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        136
com=^ complete layer^
cuboid      1
            7.620000E-01 -7.620000E-01 1.319800E+00
            -1.319800E+00 1.206480E+01 0.000000E+00
media      8      1      1
hole      41 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00

```

```

hole 43 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 137
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 48 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 140
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 12 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 141
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 18 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 142
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 23 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 143
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 28 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 144
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 33 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 145
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 38 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 146
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1

```

```

hole 42 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 43 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 147
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 48 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 150
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 13 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 151
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 19 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 152
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 153
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 29 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 34 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 39 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00

```

```

-1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 44 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 49 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 164
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1

```

```

7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
boundary 1
unit 170
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 171
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 172
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 173
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 174
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 175
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 176
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 177
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
boundary 1
unit 180
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 4.682500E+00 0.000000E+00
media 8 1 1

```

```

hole 12 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 181
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 18 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 182
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 193
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 29 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 194
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 34 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 195
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 39 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 196
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 44 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 197
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 49 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 202
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.319800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.319800E+00 z=
0.000000E+00
hole 53 origin x= -7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 7.620000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 203
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.556000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 204
com=^ complete layer^
cuboid 1
7.620000E-01 -7.620000E-01 1.319800E+00
-1.319800E+00 3.031850E+01 0.000000E+00
media 8 1 1
boundary 1
end geometry

```

```

read array
ara=1 nux=33 nuy=19 nuz=1 fill
12r114 9r110 12r114
8r114 110 106 2r103 9r101 2r103 107 110 8r114
6r114 110 106 17r101 107 110 6r114
5r114 106 21r101 107 5r114
4r114 106 23r101 107 4r114
3r114 106 25r101 107 3r114
2r114 106 27r101 107 2r114
2r114 104 27r101 105 2r114
114 113 29r101 112 114
2q33
2r114 104 27r101 105 2r114
2r114 109 27r101 108 2r114
3r114 109 25r101 108 3r114
4r114 109 23r101 108 4r114
5r114 109 21r101 108 5r114
6r114 111 109 17r101 108 111 6r114
8r114 111 109 2r102 9r101 2r102 108 111 8r114
12r114 9r111 12r114
end fill
'----- Fuel Rod Layer Stacks
ara=10 nux=1 nuy=1 nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11 nux=1 nuy=1 nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12 nux=1 nuy=1 nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13 nux=1 nuy=1 nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14 nux=1 nuy=1 nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15 nux=1 nuy=1 nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16 nux=1 nuy=1 nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17 nux=1 nuy=1 nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18 nux=1 nuy=1 nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19 nux=1 nuy=1 nuz=12
fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20 nux=1 nuy=1 nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21 nux=1 nuy=1 nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22 nux=1 nuy=1 nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23 nux=1 nuy=1 nuz=8
fill 5 203 202 203 202 203 202 204 end fill
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end

1.29 CASE MIXCT_009_CASE3_K6

#csas26 parm='size=00500000'
1.5 wt % with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group latticecell
' Fuel Meat UO2 = 1.5 %
pu-239 1 0 2.9191e-04 298 end
pu-240 1 0 2.5004e-05 298 end
pu-241 1 0 2.1087e-06 298 end
am-241 1 0 2.2243e-07 298 end
pu-242 1 0 9.5801e-08 298 end
u-234 1 0 1.1580e-06 298 end
u-235 1 0 3.3688e-05 298 end
u-238 1 0 2.1020e-02 298 end
o 1 0 4.2749e-02 298 end
' Zirc-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end
sn-112 2 0 4.6877e-06 298 end
sn-114 2 0 3.1413e-06 298 end
sn-115 2 0 1.7398e-06 298 end
sn-116 2 0 7.0219e-05 298 end
sn-117 2 0 3.7115e-05 298 end

sn-118 2 0 1.1705e-04 298 end
sn-119 2 0 4.1465e-05 298 end
sn-120 2 0 1.5750e-04 298 end
sn-122 2 0 2.2375e-05 298 end
sn-124 2 0 2.7981e-05 298 end
' Water
h 3 0 6.6662e-02 298 end
o 3 0 3.3331e-02 298 end
' ZrO2
zr 4 0 2.0854e-02 298 end
o 4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe 5 0 5.5766e-03 298 end
cr 5 0 1.6386e-03 298 end
ni 5 0 7.6409e-04 298 end
mn 5 0 8.1627e-05 298 end
c 5 0 5.6004e-06 298 end
si 5 0 7.9836e-05 298 end
s 5 0 2.0978e-06 298 end
p 5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr 6 0 1.4231e-02 298 end
ni 6 0 1.0129e-05 298 end
cr 6 0 2.5407e-05 298 end
fe 6 0 3.1934e-05 298 end
sn-112 6 0 1.5652e-06 298 end
sn-114 6 0 1.0488e-06 298 end
sn-115 6 0 5.8090e-07 298 end
sn-116 6 0 2.3446e-05 298 end
sn-117 6 0 1.2392e-05 298 end
sn-118 6 0 3.9081e-05 298 end
sn-119 6 0 1.3845e-05 298 end
sn-120 6 0 5.2587e-05 298 end
sn-122 6 0 7.4710e-06 298 end
sn-124 6 0 9.3427e-06 298 end
h 6 0 4.4404e-02 298 end
o 6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr 7 0 1.3748e-02 298 end
ni 7 0 9.7854e-06 298 end
cr 7 0 2.4545e-05 298 end
fe 7 0 3.0851e-05 298 end
sn-112 7 0 1.5121e-06 298 end
sn-114 7 0 1.0133e-06 298 end
sn-115 7 0 5.6120e-07 298 end
sn-116 7 0 2.2651e-05 298 end
sn-117 7 0 1.1972e-05 298 end
sn-118 7 0 3.7757e-05 298 end
sn-119 7 0 1.3375e-05 298 end
sn-120 7 0 5.0805e-05 298 end
sn-122 7 0 7.2177e-06 298 end
sn-124 7 0 9.0260e-06 298 end
h 7 0 4.5159e-02 298 end
o 7 0 2.2580e-02 298 end
' Water
h 8 0 6.6662e-02 298 end
o 8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si 9 0 3.4607e-04 298 end
fe 9 0 1.0152e-04 298 end
cu 9 0 6.3731e-05 298 end
mn 9 0 2.2115e-05 298 end
mg 9 0 6.6651e-04 298 end
cr 9 0 6.2310e-05 298 end
ti 9 0 2.5375e-05 298 end
al 9 0 5.8433e-02 298 end

end comp
triangpitch 1.8034 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit 5
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
boundary 1
unit 10
com=^ top hemicylinder^
cylinder 1
5.384800E-01 3.333800E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 7 1 1
cylinder 2
5.384800E-01 4.682500E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 11
com=^ bottom hemicylinder^
cylinder 1
    5.384800E-01 3.333800E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 7 1 1
cylinder 2
    5.384800E-01 4.682500E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 12
com=^ left hemicylinder^
cylinder 1
    5.384800E-01 3.333800E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 7 1 1
cylinder 2
    5.384800E-01 4.682500E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 13
com=^ right hemicylinder^
cylinder 1
    5.384800E-01 3.333800E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 7 1 1
cylinder 2
    5.384800E-01 4.682500E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 15
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 16
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 17
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 18
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 19
com=^ right hemicylinder^
cylinder 1
    4.724400E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 3.087750E+01 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 20
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 21
com=^ top hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 22
com=^ bottom hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 23
com=^ left hemicylinder^
cylinder 1
    4.724400E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
    5.384800E-01 1.905000E+00 0.000000E+00
    origin x= 0.000000E+00 y=
0.000000E+00

```



```

chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 24
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 25
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 26
com=^ top hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 27
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 28
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 29
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 30
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 31
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 33
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 34
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 35
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

hole      34 origin x=  9.017000E-01 y=  0.000000E+00 z=
0.000000E+00
boundary  1
unit      36
com=^ top hemicylinder^
cylinder  1
          4.724400E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord -y=  0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord -y=  0.000000E+00
media     2 1 2 -1
boundary  2
unit      37
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord +y=  0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord +y=  0.000000E+00
media     2 1 2 -1
boundary  2
unit      38
com=^ left hemicylinder^
cylinder  1
          4.724400E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord +x=  0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord +x=  0.000000E+00
media     2 1 2 -1
boundary  2
unit      39
com=^ right hemicylinder^
cylinder  1
          4.724400E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord -x=  0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01  6.350000E-01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord -x=  0.000000E+00
media     2 1 2 -1
boundary  2
unit      40
com=^ complete layer^
cuboid    1
          9.017000E-01 -9.017000E-01  1.561800E+00
          -1.561800E+00  6.350000E-01  0.000000E+00
media     8 1 1
hole      36 origin x=  0.000000E+00 y=  1.561800E+00 z=
0.000000E+00
hole      37 origin x=  0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole      38 origin x= -9.017000E-01 y=  0.000000E+00 z=
0.000000E+00
hole      39 origin x=  9.017000E-01 y=  0.000000E+00 z=
0.000000E+00
boundary  1
unit      41
com=^ top hemicylinder^
cylinder  1
          4.724400E-01  1.206480E+01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00
          chord -y=  0.000000E+00
media     5 1 1
cylinder  2
          5.384800E-01  1.206480E+01  0.000000E+00
          origin x=  0.000000E+00 y=
0.000000E+00

```

```

chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 42
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 43
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 44
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 45
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 46
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 47
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00

```

```

chord +y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 48
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 49
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 50
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 48 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 51
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 8 1 1
boundary 1
unit 52
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 8 1 1
boundary 1
unit 53
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 8 1 1
boundary 1
unit 54
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 8 1 1
boundary 1
unit 60
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 61
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 62
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 63
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 64
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 65
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 38 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 66
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 67
com=^ complete layer^
cuboid 1

```



```

hole 34 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 85
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 39 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 86
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 44 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 87
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 49 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 90
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 91
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 92
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 93
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1

```

```

hole 26 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 94
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 95
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 38 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 96
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 97
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 48 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 101
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.446185E+02 0.000000E+00
array 10 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 102
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.446185E+02 0.000000E+00
array 11 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 103
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.446185E+02 0.000000E+00
array 12 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.450000E+02 0.000000E+00

```

```

media      8      1      2      -1
boundary   2
unit       104
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      13      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       105
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      14      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       106
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      15      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       107
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      16      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       108
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      17      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       109
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      18      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       110
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      19      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       111
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      20      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2

```

```

unit       112
cuboid     1
    -9.017000E-01 -9.017000E-01 -1.561800E+00
    -1.561800E+00 0.000000E+00 0.000000E+00
array      21      1
    place 1 1 1 -9.017000E-01 -1.561800E+00
    0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       113
cuboid     1
    -9.017000E-01 -9.017000E-01 -1.561800E+00
    -1.561800E+00 0.000000E+00 0.000000E+00
array      22      1
    place 1 1 1 -9.017000E-01 -1.561800E+00
    0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       114
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.446185E+02 0.000000E+00
array      23      1
    place 1 1 1 0. 0. 0.000000E+00
cuboid     2
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.450000E+02 0.000000E+00
media      8      1      2      -1
boundary   2
unit       115
cuboid     1
    4.688840E+01 0.000000E+00 4.685400E+01
    0.000000E+00 1.450000E+02 0.000000E+00
array      1
    place 1 1 1 9.017000E-01 1.561800E+00
    0.000000E+00
cuboid     2
    8.000000E+01 -2.000000E+01 8.000000E+01
    -2.000000E+01 1.499394E+02 -1.476380E+01
media      8      1      2      -1
cuboid     3
    8.000000E+01 -2.000000E+01 8.000000E+01
    -2.000000E+01 1.499394E+02 -1.603380E+01
media      9      1      3      -2      -1
boundary   3
unit       120
com=^ complete layer^
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole      10 origin x= 0.000000E+00 y= 1.561800E+00 z=
    0.000000E+00
hole      13 origin x= 9.017000E-01 y= 0.000000E+00 z=
    0.000000E+00
boundary   1
unit       121
com=^ complete layer^
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole      16 origin x= 0.000000E+00 y= 1.561800E+00 z=
    0.000000E+00
hole      19 origin x= 9.017000E-01 y= 0.000000E+00 z=
    0.000000E+00
boundary   1
unit       122
com=^ complete layer^
cuboid     1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole      21 origin x= 0.000000E+00 y= 1.561800E+00 z=
    0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.561800E+00 z=
    0.000000E+00
hole      53 origin x= -9.017000E-01 y= 0.000000E+00 z=
    0.000000E+00
hole      24 origin x= 9.017000E-01 y= 0.000000E+00 z=
    0.000000E+00
boundary   1
unit       123

```

```

com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 29 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 124
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 34 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 125
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 39 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 126
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 44 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 127
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 49 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 130
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 131
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 132
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

boundary 1
unit 133
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 134
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 135
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 38 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 136
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 137
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 48 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 140
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 141
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 142
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00

```

```

hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 143
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 144
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 145
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 38 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 146
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 147
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 48 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 150
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 13 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 151
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 19 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 152
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00

```

```

hole 53 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 153
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 29 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 34 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 39 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 44 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 49 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
    9.017000E-01 -9.017000E-01 1.561800E+00
    -1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 53 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00

```



```

hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 164
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
boundary 1
unit 170
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 171
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 172
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 53 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 173
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1

```

```

unit 174
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 175
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 176
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 177
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
boundary 1
unit 180
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 12 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 181
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 18 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 182
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole 23 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 183
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 28 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 184
com=^ complete layer^
cuboid 1
9.017000E-01 -9.017000E-01 1.561800E+00
-1.561800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 33 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 185
com=^ complete layer^
cuboid 1

```

```

          9.017000E-01 -9.017000E-01 1.561800E+00
media      8      1      1
hole      38 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       186
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 1.206480E+01 0.000000E+00
media      8      1      1
hole      43 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       187
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 2.141200E+00 0.000000E+00
media      8      1      1
hole      48 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       190
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 4.682500E+00 0.000000E+00
media      8      1      1
hole      13 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       191
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 3.087750E+01 0.000000E+00
media      8      1      1
hole      19 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       192
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 1.905000E+00 0.000000E+00
media      3      1      1
hole      51 origin x= 0.000000E+00 y= 1.561800E+00 z=
0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.561800E+00 z=
0.000000E+00
hole      53 origin x= -9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
hole      54 origin x= 9.017000E-01 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       203
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 3.556000E+01 0.000000E+00
media      8      1      1
boundary    1
unit       204
com=^ complete layer^
cuboid      1
          9.017000E-01 -9.017000E-01 1.561800E+00
          -1.561800E+00 3.031850E+01 0.000000E+00
media      8      1      1
boundary    1
end geometry

read array
ara=1 nux=26 nuy=15 nuz=1 fill
10r114 110 106 2r103 107 110 10r114
7r114 110 106 103 6r101 103 107 110 7r114
5r114 106 103 12r101 103 107 5r114
4r114 106 16r101 107 110 3r114
2r114 106 103 19r101 107 2r114
2r114 104 20r101 105 2r114
114 106 22r101 107 114
114 104 22r101 105 114
114 109 22r101 108 114
2r114 104 20r101 105 2r114
2r114 109 20r101 108 2r114
3r114 111 109 16r101 108 111 3r114
5r114 109 102 12r101 102 108 5r114
7r114 111 109 102 6r101 102 108 111 7r114
10r114 111 109 2r102 108 111 10r114 t
end fill
'----- Fuel Rod Layer Stacks
ara=10 nux=1 nuy=1 nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11 nux=1 nuy=1 nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12 nux=1 nuy=1 nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13 nux=1 nuy=1 nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14 nux=1 nuy=1 nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15 nux=1 nuy=1 nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16 nux=1 nuy=1 nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17 nux=1 nuy=1 nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18 nux=1 nuy=1 nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19 nux=1 nuy=1 nuz=12
fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20 nux=1 nuy=1 nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21 nux=1 nuy=1 nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22 nux=1 nuy=1 nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23 nux=1 nuy=1 nuz=8
fill 5 203 202 203 202 203 202 204 end fill

```

```
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end
```

## 1.30 CASE MIXCT\_009\_CASE4\_K6

```
#csas26      parm='size=00500000'
1.5 wt %    with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group    latticecell
' Fuel Meat UO2 = 1.5 %
pu-239      1 0 2.9191e-04 298 end
pu-240      1 0 2.5004e-05 298 end
pu-241      1 0 2.1087e-06 298 end
am-241      1 0 2.2243e-07 298 end
pu-242      1 0 9.5801e-08 298 end
u-234       1 0 1.1580e-06 298 end
u-235       1 0 3.3688e-05 298 end
u-238       1 0 2.1020e-02 298 end
o           1 0 4.2749e-02 298 end
' Zirc-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112      2 0 4.6877e-06 298 end
sn-114      2 0 3.1413e-06 298 end
sn-115      2 0 1.7398e-06 298 end
sn-116      2 0 7.0219e-05 298 end
sn-117      2 0 3.7115e-05 298 end
sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
' Water
h           3 0 6.6662e-02 298 end
o           3 0 3.3331e-02 298 end
' ZrO2
zr          4 0 2.0854e-02 298 end
o           4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe          5 0 5.5766e-03 298 end
cr          5 0 1.6386e-03 298 end
ni          5 0 7.6409e-04 298 end
mn          5 0 8.1627e-05 298 end
c           5 0 5.6004e-06 298 end
si          5 0 7.9836e-05 298 end
s           5 0 2.0978e-06 298 end
p           5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr          6 0 1.4231e-02 298 end
ni          6 0 1.0129e-05 298 end
cr          6 0 2.5407e-05 298 end
fe          6 0 3.1934e-05 298 end
sn-112      6 0 1.5652e-06 298 end
sn-114      6 0 1.0488e-06 298 end
sn-115      6 0 5.8090e-07 298 end
sn-116      6 0 2.3446e-05 298 end
sn-117      6 0 1.2392e-05 298 end
sn-118      6 0 3.9081e-05 298 end
sn-119      6 0 1.3845e-05 298 end
sn-120      6 0 5.2587e-05 298 end
sn-122      6 0 7.4710e-06 298 end
sn-124      6 0 9.3427e-06 298 end
h           6 0 4.4404e-02 298 end
o           6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr          7 0 1.3748e-02 298 end
ni          7 0 9.7854e-06 298 end
cr          7 0 2.4545e-05 298 end
fe          7 0 3.0851e-05 298 end
sn-112      7 0 1.5121e-06 298 end
sn-114      7 0 1.0133e-06 298 end
sn-115      7 0 5.6120e-07 298 end
sn-116      7 0 2.2651e-05 298 end
sn-117      7 0 1.1972e-05 298 end
sn-118      7 0 3.7757e-05 298 end
sn-119      7 0 1.3375e-05 298 end
sn-120      7 0 5.0805e-05 298 end
sn-122      7 0 7.2177e-06 298 end
```

```
sn-124      7 0 9.0260e-06 298 end
h           7 0 4.5159e-02 298 end
o           7 0 2.2580e-02 298 end
' Water
h           8 0 6.6662e-02 298 end
o           8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si          9 0 3.4607e-04 298 end
fe          9 0 1.0152e-04 298 end
cu          9 0 6.3731e-05 298 end
mn          9 0 2.2115e-05 298 end
mg          9 0 6.6651e-04 298 end
cr          9 0 6.2310e-05 298 end
ti          9 0 2.5375e-05 298 end
al          9 0 5.8433e-02 298 end
end comp
triangpitch 2.0320 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit        5
cuboid      1
            1.016000E+00 -1.016000E+00 1.759800E+00
            -1.759800E+00 1.905000E+00 0.000000E+00
media       3 1 1
boundary    1
unit        10
com=^ top hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        11
com=^ bottom hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        12
com=^ left hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        13
com=^ right hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit        15
com=^ complete layer^
cuboid      1
```

```

1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 16
com=^ top hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 17
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 18
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 19
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 20
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 21
com=^ top hemicylinder^
cylinder 1

```

```

4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 22
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 23
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 24
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 25
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 26
com=^ top hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 27
com=^ bottom hemicylinder^
cylinder 1

```

```

4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 28
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 29
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 30
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 31
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 33
com=^ left hemicylinder^
cylinder 1

```

```

4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 34
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 35
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 36
com=^ top hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 37
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 38
com=^ left hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 39
com=^ right hemicylinder^
cylinder 1

```

```

4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 40
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 41
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 42
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 43
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 44
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 45
com=^ complete layer^
cuboid 1

```

```

1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 46
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 47
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 48
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 49
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 50
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 51
com=^ top hemicylinder^
cylinder 1

```

```

5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 8 1 1
boundary 1
unit 52
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 8 1 1
boundary 1
unit 53
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 8 1 1
boundary 1
unit 54
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 8 1 1
boundary 1
unit 60
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 61
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 62
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 63
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 64
com=^ complete layer^
cuboid 1

```

```

1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 65
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 66
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 67
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 70
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 71
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 72
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1

```





```

hole 11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 91
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 92
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 93
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 94
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 95
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 96
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 97
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 101
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 10 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 102
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 11 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 103
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 12 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 104
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 13 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 105
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 14 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 106
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 15 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 107
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 16 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 108
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 17 1

```

```

place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 109
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 18 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 110
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 19 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 111
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 20 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 112
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 21 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 113
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 22 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 114
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.446185E+02 0.000000E+00
array 23 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 115
cuboid 1
4.876800E+01 0.000000E+00 4.927440E+01
0.000000E+00 1.450000E+02 0.000000E+00
array 1 1
place 1 1 1 1.016000E+00 1.759800E+00
0.000000E+00
cuboid 2
8.000000E+01 -2.000000E+01 8.000000E+01
-2.000000E+01 1.499394E+02 -1.476380E+01
media 8 1 2 -1
cuboid 3
8.000000E+01 -2.000000E+01 8.000000E+01
-2.000000E+01 1.499394E+02 -1.603380E+01
media 9 1 3 -2 -1
boundary 3
unit 120

```

```

com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 121
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 122
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 123
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 29 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 124
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 34 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 125
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 39 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 126
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 44 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 127
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 49 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00

```

```

boundary      1
unit          130
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 4.682500E+00 0.000000E+00
media          8      1      1
hole          10 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          131
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 3.087750E+01 0.000000E+00
media          8      1      1
hole          16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          132
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.905000E+00 0.000000E+00
media          3      1      1
hole          21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole          54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          133
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 3.556000E+01 0.000000E+00
media          8      1      1
hole          26 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          134
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.547750E+01 0.000000E+00
media          8      1      1
hole          31 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          135
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 6.350000E-01 0.000000E+00
media          8      1      1
hole          36 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          136
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.206480E+01 0.000000E+00
media          8      1      1
hole          41 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          137
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 2.141200E+00 0.000000E+00
media          8      1      1
hole          46 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00

```

```

hole          48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          140
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 4.682500E+00 0.000000E+00
media          8      1      1
hole          11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          141
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 3.087750E+01 0.000000E+00
media          8      1      1
hole          17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          142
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.905000E+00 0.000000E+00
media          3      1      1
hole          51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole          22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole          54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          143
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 3.556000E+01 0.000000E+00
media          8      1      1
hole          27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          144
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.547750E+01 0.000000E+00
media          8      1      1
hole          32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          145
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 6.350000E-01 0.000000E+00
media          8      1      1
hole          37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          146
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 1.206480E+01 0.000000E+00
media          8      1      1
hole          42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole          43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          147
com=^ complete layer^
cuboid        1
              1.016000E+00 -1.016000E+00 1.759800E+00
              -1.759800E+00 2.141200E+00 0.000000E+00
media          8      1      1

```

```

hole 47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 150
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 151
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 152
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 153
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 29 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 34 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 39 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 44 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 49 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 164
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 4.682500E+00 0.000000E+00

```

```

media      8      1      1
hole     11 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       171
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 3.087750E+01 0.000000E+00

media      8      1      1
hole     17 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       172
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.905000E+00 0.000000E+00

media      3      1      1
hole     51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole     22 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole     53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole     54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       173
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 3.556000E+01 0.000000E+00

media      8      1      1
hole     27 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       174
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.547750E+01 0.000000E+00

media      8      1      1
hole     32 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       175
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 6.350000E-01 0.000000E+00

media      8      1      1
hole     37 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       176
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.206480E+01 0.000000E+00

media      8      1      1
hole     42 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       177
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 2.141200E+00 0.000000E+00

media      8      1      1
hole     47 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
boundary    1
unit       180
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 4.682500E+00 0.000000E+00

media      8      1      1
hole     12 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       181
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 3.087750E+01 0.000000E+00

media      8      1      1
hole     18 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00

```

```

boundary    1
unit       182
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.905000E+00 0.000000E+00

media      3      1      1
hole     51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole     23 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole     54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       183
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 3.556000E+01 0.000000E+00

media      8      1      1
hole     28 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       184
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.547750E+01 0.000000E+00

media      8      1      1
hole     33 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       185
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 6.350000E-01 0.000000E+00

media      8      1      1
hole     38 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       186
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.206480E+01 0.000000E+00

media      8      1      1
hole     43 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       187
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 2.141200E+00 0.000000E+00

media      8      1      1
hole     48 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       190
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 4.682500E+00 0.000000E+00

media      8      1      1
hole     13 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       191
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 3.087750E+01 0.000000E+00

media      8      1      1
hole     19 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       192
com=^ complete layer^
cuboid     1
          1.016000E+00 -1.016000E+00 1.759800E+00
          -1.759800E+00 1.905000E+00 0.000000E+00

media      3      1      1
hole     51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00

```

```

hole 53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 193
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 29 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 194
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 34 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 195
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 39 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 196
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 44 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 197
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 49 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 202
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.759800E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.759800E+00 z=
0.000000E+00
hole 53 origin x= -1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.016000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 203
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.556000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 204
com=^ complete layer^
cuboid 1
1.016000E+00 -1.016000E+00 1.759800E+00
-1.759800E+00 3.031850E+01 0.000000E+00
media 8 1 1
boundary 1
end geometry

read array
ara=1 nux=24 nuy=14 nuz=1 fill
9r114 6r110 9r114
6r114 110 106 103 6r101 103 107 110 6r114
4r114 106 103 12r101 103 107 4r114
2r114 110 106 16r101 107 110 2r114
2r114 104 18r101 105 2r114
114 106 20r101 107 114
114 104 20r101 105 114

q24
114 109 20r101 108 114
114 113 20r101 112 114
2r114 111 109 16r101 108 111 2r114
4r114 109 102 12r101 102 108 4r114
6r114 111 109 102 6r101 102 108 111 6r114
9r114 6r111 9r114 t
end fill

' ----- Fuel Rod Layer Stacks
ara=10 nux=1 nuy=1 nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11 nux=1 nuy=1 nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12 nux=1 nuy=1 nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13 nux=1 nuy=1 nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14 nux=1 nuy=1 nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15 nux=1 nuy=1 nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16 nux=1 nuy=1 nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17 nux=1 nuy=1 nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18 nux=1 nuy=1 nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19 nux=1 nuy=1 nuz=12
fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20 nux=1 nuy=1 nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21 nux=1 nuy=1 nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22 nux=1 nuy=1 nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23 nux=1 nuy=1 nuz=8
fill 5 203 202 203 202 203 202 204 end fill
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end

1.31 CASE MIXCT_009_CASE5_K6

#csas26 parm='size=00500000'
1.5 wt % with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group latticecell
' Fuel Meat UO2 = 1.5 %
pu-239 1 0 2.9191e-04 298 end
pu-240 1 0 2.5004e-05 298 end
pu-241 1 0 2.1087e-06 298 end
am-241 1 0 2.2243e-07 298 end
pu-242 1 0 9.5801e-08 298 end
u-234 1 0 1.1580e-06 298 end
u-235 1 0 3.3688e-05 298 end
u-238 1 0 2.1020e-02 298 end
o 1 0 4.2749e-02 298 end
' Zirc-2
zr 2 0 4.2621e-02 298 end
ni 2 0 3.0336e-05 298 end
cr 2 0 7.6093e-05 298 end
fe 2 0 9.5642e-05 298 end
sn-112 2 0 4.6877e-06 298 end
sn-114 2 0 3.1413e-06 298 end
sn-115 2 0 1.7398e-06 298 end
sn-116 2 0 7.0219e-05 298 end
sn-117 2 0 3.7115e-05 298 end
sn-118 2 0 1.1705e-04 298 end
sn-119 2 0 4.1465e-05 298 end
sn-120 2 0 1.5750e-04 298 end
sn-122 2 0 2.2375e-05 298 end
sn-124 2 0 2.7981e-05 298 end
' Water
h 3 0 6.6662e-02 298 end
o 3 0 3.3331e-02 298 end
' ZrO2
zr 4 0 2.0854e-02 298 end
o 4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe 5 0 5.5766e-03 298 end
cr 5 0 1.6386e-03 298 end

```

```
nl      5 0 7.6409e-04 298 end
mn      5 0 8.1627e-05 298 end
c       5 0 5.6004e-06 298 end
si      5 0 7.9836e-05 298 end
s       5 0 2.0978e-06 298 end
p       5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr      6 0 1.4231e-02 298 end
ni      6 0 1.0129e-05 298 end
cr      6 0 2.5407e-05 298 end
fe      6 0 3.1934e-05 298 end
sn-112 6 0 1.5652e-06 298 end
sn-114 6 0 1.0488e-06 298 end
sn-115 6 0 5.8090e-07 298 end
sn-116 6 0 2.3446e-05 298 end
sn-117 6 0 1.2392e-05 298 end
sn-118 6 0 3.9081e-05 298 end
sn-119 6 0 1.3845e-05 298 end
sn-120 6 0 5.2587e-05 298 end
sn-122 6 0 7.4710e-06 298 end
sn-124 6 0 9.3427e-06 298 end
h       6 0 4.4404e-02 298 end
o       6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr      7 0 1.3748e-02 298 end
ni      7 0 9.7854e-06 298 end
cr      7 0 2.4545e-05 298 end
fe      7 0 3.0851e-05 298 end
sn-112 7 0 1.5121e-06 298 end
sn-114 7 0 1.0133e-06 298 end
sn-115 7 0 5.6120e-07 298 end
sn-116 7 0 2.2651e-05 298 end
sn-117 7 0 1.1972e-05 298 end
sn-118 7 0 3.7757e-05 298 end
sn-119 7 0 1.3375e-05 298 end
sn-120 7 0 5.0805e-05 298 end
sn-122 7 0 7.2177e-06 298 end
sn-124 7 0 9.0260e-06 298 end
h       7 0 4.5159e-02 298 end
o       7 0 2.2580e-02 298 end
' Water
h       8 0 6.6662e-02 298 end
o       8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si      9 0 3.4607e-04 298 end
fe      9 0 1.0152e-04 298 end
cu      9 0 6.3731e-05 298 end
mn      9 0 2.2115e-05 298 end
mg      9 0 6.6651e-04 298 end
cr      9 0 6.2310e-05 298 end
ti      9 0 2.5375e-05 298 end
al      9 0 5.8433e-02 298 end
end comp
triangpitch 2.2860 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit    5
cuboid  1
          1.143000E+00 -1.143000E+00 1.979700E+00
        -1.979700E+00 1.905000E+00 0.000000E+00
media   3 1 1
boundary 1
unit    10
com=^ top hemicylinder^
cylinder 1
          5.384800E-01 3.333800E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media   7 1 1
cylinder 2
          5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media   2 1 2 -1
boundary 2
unit    11
com=^ bottom hemicylinder^
cylinder 1
          5.384800E-01 3.333800E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media   7 1 1
cylinder 2
          5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media   7 1 1
cylinder 2
          5.384800E-01 4.682500E+00 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media   2 1 2 -1
boundary 2
unit    15
com=^ complete layer^
cuboid  1
          1.143000E+00 -1.143000E+00 1.979700E+00
        -1.979700E+00 4.682500E+00 0.000000E+00
media   8 1 1
hole    10 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole    11 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole    12 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole    13 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit    16
com=^ top hemicylinder^
cylinder 1
          4.724400E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media   2 1 2 -1
boundary 2
unit    17
com=^ bottom hemicylinder^
cylinder 1
          4.724400E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media   2 1 2 -1
boundary 2
unit    18
com=^ left hemicylinder^
cylinder 1
          4.724400E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media   1 1 1
cylinder 2
          5.384800E-01 3.087750E+01 0.000000E+00
        origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 19
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.087750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 20
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 17 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 18 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 21
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 22
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 23
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 24
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.905000E+00 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 25
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 23 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 26
com=^ top hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 27
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 28
com=^ left hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 29
com=^ right hemicylinder^
cylinder 1
4.724400E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 3.556000E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 30
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 27 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00

```



```

hole 28 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 31
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 32
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 33
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 34
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 1 1 1
cylinder 2
5.384800E-01 1.547750E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 35
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 36
com=^ top hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 37
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 38
com=^ left hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 39
com=^ right hemicylinder^
cylinder 1
4.724400E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 4 1 1
cylinder 2
5.384800E-01 6.350000E-01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 40
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 41
com=^ top hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 42
com=^ bottom hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 43
com=^ left hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 44
com=^ right hemicylinder^
cylinder 1
4.724400E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 5 1 1
cylinder 2
5.384800E-01 1.206480E+01 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 2 -1
boundary 2
unit 45
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 46
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 47
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 48
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00

```

```

origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 49
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.348700E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 2 1 1
cylinder 2
5.384800E-01 2.141200E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 6 1 2 -1
boundary 2
unit 50
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 51
com=^ top hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -y= 0.000000E+00
media 8 1 1
boundary 1
unit 52
com=^ bottom hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +y= 0.000000E+00
media 8 1 1
boundary 1
unit 53
com=^ left hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord +x= 0.000000E+00
media 8 1 1
boundary 1
unit 54
com=^ right hemicylinder^
cylinder 1
5.384800E-01 1.905000E+00 0.000000E+00
origin x= 0.000000E+00 y=
0.000000E+00
chord -x= 0.000000E+00
media 8 1 1
boundary 1
unit 60
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 12 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 13 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 61
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1

```

```

hole 17 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 18 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 19 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 62
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 23 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 63
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 28 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 29 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 64
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 34 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 65
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 39 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 66
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 44 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 67
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 49 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 70
com=^ complete layer^
cuboid 1

```

			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.979700E+00	4.682500E+00	0.000000E+00	
hole	10	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	12	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	13	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	71					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.979700E+00	3.087750E+01	0.000000E+00	
hole	16	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	18	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	19	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	72					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	3	1	-1.979700E+00	1.905000E+00	0.000000E+00	
hole	21	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	52	origin	x=	0.000000E+00	y=	-1.979700E+00 z=
0.000000E+00						
hole	23	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	24	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	73					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.979700E+00	3.556000E+01	0.000000E+00	
hole	26	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	28	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	29	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	74					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.979700E+00	1.547750E+01	0.000000E+00	
hole	31	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	33	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	34	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	75					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.979700E+00	6.350000E-01	0.000000E+00	
hole	36	origin	x=	0.000000E+00	y=	1.979700E+00 z=
0.000000E+00						
hole	38	origin	x=	-1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
hole	39	origin	x=	1.143000E+00	y=	0.000000E+00 z=
0.000000E+00						
boundary	1					
unit	76					
com=^	complete	layer^				
cuboid	1					
			1.143000E+00	-1.143000E+00	1.979700E+00	
media	8	1	-1.9			



```

hole 31 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 95
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 96
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 97
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 101
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 10 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 102
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 11 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 103
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 12 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 104
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 13 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 113
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 14 1
place 1 1 1 -1.143000E+00 -1.979700E+00
0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 106
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 15 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 107
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 16 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 108
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 17 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 109
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 18 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 110
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 19 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 111
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 20 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 112
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.446185E+02 0.000000E+00
array 21 1
place 1 1 1 0. 0. 0.000000E+00
cuboid 2
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.450000E+02 0.000000E+00
media 8 1 2 -1
boundary 2
unit 113

```

```

cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
array      22
  1
  place 1 1 1 0. 0. 0.000000E+00
cuboid      2
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.446185E+02 0.000000E+00
media      8
  1      2 -1
boundary    2
unit      114
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.446185E+02 0.000000E+00
array      23
  1
  place 1 1 1 0. 0. 0.000000E+00
cuboid      2
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.450000E+02 0.000000E+00
media      8
  1      2 -1
boundary    2
global
unit      115
cuboid      1
  5.943600E+01 0.000000E+00 5.939100E+01
  0.000000E+00 1.450000E+02 0.000000E+00
array      1
  1
  place 1 1 1 1.143000E+00 1.979700E+00
0.000000E+00
cuboid      2
  8.000000E+01 -2.000000E+01 8.000000E+01
  -2.000000E+01 1.499394E+02 -1.476380E+01
media      8
  1      2 -1
cuboid      3
  8.000000E+01 -2.000000E+01 8.000000E+01
  -2.000000E+01 1.499394E+02 -1.603380E+01
media      9
  1      3 -2 -1
boundary    3
unit      120
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 4.682500E+00 0.000000E+00
media      8
  1      1
hole      10 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      13 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      121
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 3.087750E+01 0.000000E+00
media      8
  1      1
hole      16 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      19 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      122
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.905000E+00 0.000000E+00
media      3
  1      1
hole      21 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole      53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole      24 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      123
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 3.556000E+01 0.000000E+00
media      8
  1      1
hole      26 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      29 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      124
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00

media      8
  1      1
hole      31 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      34 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      125
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 6.350000E-01 0.000000E+00
media      8
  1      1
hole      36 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      39 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      126
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.206480E+01 0.000000E+00
media      8
  1      1
hole      41 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      44 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      127
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 2.141200E+00 0.000000E+00
media      8
  1      1
hole      46 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      49 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      130
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 4.682500E+00 0.000000E+00
media      8
  1      1
hole      10 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      12 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      131
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 3.087750E+01 0.000000E+00
media      8
  1      1
hole      16 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      18 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      132
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 1.905000E+00 0.000000E+00
media      3
  1      1
hole      21 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole      23 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole      54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      133
com=^ complete layer^
cuboid      1
  1.143000E+00 -1.143000E+00 1.979700E+00
  -1.979700E+00 3.556000E+01 0.000000E+00
media      8
  1      1
hole      26 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole      28 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit      134
com=^ complete layer^

```

```

cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.547750E+01 0.000000E+00
media        8      1      1
hole        31 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        135
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 6.350000E-01 0.000000E+00
media        8      1      1
hole        36 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        136
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.206480E+01 0.000000E+00
media        8      1      1
hole        41 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        137
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 2.141200E+00 0.000000E+00
media        8      1      1
hole        46 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        140
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 4.682500E+00 0.000000E+00
media        8      1      1
hole        11 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        12 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        141
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 3.087750E+01 0.000000E+00
media        8      1      1
hole        17 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        18 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        142
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.905000E+00 0.000000E+00
media        3      1      1
hole        51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        22 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        23 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole        54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        143
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 3.556000E+01 0.000000E+00
media        8      1      1
hole        27 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        28 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1

unit        144
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.547750E+01 0.000000E+00
media        8      1      1
hole        32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        145
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 6.350000E-01 0.000000E+00
media        8      1      1
hole        37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        146
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.206480E+01 0.000000E+00
media        8      1      1
hole        42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        147
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 2.141200E+00 0.000000E+00
media        8      1      1
hole        47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        150
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 4.682500E+00 0.000000E+00
media        8      1      1
hole        11 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        13 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        151
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 3.087750E+01 0.000000E+00
media        8      1      1
hole        17 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        19 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        152
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 1.905000E+00 0.000000E+00
media        3      1      1
hole        51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole        22 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole        53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole        24 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit        153
com=^ complete layer^
cuboid      1
             1.143000E+00 -1.143000E+00 1.979700E+00
             -1.979700E+00 3.556000E+01 0.000000E+00
media        8      1      1
hole        27 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00

```

```

hole 29 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 34 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 39 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 44 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 49 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 164

```

```

com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
boundary 1
unit 170
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 171
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 172
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 173
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 174
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 175
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00

```



```

-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 176
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 177
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
boundary 1
unit 180
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 12 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 181
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 18 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 182
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 23 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 183
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 28 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 184
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 33 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 185
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 38 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 186
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1

```

```

hole 43 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 187
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 48 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 190
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 13 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 191
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 19 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 192
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole 53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 193
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 29 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 194
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 34 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 195
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 39 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 196
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 44 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 197
com=^ complete layer^
cuboid 1
1.143000E+00 -1.143000E+00 1.979700E+00
-1.979700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 49 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1

```

```

unit      202
com=^ complete layer^
cuboid    1
          1.143000E+00 -1.143000E+00 1.979700E+00
          -1.979700E+00 1.905000E+00 0.000000E+00
media     3      1      1
hole     51 origin x= 0.000000E+00 y= 1.979700E+00 z=
0.000000E+00
hole     52 origin x= 0.000000E+00 y= -1.979700E+00 z=
0.000000E+00
hole     53 origin x= -1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
hole     54 origin x= 1.143000E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      203
com=^ complete layer^
cuboid    1
          1.143000E+00 -1.143000E+00 1.979700E+00
          -1.979700E+00 3.556000E+01 0.000000E+00
media     8      1      1
boundary  1
unit      204
com=^ complete layer^
cuboid    1
          1.143000E+00 -1.143000E+00 1.979700E+00
          -1.979700E+00 3.031850E+01 0.000000E+00
media     8      1      1
boundary  1
end geometry

read array
ara=1 nux=26 nuy=15 nuz=1 fill
10r114 6r110 10r114
7r114 110 106 103 6r101 103 107 110 7r114
5r114 110 106 12r101 107 110 5r114
4r114 106 16r101 107 4r114
3r114 106 18r101 107 3r114
2r114 113 20r101 112 2r114
2r114 106 20r101 107 2r114
114 113 22r101 112 114
2r114 104 20r101 108 2r114
2r114 109 20r101 112 2r114
3r114 109 18r101 108 3r114
4r114 109 16r101 108 4r114
5r114 111 109 12r101 108 111 5r114
7r114 111 109 102 6r101 102 108 111 7r114
10r114 6r111 10r114 t
end fill
'----- Fuel Rod Layer Stacks
ara=10 nux=1 nuy=1 nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11 nux=1 nuy=1 nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12 nux=1 nuy=1 nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13 nux=1 nuy=1 nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14 nux=1 nuy=1 nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15 nux=1 nuy=1 nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16 nux=1 nuy=1 nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17 nux=1 nuy=1 nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18 nux=1 nuy=1 nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19 nux=1 nuy=1 nuz=12
fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20 nux=1 nuy=1 nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21 nux=1 nuy=1 nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22 nux=1 nuy=1 nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23 nux=1 nuy=1 nuz=8
fill 5 203 202 203 202 203 202 204 end fill
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end

```

## 1.32 CASE MIXCT\_009\_CASE6\_K6

```

#csas26      parm='size=00500000'
1.5 wt % with 8 % pu-240. depleted uranium. 1. 1487 pin.
238group      latticecell
' Fuel Meat UO2 = 1.5 %
pu-239      1 0 2.9191e-04 298 end
pu-240      1 0 2.5004e-05 298 end
pu-241      1 0 2.1087e-06 298 end
am-241      1 0 2.2243e-07 298 end
pu-242      1 0 9.5801e-08 298 end
u-234      1 0 1.1580e-06 298 end
u-235      1 0 3.3688e-05 298 end
u-238      1 0 2.1020e-02 298 end
o          1 0 4.2749e-02 298 end
' Zirc-2
zr          2 0 4.2621e-02 298 end
ni          2 0 3.0336e-05 298 end
cr          2 0 7.6093e-05 298 end
fe          2 0 9.5642e-05 298 end
sn-112      2 0 4.6877e-06 298 end
sn-114      2 0 3.1413e-06 298 end
sn-115      2 0 1.7398e-06 298 end
sn-116      2 0 7.0219e-05 298 end
sn-117      2 0 3.7115e-05 298 end
sn-118      2 0 1.1705e-04 298 end
sn-119      2 0 4.1465e-05 298 end
sn-120      2 0 1.5750e-04 298 end
sn-122      2 0 2.2375e-05 298 end
sn-124      2 0 2.7981e-05 298 end
' Water
h          3 0 6.6662e-02 298 end
o          3 0 3.3331e-02 298 end
' ZrO2
zr          4 0 2.0854e-02 298 end
o          4 0 4.1708e-02 298 end
' Homogenized Stainless Steel Spring
fe          5 0 5.5766e-03 298 end
cr          5 0 1.6386e-03 298 end
ni          5 0 7.6409e-04 298 end
mn          5 0 8.1627e-05 298 end
c          5 0 5.6004e-06 298 end
si          5 0 7.9836e-05 298 end
s          5 0 2.0978e-06 298 end
p          5 0 3.1852e-06 298 end
' Homogenized Top Plug
zr          6 0 1.4231e-02 298 end
ni          6 0 1.0129e-05 298 end
cr          6 0 2.5407e-05 298 end
fe          6 0 3.1934e-05 298 end
sn-112      6 0 1.5652e-06 298 end
sn-114      6 0 1.0488e-06 298 end
sn-115      6 0 5.8090e-07 298 end
sn-116      6 0 2.3446e-05 298 end
sn-117      6 0 1.2392e-05 298 end
sn-118      6 0 3.9081e-05 298 end
sn-119      6 0 1.3845e-05 298 end
sn-120      6 0 5.2587e-05 298 end
sn-122      6 0 7.4710e-06 298 end
sn-124      6 0 9.3427e-06 298 end
h          6 0 4.4404e-02 298 end
o          6 0 2.2202e-03 298 end
' Homogenized Lower Plug
zr          7 0 1.3748e-02 298 end
ni          7 0 9.7854e-06 298 end
cr          7 0 2.4545e-05 298 end
fe          7 0 3.0851e-05 298 end
sn-112      7 0 1.5121e-06 298 end
sn-114      7 0 1.0133e-06 298 end
sn-115      7 0 5.6120e-07 298 end
sn-116      7 0 2.2651e-05 298 end
sn-117      7 0 1.1972e-05 298 end
sn-118      7 0 3.7757e-05 298 end
sn-119      7 0 1.3375e-05 298 end
sn-120      7 0 5.0805e-05 298 end
sn-122      7 0 7.2177e-06 298 end
sn-124      7 0 9.0260e-06 298 end
h          7 0 4.5159e-02 298 end
o          7 0 2.2580e-02 298 end
' Water
h          8 0 6.6662e-02 298 end
o          8 0 3.3331e-02 298 end
' Aluminum 6061 -Zn
si          9 0 3.4607e-04 298 end
fe          9 0 1.0152e-04 298 end
cu          9 0 6.3731e-05 298 end
mn          9 0 2.2115e-05 298 end
mg          9 0 6.6651e-04 298 end

```

```

cr          9 0 6.2310e-05 298 end
ti          9 0 2.5375e-05 298 end
al          9 0 5.8433e-02 298 end
end comp
triangpitch 2.3622 0.94488 1 8 1.07696 2 end
more data DAB=300 end more
read parm tme=180 gen=800 npg=800 nsk=10 run=yes plt=no
nub=yes end parm
read geometry
unit
cuboid      1
            1.181100E+00 -1.181100E+00 2.045700E+00
            -2.045700E+00 1.905000E+00 0.000000E+00
media       3 1 1
boundary    1
unit       10
com=^ top hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       11
com=^ bottom hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       12
com=^ left hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       13
com=^ right hemicylinder^
cylinder    1
            5.384800E-01 3.333800E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       7 1 1
cylinder    2
            5.384800E-01 4.682500E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       15
com=^ complete layer^
cuboid      1
            1.181100E+00 -1.181100E+00 2.045700E+00
            -2.045700E+00 1.905000E+00 0.000000E+00
media       8 1 1
hole       10 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole       11 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole       12 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole       13 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1

unit       16
com=^ top hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       17
com=^ bottom hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +y= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       18
com=^ left hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord +x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       19
com=^ right hemicylinder^
cylinder    1
            4.724400E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 3.087750E+01 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -x= 0.000000E+00
media       2 1 2 -1
boundary    2
unit       20
com=^ complete layer^
cuboid      1
            1.181100E+00 -1.181100E+00 2.045700E+00
            -2.045700E+00 3.087750E+01 0.000000E+00
media       8 1 1
hole       16 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole       17 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole       18 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole       19 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary    1
unit       21
com=^ top hemicylinder^
cylinder    1
            4.724400E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       1 1 1
cylinder    2
            5.384800E-01 1.905000E+00 0.000000E+00
            origin x= 0.000000E+00 y=
0.000000E+00
            chord -y= 0.000000E+00
media       2 1 2 -1
boundary    2

```

```

unit      22
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      23
com=^ left hemicylinder^
cylinder  1
          4.724400E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      24
com=^ right hemicylinder^
cylinder  1
          4.724400E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.905000E+00  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      25
com=^ complete layer^
cuboid    1
          1.181100E+00 -1.181100E+00  2.045700E+00
          -2.045700E+00  1.905000E+00  0.000000E+00
media     3  1  1
hole     21 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole     22 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole     23 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole     24 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      26
com=^ top hemicylinder^
cylinder  1
          4.724400E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      27
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     2  1  2 -1
boundary  2

```

```

unit      28
com=^ left hemicylinder^
cylinder  1
          4.724400E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      29
com=^ right hemicylinder^
cylinder  1
          4.724400E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  3.556000E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      30
com=^ complete layer^
cuboid    1
          1.181100E+00 -1.181100E+00  2.045700E+00
          -2.045700E+00  3.556000E+01  0.000000E+00
media     8  1  1
hole     26 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole     27 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole     28 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole     29 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      31
com=^ top hemicylinder^
cylinder  1
          4.724400E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      32
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     2  1  2 -1
boundary  2
unit      33
com=^ left hemicylinder^
cylinder  1
          4.724400E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     1  1  1
cylinder  2
          5.384800E-01  1.547750E+01  0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     2  1  2 -1
boundary  2

```

```

unit      34
com=^ right hemicylinder^
cylinder  1
          4.724400E-01 1.547750E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     1 1 1
cylinder  2
          5.384800E-01 1.547750E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      35
com=^ complete layer^
cuboid    1
          1.181100E+00 -1.181100E+00 2.045700E+00
          -2.045700E+00 1.547750E+01 0.000000E+00
media     8 1 1
hole     31 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole     32 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole     33 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole     34 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      36
com=^ top hemicylinder^
cylinder  1
          4.724400E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      37
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      38
com=^ left hemicylinder^
cylinder  1
          4.724400E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      39
com=^ right hemicylinder^
cylinder  1
          4.724400E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     4 1 1
cylinder  2
          5.384800E-01 6.350000E-01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     2 1 2 -1
boundary  2

```

```

unit      40
com=^ complete layer^
cuboid    1
          1.181100E+00 -1.181100E+00 2.045700E+00
          -2.045700E+00 6.350000E-01 0.000000E+00
media     8 1 1
hole     36 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole     37 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole     38 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole     39 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1
unit      41
com=^ top hemicylinder^
cylinder  1
          4.724400E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     5 1 1
cylinder  2
          5.384800E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -y= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      42
com=^ bottom hemicylinder^
cylinder  1
          4.724400E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     5 1 1
cylinder  2
          5.384800E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +y= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      43
com=^ left hemicylinder^
cylinder  1
          4.724400E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     5 1 1
cylinder  2
          5.384800E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord +x= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      44
com=^ right hemicylinder^
cylinder  1
          4.724400E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     5 1 1
cylinder  2
          5.384800E-01 1.206480E+01 0.000000E+00
          origin x= 0.000000E+00 y=
0.000000E+00
          chord -x= 0.000000E+00
media     2 1 2 -1
boundary  2
unit      45
com=^ complete layer^
cuboid    1
          1.181100E+00 -1.181100E+00 2.045700E+00
          -2.045700E+00 1.206480E+01 0.000000E+00
media     8 1 1
hole     41 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole     42 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole     43 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole     44 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary  1

```

```

unit          46
com=^ top hemicylinder^
cylinder      1
              5.384800E-01 1.348700E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         2      1      1
cylinder      2
              5.384800E-01 2.141200E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         6      1      2 -1
boundary      2
unit          47
com=^ bottom hemicylinder^
cylinder      1
              5.384800E-01 1.348700E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         2      1      1
cylinder      2
              5.384800E-01 2.141200E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +y= 0.000000E+00
media         6      1      2 -1
boundary      2
unit          48
com=^ left hemicylinder^
cylinder      1
              5.384800E-01 1.348700E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         2      1      1
cylinder      2
              5.384800E-01 2.141200E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         6      1      2 -1
boundary      2
unit          49
com=^ right hemicylinder^
cylinder      1
              5.384800E-01 1.348700E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         2      1      1
cylinder      2
              5.384800E-01 2.141200E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         6      1      2 -1
boundary      2
unit          50
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 2.141200E+00 0.000000E+00
media         8      1      1
hole          46 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole          47 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          48 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          49 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          51
com=^ top hemicylinder^
cylinder      1
              5.384800E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -y= 0.000000E+00
media         8      1      1
boundary      1
unit          52
com=^ bottom hemicylinder^
cylinder      1
              5.384800E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00

```

```

media         8      1      1
boundary      1
unit          53
com=^ left hemicylinder^
cylinder      1
              5.384800E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord +x= 0.000000E+00
media         8      1      1
boundary      1
unit          54
com=^ right hemicylinder^
cylinder      1
              5.384800E-01 1.905000E+00 0.000000E+00
              origin x= 0.000000E+00 y=
0.000000E+00
              chord -x= 0.000000E+00
media         8      1      1
boundary      1
unit          60
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 4.682500E+00 0.000000E+00
media         8      1      1
hole          11 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          12 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          13 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          61
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 3.087750E+01 0.000000E+00
media         8      1      1
hole          17 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          18 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          19 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          62
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 1.905000E+00 0.000000E+00
media         3      1      1
hole          51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole          22 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          23 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          24 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          63
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 3.556000E+01 0.000000E+00
media         8      1      1
hole          27 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          28 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          29 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          64
com=^ complete layer^
cuboid        1
              1.181100E+00 -1.181100E+00 2.045700E+00
              -2.045700E+00 1.547750E+01 0.000000E+00
media         8      1      1
hole          32 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole          33 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole          34 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary      1
unit          65
com=^ complete layer^

```







```

array 10      -2.045700E+00  1.446185E+02  0.000000E+00
              1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 102
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 11      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 103
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 12      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 104
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 13      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 105
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 14      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 106
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 15      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 107
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 16      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 108
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 17      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 109
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 18      1

```

```

              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 110
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 19      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 111
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 20      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 112
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 21      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 113
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 22      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 114
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.446185E+02  0.000000E+00
array 23      1
              place 1 1 1  0. 0.  0.000000E+00
cuboid 2      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  1.450000E+02  0.000000E+00
media 8       1      2 -1
boundary 2
unit 115
cuboid 1      6.141720E+01  0.000000E+00  6.137100E+01
              0.000000E+00  1.450000E+02  0.000000E+00
array 1       1
              place 1 1 1  1.181100E+00  2.045700E+00
0.000000E+00
cuboid 2      8.000000E+01 -2.000000E+01  8.000000E+01
              -2.000000E+01  1.499394E+02 -1.476380E+01
media 8       1      2 -1
cuboid 3      8.000000E+01 -2.000000E+01  8.000000E+01
              -2.000000E+01  1.499394E+02 -1.603380E+01
media 9       1      3 -2 -1
boundary 3
unit 120
com=^ complete layer^
cuboid 1      1.181100E+00 -1.181100E+00  2.045700E+00
              -2.045700E+00  4.682500E+00  0.000000E+00
media 8       1      1
hole 10      origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 13      origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 121

```



```

hole 12 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 141
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 18 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 142
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 23 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 143
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 28 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 144
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 33 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 145
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 38 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 146
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 43 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 147
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 48 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 150
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 4.682500E+00 0.000000E+00
media 8 1 1

```

```

hole 11 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 13 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 151
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 17 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 19 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 152
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 53 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 24 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 153
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 29 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 154
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 34 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 155
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 39 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 156
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 44 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 157
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 49 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 160
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00

```

```

-2.045700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 10 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 161
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 16 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 162
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 21 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 53 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 163
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 26 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 164
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 31 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 165
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 36 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 166
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 41 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 167
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 46 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
boundary 1
unit 170
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 11 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 171
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1

```

```

hole 17 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 172
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 22 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 53 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 173
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 27 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 174
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 32 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 175
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 37 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 176
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 42 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 177
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 47 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
boundary 1
unit 180
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 12 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 181
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 18 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 182
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00

```

```

hole 52 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 23 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 183
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
hole 28 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 184
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.547750E+01 0.000000E+00
media 8 1 1
hole 33 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 185
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 6.350000E-01 0.000000E+00
media 8 1 1
hole 38 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 186
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.206480E+01 0.000000E+00
media 8 1 1
hole 43 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 187
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 2.141200E+00 0.000000E+00
media 8 1 1
hole 48 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 190
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 4.682500E+00 0.000000E+00
media 8 1 1
hole 13 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 191
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.087750E+01 0.000000E+00
media 8 1 1
hole 19 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 192
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 1.905000E+00 0.000000E+00
media 3 1 1
hole 51 origin x= 0.000000E+00 y= 2.045700E+00 z=
0.000000E+00
hole 52 origin x= 0.000000E+00 y= -2.045700E+00 z=
0.000000E+00
hole 53 origin x= -1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
hole 54 origin x= 1.181100E+00 y= 0.000000E+00 z=
0.000000E+00
boundary 1
unit 203
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.556000E+01 0.000000E+00
media 8 1 1
boundary 1
unit 204
com=^ complete layer^
cuboid 1
1.181100E+00 -1.181100E+00 2.045700E+00
-2.045700E+00 3.031850E+01 0.000000E+00
media 8 1 1
boundary 1
end geometry

read array
ara=1 nux=26 nuy=15 nuz=1 fill
10r114 110 106 2r103 107 110 10r114
7r114 110 106 103 6r101 103 107 110 7r114
5r114 106 103 12r101 103 107 5r114
3r114 110 106 16r101 107 110 3r114
2r114 106 20r101 107 2r114
2r114 104 21r101 112 114
114 106 22r101 107 114
114 104 22r101 105 114
114 109 22r101 108 114
114 113 22r101 112 114
2r114 109 20r101 108 2r114
3r114 111 109 16r101 108 111 3r114
5r114 109 102 12r101 102 108 5r114
7r114 111 109 102 6r101 102 108 111 7r114
10r114 111 109 2r102 108 111 10r114 t
end fill
' ----- Fuel Rod Layer Stacks

```

```
ara=10  nux=1  nuy=1  nuz=12
fill 5 15 20 25 30 25 30 25 35 40 45 50 end fill
ara=11  nux=1  nuy=1  nuz=12
fill 5 60 61 62 63 62 63 62 64 65 66 67 end fill
ara=12  nux=1  nuy=1  nuz=12
fill 5 70 71 72 73 72 73 72 74 75 76 77 end fill
ara=13  nux=1  nuy=1  nuz=12
fill 5 80 81 82 83 82 83 82 84 85 86 87 end fill
ara=14  nux=1  nuy=1  nuz=12
fill 5 90 91 92 93 92 93 92 94 95 96 97 end fill
ara=15  nux=1  nuy=1  nuz=12
fill 5 120 121 122 123 122 123 122 124 125 126 127 end fill
ara=16  nux=1  nuy=1  nuz=12
fill 5 130 131 132 133 132 133 132 134 135 136 137 end fill
ara=17  nux=1  nuy=1  nuz=12
fill 5 140 141 142 143 142 143 142 144 145 146 147 end fill
ara=18  nux=1  nuy=1  nuz=12
fill 5 150 151 152 153 152 153 152 154 155 156 157 end fill
ara=19  nux=1  nuy=1  nuz=12
fill 5 160 161 162 163 162 163 162 164 165 166 167 end fill
ara=20  nux=1  nuy=1  nuz=12
fill 5 170 171 172 173 172 173 172 174 175 176 177 end fill
ara=21  nux=1  nuy=1  nuz=12
fill 5 180 181 182 183 182 183 182 184 185 186 187 end fill
ara=22  nux=1  nuy=1  nuz=12
fill 5 190 191 192 193 192 193 192 194 195 196 197 end fill
ara=23  nux=1  nuy=1  nuz=8
fill 5 203 202 203 202 203 202 204 end fill
end array
read plot
scr=yes pic=mixture lpi=10.0
xul=-21.0 yul=12 zul=150 xlr=80 ylr=12 zlr=-1.0
uax=1 vax=0 wax=0 udn=0 vdn=0 wdn=-1 nax=600 nch=!.faw!
end plt1
xul=-21.0 yul=83 zul=15 xlr=80 ylr=-21.0 zlr=15
uax=1 vax=0 wax=0 udn=0 vdn=-1 wdn=0 nax=600 nch=!.faw!
end plt2
end plot
end data
end
```