A major purpose of the Technical Information Center is to provide the broadest dissemination possible of information contained in DOE's Research and Development Reports to business, industry, the academic community, and federal, state and local governments.

Although a small portion of this report is not reproducible, it is being made available to expedite the availability of information on the research discussed herein.

28
11-12-84 JS ①

I-18419

DR-0657-2

ORNL/CSD/TM-221

MARTIN MARIETTA

Validation of the Monte Carlo Criticality Program Keno V. a For Highly-Enriched Uranium Systems

J. R. Knight

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

NOTICE
PORTIONS OF THIS REPORT ARE ILLEGIBLE.
It has been reproduced from the best available copy to permit the broadest possible availability.

CRNL/CSD/TH--221

DE85 004325

**VALIDATION OF THE MONTE CARLO CRITICALITY PROGRAM KENO V.a FOR
HIGHLY-ENRICHED URANIUM SYSTEMS**

J. P. Knight

Date Published - November 1984

COMPUTING AND TELECOMMUNICATIONS DIVISION
at
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37831

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

MASTER

Martin Marietta Energy Systems, Inc.
operating the
Oak Ridge Gaseous Diffusion Plant Paducah Gaseous Diffusion Plant
Oak Ridge Y-12 Plant Oak Ridge National Laboratory
under Contract No. DE-AC05-84OR21400
for the
DEPARTMENT OF ENERGY

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	v
ACKNOWLEDGMENTS.	vii
ABSTRACT	ix
INTRODUCTION	1
CALCULATION PROCEDURE	1
DISCUSSION OF RESULTS.	2
CONCLUSIONS.	2
REFERENCES	23
APPENDIX	25

LIST OF TABLES

	<u>Page</u>
Table 1	3
Table 2	14
Table 3	15
Table 4	16
Table 5	17
Table 6	18
Table 7	19
Table 8	21

ACKNOWLEDGMENTS

This work was supported by the Health, Safety and Environmental Affairs Department of the Y-12 Plant. The author wishes to recognize N. F. Landers and L. M. Petrie for assistance in performing the analyses and D. J. Hamby for the preparation of the manuscript.

ABSTRACT

A series of calculations based on critical experiments have been performed using the KENO V.a Monte Carlo Criticality Program for the purpose of validating KENO V.a for use in evaluating Y-12 Plant criticality problems. The experiments were reflected and unreflected systems of single units and arrays containing highly enriched uranium metal or uranium compounds. Various geometrical shapes were used in the experiments.

The SCALE control module CSAS25 with the 27-group ENDF/B-4 cross-section library was used to perform the calculations. Some of the experiments were also calculated using the 16-group Hansen-Roach Library. The results are presented in a series of tables and discussed in the text. The results show that the criteria established for the safe application of the KENO IV program may also be used for KENO V.a results.

VALIDATION OF THE MONTE CARLO CRITICALITY PROGRAM KENO V.a FOR HIGHLY-ENRICHED URANIUM SYSTEMS

J. R. Knight

INTRODUCTION

The KENO V.a Monte Carlo Criticality Program is an extensive revision of KENO IV. KENO IV was validated for Y-12 applications in an earlier study. Many new KENO V.a features allow a wider choice of geometry options which enable the user to describe more complex problems. The purpose of this report is to describe a set of calculations that were used for the purpose of validating KENO V.a for the Y-12 Criticality Safety Group's use in evaluating Y-12 criticality problems.

All of the calculations are based on critical experiments. Each experiment contains highly enriched (~93% U-235) uranium, either as uranium metal or as a uranium compound in aqueous solution. Unreflected and reflected systems of both single units and arrays of fissile material are included. Various geometric shapes are used in these systems. In some of the arrays moderating material is placed between the various units in the array. These calculations should represent systems that are typical of many Y-12 criticality problems, and their results may be used as a guide in determining the uncertainties in the evaluation of new problems.

CALCULATION PROCEDURE

For quality assurance purposes, a special version of SCALE, named Y12CSG, was prepared. It contains all of the features of SCALE, including cross section libraries used by SCALE. The CSAS25 control module of Y12CSG was used to perform all of the calculations described here. This module calculates number densities and resonance parameters for all of the materials used in the calculation. Next the functional modules BONAMI and NITAWL do the resonance data processing and produce a working library. ICE prepares the necessary mixture cross sections, and KENO V.a does the Monte Carlo criticality calculation.

All of the problems were calculated using the 27 group ENDF/B-4 cross-section library. Most of the problems from reference 10 were also calculated using the 16-group Hansen-Roach library. Between 60000 and 100000 neutron histories were run to reduce the statistical uncertainty of the answers. The input material descriptions were entered in terms of values given in the references. This means that the number densities used were calculated internally by CSAS25. This results in values that are slightly different from the values used for the KENO IV calculations described in reference 18.

The results of the 27-group calculations are given in Table 1, which also includes a brief description of each experiment. Tables 2 through 8 give the results for various categories of experiments. The 16-group results are included here for comparison. Input data used for the calculations are listed in the Appendix.

DISCUSSION OF RESULTS

The deviations given in the tables are standard deviations, and with a few exceptions vary between .003 and .004. $K(\text{eff})$ varies from a minimum of 0.974 to a maximum of 1.051. The 16-group results for problems A1-A11 and B1-B18 are somewhat different from the values reported in reference 18. This is because of the difference in the number densities and differences in the random sequences followed by KENO IV and KENO V.a. The calculations for bare uranium metal given in Table 2 and for reflected metal given in Table 3 are in good agreement with the experiments. The few calculations for moderated metal systems given in Table 4 also give fairly good agreement with the experiments.

The bare uranium solution results given in Table 5 are for experiments that have no significant external scattering, or where the significant scattering sources were accounted for. These results are also in good agreement with the experiments. Table 6 includes experiments which had significant external scattering from walls, floor, and pieces of experimental equipment in the experiment room that were neglected in the calculations. These results are uniformly low in $K(\text{eff})$. For example, problem B13 was recalculated as U4B641F (Table 5), and showed an increase in $K(\text{eff})$ from 0.985 to 0.998. This shows that poor results may be due to an incomplete description of the experiment.

Table 7 gives the results for uranium solution experiments with external reflectors. The effect of scattering by material outside of the reflector should not be significant. The calculated $K(\text{eff})$ values are all high. No satisfactory explanation for these higher results has been found. However, the calculations for uranium solution experiments that are reflected and moderated by water given in Table 8 give good agreement with the experiments.

CONCLUSIONS

A wide selection of highly-enriched uranium critical systems have been evaluated using KENO V.a as a part of the control module CSA825. A number of problems not included in the KENO IV validation study (reference 18) have been added. The results show that the criteria established for the safe application of the KENO IV program given in reference 18 may also be used for KENO V.a results obtained by the methods described here.

TABLE 1
Results of Calculations

Experiment	Reference	k_{eff}	Deviation
Problem A1 Y-12 VALIDATION CASE A-1. 93.8% U METAL SPHERE, UNREFLECTED. (GODIVA)	1	0.999	.003
Problem A2 Y-12 VALIDATION CASE A-2. 93.2% U-MO ALLOY CYLINDER ANNULUS, UNREFLECTED.	2	1.006	.003
Problem A3 Y-12 VALIDATION CASE A-3. 93.2% UO ₂ F ₂ SOLUTION. 19.992 G U/L. IN AL SPHERE, UNREFLECTED.	3	1.008	.002
Problem A4 Y-12 VALIDATION CASE A-4. 93.18% UO ₂ (NO ₃) ₂ SOLUTION, 20.12 G U/L. IN AL SPHERE, UNREFLECTED.	4	0.997	.003
Problem A5 Y-12 VALIDATION CASE A-5. 93.5% U METAL HEMISPHERICAL SHELL, H ₂ O REFLECTED.	5	1.004	.003
Problem A6 Y-12 VALIDATION CASE A-6. 93.2% U METAL CYLINDER ANNULUS, GRAPHITE REFLECTED.	6	1.016	.003
Problem A7 Y-12 VALIDATION CASE A-7. 94% U METAL CUBOID. NATURAL U REFLECTED.	5	1.000	.003
Problem A8 Y-12 VALIDATION CASE A-8. 93.1% U METAL HEMISPHERICAL SHELL, OIL REFLECTED.	7	1.011	.003
Problem A9 Y-12 VALIDATION CASE A-9. 93.1% U METAL HEMISPHERICAL SHELL, STEEL CENTER AND OIL REFLECTED.	7	1.002	.003
Problem A10 Y-12 VALIDATION CASE A-10. 97.67% U METAL SPHERE, H ₂ O REFLECTED.	8	1.001	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem A11 Y-12 VALIDATION CASE A-11. 93.172% UO ₂ (NO ₃) ₂ SOLUTION, 346.7 G U/L. IN SS CYLINDER, UNREFLECTED.	9	1.013	.004
Problem B1 Y-12 VALIDATION CASE B-1. 93.2% U METAL CYLINDER ANNULUS, UNREFLECTED. SMALLER U CYLINDER IN HOLE TOUCHING ONE WALL.	10	1.003	.003
Problem B2 Y-12 VALIDATION CASE B-2. 93.2% U METAL CYLINDER ANNULUS, UNREFLECTED. SMALLER U BLOCK IN HOLE TOUCHING ONE WALL.	10	1.003	.003
Problem B3 Y-12 VALIDATION CASE B-3. 93.2% U METAL, UNREFLECTED CYLINDERS AND CUBOIDS IN APPROXIMATE CIRCULAR ARRANGEMENT. CYLINDER, CUBOID, AND HEMISPHERE STACK IN CENTER.	10	0.996	.003
Problem B4 Y-12 VALIDATION CASE B-4. 93.2% U METAL CYLINDERS, 4X4X4 ARRAY. UNREFLECTED.	11	0.992	.003
Problem B5 Y-12 VALIDATION CASE B-5. 93.2% U METAL CYLINDERS. 2X2X2 ARRAY. EACH UNIT IN THE ARRAY IS A SMALLER CYLINDER CAPPED ON EACH END BY A LARGER CYLINDER. UNREFLECTED.	11	0.998	.003
Problem B6 Y-12 VALIDATION CASE B-6. 93.2% U METAL CYLINDERS. 2X2X2 ARRAY. PARAFFIN REFLECTED.	11	1.003	.003
Problem B7 Y-12 VALIDATION CASE B-7. 93.2% U METAL CYLINDERS, 2X2X2 ARRAY. EACH UNIT IN THE ARRAY IS A SMALLER CYLINDER CAPPED ON EACH END BY A LARGER CYLINDER. PARAFFIN REFLECTED.	11	1.009	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem B8 Y-12 VALIDATION CASE B-8. 93.2% U METAL CYLINDERS EACH IN A PLEXIGLAS BOX. 2X2X2 ARRAY OF THESE UNITS, UNREFLECTED.	11	1.006	.003
Problem B9 Y-12 VALIDATION CASE B-9. 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY. UNREFLECTED. (SEE ALSO PROBLEM U4B271F)	12	0.995	.004
Problem B10 Y-12 VALIDATION CASE B-10. 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 63.3 G U/L. IN PLEXIGLAS CYLINDERS, 3X3X3 ARRAY, UNREFLECTED. (SEE ALSO PROBLEM U6B271F)	12	0.988	.003
Problem B11 Y-12 VALIDATION CASE B-11. 93.2 % UO ₂ (NO ₃) ₂ SOLUTION, 505 G U/L, IN SS CYLINDERS. 4X4 ARRAY. STANDING IN A SOLUTION SLAB. PLEXIGLAS REFLECTED.	13	1.051	.004
Problem B12 Y-12 VALIDATION CASE B-12. 93.2% U METAL CYLINDERS. 2X2X2 ARRAY, GRAPHITE MODERATED AND POLYETHYLENE REFLECTED.	14	1.016	.003
Problem B13 Y-12 VALIDATION CASE B-13. 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 4X4X4 ARRAY. UNREFLECTED. (SEE ALSO PROBLEM U4B641F)	12	0.985	.004
Problem B14 Y-12 VALIDATION CASE B-14. 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, PARAFFIN REFLECTED. (SEE ALSO PROBLEM U4R271F)	12	1.027	.004
Problem B15 Y-12 VALIDATION CASE B-15. 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, PLEXIGLAS REFLECTED. (SEE ALSO PROBLEM U4R27G1F)	12	1.002	.004

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem B16 Y-12 VALIDATION CASE B-16. 93.1% UO ₂ (NO ₃) ₂ SOLUTION, 450.8 G U/L, IN SS CONTAINERS. SQUARE CENTRAL COLUMN WITH 8 PERPENDICULAR CYLINDRICAL ARMS. UNREFLECTED.	15,16	1.026	.004
MEMBRER: B17 Y-12 VALIDATION CASE B-17. 93.17% UO ₂ (NO ₃) ₂ SOLUTION, 355.9 G U/L, IN AL CYLINDERS. 4X4 ARRAY, PLEXIGLAS REFLECTED.	9	1.030	.004
Problem B18 Y-12 VALIDATION CASE B-18. 93.17% UO ₂ (NO ₃) ₂ SOLUTION, 364.1 G U/L, IN AL CYLINDERS. 4X4 ARRAY, CONCRETE REFLECTED.	9	1.026	.004
Problem S333SP0 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 0 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	1.001	.003
Problem S333SP1 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 2.54 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	1.007	.003
Problem S333SP3 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 7.62 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	0.994	.003
Problem S333SP4 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 11.43 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	0.995	.003
Problem S333SP5 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 13.97 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	0.999	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem S333SP6 93.2% UO2F2 SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 15.24 CM SEPARATION. UNREFLECTED. CYLINDRICAL TANK, FLOOR, & WALLS IN EXPERIMENT ROOM INCLUDED.	17	1.003	.003
Problem S333SP0R 93.2% UO2F2 SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 0 CM SEPARATION. H2O REFL.	17	0.995	.003
Problem S333SP1R 93.2% UO2F2 SOLUTION. 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 2.54 CM SEPARATION. H2O REFL.	17	1.001	.003
Problem S333SP3R 93.2% UO2F2 SOLUTION. 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 7.62 CM SEPARATION. H2O REFL.	17	0.993	.003
Problem S333SP4R 93.2% UO2F2 SOLUTION, 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 11.43 CM SEPARATION. H2O REFL.	17	1.002	.003
Problem S333SP5R 93.2% UO2F2 SOLUTION. 81.8 G U/L, IN AL SLABS. 3 7.62 CM SLABS IN 3X1 ARRAY, 13.97 CM SEPARATION. H2O REFL.	17	1.003	.003
Problem S36SP2 93.2% UO2F2 SOLUTION. 81.8 G U/L IN AL SLABS. 7.62 CM AND 14.834 CM SLABS IN 2X1 ARRAY. 5.08 CM SEPARATION. UNREFLECTED.	17	0.988	.003
Problem S36SP15 93.2% UO2F2 SOLUTION. 81.8 G U/L IN AL SLABS. 7.62 CM AND 14.834 CM SLABS IN 2X1 ARRAY. 38.1 CM SEPARATION. UNREFLECTED.	17	0.974	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem S36SP30 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L IN AL SLABS. 7.62 CM AND 14.834 CM SLABS IN 2X1 ARRAY, 76.2 CM SEPARATION. UNREFLECTED.	17	0.977	.003
Problem S36SP48 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L IN AL SLABS. 7.62 CM AND 14.834 CM SLABS IN 2X1 ARRAY. 121.92 CM SEPARATION. UNREFLECTED.	17	0.974	.003
Problem S363SP0 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. 7.62 CM, 14.834 CM, AND 7.62 CM SLABS IN 3X1 ARRAY. 0 CM SEPARATION. UNREFLECTED.	17	0.987	.003
Problem S363SP10 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. 7.62 CM, 14.834 CM, AND 7.62 CM SLABS IN 3X1 ARRAY. 25.4 CM SEPARATION. UNREFLECTED.	17	0.979	.003
Problem S363SP20 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. 7.62 CM, 14.834 CM, AND 7.62 CM SLABS IN 3X1 ARRAY. 50.8 CM SEPARATION. UNREFLECTED.	17	0.978	.003
Problem S363SP32 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. 7.62 CM, 14.834 CM, AND 7.62 CM SLABS IN 3X1 ARRAY. 81.28 CM SEPARATION. UNREFLECTED.	17	0.983	.003
Problem S63SP6 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. ONE SLAB IS MADE UP FROM TWO 7.62 CM SLABS SNUGLY FIT TOGETHER, THE OTHER IS 7.62 CM. 2X1 ARRAY, 15.24 CM SEPARATION. UNREFLECTED.	17	0.986	.003
Problem S63SP12 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L. IN AL SLABS. ONE SLAB IS MADE UP FROM TWO 7.62 CM SLABS SNUGLY FIT TOGETHER, THE OTHER IS 7.62 CM. 2X1 ARRAY, 30.48 CM SEPARATION. UNREFLECTED.	17	0.983	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem S63SP18 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L. IN AL SLABS. ONE SLAB IS MADE UP FROM TWO 7.62 CM SLABS SNUGLY FIT TOGETHER, THE OTHER IS 7.62 CM. 2X1 ARRAY. 45.72 CM SEPARATION. UNREFLECTED.	17	0.986	.003
Problem S63SP30 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L. IN AL SLABS. ONE SLAB IS MADE UP FROM TWO 7.62 CM SLABS SNUGLY FIT TOGETHER, THE OTHER IS 7.62 CM. 2X1 ARRAY, 76.2 CM SEPARATION. UNREFLECTED.	17	0.983	.003
Problem S66SP2 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 5.08 CM SEPARATION. UNREFLECTED.	17	0.982	.003
Problem S66SP6 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 15.24 CM SEPARATION. UNREFLECTED.	17	0.980	.003
Problem S66SP15 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 38.1 CM SEPARATION. UNREFLECTED.	17	0.985	.003
Problem S66SP20 93.2% UO ₂ F ₂ SOLUTION, 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 50.8 CM SEPARATION. UNREFLECTED.	17	0.981	.003
Problem S66SP30 93.2% UO ₂ F ₂ SOLUTION. 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 76.2 CM SEPARATION. UNREFLECTED.	17	0.989	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem S66SP48 93.2% UO2F2 SOLUTION, 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 121.92 CM SEPARATION. UNREFLECTED.	17	0.991	.003
Problem S66SP66 93.2% UO2F2 SOLUTION. 81.8 G U/L, IN AL SLABS. ONE SLAB IS 14.834 CM, AND THE OTHER IS MADE UP FROM TWO 7.62 SLABS SNUGLY FIT TOGETHER. 2X1 ARRAY, 167.64 CM SEPARATION. UNREFLECTED.	17	0.979	.003
Problem U6B271F 92.6% UO2(NO3)2 SOLUTION, 63.3 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	1.002	.003
Problem U2B271F 92.6% UO2(NO3)2 SOLUTION. 279 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	0.994	.003
Problem U2B81F 92.6% UO2(NO3)2 SOLUTION. 279 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	1.007	.003
Problem U4B1251F 92.6% UO2(NO3)2 SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 5X5X5 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	0.998	.003
Problem U4B641F 92.6% UO2(NO3)2 SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 4X4X4 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	0.998	.003
Problem U4B271F 92.6% UO2(NO3)2 SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	1.001	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem U4B81F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, UNREFLECTED. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	1.007	.003
Problem U4U2B27 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, UNREFLECTED. 279 G U/L IN 5 CENTRAL UNITS. WALLS, FLOOR, & TANK IN EXPERIMENT ROOM INCLUDED.	12	1.001	.003
Problem U4R27A1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 1.27 CM PLEXIGLAS ON OTHER FACES.	12	1.007	.003
Problem U4R27B1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 2.54 CM PLEXIGLAS ON OTHER FACES.	12	1.010	.003
Problem U4R27C1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 1.27 CM PARAFFIN ON OTHER FACES.	12	1.017	.004
Problem U4R27D1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON 5 FACES, 15.24 CM PLEXIGLAS ON 1 FACE.	12	1.018	.003
Problem U4R27E1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 3.81 CM PARAFFIN ON OTHER FACES.	12	1.023	.004
Problem U4R27F1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 7.62 CM PARAFFIN ON OTHER FACES.	12	1.032	.004

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem U4R27G1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 1.27 CM PLEXIGLASS ALL FACES.	12	1.005	.003
Problem U4R27H1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 1.27 CM PARAFFIN ALL FACES.	12	1.010	.003
Problem U4R27I1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 15.24 CM PARAFFIN ALL FACES.	12	1.030	.003
Problem U4R27J1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 3X3X3 ARRAY, REFLECTED. 3.81 CM PARAFFIN ALL FACES.	12	1.031	.003
Problem U4R8A1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 1.27 CM PLEXIGLAS ON OTHER FACES.	12	1.017	.003
Problem U4R8B1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 1.43 CM PLEXIGLAS ON OTHER FACES.	12	1.026	.004
Problem U4R8C1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 15.24 CM PLEXIGLAS ON OTHER FACES.	12	1.025	.003
Problem U4R8D1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 2.54 CM PLEXIGLAS ON OTHER FACES.	12	1.013	.003
Problem U4R8E1F 92.6% UO ₂ (NO ₃) ₂ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 4.45 CM PLEXIGLAS ON OTHER FACES.	12	1.024	.003

Table 1 (cont'd)

Experiment	Reference	k_{eff}	Deviation
Problem U4R8F1F 92.6% $UO_2(NO_3)_2$ SOLUTION, 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 6.35 CM PLEXIGLAS ON OTHER FACES.	12	1.022	.003
Problem U4R8G1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 1.27 CM PARAFFIN ON OTHER FACES.	12	1.018	.003
Problem U4R8H1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 3.81 CM PARAFFIN ON OTHER FACES.	12	1.018	.004
Problem U4R8I1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ON BOTTOM, 7.62 CM PARAFFIN ON OTHER FACES.	12	1.020	.004
Problem U4R8J1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 1.27 CM PLEXIGLASS ALL FACES.	12	1.007	.003
Problem U4R8K1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 1.27 CM PARAFFIN ALL FACES.	12	1.009	.003
Problem U4R8L1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 15.24 CM PARAFFIN ALL FACES.	12	1.022	.003
Problem U4R8M1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 3.81 CM PARAFFIN ALL FACES.	12	1.026	.003
Problem U4R8N1F 92.6% $UO_2(NO_3)_2$ SOLUTION. 415 G U/L, IN PLEXIGLAS CYLINDERS. 2X2X2 ARRAY, REFLECTED. 7.62 CM PARAFFIN ALL FACES.	12	1.027	.004

TABLE 2
Bare Metal Systems

Problem	Enrichment	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
		K(eff)	Deviation	K(eff)	Deviation
A1	93.8	0.999	.003	0.992	.003
A2	93.2	1.006	.003	0.996	.003
B1	93.2	0.989	.003	0.989	.003
B2	93.2	1.003	.003	1.001	.003
B3	93.2	0.996	.003	0.990	.003
B4	93.2	0.992	.003	0.986	.003
B5	93.2	1.008	0.003	0.998	0.003
Average		0.995		0.995	

TABLE 3

Reflected Metal Systems

Problem	Enrichment	Reflector	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
			K(eff)	Deviation	K(eff)	Deviation
A5	93.5	water	1.004	.003	1.014	.003
A10	97.67	water	1.001	.003	0.999	.004
Average			1.003		1.007	
A8	93.1	oil	1.011	.003	1.007	.004
A9	93.1	oil	1.002	.003	0.996	.003
Average			1.007		1.002	
B6	93.2	paraffin	1.003	.003	1.008	.003
B7	93.2	paraffin	1.009	.003	1.005	.003
Average			1.006		1.007	
A6	93.2	graphite	1.016	.003	1.018	.004
A7	94.0	natural U	1.000	.003	0.992	.003

TABLE 4
Moderated Metal Systems

Problem	Enrichment	Moderator	Reflector	k(eff)	Deviation	Xsects
B8	93.2	Plexiglas	none	0.996	.003	16 Gp
				1.006	.003	27 Gp
B12	93.2	graphite	polyethylene	1.017	.003	16 Gp
				1.016	.003	27 Gp

TABLE 5

Bare Solution Systems

Problem	Enrichment	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
		K(eff)	Deviation	K(eff)	Deviation
A3	93.2	1.008	.002	1.011	.002
A4	93.18	0.997	.003	1.007	.003
A11	93.17	1.013	.004	0.991	.004
B16	93.1	1.026	.004	1.010	.004
S333SP0	93.2	1.001	.003		
S333SP1	93.2	1.007	.003		
S333SP3	93.2	0.994	.003		
S333SP4	93.2	0.995	.003		
S333SP5	93.2	0.999	.003		
S333SP6	93.2	1.003	.003		
U6B271F	92.6	1.002	.003		
U2B271F	92.6	0.994	.003		
U2B81F	92.6	1.007	.003		
U4B1251F	92.6	0.998	.003		
U4B641F	92.6	0.998	.003		
U4B271F	92.6	1.001	.003		
U4B81F	92.6	1.007	.003		
U4U2B27	92.6	<u>1.001</u>	.003	<u> </u>	
Average		1.003		1.005	

TABLE 6

Bare Solution Systems (Neglecting External
Scatter That May Be Significant)

Problem	Enrichment	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
		K(eff)	Deviation	K(eff)	Deviation
B9	92.6	0.995	.004	0.972	.004
B10	92.6	0.988	.003	0.986	.003
B13	92.6	0.985	.004	0.962	.004
S36SP2	93.2	0.988	.003		
S36SP15	93.2	0.974	.003		
S36SP30	93.2	0.977	.003		
S36SP48	93.2	0.974	.003		
S363SP0	93.2	0.981	.003		
S363SP10	93.2	0.979	.003		
S363SP20	93.2	0.978	.003		
S363SP32	93.2	0.983	.003		
S63SP6	93.2	0.986	.003		
S63SP12	93.2	0.983	.003		
S63SP18	93.2	0.986	.003		
S63SP30	93.2	0.983	.003		
S66SP2	93.2	0.982	.003		
S66SP6	93.2	0.980	.003		
S66SP15	93.2	0.985	.003		
S66SP20	93.2	0.981	.003		
S66SP30	93.2	0.989	.003		
S66SP48	93.2	0.991	.003		
S66SP66	93.2	<u>0.979</u>	.003		
Average		0.983		0.973	

TABLE 7
Reflected Solution Systems

Problem	Enrichment	Reflector	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
			K(eff)	Deviation	K(eff)	Deviation
B11	93.2	Plexiglas	1.051	.004	1.029	.004
B14	92.6	paraffin	1.027	.004	1.001	.004
B15	92.6	Plexiglas	1.002	.004	0.985	.004
B17	93.17	Plexiglas	1.030	.004	1.009	.004
U4R27A1F	92.6	paraffin, Plexiglas	1.007	.003		
U4R27B1F	92.6	paraffin, Plexiglas	1.010	.003		
U4R27C1F	92.6	paraffin	1.017	.004		
U4R27D1F	92.6	paraffin, Plexiglas	1.018	.003		
U4R27E1F	92.6	paraffin	1.023	.003		
U4R27F1F	92.6	paraffin	1.032	.004		
U4R27G1F	92.6	Plexiglas	1.005	.003		
U4R27H1F	92.6	paraffin	1.010	.003		
U4R27I1F	92.6	paraffin	1.030	.003		
U4R27J1F	92.6	paraffin	1.031	.003		
U4R8A1F	92.6	paraffin, Plexiglas	1.017	.003		
U4R8B1F	92.6	paraffin, Plexiglas	1.026	.004		
U4R8C1F	92.6	paraffin, Plexiglas	1.025	.003		
U4R8D1F	92.6	paraffin, Plexiglas	1.013	.003		
U4R8E1F	92.6	paraffin, Plexiglas	1.024	.003		
U4R8F1F	92.6	paraffin, Plexiglas	1.022	.003		

TABLE 7 (cont'd)

Problem	Enrichment	Reflector	<u>27 Group Xsects</u>		<u>16 Group Xsects</u>	
			<u>L(eff)</u>	<u>Deviation</u>	<u>K(eff)</u>	<u>Deviation</u>
U4R8G1F	92.6	paraffin	1.018	.003		
U4R8H1F	92.6	paraffin	1.018	.004		
U4R8I1F	92.6	paraffin	1.020	.004		
U4R8J1F	92.6	Plexiglas	1.007	.003		
U4R8K1F	92.6	paraffin	1.009	.003		
U4R8L1F	92.6	paraffin	1.022	.003		
U4R8M1F	92.6	paraffin	1.026	.003		
U4R8N1F	92.6	paraffin	1.027	.004		
Average			1.020		1.006	
B18	93.17	concrete	1.026	.004	1.004	.004

21/12

TABLE 8

Water Moderated and Reflected Systems

Problem	Enrichment	<u>27 Group 1/2 sects</u>	
		K(eff)	Deviation
S333SP0R	93.2	0.995	.003
S333SP1R	93.2	1.001	.003
S333SP3R	93.2	0.993	.003
S333SP4R	93.2	1.002	.003
S333SP5R	93.2	<u>1.003</u>	.003
Average		0.999	

REFERENCES

1. G. E. Hansen, "Properties of Elementary Fast Neutron Critical Assemblies," Proc. U.N. Intern. Conf. Peaceful Uses At. Energy, 2nd Geneva, 1958 (United Nations, Geneva, 1958), Vol. 12, p. 84.
2. J. T. Mihalczo and W. E. Kinney, *Trans. Am. Nucl. Soc.* 4, 302 (1961).
3. J. K. Fox, L. W. Gilley, R. Gwin, and J. T. Thomas, Neutron Physics Division Annual Progress Report, Oak Ridge National Laboratory, Oak Ridge, Tenn. ORNL-2609, p. 42 (1958).
4. R. Gwin and D. W. Magnuson, *Nucl. Sci. Eng.* 12, 364 (1962).
5. H. C. Paxton, Los Alamos Critical Mass Data, Los Alamos National Laboratory, Los Alamos, N. Mex., LAMS-3067 (1964).
6. J. T. Mihalczo, *Trans. Am. Nucl. Soc.* 8, 442 (1965).
7. G. Tuck, "Critical Masses of Spherical and Hemispherical Enriched Uranium Assemblies," *J. Nucl. Energy* 23, 663 (1969).
8. C. C. Byers, J. J. Koelling, G. E. Hansen, D. R. Smith, and H. R. Dyer, "Critical Measurements of a Water-Reflected Enriched Uranium Sphere," *Trans. Am. Nucl. Soc.* 27, 412 (1977).
9. R. E. Rothe and I. Oh, Benchmark Critical Experiments on High Enriched Uranyl Nitrate Solutions Systems, Rockwell International, Rocky Flats, Golden, Colo. RFP-2710 (April 1978).
10. D. C. Irving and J. T. Mihalczo, *Trans. Am. Nucl. Soc.* 7, 287 (1964).
11. J. T. Thomas, Critical Three-Dimensional Arrays of Neutron-Interacting Units, Part II - U(93.2) Metal, Oak Ridge National Laboratory, Oak Ridge, Tenn., ORNL-TM-868 (1964).
12. J. T. Thomas, Critical Three-Dimensional Arrays of Neutron-Interacting Units. Oak Ridge National Laboratory, Oak Ridge, Tenn. ORNL-TM-719 (1963).
13. G. Tuck and H. E. Clark, "Critical Parameters of a Uranium Solution Slab-Cylinder System," *Nucl. Sci. Eng.* 40, 407-413 (1970).
14. E. C. Crume and J. T. Thomas, Critical and Near Critical Graphite Moderated Arrays of U(93.2) Cylinders, Union Carbide Corporation, Nuclear Division, Oak Ridge Y-12 Plant, Oak Ridge, Tenn., Y-DD-32 (1969).
15. B. B. Ernst and C. L. Schuske, Empirical Method for Calculating Pipe Intersections Containing Fissile Solution, Rockwell International, Rocky Flats, Golden, Colo., RFP-1197 (September 1968).

REFERENCES (cont'd)

16. D. Dickinson and C. L. Schuske, "An Empirical Model for Safe Pipe Interactions Containing Fissile Solution," Nucl. Technol. 10, 179-187 (1971).
17. J. K. Fox and L. W. Gilley, "Preliminary Report of Critical Experiments in Slab Geometry," ORNL-CF-56-7-148 (1956).
18. G. R. Handley, L. C. Masters, and A. V. Stachowiak, "Validation of the Monte Carlo Criticality Program KENO IV and the Hansen-Roach Sixteen Energy-Group-Cross Sections for High Assay Uranium Systems," Y-2234 (1981).

APPENDIX

Input Data

Problem A1

```
=CSAS25
KENO-5 VALIDATION CASE A-1
27GROUPNDF4 MULTIREGION
URANIUM 1 .9837 293 92235 93.8 92238 6.2 END
END COMP
SPHERICAL END
1 8.73136 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-1
READ PARAM TME=2 GEN=203 END PARAM
READ GEOM
SPHERE 1 1 8.73136
END GEOM
END DATA
END
```

Problem A2

```
=CSAS25
KENO-5 VALIDATION CASE A-2
27GROUPNDF4 MULTIREGION
ARBMUM0 17.08 2 1 0 1 92000 90 42000 10 1 1 293 92235 93.2 92238 6.8 END
END COMP
CYLINDRICAL END
1 7.62 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-2
READ PARAM TME=2 GEN=203 END PARAM
READ GEOM
CYLINDER 0 1 2.54 9.87 -9.87
CYLINDER 1 1 10.16 9.87 -9.87
CUBE 0 1 10.16 -10.16
END GEOM
END DATA
END
```

Problem A3

```
=CSAS25
KENO-5 VALIDATION CASE A-3
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 19.992 0 1 293 92235 93.2 92238 6.8 END
AL 2 END
END COMP
SPHERICAL END
```

```

1 34.6 ONEEXTERMOD 2 34.92 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-3
READ PARAM TME=26 GEN=203 END PARAM
READ GEOM
SPHERE 1 1 34.6
SPHERE 2 1 34.92
CUBE 0 1 35.0 -35.0
END GEOM
END DATA
END

```

Problem A4

```

=CSAS25
KENO-5 VALIDATION CASE A-4
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 20.15 .139 1 293 92235 93.18 92238 6.82 END
AL 2 END
END COMI
SPHERIC/L END
1 34.6 ONEEXTERMOD 2 34.92 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-4
READ PARAM TME=26 GEN=203 END PARAM
READ GEOM
SPHERE 1 1 34.6
SPHERE 2 1 34.92
CUBE 0 1 35.0 -35.0
END GEOM
END DATA
END

```

Problem 45

```

=CSAS25
KENO-5 VALIDATION CASE A-5
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 283 92235 93.5 92238 6.5 END
H2O 2 END
END COMP
SPHERICAL END
1 12.7 ONEEXTERMOD 2 31. NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-5
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
HEMISPHERE 2 1 12.7
HEMISPHERE 1 1 15.24
CUBOID 2 1 31.00 -31.00 31.00 -31.00 31.00 -16.
END GEOM
END DATA
END

```


Problem A6

```

=CSAS25
KENO-5 VALIDATION CASE A-6
27GROUPNDF4 MULTIREGION
C      1 .7522 END
URANIUM 2 .9848 293 92235 93.2 92238 6.8 END
END COMP
CYLINDRICAL END
1 8.89 NOEXTERMOD 2 13.97 TWOEXTERMOD 1 31.75 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-6
READ PARAM TME=10 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 8.89 3.425 -3.425
CYLINDER 2 1 11.43 3.425 -3.425
CYLINDER 1 1 11.43 3.495 -3.425
CYLINDER 2 1 13.97 3.495 -3.425
CYLINDER 1 1 31.75 21.275 -21.205
CUBE      0 1 32.0 -32.0
END GEOM
END DATA
END

```

Problem A7

```

=CSAS25
KENO-5 VALIDATION CASE A-7
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 293 92235 94 92238 6 END
URANIUM 2 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 52.02 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-7
READ PARAM TME=10 GEN=203 END PARAM
READ GEOM
CUBOID    1 1 3.81 -3.81 4.445 -4.445 7.62 -7.62
CUBOID    2 1 26.01 -26.01 26.645 -26.645 29.82 -29.82
CUBE      0 1 30.0 -30.0
END GEOM
END DATA
END

```

Problem A8

```

=CSAS25
KENO-5 VALIDATION CASE A-8
27GROUPNDF4 MULTIREGION
ARMOIL    .88 3 0 0 0 6012 86.82 1001 13.16 16032 .02 1 END
URANIUM    2 .9528 293 92235 93.1 92238 6.9 END

```

```

ARBMPJEL .024 2 0 0 0 6012 85 1001 15 2 END
END COMP
SPHERICAL END
1 6.679 NOEXTERMOD 2 25.5 TWOEXTERMOD 1 40.5 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-8
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
HEMISPHERE 1 1 6.679
HEMISPHERE 2 1 10.5254
SPHERE 1 1 40.5254
CUBE 0 1 42.0 -42.0
END GEOM
END DATA
END

```

Problem A9

```

=CSAS25
KENO-5 VALIDATION CASE A-9
27GROUPNDF4 MULTIREGION
ARBMOL .88 3 0 0 0 6012 86.82 1001 13.16 16032 .02 1 END
URANIUM 2 .9528 293 92235 93.1 92238 6.9 END
ARBMPJEL .024 2 0 0 0 6012 85 1001 15 2 END
CARBONSTEEL 3 END
END COMP
SPHERICAL END
2 8.2 ONEEXTERMOD 1 40.5 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-9
READ PARAM
TME=60 GEN=203 END PARAM
READ GEOM
HEMISPHERE 3 1 6.012
HEMISPHERE 2 1 10.488
SPHERE 1 1 40.488
CUBE 0 1 41.0 -41.0
END GEOM
END DATA
END

```

Problem A10

```

=CSAS25
KENO-5 VALIDATION CASE A-10
27GROUPNDF4 MULTIREGION
URANIUM 1 .9866 293 92235 97.67 92238 2.33 END
H2O 2 END
PLEXIGLASS 3 END
END COMP
SPHERICAL END
1 6.55 ONEEXTERMOD 2 12.7 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE A-10

```

```

READ PARAM TME=64 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
SPHERE 1 1 6.5537
CUPOID 2 1 12.7 -12.7 12.7 -12.7 6.5537 -6.5537
LOX TYPE 2
CYLINDER 2 1 4.1275 1.27 -1.27
CYLINDER 3 1 12.7 1.27 -1.27
CUBOID 2 1 12.7 -12.7 12.7 -12.7 1.27 -1.27
CORE 0 1 -12.7 -12.7 -7.8237
CYLINDER 2 1 30.48 24.3337 -39.5737
END GEOM
READ ARRAY NUX=1 NUY=1 NUZ=2 LOOP
1 1 1 1 1 2 2 1
2 1 1 1 1 1 1 1
END ARRAY
END DATA
END

```

Problem A11

```

=CSAS25
KENO-5 VALIDATION CASE A11
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 346.73 .542 1 293 92235 93.172 92238 6.828 END
SS304 2 END
END COMP
CYLINDRICAL END
1 13.96 CNEEXTERMOD 2 14.28 ONEEXTERMOD END ZONE
KENO-5 VALIDATION CASE A11
READ PARAM TME=16 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 13.96 14.465 -14.465
CYLINDER 0 1 13.96 27.135 -14.465
CYLINDER 2 1 14.28 27.135 -15.105
END GEOM
END DATA
END

```

Problem B1

```

=CSAS25
KENO-5 VALIDATION CASE B-1
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 293 92235 93.2 92238 6.8 END
END COMP
CYLINDRICAL END
1 8.89 NOEXTERMOD END ZONE

```

KENO-5 VALIDATION CASE B-1
 READ PARAM TME=4 GEN=203 END PARAM
 READ GEOM
 CYLINDER 1 1 8.89 10.1092 0. ORIGIN -5.08 0.
 CYLINDER 0 1 13.97 10.1092 0.
 CYLINDER 1 1 19.05 10.1092 0.
 END GEOM
 END DATA
 END

Problem B2

=CSAS25
 KENO-5 VALIDATION CASE B-2
 27GROUPNDF4 MULTIREGION
 URANIUM 1 .9848 293 92235 93.2 92238 6.8 END
 END COMP
 CYLINDRICAL END
 1 8.89 NOEXTERMOD END ZONE
 KENO-5 VALIDATION CASE B-2
 READ PARAM TME=2 GEN=203 END PARAM
 READ GEOM
 CUBOID 1 1 0.3434 -12.4434 6.35 -6.35 6.49 -6.49
 CYLINDER 0 1 13.97 6.49 -6.49
 CYLINDER 1 1 19.05 6.49 -6.49
 CUBE 0 1 20.0 -20.0
 END GEOM
 END DATA
 END

Problem B3

=CSAS25
 KENO-5 VALIDATION CASE B-3
 27GROUPNDF4 MULTIREGION
 URANIUM 1 .98231 293 92235 93.2 92238 6.8 END
 END COMP
 CYLINDRICAL END
 1 4.55 NOEXTERMOD END ZONE
 KENO-5 VALIDATION CASE B-3
 READ PARAM GEN=203 TME=6 PLT=NO END PARAM
 READ GEOM
 UNIT 1
 CUBOID 1 1 2P6.3515 1.2685 -3.8115 13.377 13.058
 CUBOID 0 1 2P6.3515 6.3515 -3.8115 13.377 13.058
 CUBOID 1 1 2P6.3515 6.3515 -3.8115 13.377 11.155
 CUBOID 0 1 4P6.3515 13.377 11.155
 CUBOID 1 1 4P6.3515 13.377 0.

```

UNIT 2
CYLINDER 1 1 4.5555 12.918 0.
UNIT 3
CYLINDER 1 1 5.761 13.475 0.
UNIT 4
CYLINDER 1 1 4.5525 12.969 0.
UNIT 5
ARRAY 1 -4.573 -4.573 0.
UNIT 6
CYLINDER 1 1 4.5545 12.974 0.
UNIT 7
CYLINDER 1 1 5.7495 13.475 0.
UNIT 8
CYLINDER 1 1 4.5565 12.954 0.
UNIT 9
COM='CENTERPIECE'
ARRAY 2 -6.35 -6.35 0.
UNIT 10
COM='BOTTOM OF UNIT 5'
CUBOID 1 1 2P3.81 8.13 -4.573 8.91 0
CUBOID 0 1 2P4.573 8.13 -4.573 8.91 0.
UNIT 11
COM='TOP OF UNIT 5'
CYLINDER 1 1 4.573 4.319 0.
CUBOID 0 1 2P4.573 8.13 -4.573 4.319 0.
UNIT 12
COM='BOTTOM OF CENTERPIECE'
CYLINDER 1 1 5.757 2.690 0. ORIGIN -.593 -.593
CUBOID 0 1 4P6.35 2.690 0.
UNIT 13
COM='MIDDLE OF CENTERPIECE'
CUBOID 1 1 4P6.35 5.718 0.
UNIT 14
COM='TOP OF CENTERPIECE'
HEMISPHERE 1 1 6.082 ORIGIN -.268 .268 0.
CUBOID 0 1 4P6.35 6.082 0.
GLOBAL
UNIT 15
CUBOID 0 1 4P25.0 15.0 -2.0
HOLE 1 0.0 -17.306 0.15
HOLE 2 -12.051 -9.247 0.111
HOLE 3 -16.196 1.845 0.174
HOLE 4 -9.394 10.999 0.156
HOLE 5 0.0 15.400 0.29
HOLE 6 9.727 10.803 0.134
HOLE 7 16.224 1.419 0.140
HOLE 8 11.931 -9.322 0.087
HOLE 9 0.0 0.0 -1.755
END GEOM
READ ARRAY

```

```

ARA=1 NUX=1 NUY=1 NUZ=2 FILL 10 11 END FILL
ARA=2 NUX=1 NUY=1 NUZ=3 FILL 12 13 14 END FILL
END ARRAY
READ PLOT TTL='GROTESQUE' PIC=MIX
XUL=-25 YUL=25 ZUL=0.5   XLR=25 YLR=-25 ZLR=.5
UAX=1 VDN=-1 NAX=130 END
XUL=-25 YUL=25 ZUL=2   XLR=25 YLR=-25 ZLR=2 END
XUL=-25 YUL=25 ZUL=5.5 XLR=25 YLR=-25 ZLR=9.5 END
XUL=-.593 YUL=-25 ZUL=15 XLR=-.593 YLR=25 ZLR=-2
UAX=0 VAX=1 VDN=0 WDN=-1 NAX=130 END
END PLOT
END DATA
END

```

Problem B4

```

=CSAS25
KENO-5 VALIDATION CASE B-4
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 293 92235 93.2 92238 6.8 END
SS304 2 END
INCONEL 3 END
END COMP
CYLINDRICAL END
2 .254 NOEXTERMOD 1 5.74 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-4
READ PARAM TME=6 GEN=203 END PARAM
READ GEOM
UNIT 1
COM='SS RODS IN FUEL'
CYLINDER 2 1 .254 2P2.691
UNIT 2
COM='SS ROD & INCONEL SLEEVE'
CYLINDER 2 1 .254 2P.987
CYLINDER 3 1 .381 2P.987
UNIT 3
COM='A6 CYLINDER & SUPPORT RODS'
CYLINDER 1 1 5.7405 2P2.691
HOLE 1 -4.2735 2R0
HOLE 1 4.2735 2R0
CUBOID 0 1 4P7.7165 2P4.667
HOLE 2 -4.2735 0 -3.679
HOLE 2 -4.2735 0 3.679
HOLE 2 4.2735 0 -3.679
HOLE 2 4.2735 0 3.679
END GEOM
READ ARRAY
NUX=4 NUY=4 NUZ=4 FILL F3 END FILL

```

```

END ARRAY
READ PLOT TTL='A6 UNIT WITH SUPPORTS' PLT=NO
XUL=0 YUL=7.7165 ZUL=9.334 XLR=15.433 YLR=7.7165 ZLR=0
UAX=1 WDN=-1 NAX=125 END PLOT
END DATA
END

```

Problem B5

```

=CSAS25
KENO-5 VALIDATION CASE B-5
27GROUPNDF4 MULTIREGION
URANIUM 1 .9809 293 92235 93.2 92238 6.8 END
END COMP
CYLINDRICAL END
1 4.56 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-5
READ PARAM TME=2 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 4.558 2.16 -2.16
CYLINDER 0 1 5.747 2.16 -2.16
CYLINDER 1 1 5.747 4.851 -4.851
CUBOID 0 1 5.8554 -5.8554 5.8554 -5.8554 4.9771 -4.9771
END GEOM
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem B6

```

=CSAS25
KENO-5 VALIDATION CASE B-6
27GROUPNDF4 MULTIREGION
URANIUM 1 .9809 293 92235 93.2 92238 6.8 END
PARAFFIN 2 END
END COMP
CYLINDRICAL END
1 4.56 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-6
READ PARAM TME=54 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 4.558 8.641 -8.641
CUBOID 0 1 9.7212 -9.7212 9.7212 -9.7212 13.8041 -13.8041
CORE 0 1 -19.4424 -19.4424 -27.6082
REFLECTOR 2 1 6R15.2 1

```

```

END GEOM
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem B7

```

=CSAS25
KENO-5 VALIDATION CASE B-7
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 293 92235 93.2 92238 6.8 END
PARAFFIN 2 END
END COMP
CYLINDRICAL END
1 4.558 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-7
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 4.558 2.160 -2.160
CYLINDER 0 1 5.747 2.160 -2.160
CYLINDER 1 1 5.747 4.851 -4.851
CUBOID 0 1 9.2083 -9.2083 9.2083 -9.2083 8.2875 -8.2875
CORE 0 1 -18.4166 -18.4166 -16.575
REFLECTOR 2 1 6R15.2 1
END GEOM
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem B8

```

=CSAS25
KENO-5 VALIDATION CASE B-8
27GROUPNDF4 MULTIREGION
URANIUM 1 .9848 293 92235 93.2 92238 6.8 END
PLEXIGLAS 2 1 END
END COMP
CYLINDRICAL END
1 5.753 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-8
READ PARAM TME=4 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 5.753 5.3825 -5.3825
CUBOID 0 1 7.68 -7.68 7.68 -7.68 7.33 -7.33
CUBOID 2 1 8.95 -8.95 8.95 -8.95 8.6 -8.6
CUBOID 0 1 9.0599 -9.0599 9.0599 -9.0599 8.6975 -8.6975

```



```

END GEOM
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem B9

```

=CSAS25
KENO-5 VALIDATION CASE B-9
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-9
READ PARAM TME=6 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 9.52 8.7804 -8.7804
CYLINDER 0 1 9.52 8.9896 -8.7804
CYLINDER 2 1 10.16 9.6296 -9.4204
CUBOID 0 1 13.4 -13.4 13.4 -13.4 12.8696 -12.6604
END GEOM
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem B10

```

=CSAS25
KENO-5 VALIDATION CASE B-10
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 63.3 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-10
READ PARAM TME=14 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 9.52 8.7804 -8.7804
CYLINDER 0 1 9.52 8.9895 -8.7804
CYLINDER 2 1 10.16 9.6295 -9.4204
CUBOID 0 1 11.282 -11.282 11.262 -11.282 10.7179 -11.7179
END GEOM

```

```

READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
READ START NST=1 END START
END DATA
END

```

Problem B11

```

=CSAS25
KENO-5 VALIDATION CASE B-11
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 505 0 1 293 92235 93.2 92238 6.8 END
PLEXIGLAS 2 1 END
SS304 3 END
END COMP
CYLINDRICAL END
1 6.8 NOEXTERMOD 2 7.08 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-11
READ PARAM TME=28 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 6.8 1.76 -1.76
CYLINDER 3 1 7.08 1.76 -2.04
CUBOID 1 1 15.0875 -15.0875 15.0875 -15.0875 1.76 -2.04
BOX TYPE 2
CYLINDER 1 1 6.8 30.5 -30.5
CYLINDER 0 1 6.8 96.7 -30.5
CYLINDER 3 1 7.08 96.7 -30.5
CUBOID 0 1 15.0875 -15.0875 15.0875 -15.0875 125.7 -30.5
CORE 0 1 -60.35 -60.35 -80.0
REFLECTOR 3 1 5Z .635 1
CUBOID 2 1 70.55 -70.55 70.55 -70.55 90.2 -90.835
CUBE 0 1 95.0 -95.0
END GEOM
READ ARRAY NUX=4 NUY=4 NUZ=2 LOOP
1 1 4 1 1 4 1 1 1 1 2 1 4 1 1 4 1 2 2 1
END LOOP END ARRAY
END DATA
END

```

Problem B12

```

=CSAS25
KENO-5 VALIDATION CASE B-12
27GROUPNDF4 MULTIREGION
URANIUM 1 .9829 293 92235 93.2 92238 6.8 END
C 2 .8296 END
POLYETHYLENE 3 1 END
END COMP
CYLINDRICAL END

```

```

1 5.747 ONEEXTERMOD 2 10.92 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-12
READ PARAM TME=62 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 5.747 3.9699 -4.1071
CYLINDER 0 1 5.777 4.1071 -4.1071
CUBOID 2 1 10.9195 -10.9195 10.9195 -10.9195 7.8755 -7.8755
CUBOID 0 1 15.047 -15.047 15.047 -15.047 12.0035 -12.0035
CORE 0 1 -30.094 -30.094 -24.007
CUBOID 3 1 45.344 -45.344 45.344 -45.344 39.247 -39.247
CUBE 0 1 46.0 -46.0
END GEOM
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem B13

```

=CSAS25
KENO-5 VALIDATION CASE B-13
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
KENO-5 VALIDATION CASE B-13
READ PARAM TME=10 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 9.52 8.7804 -8.7804
CYLINDER 0 1 9.52 8.9896 -8.7804
CYLINDER 2 1 10.16 9.6296 -9.4204
CUBOID 0 1 15.495 -15.495 15.495 -15.495 14.9646 -14.7554
END GEOM
READ ARRAY NUX=4 NUY=4 NUZ=4 END ARRAY
END DATA
END

```

Problem B14

```

=CSAS25
KENO-5 VALIDATION CASE B-14
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 END
END COMP

```

```

CYLINDRICAL  END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD  END ZONE
KENO-5 VALIDATION CASE B-14
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 9.52 8.7804 -8.7804
CYLINDER 0 1 9.52 8.9896 -8.7804
CYLINDER 2 1 10.16 9.6296 -9.4204
CUBOID 0 1 18.425 -18.425 18.425 -18.425 17.8946 -17.6854
CORE 0 1 -55.275 -55.275 -53.37
CUBOID 3 1 70.515 -70.515 70.515 -70.515 68.61 -68.61
END GEOM
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem B15

```

=CSAS25
KENO-5 VALIDATION CASE B-15
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
END COMP
CYLINDRICAL  END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD  END ZONE
KENO-5 VALIDATION CASE B-15
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 9.52 8.7804 -8.7804
CYLINDER 0 1 9.52 8.9896 -8.7804
CYLINDER 2 1 10.16 9.6296 -9.4204
CUBOID 0 1 14.54 -14.54 14.54 -14.54 14.0096 -13.8004
CORE 0 1 -43.62 -43.62 -41.715
CUBOID 2 1 44.89 -44.89 44.89 -44.89 42.985 -42.985
END GEOM
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem B16

```

=CSAS25
KENO-5 VALIDATION CASE B-16
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 450.8 .72 1 293 92235 93.1 92238 6.9 END
SS304 2 END
END COMP

```

```

CYLINDRICAL  END
1 8.128 NOEXTERMOD  2 8.4074 NOEXTERMOD  END ZONE
KENO-5 VALIDATION CASE B-16
READ PARAM TME=10 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
XCYLINDER 1 1 8.128 68.3006 -68.3006
XCYLINDER 2 1 8.4074 68.58 -68.58
CUBOID 0 1 68.58 -68.58 9.2075 -9.2075 14.999 -110.32
BOX TYPE 2
YCYLINDER 1 1 8.128 68.3006 -68.3006
YCYLINDER 2 1 8.4074 68.58 -68.58
CUBOID 0 1 9.2075 -9.2075 68.58 -68.58 14.999 -110.32
BOX TYPE 3
XCYLINDER 1 1 8.128 68.3006 -68.3006
XCYLINDER 2 1 8.4074 68.58 -68.58
CUBOID 0 1 68.58 -68.58 9.2075 -9.2075 125.09 -14.999
BOX TYPE 4
YCYLINDER 1 1 8.128 68.3006 -68.3006
YCYLINDER 2 1 8.4074 68.58 -68.58
CUBOID 0 1 9.2075 -9.2075 68.58 -68.58 125.09 -14.999
BOX TYPE 5
CUBOID 1 1 8.89 -8.89 8.89 -8.89 14.999 -110.00
CUBOID 2 1 9.2075 -9.2075 9.2075 -9.2075 14.999 -110.32
BOX TYPE 6
CUBOID 1 1 8.89 -8.89 8.89 -8.89 125.09 -14.999
CUBOID 2 1 9.2075 -9.2075 9.2075 -9.2075 125.09 -14.999
BOX TYPE 7
CUBOID 0 1 68.58 -68.58 68.58 -68.58 14.999 -110.32
BOX TYPE 8
CUBOID 0 1 68.58 -68.58 68.58 -68.58 125.09 -14.999
END GEOM
READ ARRAY NUX=3 NUY=3 NUZ=2 LOOP
1 1 3 2 2 2 1 1 1 1 2 2 2 1 1 3 2 1 1 1 3 1 3 2 2 2 1 2 2 1
4 2 2 1 1 3 2 2 2 1 5 2 2 1 2 2 1 1 1 1 6 2 2 1 2 2 1 2 2 1
7 1 3 2 1 3 2 1 1 1 8 1 3 2 1 3 2 2 2 1
END LOOP END ARRAY
END DATA
END

```

Problem B17

```

=CSAS25
KENO-5 VALIDATION CASE B-17
27GROUPNDF4 MULTIREGION
SOLNU02(N03)2 1 355.96 .494 1 293 92235 93.172 92238 6.828 END
.RBMAL 2.737 9 0 0 1 12000 1 13027 97.35 14028 .6 22000 .03
24000 .17 25055 .07 26000 .47 29000 .25 30000 .06 2 END
PLEXIGLAS 3 1 END
END COMP

```

```

CYLINDRICAL  END
1 10.56 NOEXTERMOD 2 10.96 NOEXTERMOD  END ZONE
KENO-5 VALIDATION CASE B-17
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
CYLINDER 1 1 10.56 9.41 -9.41
CYLINDER 0 1 10.56 109.69 -9.41
CYLINDER 2 1 10.96 103.69 -9.73
CUBOID 0 1 15.24 -15.24 15.24 -15.24 113.17 -9.73
CORE 0 1 -60.96 -60.96 -61.45
REFLECTOR 0 1 4RC.49 22 1
CUBE 3 1 82.05 -82.05
END GEOM
READ ARRAY NUX=4 NUY=4 END ARRAY
END DATA
END

```

Problem B13

```

=CSAS25
KENO-5 VALIDATION CASE B-18
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 364.11 .584 1 293 92235 93.172 92238 6.828 END
ARBMAL 2.737 9 0 0 1 12000 1 13027 97.35 14028 .6 22000 .03
24000 .17 25055 .07 26000 .47 29000 .25 30000 .06 2 END
ARBMCONC 2.321 13 0 0 1 1001 .75 6012 5.55 7014 .01 8016 49.29
11023 .42 12000 1.48 13027 2.06 14028 15.7 16032 .17 19039 .75 20040 22.95
22000 .05 26000 .82 3 END
END COMP
CYLINDRICAL  END
1 10.56 NOEXTERMOD 2 10.96 NOEXTERMOD  END ZONE
KENO-5 VALIDATION CASE B-18
READ PARAM TME=60 GEN=203 END PARAM
READ GEOM
BOX TYPE 1
CYLINDER 1 1 10.56 8.565 -8.565
CYLINDER 0 1 10.56 110.535 -8.565
CYLINDER 2 1 10.96 110.535 -8.885
CUBOID 0 1 15.25 -15.15 15.25 -15.25 115.515 -8.885
BOX TYPE 2
CYLINDER 1 1 10.56 8.565 -8.565
CYLINDER 0 1 10.56 110.535 -8.565
CYLINDER 2 1 10.96 110.535 -8.885
CUBOID 0 1 15.15 -15.25 15.25 -15.25 115.515 -8.885
BOX TYPE 3
CYLINDER 1 1 10.56 8.565 -8.565
CYLINDER 0 1 10.56 110.535 -8.565
CYLINDER 2 1 10.96 110.535 -8.885
CUBOID 0 1 15.25 -15.25 15.25 -15.25 115.515 -8.835
CORE 0 1 -60.9 -61.0 -62.2

```

```

REFLECTOR 0 1 2Z 2R.1 2Z 1
CUBOID      3 1 86.6 -86.6 86.8 -86.8 87.9 -87.9
END GEOM
READ ARRAY NUX=4 NUY=4 LOOP
1 1 1 1 1 4 1 1 1 1 2 4 4 1 1 4 1 1 1 1 3 2 3 1 1 4 1 1 1 1
END LOOP END ARRAY
END DATA
END

```

Problem S333SP0

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
CARBONSTEEL 3 1 END
PLEXIGLAS   4 1 END
ARBMWOOD    .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 0 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID      1 1 2P3.81 2P60.325 25.50 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
CORE 0 1 -12.384 -55. -1.
CYLINDER    0 1 142.8 212. -60.
CYLINDER    3 1 144.8 212. -62.
CUBOID      0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR   4 1 5R0 .32 1
REFLECTOR   5 1 5R0 1.27 1
REFLECTOR   3 1 5R0 .64 1
REFLECTOR   0 1 5R0 365 1
REFLECTOR   6 2 6R3 10
REFLECTOR   6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP1

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL 2 1 END
CARBONSTEEL 3 1 END
PLEXIGLAS 4 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 1 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID 1 1 2P3.81 2P60.325 34.44 0
REFLECTOR 2 1 4R.318 0 .318 1
CUBOID 0 1 2P5.08 2P65. 150. -1.
CORE 0 1 -15.24 -65. -1.
CYLINDER 0 1 142.8 212. -60.
CYLINDER 3 1 144.8 212. -62.
CUBOID 0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR 4 1 5R0 .32 1
REFLECTOR 5 1 5R0 1.27 1
REFLECTOR 3 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 6 2 6R3 10
REFLECTOR 6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP3

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL 2 1 END
CARBONSTEEL 3 1 END
PLEXIGLAS 4 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END

```



```

END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 3 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID      1 1 2P3.81 2P60.325 58.78 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.62 2P65. 150. -1.
CORE 0 1 -22.86 -65. -1.
CYLINDER    0 1 142.8 212. -60.
CYLINDER    3 1 144.8 212. -62.
CUBOID      0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR   4 1 5R0 .32 1
REFLECTOR   5 1 5R0 1.27 1
REFLECTOR   3 1 5R0 .64 1
REFLECTOR   0 1 5R0 365 1
REFLECTOR   6 2 6R3 10
REFLECTOR   6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP4

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
CARBONSTEEL 3 1 END
PIEXIGLAS   4 1 END
ARBMWOOD    .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 4.5 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID      1 1 2P3.81 2P60.325 85.52 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P9.525 2P65. 150. -1.
CORE 0 1 -28.575 -65. -1.
CYLINDER    0 1 142.8 212. -60.
CYLINDER    3 1 144.8 212. -62.

```

```

CUBOID      0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR 4 1 5R0 .32 1
REFLECTOR 5 1 5R0 1.27 1
REFLECTOR 3 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 6 2 6R3 10
REFLECTOR 6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP5

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
CARBONSTEEL 3 1 END
PLEXIGLAS   4 1 END
ARMWOOD     .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 5.5 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID      1 1 2P3.81 2P60.325 107.37 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P10.795 2P65. 150. -1.
CORE 0 1 -32.385 -65. -1.
CYLINDER    0 1 142.8 212. -60.
CYLINDER    3 1 144.8 212. -62.
CUBOID      0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR 4 1 5R0 .32 1
REFLECTOR 5 1 5R0 1.27 1
REFLECTOR 3 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 6 2 6R3 10
REFLECTOR 6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=^ NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP6

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL 2 1 END
CARBONSTEEL 3 1 END
PLEXIGLAS 4 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 5 END
REG-CONCRETE 6 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3 IN AL SLAB 3X1X1 ARRAY 6 IN SEP ROOM
READ PARAM NPG=1000 TME=18 END PARAM
READ GEOM
CUBOID 1 1 2P3.81 2P60.325 120.4 0
REFLECTOR 2 1 4R.318 0 .318 1
CUBOID 0 1 2P11.43 2P65. 150. -1.
CORE 0 1 -34.29 -65. -1.
CYLINDER 0 1 142.8 212. -60.
CYLINDER 3 1 144.8 212. -62.
CUBOID 0 1 275.5 -638.9 475. -744.2 588. -62.
REFLECTOR 4 1 5R0 .32 1
REFLECTOR 5 1 5R0 1.27 1
REFLECTOR 3 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 6 2 6R3 10
REFLECTOR 6 12 0 3 4R0 10
END GEOM
READ BIAS ID=301 2 21 END BIAS
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
END DATA
END

```

Problem S333SP0R

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL 2 1 END
H2O 3 1 END
END COMP
SLAB END
1 3.81 ONEXTERMOD 2 4.12 NOEXTERMOD 3 22.12 NOEXTERMOD END ZONE

```

```

93.2% U02F2 3 IN AL SLAB 3X1X1 ARRAY 0 IN SEP H2O REFL
READ PARAM NPG=1000 TME=19 END PARAM
READ GEOM
CUBOID      1 1 2P3.81 2P60.325 17.32 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P60.643 17.32 -.318
CORE        0 1 3R0
REFLECTOR   3 2 4R3 0 3 6
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 END ARRAY
READ BIAS ID=500 2 7 END BIAS
END DATA
END

```

Problem S333SP1R

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
H2O         3 1 END
END COMP
SLAB END
1 3.81 ONEXTERMOD 2 4.12 NOEXTERMOD 3 22.12 NOEXTERMOD END ZONE
93.2% U02F2 3 IN AL SLAB 3X1X1 ARRAY 1 IN SEP H2O REFL
READ PARAM NPG=1000 TME=19 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 19.13 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P60.643 19.13 -.318
UNIT 2
CUBOID      3 1 2.54 0 2P60.643 19.13 -.318
CORE        0 1 3R0
REFLECTOR   3 2 4R3 0 3 6
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 2 1 2 1 END FILL END ARRAY
READ BIAS ID=500 2 7 END BIAS
END DATA
END

```

Problem S333SP3R

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION

```

```

SOLNU02F2  1 81.845 0 1 293  92235 93.2
92238 6.8 END
AL          2 1 END
H20         3 1 END
END COMP
SLAB END
1 3.81 ONEXTERMOD  2 4.12 NOEXTERMOD 3 22.12 NOEXTERMOD END ZONE
93.2% U02F2 3 IN AL SLAB 3X1X1 ARRAY 3 IN SEP H20 REFL
READ PARAM NPG=1000 TME=19 END PARAM
READ GEOM
UNIT 1
CUBOID      : 1 2P3.81 2P60.325 32.92 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P60.643 32.92 -.318
UNIT 2
CUBOID      3 1 7.62 0 2P60.643 32.92 -.318
CORE        0 1 3R0
REFLECTOR   3 2 4R3 0 3 6
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 2 1 2 1 END FILL END ARRAY
READ BIAS ID=500 2 7 END BIAS
END DATA
END

```

Problem S333SP4R

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2  1 81.845 0 1 293  92235 93.2
92238 6.8 END
AL          2 1 END
H20         3 1 END
END COMP
SLAB END
1 3.81 ONEXTERMOD  2 4.12 NOEXTERMOD 3 22.12 NOEXTERMOD END ZONE
93.2% U02F2 3 IN AL SLAB 3X1X1 ARRAY 4.5 IN SEP H20 REFL
READ PARAM NPG=1000 TME=19 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 61.06 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P60.643 61.06 -.318
UNIT 2
CUBOID      3 1 11.43 0 2P60.643 61.06 -.318
CORE        0 1 3R0
REFLECTOR   3 2 4R3 0 3 6
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 2 1 2 1 END FILL END ARRAY
READ BIAS ID=500 2 7 END BIAS
END DATA
END

```

Problem S333SP5R

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
H2O     3 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD 3 22.12 NOEXTERMOD END ZONE
93.2% U02F2 3 IN AL SLAB 3X1X1 ARRAY 5.5 IN SEP H2O REFL
READ PARAM NPG=1000 TME=19 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 111.68 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P60.643 111.68 -.318
UNIT 2
CUBOID      3 1 13.97 0 2P60.643 111.68 -.318
CORE        0 1 3R0
REFLECTOR   3 2 4R3 0 3 6
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 2 1 2 1 END FILL END ARRAY
READ BIAS ID=500 2 7 END BIAS
END DATA
END

```

Problem SS36SP2

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% U02F2 3, 6 IN AL SLABS 2X1X1 ARRAY 2 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 32.39 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2

```

```

CUBOID      1 1 2P7.417 2P60.325 32.39 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 5.08 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S36SP15

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3. 6 IN AL SLABS 2X1X1 ARRAY 15 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 65.81 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 65.81 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 38.1 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S36SP30

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP

```

```

SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3. 6 IN AL SLABS 2X1X1 ARRAY 30 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 92.48 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 92.48 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 76.2 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S36SP48

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3. 6 IN AL SLABS 2X1X1 ARRAY 48 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 113.84 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 113.84 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 121.92 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```


Problem S363SP0

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3. 6. 3 IN AL SLABS 3X1X1 ARRAY 0 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 19.63 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 19.63 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 1 2 1 END FILL END ARRAY
END DATA
END

```

Problem S363SP10

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3. 6. 3 IN AL SLABS 3X1X1 ARRAY 10 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 44.25 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 44.25 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.

```

```

UNIT 3
CUBOID      0 1 25.4 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 3 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S363SP20

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3, 6, 3 IN AL SLABS 3X1X1 ARRAY 20 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 62.55 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 62.56 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 50.8 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 3 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S363SP32

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 3.81 NOEXTERMOD 2 4.12 NOEXTERMOD END ZONE
93.2% UO2F2 3, 6, 3 IN AL SLABS 3X1X1 ARRAY 32 IN SEP

```

```

READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 81.56 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      1 1 2P7.417 2P60.325 81.56 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P7.735 2P65. 150. -1.
UNIT 3
CUBOID      0 1 81.28 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=5 NUY=1 NUZ=1 FILL 1 3 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S63SP6

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 5.8 END
AL      2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% U02F2 6 & 3 IN AL SLABS 2X1X1 ARRAY 6 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 45.03 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 45.03 0
CUBOID      1 1 2P7.938 2P60.325 45.03 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P8.574 2P65. 150. -1.
UNIT 3
CUBOID      0 1 15.24 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S63SP12

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% U02F2 6 & 3 IN AL SLABS 2X1X1 ARRAY 12 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 58.19 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 58.19 0
CUBOID      1 1 2P7.938 2P60.325 58.19 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P8.574 2P65. 150. -1.
UNIT 3
CUBOID      0 1 30.48 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S63SP18

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% U02F2 6 & 3 IN AL SLABS 2X1X1 ARRAY 18 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 68.3 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2

```

```

CUBOID      2 1 2P.318 2P60.325 68.3 0
CUBOID      1 1 2P7.938 2P60.325 68.3 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P8.574 2P65. 150. -1.
UNIT 3
CUBOID      0 1 45.72 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S63SP30

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% U02F2 6 & 3 IN AL SLABS 2X1X1 ARRAY 30 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P3.81 2P60.325 83.11 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P4.128 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 83.11 0
CUBOID      1 1 2P7.938 2P60.325 83.11 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P8.574 2P65. 150. -1.
UNIT 3
CUBOID      0 1 76.2 0 2P65. 150. -1.
END GEOM
READ ARRAY NUX=3 NUY=1 NUZ=1 FILL 2 3 1 END FILL END ARRAY
END DATA
END

```

Problem S66SP2

```

=CSAS25
93.2% U02F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNU02F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END

```

```

END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 2 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 25.43 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P10.274 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 25.43 0
CUBOID      1 1 2P7.938 2P60.325 25.43 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P10.795 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP6

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 6 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 32.79 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P15.354 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 32.79 0
CUBOID      1 1 2P7.938 2P60.325 32.79 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P15.875 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP15

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 15 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 44.88 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P26.784 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 44.88 0
CUBOID      1 1 2P7.938 2P60.325 44.88 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P27.305 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP20

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL      2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 20 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 50.27 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P33.134 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 50.27 0
CUBOID      1 1 2P7.938 2P60.325 50.27 0

```

```

REFLECTOR  2 1 4R.318 0 .318 1
CUBOID      0 1 2P33.655 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP30

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2  1 81.845 0 1 293  92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
  7.62 NOEXTERMOD  2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 30 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 59.72 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P45.834 2P65. 150. -1.
UNIT 2
CUBOID      2 1 2P.318 2P60.325 59.72 0
CUBOID      1 1 2P7.938 2P60.325 59.72 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P46.355 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP48

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2  1 81.845 0 1 293  92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
  1 7.62 NOEXTERMOD  2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 48 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM

```



```

READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 73.23 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P68.694 2P65. 150. -1.
UNIT 2
CUBOUD      2 1 2P.318 2P60.325 73.23 0
CUBOID      1 1 2P7.938 2P60.325 73.23 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P69.215 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem S66SP66

```

=CSAS25
93.2% UO2F2 H/U-235=337
27GROUPNDF4 MULTIREGION
SOLNUO2F2 1 81.845 0 1 293 92235 93.2
92238 6.8 END
AL          2 1 END
END COMP
SLAB END
1 7.62 NOEXTERMOD 2 7.94 NOEXTERMOD END ZONE
93.2% UO2F2 6 IN AL SLAB 2X1X1 ARRAY 66 IN SEP
READ PARAM NPG=1000 TME=10 END PARAM
READ GEOM
UNIT 1
CUBOID      1 1 2P7.417 2P60.325 82.12 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P91.554 2P65. 150. -1.
UNIT 2
CUBOUD      2 1 2P.318 2P60.325 82.12 0
CUBOID      1 1 2P7.938 2P60.325 82.12 0
REFLECTOR   2 1 4R.318 0 .318 1
CUBOID      0 1 2P92.075 2P65. 150. -1.
END GEOM
READ ARRAY NUX=2 NUY=1 NUZ=1 FILL 1 2 END FILL END ARRAY
END DATA
END

```

Problem U6B271F

```

=CSAS25
UO2(NO3)2 63.3 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 63.3 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLAS      2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 63.3 G U/L 3X3X3 ARRAY UNREFL. WALLS, FLOOR, & TANK
READ PARAM TME=18 NPG=1000 END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P11.365 19.615 -1.845
UNIT 2
ARRAY 1 2R-34.095 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=165 XSP=234 YSM=165 YSP=234 ZSM=50 ZSP=115 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=3 NUY=3 NUZ=3 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U2B271F

```

=CSAS25
UO2(NO3)2 279 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 279 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLAS      2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 279 G U/L 3X3X3 ARRAY UNREFL. WALLS, TANK, & FLOOR
READ PARAM TME=18 NPG=1000 END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.36 21.61 -3.84
UNIT 2
ARRAY 1 2R-40.08 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=160 XSP=240 YSM=160 YSP=240 ZSM=50 ZSP=127 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=3 NUY=3 NUZ=3 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT PLT=NO
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U2B81F

```

=CSAS25
U02(NO3)2 279 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 279 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLAS      2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
END COMP
CYLINDRICAL    END
1 9.52 CNEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(N03)2 279 G U/L 2X2X2 ARRAY UNREFL. WALLS, TANK, & FLOOR
READ PARAM TME=18 NPC=1000 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P10.875 19.125 -1.355
UNIT 2
ARRAY 1 2R-21.75 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 216.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=178 XSP=222 YSM=178 YSP=222 ZSM=50 ZSP=91 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=2 NUY=2 NUZ=2 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U4B1251F

```

=CSAS25
U02(N03)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(N03)2 1 415 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLAS      2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 5X5X5 ARRAY UNREFL. WALLS, TANK, & FLOOR
READ PARAM TME=18 NPG=1000 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P17.36 25.61 -7.84
UNIT 2
ARRAY 1 2R-86.8 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.6 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=113 XSP=287 YSM=113 YSP=287 ZSM=50 ZSP=151 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=5 NUY=5 NUZ=5 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U4B641F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLASS      2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL     4 END
REG-CONCRETE    5 END
END COMP
CYLINDRICAL     END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 4X4X4 ARRAY UNREFL. WALLS, FLOOR, & TANK
READ PARAM TME=18 XSC=14 NPG=1000 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P15.495 23.745 -5.975
UNIT 2
ARRAY 1 2R-61.98 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=138 XSP=262 YSM=138 YSP=262 ZSM=50 ZSP=169 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=4 NUY=4 NUZ=4 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END FLCT
END DATA
END

```

Problem U4B271F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END

```

```

PLEXIGLAS      2 1 END
AREMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
END COMP
CYLINDRICAL   END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY UNREFL. WALLS, TANK, & FLOOR
READ PARAM TME=18 XSC=14 NPG=1000 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.40 21.65 -3.88
UNIT 2
ARRAY 1 2R-40.2 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=160 XSP=240 YSM=160 YSP=240 ZSM=50 ZSP=127 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=3 NUY=3 NUZ=3 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U4B81F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION

```

```

SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
ARBMWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL 4 END
REG-CONCRETE 5 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY UNREFL. WALLS, FLOOR, & TANK
READ PARAM TME=18 XSC=14 NPG=1000 RND=CB0F8A7638C5 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P10.875 19.125 -1.355
UNIT 2
ARRAY 1 2R-21.75 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=178 XSP=222 YSM=178 YSP=222 ZSM=50 ZSP=91 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=2 NUY=2 NUZ=2 FILL F1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U4U2B27

```

=CSAS25
U02(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END

```



```

PLEXIGLAS      2 1 END
ARBWOOD .640525 3 0 0 0 6012 44.435 1001 6.2639 8016 49.301 3 END
CARBONSTEEL    4 END
REG-CONCRETE   5 END
SOLNUO2(NO3)2  6 279 0 1 293 92235 92.6 92238 7.4 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY UNREFL. 279 G U/L 5 CENT. UNITS WALLS, FLOOR, &
READ PARAM TME=18 XSC=14 NPG=1000 PLT=NO END PARAM
READ GEOM
UNIT 1
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.365 21.615 -3.845
UNIT 4
CYLINDER 6 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.365 21.615 -3.845
UNIT 2
ARRAY 1 2R-40.095 0.
CUBOID 0 1 4P200. 250. -50.
UNIT 3
CYLINDER 0 1 142.8 224. -48.
CYLINDER 4 1 144.8 224. -50.
CUBOID 0 1 218.1 -181.9 215. -185. 250. -50.
ARRAY 2 3R0.
REFLECTOR 0 1 57.4 57. 260. 559.2 400. 0. 1
REFLECTOR 2 1 5R0 .32 1
REFLECTOR 3 1 5R0 1.27 1
REFLECTOR 4 1 5R0 .64 1
REFLECTOR 0 1 5R0 365 1
REFLECTOR 5 2 6R3 10
REFLECTOR 5 12 0 3 4R0 10
END GEOM
READ START XSM=138 XSP=262 YSM=138 YSP=262 ZSM=50 ZSP=169 END START
READ BIAS ID=301 2 21 END BIAS
READ ARRAY ARA=1 NUX=3 NUY=3 NUZ=3 FILL 10R1 4 1 3R4 1 4 10R1 END FILL
ARA=2 NUX=2 NUY=1 NUZ=1 FILL 2 3 END FILL END ARRAY
READ PLOT
XUL=113.2 YUL=286.8 ZUL=60. XLR=286.8 YLR=113.2 ZLR=60.
UAX=1 VDN=-1 NAX=125 END
XUL=437.1 YUL=329.8 ZUL=60. XLR=726.7 YLR=40.2 ZLR=60. END
END PLOT
END DATA
END

```

Problem U4R27A1F

```
=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR. BOT., 1.27 CM PLEX.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.95 23.20 -5.43
CORE 0 1 3R0.
REFLECTOR 2 2 5R1.27 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END
```

Problem U4R27B1F

```
=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR. BOT.. 2.54 CM PLEX.
READ PARAM TME=10 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P16.13 24.38 -6.61
CORE 0 1 3R0.
REFLECTOR 2 2 5R2.54 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
```

```

END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27C1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR. BOT., 1.27 CM PAR.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P15.10 23.35 -5.58
CORE 0 1 3R0.
REFLECTOR 3 2 5R1.27 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27D1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR 5 FC, PLEX 1 FC
READ PARAM TME=15 NPG=1000 END PARAM
READ GEOM

```

```

CYLINDER 1 1 9.52 17.5603 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P18.615 26.865 -9.095
CORE 0 1 3R0.
REFLECTOR 3 2 0 5R3 4
REFLECTOR 3 6 0 5R3.24 1
REFLECTOR 2 2 3 5R0 4
REFLECTOR 2 6 3.24 5R0 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27E1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNJO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR. BOT., 3.81 CM PAR.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P17.295 25.545 -7.775
CORE 0 1 3R0.
REFLECTOR 3 2 5R3.81 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27F1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION

```

```

SOLNUO2(NO3)2  1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD  2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PAR. BOT., 7.62 CM PAR.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER  1 1 9.52 17.5609 0.
CYLINDER  0 1 9.52 17.77 0.
CYLINDER  2 1 10.16 18.41 -.64
CUBOID    0 1 4P18.085 26.335 -8.565
CORE      0 1 3R0.
REFLECTOR 3 2 5R3 0 2
REFLECTOR 3 4 5R1.62 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27G1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2  1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL    END
1 9.52 ONEEXTERMOD  2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 1.27 CM PLEXIGLASS REFL.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER  1 1 9.52 17.5609 0.
CYLINDER  0 1 9.52 17.77 0.
CYLINDER  2 1 10.16 18.41 -.64
CUBOID    0 1 4P14.54 22.79 -5.02
CORE      0 1 3R0.
REFLECTOR 2 2 6R1.27 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R27H1F

```
=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 1.27 CM PARAFFIN REFL.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.67 22.92 -5.15
CORE 0 1 3R0.
REFLECTOR 3 2 6R1.27 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END
```

Problem U4R27I1F

```
=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 15.24 CM PARAFFIN REFL.
READ PARAM TME=15 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P18.425 26.675 -8.905
CORE 0 1 3R0.
REFLECTOR 3 2 6R3 4
REFLECTOR 3 6 6R3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END
```

Problem U4R27J1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 3X3X3 ARRAY 3.81 CM PARAFFIN REFL.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P17.005 25.255 -7.485
CORE 0 1 3RC.
REFLECTOR 3 2 6R3.81 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=3 NUY=3 NUZ=3 END ARRAY
END DATA
END

```

Problem U4R8A1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 1.27 CM PLEX.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P11.965 20.215 -2.445
CORE 0 1 3R0.
REFLECTOR 2 2 5R1.27 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8B1F

=CSAS25

UO2(NO3)2 415 G U/L

27GROUPNDF4 MULTIREGION

SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END

PLEXIGLAS 2 1 END

PARAFFIN 3 1 END

END COMP

CYLINDRICAL END

1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE

UO2(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 11.43 CM PLEX.

READ PARAM TME=12 NPG=1000 END PARAM

READ GEOM

CYLINDER 1 1 9.52 17.5609 0.

CYLINDER 0 1 9.52 17.77 0.

CYLINDER 2 1 10.16 18.41 -.64

CUBOID 0 1 4P14.925 23.175 -5.405

CORE 0 1 3R0.

REFLECTOR 2 2 5R3.0 0 3

REFLECTOR 2 5 5R2.43 0 1

REFLECTOR 3 2 5R0 3 4

REFLECTOR 3 6 5P0 3.24 1

END GEOM

READ BIAS ID=400 2 6 END BIAS

READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY

END DATA

END

Problem U4R8C1F

=CSAS25

UO2(NO3)2 415 G U/L

27GROUPNDF4 MULTIREGION

SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END

PLEXIGLAS 2 1 END

PARAFFIN 3 1 END

END COMP

CYLINDRICAL END

1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE

UO2(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 15.24 CM PLEX.

READ PARAM TME=14 NPG=1000 END PARAM

READ GEOM

CYLINDER 1 1 9.52 17.5609 0.

CYLINDER 0 1 9.52 17.77 0.

CYLINDER 2 1 10.16 18.41 -.64

CUBOID 0 1 4P14.96 23.21 -5.44

CORE 0 1 3R0.

REFLECTOR 2 2 5R3.0 0 4


```

REFLECTOR 2 6 5R3.24 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8D1F

```

=CSAS25
U02(N03)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(N03)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(N03)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT.. 2.54 CM PLEX.
READ PARAM TME=10 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P12.865 21.115 -3.345
CORE 0 1 3R0.
REFLECTOR 2 2 5R2.54 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8E1F

```

=CSAS25
U02(N03)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(N03)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END

```

```

1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 4.45 CM PLEX.
READ PARAM TME=10 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.54
CUBOID 0 1 4P13.855 22.105 -4.335
CORE 0 1 3R0.
REFLECTOR 2 2 5R3.0 0 1
REFLECTOR 2 3 5R1.45 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8F1F

```

=CSAS25
U02(NO3)2 415 G U/L
27GROUPEPNDP4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 6.35 CM PLEX.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.48 22.73 -4.96
CORE 0 1 3R0.
REFLECTOR 2 2 5R3.0 0 1
REFLECTOR 2 3 5R3.35 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8G1F

```

=CSAS25
U02(NO3)2 415 G U/L
27GROU?NDF4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2Y2 ARRAY 15.24 CM PAR. BOT.. 1.27 CM PAR.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P12.09 20.34 -2.57
CORE 0 1 3R0.
REFLECTOR 3 2 5R1.27 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8H1F

```

=CSAS25
U02(NO3)2 415 G U/L
27GROU?NDF4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 3.81 CM PAR.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.79 22.04 -4.27
CORE 0 1 3R0.
REFLECTOR 3 2 5R3.81 0 1
REFLECTOR 3 2 5R0 3 4

```

```

REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8I1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PAR. BOT., 7.62 CM PAR.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.515 22.765 -4.995
CORE 0 1 3R0.
REFLECTOR 3 2 5R3 0 2
REFLECTOR 3 4 5R1.62 0 1
REFLECTOR 3 2 5R0 3 4
REFLECTOR 3 6 5R0 3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8J1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END

```

```

1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY 1.27 CM PLEXIGLAS REFL.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P11.66 19.91 -2.14
CORE 0 1 3R0.
REFLECTOR 2 2 6R1.27 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8K1F

```

=CSAS25
U02(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(NO3)2 415 G U/L 2X2X2 ARRAY 1.27 CM PARAFFIN REFL.
READ PARAM TME=8 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P11.80 20.05 -2.28
CORE 0 1 3R0.
REFLECTOR 3 2 6R1.27 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8L1F

```

=CSAS25
U02(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION

```

```

U-235 1 0 9.846-4 END
U-238 1 0 7.769-5 END
H      1 0 5.809-2 END
N      1 0 2.131-3 END
O      1 0 3.756-2 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 2X2X2 ARRAY 15.24 CM PARAFFIN REFL.
READ PARAM TME=15 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.655 22.905 -5.135
CORE 0 1 3R0.
REFLECTOR 3 2 6R3 4
REFLECTOR 3 6 6R3.24 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END

```

Problem U4R8M1F

```

=CSAS25
UO2(NO3)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNUO2(NO3)2 1 415 0 1 293 92235 92.6 92238 7.4 END
PLEXIGLAS      2 1 END
PARAFFIN       3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
UO2(NO3)2 415 G U/L 2X2X2 ARRAY 3.81 CM PARAFFIN REFL.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P13.615 21.865 -4.095
CORE 0 1 3R0.
REFLECTOR 3 2 6R3.81 1
END GEOM

```

81/82

```
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END
```

Problem U4R8N1F

```
=CSAS25
U02(N03)2 415 G U/L
27GROUPNDF4 MULTIREGION
SOLNU02(N03)2 1 415 0 1 295 92235 92.6 92238 7.4 END
PLEXIGLAS 2 1 END
PARAFFIN 3 1 END
END COMP
CYLINDRICAL END
1 9.52 ONEEXTERMOD 2 10.16 NOEXTERMOD END ZONE
U02(N03)2 415 G U/L 2X2X2 ARRAY 7.62 CM PARAFFIN REFL.
READ PARAM TME=12 NPG=1000 END PARAM
READ GEOM
CYLINDER 1 1 9.52 17.5609 0.
CYLINDER 0 1 9.52 17.77 0.
CYLINDER 2 1 10.16 18.41 -.64
CUBOID 0 1 4P14.40 22.65 -4.88
CORE 0 1 3R0.
REFLECTOR 3 2 6R3 2
REFLECTOR 3 4 6R1.62 1
END GEOM
READ BIAS ID=400 2 6 END BIAS
READ ARRAY NUX=2 NUY=2 NUZ=2 END ARRAY
END DATA
END
```

INTERNAL DISTRIBUTION

1. H. P. Carter/CS Library	17. R. G. Taylor, Y-12
2. P. B. Fox	18. J. T. Thomas
3. G. R. Handley, Y-12	19. J. C. Turner
4. C. M. Hopper	20. R. M. Westfall
5-9. J. R. Knight	21. G. E. Whitesides
10. N. F. Landers	22-23. Central Research Library
11. L. C. Masters, Y-12	24. Y-12 Document Reference Section
12. W. T. Mee, Y-12	25-26. Laboratory Records
13. C. V. Parks	27. Laboratory Records - RC
14. L. M. Petrie	28. ORNL Patent Section
15. D. A. Reed, Y-12	29. K-25 Plant Library
16. J. S. Tang	

EXTERNAL DISTRIBUTION

30. J. N. Rogers, Div. 8324, Sandia Laboratories, Livermore, CA 94550.
31. Division of Engineering, Mathematics and Geosciences, DOE, Washington, DC 20545.
32. Office of Assistant Manager for Energy Research and Development, DOE-ORO, Oak Ridge, TN 37830.
33. R. H. Odegarden, Transportation Branch, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission, Washington, DC 20555.
34. Brian L. Koponen, L-303, Lawrence Livermore National Laboratory, P. O. Box 808, Livermore, CA 94550.
35. Jack D. Rollins, GNS - Atlanta, 340 Six Branches Court, Roswell, GA 30076.
- 36-62. Technical Information Center, DOE, Oak Ridge, TN 37831.