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Design Analysis Cover Sheet

Complete only applicable items.

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Table of Contents:

1. Purpose

The purpose of this design analysis is to determine the accuracy of the SAS2H module of SCALE 4.3 in predicting isotopic concentrations of spent fuel assemblies. The objective is to develop a methodology for modeling assemblies similar to those evaluated within this analysis and to establish the consistency of SAS2H predictions. The results of this analysis may then be applied to future depletion calculations using SAS2H in which no measurements are available.

2. Quality Assurance

The Quality Assurance (QA) program applies to this analysis. The work reported in this document is part of the Waste Package Design analysis that will eventually support the License Application Design phase. This activity, when appropriately confirmed, can impact the proper functioning of the Mined Geologic Disposal System (MGDS) waste package; the waste package has been identified as an MGDS Q-List item important to safety and waste isolation (pp. 4, 15, Reference 5.1). The waste package is on the Q-List by direct inclusion by the Department of Energy (DOE), without conducting a QAP-2-3 evaluation. The Waste Package Development Department (WPDD) responsible manager has evaluated this activity in accordance with QAP-2-0, *Conduct of Activities*. The *Perform Criticality, Thermal, Structural, and Shielding Analyses* (Reference 5.2) evaluation has determined the preparation and review of this design analysis is subject to *Quality Assurance Requirements and Description* (Reference 5.3) requirements. As specified in NLP-3-18, this activity is subject to QA controls.

The analysis described in this document supports development of the disposal criticality analysis methodology. No designs were analyzed in this document. This document will not directly support any construction, fabrication, or procurement activity and therefore is not required to be procedurally controlled as TBV (to be verified). The calculation design inputs or information used in this document come from data accepted by the Nuclear Regulatory Commission and by the scientific and engineering community as established fact. The specific references are listed in Section 5 and identified in Section 7. The information is therefore not treated as unqualified data.

3. Method

The analytical model employed for this analysis was the SAS2H module of the SCALE sequence. Based upon fuel design, power history, and operating data for specific assemblies in the Mihama pressurized water reactor (PWR), a computational model was developed for use with the SAS2H module of SCALE. The SAS2H module is used to perform a fuel depletion analysis to predict the isotopic concentrations in localized areas of assembly pins (pellet samples) subsequent to irradiation and cooling time. The isotopic concentrations predicted by the SAS2H module are then compared with measured concentrations of the same localized areas (axial locations) of the assembly pins to determine the accuracy of the developed model. The measured isotopic concentrations used for comparisons in the analysis are obtained from a separate report (Reference 5.5).

4. Design Inputs

The sources for the design parameters are References 5.4 through 5.9. Reference 5.4 provides information on molar masses; the assembly design, power history and operating parameters are obtained from References 5.5 and 5.6; the cladding composition from Reference 5.7; a list of trace elements in the fuel is derived from Reference 5.8; and light elements from Reference 5.9.

4.1 Design Parameters

The molar masses of selected elements are obtained from Reference 5.4 and are provided below within three significant figures. Precision beyond three significant figures is not necessary since the calculated isotopic concentrations from SCALE are only to three significant figures. Also, the weight per mole of enriched uranium is approximated by the weight per mole of natural uranium since the weight percent of enrichment is small.

Mole of natural uranium = 238 g,
6.02×10^{23} atoms per mole. (Reference 5.4)

General spent fuel characteristics for each pellet sample are presented in Table 4-1 and include the initial ^{235}U enrichment, final burnup and the cooling time (Section 2.1.2, Reference 5.5). The initial enrichment ranges from 3.203 to 3.210 wt% ^{235}U and the burnup ranges from 6.92 to 34.32 GWd/MTU. Measurements of isotopic concentrations are back calculated to a reference cooling time of 1825 days for all samples.

Assembly design parameters are presented in Table 4-2 (Section 2.1.2, Reference 5.5). The samples come from a Westinghouse 15 x 15 assembly with one instrument tube and 20 guide tube positions, which were empty during operation. A cross section of a Westinghouse 15 x 15 assembly is presented in Figure 4-1 (Section 2.1.2, Reference 5.5). Initial enrichment of ^{234}U, ^{235}U and ^{236}U are given in Table 4-3 for the three different types of assemblies (Section 2.1.2, Reference 5.5).

One assembly was irradiated for one cycle, another for two cycles and the third for three cycles. The operating parameters in Table 4-4 include the uptime and downtime, cumulative burnups, specific powers, and average cycle boron concentrations (Section 2.1.2, Reference 5.5). The cycle boron concentrations were assumed to be to 450 ppm, since detailed information was not available. The average temperatures of the fuel, and moderator are presented in Table 4-5. The moderator temperature was determined by assuming a cosine fit based on axial height, and inlet and outlet temperatures. The moderator density is obtained from Appendix A of Reference 5.5. The fuel temperatures were not known, therefore, the temperature for Turkey Point Unit 3 assemblies are used, which is also a Westinghouse 15 x 15 design with similar specific powers (Table 3.8, Reference 5.6).

The composition of the cladding, Zircaloy-4, is presented in Table 4-6, and has a density of 6.56

g/cm^3 (Reference 5.7). A list of trace elements in the fuel used in updating cross sections during the depletion analysis is presented in Table 4-7 and developed with consideration of elements used in (Table 1, Reference 5.8). A generic set of light element weights for PWRs that is typically used in depletion analyses is included in Table 4-8 (Table 17, Reference 5.9). Variations in light element masses per unit fuel in different PWRs are small when compared to this generic set (p. 2-2, Reference 5.9). This data is provided in units of kg/MTUO_2 or kg/MTU depending on the units required in the analysis.

Measured isotopic concentrations are presented in Table 4-9 and are given in g/MTU (Section 2.1.2, Reference 5.5). The measurements were performed for nine samples from three assemblies at different axial heights, with varying degrees of exposure.

Table 4-1. Spent Fuel Characteristic Parameters for Samples from Mihama 3 PWR

Assembly	Enrichment, wt % ^{235}U	Burnup, GWd/MTU	Cooling Time, days
86b02	3.208	8.30	1825
86b03	3.208	6.92	1825
86g03	3.203	21.29	1825
86g05	3.203	15.36	1825
86g07	3.203	14.66	1825
87c03	3.210	29.50	1825
87c04	3.210	32.20	1825
87c07	3.210	33.71	1825
87c08	3.210	34.32	1825

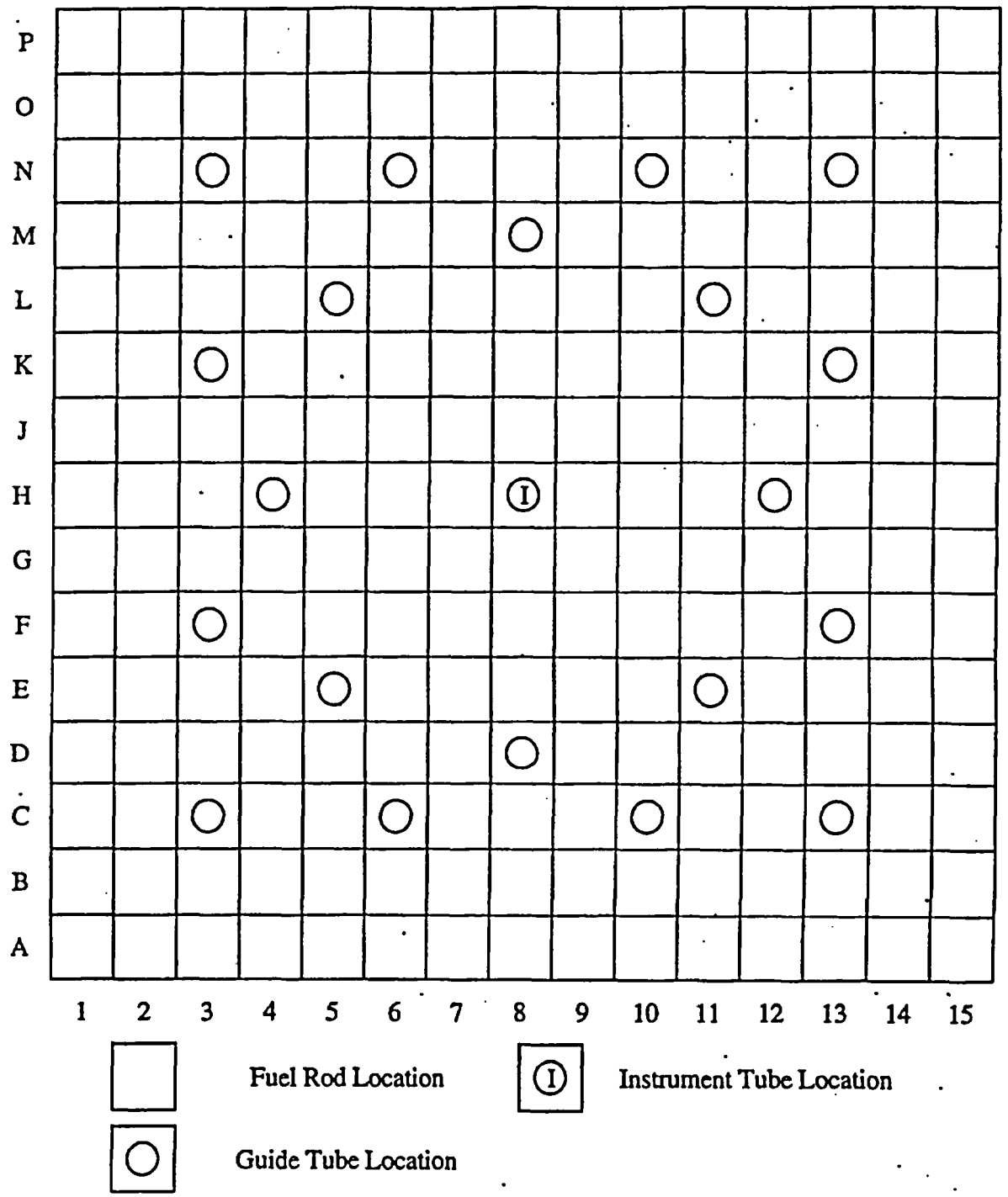
Reference 5.5

Table 4-2. Assembly Design Parameters for Mihama 3 PWR

Parameter	Data
Assembly General Data:	
Designer	Westinghouse
Lattice	15 x 15
Number of Fuel Rods	204
Number of Guide Tubes	20
Number of Instrument Tubes	1
Assembly Pitch, cm	21.50
Assembly Fuel, kg U	446
Fuel Rod Data:	
Pellet Density, g/cm^3	9.996
Rod Pitch, cm	1.430
Rod Outside Diameter (OD), cm	1.072
Rod Inside Diameter (ID), cm	0.948
Pellet Diameter, cm	0.929
Active Fuel Length, cm	365.76
Clad Material	Zircaloy-4
Guide Tube Data:	
Inner Diameter, cm	1.300
Outer Diameter, cm	1.387
Tube Material	Zircaloy-4

Reference 5.5

Figure 4-1. Cross Section of Mihama Assembly



Reference 5.5

Table 4-3. Fuel Composition by Assembly for Mihama 3 PWR

Assembly	86b	86g	87c
^{234}U wt %	0.0285	0.0285	0.0295
^{235}U wt %	3.208	3.203	3.210
^{236}U wt %	0.0208	0.0109	0.0327
^{238}U wt %	96.742	96.757	96.727

Reference 5.5

Table 4-4. Operating Data for Mihama 3 PWR

	Sample Identifier	Cycle II	Cycle III-1	Cycle III-2	Cycle IV-1	Cycle IV-2
Uptime, days		215	157	170	352	28
Downtime, days		388	9	176	0	1825
Cumulative Burnup, GWd/MTU	86b02	8.30	-	-	-	-
	86b03	6.92	-	-	-	-
	86g03	6.87	13.79	21.29	-	-
	86g05	4.94	9.95	15.36	-	-
	86g07	4.73	9.50	14.66	-	-
	87c03	5.29	10.77	16.71	28.73	29.50
	87c04	5.78	11.76	18.24	31.35	32.20
	87c07	6.05	12.31	19.10	32.82	33.71
	87c08	6.16	12.54	19.44	33.42	34.32
Specific Power, MW/MTU	86b02	38.61	-	-	-	-
	86b03	32.20	-	-	-	-
	86g03	31.95	44.10	44.10	-	-
	86g05	22.99	31.87	31.87	-	-
	86g07	22.00	30.37	30.37	-	-

Table 4-4. Operating Data for Mihama 3 PWR

	Sample Identifier	Cycle II	Cycle III-1	Cycle III-2	Cycle IV-1	Cycle IV-2
	87c03	24.61	34.92	34.92	34.15	27.47
	87c04	26.87	38.12	38.12	37.25	30.35
	87c07	28.13	39.91	39.91	38.99	31.77
	87c08	28.65	40.62	40.62	39.72	31.85
Boron Concentration, ppm	all	450	450	450	450	450

Reference 5.5

Table 4-5. Operating Temperatures for Mihama 3 PWR

Sample	Fuel, K	Cladding, K	Moderator, K	Moderator Density, g/cm^3
86b02	922	600	560	0.7518
86b03	922	634	594	0.6788
86g05	922	612	572	0.7298
86g03	922	625	585	0.6995
86g07	922	625	585	0.6995
87c03	922	600	560	0.7518
87c04	922	607	567	0.7390
87c07	922	601	561	0.7510
87c08	922	626	586	0.6984

References 5.5 and 5.6

Table 4-6. Composition of Zircaloy-4

Material	Weight Percent
O	0.12
Cr	0.10
Fe	0.20
Sn	1.40
Zr	98.18
Density = 6.56 g/cm^3	

Reference 5.7

Table 4-7. Nuclides Updated in SAS2H

^{83}Kr	^{85}Kr	^{89}Y	^{90}Sr	^{95}Mo	^{93}Zr
^{94}Zr	^{94}Nb	^{95}Zr	^{99}Tc	^{101}Ru	^{103}Rh
^{105}Rh	^{106}Ru	^{105}Pd	^{108}Pd	^{109}Ag	^{124}Sb
^{131}Xe	^{132}Xe	^{134}Cs	^{135}Xe	^{135}Cs	^{136}Xe
^{136}Ba	^{137}Cs	^{139}La	^{141}Pr	^{143}Pr	^{143}Nd
^{144}Ce	^{145}Nd	^{147}Nd	^{147}Pm	^{147}Sm	^{148}Pm
^{149}Sm	^{150}Sm	^{151}Sm	^{152}Sm	^{153}Eu	^{154}Eu
^{155}Gd	^{155}Eu				

Reference 5.8

Table 4-8. Light Element Mass per Unit of Fuel for a Typical PWR

Element	kg/MTU
O	135.0
Cr	5.9
Mn	0.33
Fe	13.0
Co	0.075
Ni	9.9
Zr	221.0
Nb	0.71
Sn	3.6

Reference 5.9

Table 4-9. Measured Isotopic Concentrations (g/MTU)

Sample	86b02	86b03	86g03	86g05	86g07	87c03	87c04	87c07	87c08
Burnup, GWd/MTU	8.30	6.92	21.29	15.36	14.66	29.50	32.20	33.71	34.32
^{234}U	267	-	-	-	-	-	174	174	-
^{235}U	23900	25200	14500	18500	18400	9790	9070	7890	8040
^{236}U	1650	1460	3270	2650	2660	3830	4000	4180	4200
^{238}U	962000	962000	952000	956000	957000	947000	944000	944000	942000
^{238}Pu	4.51	3.41	57.2	25.9	26.8	131	159	168	186
^{239}Pu	3020	2830	5080	4650	4740	5300	5470	4970	5320
^{240}Pu	422	344	1490	1030	1060	2100	2270	2320	2430
^{241}Pu	109	82.8	651	408	425	955	1060	983	1080
^{242}Pu	9.49	6.04	176	73.9	75.1	408	490	534	570

Reference 5.5

4.2 Criteria

The design of the waste package will depend on waste package configuration criticality analyses performed using an acceptable disposal criticality analysis methodology. Criteria that relate to the development and design of repository and engineered barrier components are derived from the applicable requirements and planning documents. The Engineered Barrier Design Requirements Document (EBDRD, Reference 5.12) provides requirements for engineered barrier segment design. The Repository Design Requirements Document (RDRD, Reference 5.13) provides requirements for repository design. The Controlled Design Assumptions Document (Reference 5.14) provides guidance for requirements listed in the EBDRD and RDRD which have unqualified or unconfirmed data associated with the requirement.

This analysis supports the disposal criticality analysis methodology by providing input, in the form of fuel depletion results, to benchmark calculations which address the prediction of both spent fuel isotopic compositions and their associated reactivity. These benchmark calculations will contribute to the determination of bias values in the method of critical multiplication factor calculation that is implemented by the analytic tools to be used in the disposal criticality methodology. The requirements for utilizing the bias in the method of calculation of the critical multiplication factor for disposal configurations containing spent nuclear fuel are located in Section 3.2.2.5 of the RDRD and Section 3.2.2.6 of the EBDRD. This analysis does not satisfy these requirements, but the results from this analysis will be used as input to subsequent analyses which will satisfy these requirements.

4.3 Assumptions

4.3.1 The fuel temperatures are assumed to be the same as for the Turkey Point Unit 3 temperatures from Table 3.8, Reference 5.6. This basis for this assumption is that the relationship between power and temperature in Turkey Point and Mihama are similar. The reason is that both reactors utilize the Westinghouse 15 x 15 assembly design and the samples for Mihama were irradiated at approximately the same specific power as those from Turkey Point Unit 3 (Reference 5.6, Table 3.8). This assumption is used in Section 7.2.

4.3.2 The cycle average boron concentrations are assumed to be 450 ppm. The basis for this assumption is that the value is an average of typical cycle average boron concentrations, and was obtained from Reference 5.5. This assumption is used in Section 7.2.

4.4 Codes and Standards

There are no applicable codes or standards for this design analysis.

5. References

5.1 *Yucca Mountain Site Characterization Project Q-List*, YMP/90-55Q REV 4, Yucca Mountain Site Characterization Project.

5.2 *QAP-2-0 Activity Evaluations: ID #WP-20, Perform Criticality, Thermal, Structural, and Shielding Analyses*, Civilian Radioactive Waste Management System (CRWMS) Management and Operating Contractor (M&O), August 3, 1997.

5.3 *Quality Assurance Requirements and Description*, DOE/RW-0333P REV 7, U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM).

5.4 *Nuclides and Isotopes*, General Electric Company, 14ed., 1989.

5.5 *Isotopic and Criticality Validation for PWR Actinide-Only Burnup Credit*, DOE/RW-0497, DOE OCRWM.

5.6 *Fuel Inventory and Afterheat Power Studies of Uranium-Fueled Pressurized-Water-Reactors Fuel Assemblies Using the SAS2 and ORIGEN-S Modules of SCALE with an ENDF/B-V Updated Cross Section Library*, NUREG/CR-2397, November 1981.

5.7 *Material Compositions and Number Densities for Neutronics Calculations*, Document Identifier (DI) Number: BBA000000-01717-0200-00002 REV 00, CRWMS M&O.

5.8 *SCALE-4 Analysis of Pressurized Water Reactor Critical Configurations: Volume 2-Sequoyah Unit 2 Cycle 3*, ORNL/TM-12294/V2, March 1995.

5.9 *Validation of the Scale System for PWR Spent Fuel Isotopic Composition Analyses*, ORNL/TM-12667, Oak Ridge National Laboratory, March 1995.

5.10 *SCALE 4.3, A Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation for Workstations and Personal Computers*, NUREG/CR-0200 REV 5, ORNL/NUREG/CSD-2/R5, Volumes 1-3, Oak Ridge National Laboratory.

5.11 *Software Qualification Report for the SCALE Modular Code System*, DI Number: 30011-2002 REV 01, CRWMS M&O.

5.12 *Engineered Barrier Design Requirements Document*, YMP/CM-0024, REV 00, ICN 01, DOE OCRWM.

5.13 *Repository Design Requirements Document*, YMP/CM-0023, REV 00, ICN 01, DOE OCRWM.

5.14 *Controlled Design Assumptions Document*, DI#: B00000000-01717-4600-00032 REV 04, ICN 01, CRWMS M&O.

6. Use of Computer Software

A. Reference 5.10 describes the SAS2H module of SCALE 4.3 that is used with the 44GROUPNDF5 cross section library to calculate the isotopic concentrations for the specified burnup and cooling time. The computer code's spatially independent point depletion model is appropriate for comparison with pellet sample measurements, and is used within the range of validation, as described in Reference 5.11, in accordance with the QAP-SI series procedures. SCALE is obtained from the Software Configuration Management in accordance with appropriate procedures. SCALE's CSCI number is 30011 V4.3 and is installed on the WPDD HP 9000, 700 Workstation with CRWMS M&O tag number 110433.

B. *Lotus 1-2-3* Release 5 for Windows 95 is an Acquired Software spreadsheet program as defined in QAP-SI-0. User defined formulas and/or algorithms, inputs and results, are documented in the appropriate sections.

7. Design Analysis

The SAS2H module of SCALE 4.3 is used to perform one-dimensional (1-D) neutron transport and point depletion analyses on the Mihama samples using the preferred 44GROUPNDF5 cross-section library. To properly model the neutron flux spectrum and the nuclide composition changes, it is necessary to define the compositions, temperatures, and geometry of the fuel assembly. This is accomplished with the use of data blocks in which similar parameters are grouped together.

7.1 SCALE Input Data Blocks 1, 2, and 3

Data blocks 1 through 3 define the SCALE module to be used, the title of the input file, the cross section library to be used, and the lattice type to be modeled. The module used is SAS2H and the cross sectional library is 44GROUPNDF5, abbreviated as 44GROUP. The 44GROUP cross section library is recommended by Oak Ridge National Laboratory. Since SAS2H is only to be used for isotopic depletion/generation, the 'parm=skipshipdata' option is used so that a shipping cask shielding analysis is not performed. The title is arbitrary and should contain information that is sample specific, while the lattice type is "latticecell" to reflect the array characteristic of the assembly.

7.2 SCALE Input Data Block 4

Data block 4 defines the material compositions present in the assembly. A unique mixture number is assigned to each composition, and follows the form of mixture 1 for fuel, mixture 2 for cladding and mixture 3 for moderator.

The fuel mixture is specified as UO_2 using the isotopic weight percentages from Table 4-3 and the fuel temperature obtained from Table 4-5. The stack density is calculated from the fuel dimensions and the initial uranium fuel loading, with the following equation:

$$StackDensity = \frac{ULoad}{(NFR)(\frac{\pi}{4})(PDia.)^2(FuelLength)}(\frac{1000_g U}{1_{kg} U})(\frac{270_g UO_2}{238_g U}) \qquad \text{Equation 7-1}$$

Where:

StackDensity = Fuel Stack Density (gUO_2/cm^3)
Uload = Initial Uranium Fuel Loading per Assembly ($kgUO_2$)
NFR = Number of Fuel Rods per Assembly
PDia. = Fuel Pellet Diameter (cm)
FuelLength = Active Fuel Length (cm)

The resulting stack density is 10.004 gUO_2/cm^3, compared to the pellet density of 9.996 gUO_2/cm^3. Therefore, it is concluded that the pellet density reported in Table 4-2 is the stack density, with the

difference being a result of rounding, and is used for mixture 1. Isotopes which are selected as needing their cross sections updated during the depletion analysis are included in the fuel mixture. A standard list of trace fuel elements is given in Table 4-7 and defined in the fuel mixture to have a concentration of 10^{-20} atoms/barn·cm.

The cladding material of Zircaloy-4 is not contained within the Standard Composition Library in SCALE 4.3 and must be defined as an arbitrary material. The cladding is defined with a density and isotopic weight percentages from Table 4-6 and temperature given in Table 4-5.

The moderator temperature, density and boron concentration are given in Tables 4-4 and 4-5, and is composed of H_2O and boron. The boron is defined as an arbitrary material with the moderator density and temperature, a volume fraction equal to the average boron concentration of cycle II, and a standard boron composition from the Standard Composition Library designated as 5000.

7.3 SCALE Input Data Blocks 5 Through 7

The unit fuel rod cell geometry is defined in data block 5. The 'squarepitch' designation for the type of lattice is appropriate since the fuel assembly consists of a square array of fuel rods. Fuel rod, cladding and pitch dimensions are given in Table 4-2 with the mixture number for each composition defined in Section 7.2. The gap mixture is defined as 0.

Data block 6 allows the user to specify such parameters as the spatial mesh, angular quadrature and the convergence criteria. It is determined that the default values are sufficient and such options are not used in this design model.

In data block 7 the user defines general assembly data and determines the level of detail in which the assembly is to be modeled. The number of fuel rods per assembly is given in Table 4-2 and the length is calculated so that an assembly contains 1 MTU, using the following equation:

$$Length = \frac{1}{\frac{\pi}{4}(POD)^2(PDen)(NFR)} * \frac{10^6 gUO_2}{1 MTUO_2} * \frac{270 MTUO_2}{238 MTU} \qquad \text{Equation 7-2}$$

Where:

Length = Length Required for an Assembly to Contain 1 MTU (cm)
POD = Fuel Pellet Diameter (cm)
PDen = Pellet Stack Density (gUO_2/cm^3)
NFR = Number of Fuel Rods

Since measured isotopic concentrations are presented in grams of isotope per Metric Ton of Uranium (MTU) and SCALE presents concentrations in grams of isotope per assembly, it is possible to alter the length so that the assembly contains 1 MTU. This is possible since the 1-D transport calculation is axially independent. Consequently, the length of the assembly does not impact the neutron flux spectrum nor the nuclide cross sections. The resulting length for the Mihama assembly is 820.74 cm.

One assembly was irradiated for a single cycle, another for two cycles and a third for three cycles. It is determined that approximately 80 days per cross section library is sufficient to accurately model the change in nuclide cross sections with increasing burnup, without over-burdening the SAS2H code. Therefore, the number of libraries per cycle are specified as five. To obtain the concentrations of all interested nuclides, a print level of 5 is chosen, while an input level of 2 is defined so that a Path B model may be utilized. The number of light elements is nine and is determined from Table 4-8, while the number of zones is five which is determined by the Path B model described in Section 7.4.

SAS2H calculates a linear boron concentration let down over each cycle when the number of libraries per cycle is specified as greater than one. The methodology calculates an initial boron concentration equal to 1.9 times the average boron concentration and a final boron concentration calculated as 0.1 times the average boron concentration. These two end points are used to determine a linear fit for the boron concentration let down, which is used to calculate the boron concentrations for each library in the cycle. However, a problem arises when the cycle specified is not a full cycle but rather an interval of a cycle. (It is sometimes necessary to specify an interval as a cycle in SAS2H so that either a period of downtime during the actual cycle or a power change during the actual cycle may be modeled.) In this case SAS2H would let down the boron concentration to 0.1 times the average boron concentration for the first interval and jump up to 1.9 times the average boron concentration for the beginning of the second cycle. In reality this jump does not exist and, therefore, the modeling of the boron concentration let down is inexact. A solution to this problem would be to split all cycles into approximately 80 day intervals and change the number of libraries per cycle to one. However, experience with the SAS2H code indicates that the error due to an inexact boron concentration let down function, such as described here, is usually less than 0.5%. Therefore, allowing the SAS2H code to calculate a boron concentration over an interval of a cycle is an acceptable approximation to the actual boron concentration let down.

7.4 SCALE Input Data Block 8

The Path B model for Mihama centralizes a guide tube with a surrounding homogenized fuel and moderator mixture and further surrounded by the moderator between assemblies. The equation below is used to determine the number of fuel unit cells that surround the guide tube unit cell by conserving the fuel to moderator volume ratio. All of the following equations used to calculate the

Path B model dimensions are derived. The results of the fuel-unit-cell calculations are presented in Table 7-1, and the resulting Path B model dimensions are presented in Table 7-2.

$$x=\frac{(\frac{F}{M})(CUCMV)}{(FV)-(\frac{F}{M})(MV)} \qquad \text{Equation 7-3}$$

$$\frac{F}{M}=\frac{(NFR)(\frac{\pi}{4})(POD)^2}{(NFR)[RP^2-(\frac{\pi}{4})(COD)^2]+(NGT)[RP^2-(\frac{\pi}{4})(GTOD)^2+(\frac{\pi}{4})(GTID)^2]+[RP^2-(\frac{\pi}{4})(ITOD)^2+(\frac{\pi}{4})(ITID)^2]} \qquad \text{Equation 7-4}$$

$$CUCMV=RP^2-(\frac{\pi}{4})(GTOD)^2+(\frac{\pi}{4})(GTID)^2 \qquad \text{Equation 7-5}$$

$$FV=(\frac{\pi}{4})(POD)^2 \qquad \text{Equation 7-6}$$

$$MV=RP^2-(\frac{\pi}{4})(COD)^2 \qquad \text{Equation 7-7}$$

Where:

x = Number of Unit Fuel Cells per Central Guide Tube
F/M = Fuel to Moderator Volume Ratio
NFR = Number of Fuel Rods
POD = Fuel Pellet Outer Diameter
RP = Rod Pitch
COD = Cladding Outer Diameter
NGT = Number of Guide Tubes
GTOD = Guide Tube Outer Diameter
GTID = Guide Tube Inner Diameter
ITOD = Instrument Tube Outer Diameter
ITID = Instrument Tube Inner Diameter
CUCMV = Central Unit Cell Moderator Volume
FV = Fuel Volume of One Fuel Unit Cell
MV = Moderator Volume of One Fuel Unit Cell

Once the number of fuel cells per guide tube is determined the geometry of the Path B model is calculated. Since the guide tube unit cell is centralized, the dimensions of the first two zones are the same as the guide tube inner and outer radii.

The radius for the moderator surrounding the guide tube, but still within the guide tube cell, is calculated with the following equation:

$$R_3 = \sqrt{(\frac{1}{\pi})RP^2} \qquad \text{Equation 7-8}$$

Where:

R_3 = Radius of Moderator Surrounding Guide Tube

The area of an annular region is calculated by the difference between the outer circular area and the inner circular area. Equation 7-9 is the basis for the Equations 7-10 and 7-11 which determine the radii of the homogenized fuel zone and the outer moderator zone.

$$ARA = \pi(ORAR^2 - IRAR^2) \qquad \text{Equation 7-9}$$

Where:

ARA = Annular Region Area
ORAR = Outer Radius of Annular Region
IRAR = Inner Radius of Annular Region

The area of the homogenized fuel zone surrounding the guide tube unit cell is equal to the number of fuel unit cells surrounding the guide tube multiplied by the area of a fuel unit cell. Consequently, the radius of the homogenized fuel zone is computed with the following equation:

$$R_4 = \sqrt{(\frac{x}{\pi})RP^2 + R_3^2} \qquad \text{Equation 7-10}$$

Where:

R_4 = Radius of Homogenized Fuel and Moderator Zone

The mixture number of the homogenized fuel and moderator mixture must be specified as 500. The code then determines the composition of the region based upon the dimensions and mixtures specified in the fuel unit cell data block 5.

The moderator in the channel between assemblies is determined by calculating the total moderator volume and multiplying by the fraction of unit cells in the larger unit cell of the Path B model. The total moderator volume between assemblies is determined by the assembly pitch and the fuel cell pitch multiplied by the number of unit cells. The radius of the moderator between assemblies is calculated from the following equation:

$$R_5=\sqrt{\frac{(x+1)}{\pi \cdot NCell}[AP^2-(NCell)(RP^2)]+R_4^2} \qquad \text{Equation 7-11}$$

Where:

R_5 = Radius of Moderator Surrounding Assembly Zone
NCell = Number of Cells in Assembly
AP = Assembly Pitch

Table 7-1. Calculation of Fuel Unit Cell per Guide Tube Unit Cell

F/M	CUCMV, cm²	FV, cm²	MV, cm²	x
0.5081	1.8613	0.6778	1.1423	9.7143

Table 7-2. Path B Model Dimensions

	R_1	R_2	R_3	R_4	R_5
Radius, cm	0.6500	0.6935	0.8068	2.6408	2.6470
Composition	Moderator	Cladding	Moderator	Fuel/Moderator	Moderator

7.5 SCALE Input Data Blocks 9 Through 16

Data block 9 is used to describe the power history of the reactor. The specific power, fuel irradiation period, the length of downtime, the fraction of boron and moderator density, and the temperature during the cycle may all be defined. The specific power is in units of MW/MTU, the irradiation period and length of downtime are both defined in days; with values presented in Table 4-4. The moderator density, boron concentration, and fuel temperature are assumed constant over the cycles irradiated and therefore, the options to specify cycle specific values are not used.

Light elements and their effective weight, in kg per assembly, are entered in data block 10. Table 4-8 provides a generic set of light elements and their weights, in kg per MTU. Since the fuel length is altered so that there is 1 MTU per assembly the use of light elements with weights of kg per MTU is appropriate.

Data blocks 11 through 15 describe the parameters used in radial shielding analysis of a shipping cask and are not necessary in performing the depletion analysis. Data block 16 denotes the end of the SCALE input.

7.6 Comparison of Calculated and Measured Concentrations

Comparisons of corresponding calculated and measured concentrations are performed on a percent difference basis. The difference between the measured and the calculated value is divided by the

measured value to determine the accuracy of the SAS2H calculation. A positive difference represents an over-prediction by the code, while a negative percent difference represents an under-prediction by the code. The measured concentrations are given in Table 4-9, calculated concentrations are presented in Table 7-3 and the percent differences are presented in Table 7-4.

In an attempt to determine the impact of the assumptions from Section 4.3 on the calculated isotopic concentrations, a sensitivity analysis is performed on the fuel temperature and boron concentration. Two samples representing low and high burnups, 86b02 and 87c07, are used to observe the changes in isotopic concentrations with both: 1) a 100 K decrease in fuel temperature, and 2) a 100 ppm increase in boron concentration. The results are reported in Tables 7-5 and 7-6.

7.7 Results

SAS2H predicted isotopic concentrations are presented in Table 7-3. The calculated concentrations are obtained through the methodology described in Sections 7.1 through 7.5, and with the input parameters defined in Section 4.1. Calculated concentrations are then compared with measured concentrations as described in Section 7.6 to determine the accuracy of the SAS2H module. Results of the comparison, in the form of percent differences, are presented in Table 7-4. Also, the results of the sensitivity analysis are reported in Tables 7-5 and 7-6.

Table 7-3. Calculated concentrations (g/MTU)

Sample	86b02	86b03	86g03	86g05	86g07	87c03	87c04	87c07	87c08
Burnup, GWd/MTU	8.30	6.92	21.29	15.36	14.66	29.50	32.20	33.71	34.32
^{234}U	2.53E2	-	-	-	-	-	1.82E2	1.78E2	-
^{235}U	2.34E4	2.48E4	1.39E4	1.77E4	1.83E4	9.40E3	8.31E3	7.63E3	7.77E3
^{236}U	1.75E3	1.53E3	3.25E3	2.63E3	2.54E3	4.08E3	4.23E3	4.31E3	4.32E3
^{238}U	9.62E5	9.63E5	9.52E5	9.57E5	9.57E5	9.46E5	9.44E5	9.43E5	9.42E5
^{238}Pu	4.54E0	3.30E0	5.01E1	2.18E1	2.03E1	1.15E2	1.41E2	1.54E2	1.69E2
^{239}Pu	3.05E3	2.81E3	4.98E3	4.30E3	4.29E3	5.11E3	5.21E3	5.19E3	5.45E3
^{240}Pu	4.30E2	3.47E2	1.51E3	1.01E3	9.69E2	2.05E3	2.23E3	2.30E3	2.39E3
^{241}Pu	1.09E2	8.16E1	6.14E2	3.62E2	3.47E2	8.43E2	9.31E2	9.58E2	1.03E3
^{242}Pu	1.02E1	6.26E0	1.76E2	7.04E1	6.33E1	3.81E2	4.69E2	5.19E2	5.45E2

Table 7-4. Percent Difference Between Measured and Calculated [(C/M-1)*100]

Sample	86b02	86b03	86g03	86g05	86g07	87c03	87c04	87c07	87c08
Burnup, GWd/MTU	8.30	6.92	21.29	15.36	14.66	29.50	32.20	33.71	34.32
^{234}U	-5.24	-	-	-	-	-	4.60	2.30	-
^{235}U	-2.09	-1.59	-4.14	-4.32	-0.54	-3.98	-8.38	-3.30	-3.36
^{236}U	6.06	4.79	-0.61	-0.75	-4.51	6.53	5.75	3.11	2.86
^{238}U	0.00	0.10	0.00	0.10	0.00	-0.11	0.00	-0.11	0.00
^{238}Pu	0.67	-3.23	-12.41	-15.83	-24.25	-12.21	-11.32	-8.33	-9.14
^{239}Pu	0.99	-0.71	-1.97	-7.53	-9.49	-3.58	-4.75	4.43	2.44
^{240}Pu	1.90	0.87	1.34	-1.94	-8.58	-2.38	-1.76	-0.86	-1.65
^{241}Pu	0.00	-1.45	-5.68	-11.27	-18.35	-11.73	-12.17	-2.54	-4.63
^{242}Pu	7.48	3.64	0.00	-4.74	-15.71	-6.62	-4.29	-2.81	-4.39

Table 7-5. Sensitivity Analyses for Sample 86b02

Case	Modeled Conditions	Fuel Temperature Decrease of 100 K		Boron Concentration Increase of 100 ppm	
	Calculated Concentration, g/MTU	Calculated Concentration, g/MTU	% Change in Calculated	Calculated Concentration, g/MTU	% Change in Calculated
^{234}U	2.53E2	2.53E2	0.00	2.53E2	0.00
^{235}U	2.34E4	2.34E4	0.00	2.34E4	0.00
^{236}U	1.75E3	1.75E3	0.00	1.75E3	0.00
^{238}U	9.62E5	9.62E5	0.00	9.62E5	0.00
^{238}Pu	4.54E0	4.53E0	-0.22	4.60E0	1.32
^{239}Pu	3.05E3	3.02E3	-0.98	3.07E3	0.66
^{240}Pu	4.30E2	4.28E2	-0.47	4.33E2	0.70
^{241}Pu	1.09E2	1.08E2	-0.92	1.10E2	0.92
^{242}Pu	1.02E1	1.01E1	-0.98	1.03E1	0.98

Table 7-6. Sensitivity Analyses for Sample 87c07

Case	Modeled Conditions	Fuel Temperature Decrease of 100 K		Boron Concentration Increase of 100 ppm	
Isotope	Calculated Concentration, g/MTU	Calculated Concentration, g/MTU	% Change in Calculated Concentrations	Calculated Concentration, g/MTU	% Change in Calculated Concentrations
^{234}U	1.78E2	1.78E2	0.00	1.78E2	0.00
^{235}U	7.63E3	7.57E3	-0.79	7.70E3	0.92
^{236}U	4.31E3	4.32E3	0.23	4.30E3	-0.23
^{238}U	9.43E5	9.43E5	0.00	9.43E5	0.00
^{238}Pu	1.54E2	1.53E2	-0.65	1.55E2	0.65
^{239}Pu	5.19E3	5.12E3	-1.35	5.24E3	0.96
^{240}Pu	2.30E3	2.30E3	0.00	2.31E3	0.43
^{241}Pu	9.58E2	9.47E2	-1.15	9.67E2	0.94
^{242}Pu	5.19E2	5.17E2	-0.39	5.19E2	0.00

8. Conclusions

Inspection of the measured isotopic concentrations of sample 86g07 reveals that there is an inconsistency between the measured concentration of ^{235}U relative to other samples and the reported burnup. It is expected that for samples with the same enrichment, the concentration of ^{235}U will decrease with an increase in burnup. However, the concentration of ^{235}U for sample 86g07 is lower than the concentration for 86g05, while the indicated burnup for 86g05 is greater than that for 86g07. Therefore, it is believed that the reported burnup of sample 86g07 is lower than what would be expected by examining the relative isotopic concentrations. The results from sample 86g07 are not used as an indication of the accuracy of the SAS2H modules ability to predict isotopic concentrations.

The accuracy in which the SAS2H module is able to predict isotopic concentrations is indicated by the percent differences presented in Table 7-4. Inspection of such results reveals that the code consistently under-predicts the concentrations of ^{235}U, and ^{241}Pu. Percent differences from this analysis are compared with results from Reference 5.5, in which similar calculations were performed with a previous version of SCALE and the 27burnuplib cross section library. The concentrations calculated in Reference 5.5 for the most part agree with the concentrations calculated in this analysis; however, significant differences are seen for the plutonium isotopes. Since there are few differences between the model in Reference 5.5 and the model contained within, it is determined that the discrepancy between calculated concentrations for plutonium isotopes is caused by a change in the cross section library.

An analysis of the sensitivity of isotopic concentrations in relation to the fuel temperature reveals that for a 100 K decrease in the fuel temperature, most of the plutonium isotopic concentrations decrease by around 1.35% or less. For the sample at relatively low burnup, 86b02, the isotopes of ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu decrease by 1% or less; and the remaining isotopes are unchanged. For the sample at relatively high burnup, 87c07, the isotopes of ^{235}U, ^{238}Pu, and ^{242}Pu all decrease by less than 1% or less, isotopes ^{239}Pu and ^{241}Pu decrease by little more than 1%, ^{236}U increases by less that 1% and the remaining isotopes remain unchanged. Since the actual fuel temperature is not expected to deviate more than 200 K from the temperature assumed, the assumption of a fuel temperature of 922 K does not significantly effect the calculated isotopic concentrations.

An analysis of the sensitivity of isotopic concentrations in relation to the boron concentration reveals that for a 100 ppm increase in the boron concentration, the isotopic concentrations mostly increase. For the sample at relatively low burnup, 86b02, the isotopes of ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu and ^{242}Pu increase by around 1.32% or less, and the remaining isotopes are unchanged. For the sample at relatively high burnup, 87c07, the isotopes of ^{235}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Pu increase by less than 1%, the ^{236}U isotope decreases by less than 1%, and the remaining isotopes are unchanged. Since the average boron concentration is not expected to deviate more than 250 ppm from the assumed value, the assumption of an average boron concentration of 450 ppm does not significantly effect the calculated isotopic concentrations.

The SAS2H code normally predicts isotopic concentrations as a radial assembly average; however, measurements are performed on individual pellet samples. Therefore, local pellet conditions are modeled as closely as possible in this analysis so that a more realistic pellet composition can be determined. However, approximations made to obtain local pellet conditions will influence the calculated isotopic concentrations.

In general, the measured to calculated ratios reveal that the SAS2H module of SCALE is adequate in predicting isotopic concentrations for Mihama assemblies, using the modeling methodology presented. Although the assumptions for the fuel temperature and the average boron concentration do effect the resulting isotopic concentrations, the effects are not significant enough to account for all variation between the measured and calculated concentrations. More detailed operating data would be expected to improve the accuracy of the calculated concentrations in relation to the corresponding measurements. It is recommended that future analyses use more detailed data if possible.

9. Attachments

Attachment I includes thirteen pages and contains the input files used in the modeling of the Mihama samples. A description of the parameters contained within the input files is found in Sections 7.1 through 7.5.

Included in Attachment II is an extraction from each of the output files, containing the following information:

- echo of the SAS2H input deck,
- time/date stamp for when the SAS2H depletion calculation was performed,
- the output extraction of information pertinent to the Radiochemical Assay evaluations from the final ORIGEN calculation of the SAS2H depletion calculation.

mih86b02.input

```
=sas2h    parm=skipshipdata
Mihama-3, 86b02 0, 8.3 GWd/MTU, 86b02, June 97
'
'
'----------------------------
'
'    mixtures of fuel-pin-unitcell:
'
44group      latticecell
'
'
'
uo2  1 den=9.996 1 922
  92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
       40000 98.18 2 1.0 600   end
h2o 3 den=0.7518  1  560 end
arbm-bormod  0.7518 1 1 0 0 5000 100 3 450.0e-6  560  end
'
'   450 ppm boron (wt) in moderator
'---------------------------------
end comp
'
'---------------------------------
'
'    fuel-pin-cell geometry:
'
squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end
'
'
'---------------------------------
'
'    assembly and cycle parameters:
'
npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
power=38.61 burn=215 down=1825 end
   o 135.0  cr 5.9  mn 0.33
   fe 13.0 co 0.075 ni 9.9
   zr 221.0 nb 0.71 sn 3.6
'
'---------------------------------
'
end
```

mih86b03.input

```
=sas2h    parm=skipshipdata
Mihama-3, 1, 6.92 GWd/MTU, 86b03, June 97
'
'
'  mixtures of fuel-pin-cell
'
'
'
44group   latticecell
'
'
'
uo2  1 den=9.996 1 922
  92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
       40000 98.18 2 1.0 634  end
h2o 3 den=0.6788  1  594 end
arbm-bormod  0.6788 1 1 0 0 5000 100 3 450.0e-6  594  end
end comp
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
power=32.20 burn=215 down=1825 end
'
'
  o 135.0  cr 5.9  mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
'
end
```

mih86g03.input

```
=sas2h    parm=skipshipdata
Mihama-3, 3, 21.29 GWd/MTU, 86g03, June 97
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 933
  92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 625   end
h2o 3 den=0.6995  1  585 end
arbm-bormod  0.6995 1 1 0 0 5000 100 3 450.0e-6  585  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=3 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=31.95 burn=215.0 down=388 end
power=44.10 burn=157.0 down=9.0 end
power=44.10 burn=170.0 down=1825 end
'
'
  o 135.0  cr 5.9   mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih86g05.input

```
=sas2h    parm=skipshipdata
Mihama-3, 2, 15.36 GWd/MTU, 86g05, June 97
'
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 922
  92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 612  end
h2o 3 den=0.7298  1  572 end
arbm-bormod  0.7298 1 1 0 0 5000 100 3 450.0e-6  572  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=3 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=22.99 burn=215.0 down=388 end
power=31.87 burn=157.0 down=9.0 end
power=31.87 burn=170.0 down=1825 end
'
'
  o 135.0  cr 5.9   mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih86g07.input

```
=sas2h    parm=skipshipdata
Mihama-3, 2, 14.66 GWd/MTU 86g07, June 97
'
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 922
  92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 625  end
h2o 3 den=0.6995  1  585 end
arbm-boronmod  0.6995 1 1 0 0 5000 100 3 450.0e-6  585  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=3 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=22.00 burn=215.0 down=388 end
power=30.37 burn=157.0 down=9.0 end
power=30.37 burn=170.0 down=1825 end
'
'
  o 135.0  cr 5.9   mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih87c03.input

```
=sas2h    parm=skipshipdata
Mihama-3, 5, 29.5 GWd/MTU  87c03, June 97
'
'
'
'  mixtures of fuel pin cell
'
44group   latticecell
'
'
'
uo2  1 den=9.996 1 922
  92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
       40000 98.18 2 1.0 600   end
h2o 3 den=0.7518  1  560 end
arbm-bormod  0.7518 1 1 0 0 5000 100 3 450.0e-6  560  end
end comp
'
'
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
power=24.61 burn=215.0 down=388 end
power=34.92 burn=157.0 down=9.0 end
power=34.92 burn=170.0 down=176 end
power=34.15 burn=352.0 down=0 end
power=27.47 burn=28.00 down=1825 end
'
'
   o 135.0  cr 5.9   mn 0.33
   fe 13.0  co 0.075 ni 9.9
   zr 221.0 nb 0.71  sn 3.6
'
end
```

mih87c04.input

```
=sas2h  parm=skipshipdata
Mihama-3, 6, 32.2 GWd/MTU, 87c04, June 97
'
'mixtures of fuel-pin-cell
44group  latticecell
'
'
uo2  1 den=9.996 1 922
 92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89  1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 607  end
h2o 3 den=0.7390  1  567 end
arbm-bormod  0.7390 1 1 0 0 5000 100 3 450.0e-6  567  end
end comp
'
'
squarepitch  1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=26.87 burn=215.0 down=388 end
power=38.12 burn=157.0 down=9.0 end
power=38.12 burn=170.0 down=176 end
power=37.25 burn=352.0 down=0 end
power=30.35 burn=28.00 down=1825 end
'
'
  o 135.0  cr 5.9  mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih87c07.input

```
=sas2h    parm=skipshipdata
Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 922
  92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 601   end
h2o 3 den=0.7510  1  561 end
arbm-bormod  0.7510 1 1 0 0 5000 100 3 450.0e-6  561  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=28.13 burn=215.0 down=388 end
power=39.91 burn=157.0 down=9.0 end
power=39.91 burn=170.0 down=176 end
power=38.99 burn=352.0 down=0 end
power=31.77 burn=28.00 down=1825 end
'
'
  o 135.0  cr 5.9  mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih87c08.input

```
=sas2h    parm=skipshipdata
Mihama-3, 8, 34.2 GWd/MTU, 87c08, June 97
*
'mixtures of fuel-pin-cell
44group   latticecell
*
*
uo2  1 den=9.996 1 922
 92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
*
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
       40000 98.18 2 1.0 626  end
h2o 3 den=0.6984  1  586 end
arbm-bormod  0.6984 1 1 0 0 5000 100 3 450.0e-6  586  end
end comp
*
*
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
*
*
*
*
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
*
*
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
*
*
power=28.65 burn=215.0 down=388 end
power=40.62 burn=157.0 down=9.0 end
power=40.62 burn=170.0 down=176 end
power=39.72 burn=352.0 down=0 end
power=31.85 burn=28.00 down=1825 end
*
*
  o 135.0  cr 5.9  mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
*
end
```

mih86b02less100deg.input

```
=sas2h   parm=skipshipdata
Mihama-3, 86b02 0, 8.3 GWd/MTU, 86b02, June 97
'
'
'----------------------------
'
'    mixtures of fuel-pin-unitcell:
'
44group      latticecell
'
'
'
uo2  1 den=9.996 1 822
  92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
kr-83  1 0 1-20 822  end
kr-85  1 0 1-20 822  end
y-89   1 0 1-20 822  end
sr-90  1 0 1-20 822  end
zr-93  1 0 1-20 822  end
zr-94  1 0 1-20 822  end
zr-95  1 0 1-20 822  end
nb-94  1 0 1-20 822  end
mo-95  1 0 1-20 822  end
tc-99  1 0 1-20 822  end
ru-101 1 0 1-20 822  end
ru-106 1 0 1-20 822  end
rh-103 1 0 1-20 822  end
rh-105 1 0 1-20 822  end
pd-105 1 0 1-20 822  end
pd-108 1 0 1-20 822  end
ag-109 1 0 1-20 822  end
sb-124 1 0 1-20 822  end
xe-131 1 0 1-20 822  end
xe-132 1 0 1-20 822  end
xe-135 1 0 1-20 822  end
xe-136 1 0 1-20 822  end
cs-134 1 0 1-20 822  end
cs-135 1 0 1-20 822  end
cs-137 1 0 1-20 822  end
ba-136 1 0 1-20 822  end
la-139 1 0 1-20 822  end
pr-141 1 0 1-20 822  end
pr-143 1 0 1-20 822  end
ce-144 1 0 1-20 822  end
nd-143 1 0 1-20 822  end
nd-145 1 0 1-20 822  end
nd-147 1 0 1-20 822  end
pm-147 1 0 1-20 822  end
pm-148 1 0 1-20 822  end
sm-147 1 0 1-20 822  end
sm-149 1 0 1-20 822  end
sm-150 1 0 1-20 822  end
sm-151 1 0 1-20 822  end
sm-152 1 0 1-20 822  end
eu-153 1 0 1-20 822  end
eu-154 1 0 1-20 822  end
eu-155 1 0 1-20 822  end
gd-155 1 0 1-20 822  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 600  end
h2o 3 den=0.7518  1  560 end
arbm-boremod  0.7518 1 1 0 0 5000 100 3 450.0e-6  560  end
'
'   450 ppm boron (wt) in moderator
'---------------------------------
end comp
'
'---------------------------------
'
'   fuel-pin-cell geometry:
'
squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end
'
'
'---------------------------------
'
'   assembly and cycle parameters:
'
npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
power=38.61 burn=215 down=1825 end
   o 135.0  cr 5.9  mn 0.33
   fe 13.0 co 0.075 ni 9.9
   zr 221.0 nb 0.71 sn 3.6
'
'---------------------------------
'
end
```

mih86b02plus100boron.input

```
=sas2h    parm=skipshipdata
Mihama-3, 86b02 0, 8.3 GWd/MTU, 86b02, June 97
'
'
'----------------------------
'
'    mixtures of fuel-pin-unitcell:
'
44group      latticecell
'
'
'
uo2  1 den=9.996 1 922
 92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89  1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 600  end
h2o 3 den=0.7518  1  560 end
arbm-bormod  0.7518 1 1 0 0 5000 100 3 550.0e-6  560  end
'
'  450 ppm boron (wt) in moderator
'---------------------------------
end comp
'
'---------------------------------
'
'    fuel-pin-cell geometry:
'
squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end
'
'
'---------------------------------
'
'    assembly and cycle parameters:
'
npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
power=38.61 burn=215 down=1825 end
   o 135.0  cr 5.9  mn 0.33
   fe 13.0 co 0.075 ni 9.9
   zr 221.0 nb 0.71 sn 3.6
'
'---------------------------------
'
end
```

mih87c07less100deg.input

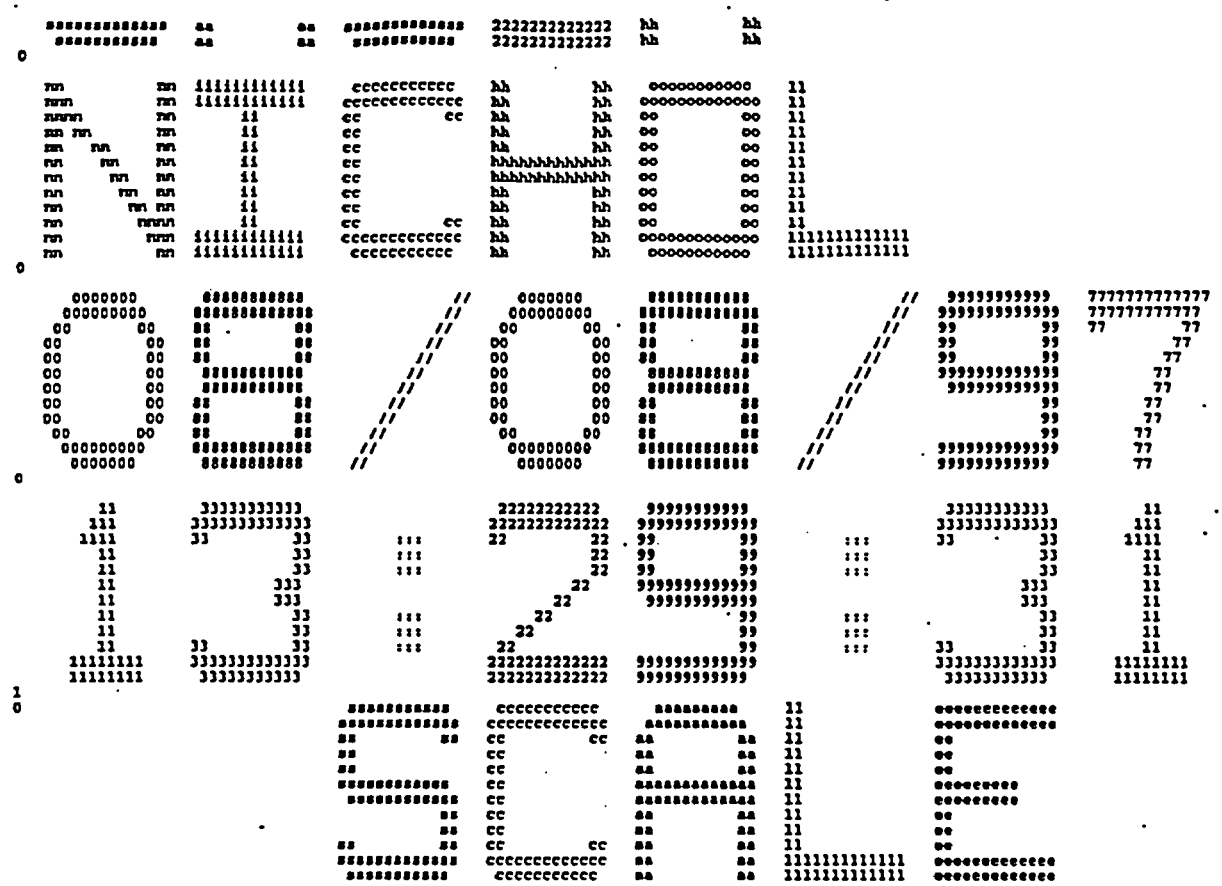
```
=sas2h    parm=skipshipdata
Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 822
  92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 822  end
kr-85  1 0 1-20 822  end
y-89   1 0 1-20 822  end
sr-90  1 0 1-20 822  end
zr-93  1 0 1-20 822  end
zr-94  1 0 1-20 822  end
zr-95  1 0 1-20 822  end
nb-94  1 0 1-20 822  end
mo-95  1 0 1-20 822  end
tc-99  1 0 1-20 822  end
ru-101 1 0 1-20 822  end
ru-106 1 0 1-20 822  end
rh-103 1 0 1-20 822  end
rh-105 1 0 1-20 822  end
pd-105 1 0 1-20 822  end
pd-108 1 0 1-20 822  end
ag-109 1 0 1-20 822  end
sb-124 1 0 1-20 822  end
xe-131 1 0 1-20 822  end
xe-132 1 0 1-20 822  end
xe-135 1 0 1-20 822  end
xe-136 1 0 1-20 822  end
cs-134 1 0 1-20 822  end
cs-135 1 0 1-20 822  end
cs-137 1 0 1-20 822  end
ba-136 1 0 1-20 822  end
la-139 1 0 1-20 822  end
pr-141 1 0 1-20 822  end
pr-143 1 0 1-20 822  end
ce-144 1 0 1-20 822  end
nd-143 1 0 1-20 822  end
nd-145 1 0 1-20 822  end
nd-147 1 0 1-20 822  end
pm-147 1 0 1-20 822  end
pm-148 1 0 1-20 822  end
sm-147 1 0 1-20 822  end
sm-149 1 0 1-20 822  end
sm-150 1 0 1-20 822  end
sm-151 1 0 1-20 822  end
sm-152 1 0 1-20 822  end
eu-153 1 0 1-20 822  end
eu-154 1 0 1-20 822  end
eu-155 1 0 1-20 822  end
gd-155 1 0 1-20 822  end
'
arbm-zirc4 6.56 5 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
        40000 98.18 2 1.0 601   end
h2o 3 den=0.7510  1  561 end
arbm-bormod  0.7510 1 1 0 0 5000 100 3 450.0e-6  561  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=28.13 burn=215.0 down=388 end
power=39.91 burn=157.0 down=9.0 end
power=39.91 burn=170.0 down=176 end
power=38.99 burn=352.0 down=0 end
power=31.77 burn=28.00 down=1825 end
'
'
  o 135.0  cr 5.9   mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih87c07plus100boron.input

```
=sas2h    parm=skipshipdata
Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
'
'mixtures of fuel-pin-cell
44group   latticecell
'
'
uo2  1 den=9.996 1 922
 92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
kr-83  1 0 1-20 922  end
kr-85  1 0 1-20 922  end
y-89   1 0 1-20 922  end
sr-90  1 0 1-20 922  end
zr-93  1 0 1-20 922  end
zr-94  1 0 1-20 922  end
zr-95  1 0 1-20 922  end
nb-94  1 0 1-20 922  end
mo-95  1 0 1-20 922  end
tc-99  1 0 1-20 922  end
ru-101 1 0 1-20 922  end
ru-106 1 0 1-20 922  end
rh-103 1 0 1-20 922  end
rh-105 1 0 1-20 922  end
pd-105 1 0 1-20 922  end
pd-108 1 0 1-20 922  end
ag-109 1 0 1-20 922  end
sb-124 1 0 1-20 922  end
xe-131 1 0 1-20 922  end
xe-132 1 0 1-20 922  end
xe-135 1 0 1-20 922  end
xe-136 1 0 1-20 922  end
cs-134 1 0 1-20 922  end
cs-135 1 0 1-20 922  end
cs-137 1 0 1-20 922  end
ba-136 1 0 1-20 922  end
la-139 1 0 1-20 922  end
pr-141 1 0 1-20 922  end
pr-143 1 0 1-20 922  end
ce-144 1 0 1-20 922  end
nd-143 1 0 1-20 922  end
nd-145 1 0 1-20 922  end
nd-147 1 0 1-20 922  end
pm-147 1 0 1-20 922  end
pm-148 1 0 1-20 922  end
sm-147 1 0 1-20 922  end
sm-149 1 0 1-20 922  end
sm-150 1 0 1-20 922  end
sm-151 1 0 1-20 922  end
sm-152 1 0 1-20 922  end
eu-153 1 0 1-20 922  end
eu-154 1 0 1-20 922  end
eu-155 1 0 1-20 922  end
gd-155 1 0 1-20 922  end
'
arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
      40000 98.18 2 1.0 601   end
h2o 3 den=0.7510  1  561 end
arbm-bormod  0.7510 1 1 0 0 5000 100 3 550.0e-6  561  end
end comp
'
'
squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
'
'
'
'
npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
printlevel=5 lightel=9 inplevel=2 numztotal=5 end
'
'
3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
'
'
power=28.13 burn=215.0 down=388 end
power=39.91 burn=157.0 down=9.0 end
power=39.91 burn=170.0 down=176 end
power=38.99 burn=352.0 down=0 end
power=31.77 burn=28.00 down=1825 end
'
'
  o 135.0  cr 5.9  mn 0.33
  fe 13.0  co 0.075 ni 9.9
  zr 221.0 nb 0.71  sn 3.6
'
end
```

mih86b02.sum

```
0*****************************************************************************
*                                                                           *
*                  SCALE4.3  Bulletin  Board                                *
*                  --------  --------  -----                                *
*                                                                           *
*                    Welcome to SCALE-4.3.                                  *
*                                                                           *
*****************************************************************************
1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
    Mihama-3, 86b02 0, 8.3 GWd/MTU, 86b02, June 97
    '
    '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    '
    '       mixtures of fuel-pin-unitcell:
    '
    44group        latticecell
    '
    '
    uo2  1 den=9.996 1 922
      92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
    kr-83  1 0 1-20 922  end
    kr-85  1 0 1-20 922  end
    y-89   1 0 1-20 922  end
    zr-90  1 0 1-20 922  end
    zr-93  1 0 1-20 922  end
    zr-94  1 0 1-20 922  end
    zr-95  1 0 1-20 922  end
    nb-94  1 0 1-20 922  end
    mo-95  1 0 1-20 922  end
    tc-99  1 0 1-20 922  end
    ru-101 1 0 1-20 922  end
    ru-106 1 0 1-20 922  end
    rh-103 1 0 1-20 922  end
    rh-105 1 0 1-20 922  end
    pd-105 1 0 1-20 922  end
    pd-108 1 0 1-20 922  end
    ag-109 1 0 1-20 922  end
    sb-124 1 0 1-20 922  end
    xe-131 1 0 1-20 922  end
    xe-132 1 0 1-20 922  end
    xe-135 1 0 1-20 922  end
    xe-136 1 0 1-20 922  end
    cs-134 1 0 1-20 922  end
    cs-135 1 0 1-20 922  end
    cs-137 1 0 1-20 922  end
    ba-136 1 0 1-20 922  end
    la-139 1 0 1-20 922  end
    pr-141 1 0 1-20 922  end
    pr-143 1 0 1-20 922  end
    ce-144 1 0 1-20 922  end
    nd-143 1 0 1-20 922  end
    nd-145 1 0 1-20 922  end
    nd-147 1 0 1-20 922  end
    pm-147 1 0 1-20 922  end
    pm-148 1 0 1-20 922  end
    sm-147 1 0 1-20 922  end
    sm-149 1 0 1-20 922  end
    sm-150 1 0 1-20 922  end
    sm-151 1 0 1-20 922  end
    sm-152 1 0 1-20 922  end
    eu-153 1 0 1-20 922  end
    eu-154 1 0 1-20 922  end
    eu-155 1 0 1-20 922  end
    gd-155 1 0 1-20 922  end
    '
    arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
               40000 98.18 2 1.0 600   end
    h2o 3 den=0.7518  1  560 end
    arbm-bormod  0.7518 1 1 0 0 5000 100 3 450.0e-6  560  end
    '
    '    450 ppm boron (wt) in moderator
    '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    end comp
    '
    '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    '
    '     fuel-pin-cell geometry:
    '
    squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end
    '
    '
    '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    '
    '     assembly and cycle parameters:
    '
    npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
    printlevel=5 lightel=9 inplevel=2 numztotal=5 end
    3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
    power=38.61 burn=215 down=1825 end
        o 135.0  cr 5.9  mn 0.33
        fe 11.0 co 0.075 ni 9.9
        zr 221.0 nb 0.71 sn 3.6
    '
    '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    '
1   ssssssssss      aaaaaaaaa      ssssssssss     22222222222    hh         hh
  ssssssssssss    aaaaaaaaaaa    ssssssssssss   2222222222222   hh         hh
  ss        ss   aa         aa   ss        ss  22         22    hh         hh
  ss             aa         aa   ss                    22    hh         hh
  ss             aa         aa   ss                    22    hh         hh
  ssssssssssss   aaaaaaaaaaaaa   ssssssssssss           22    hhhhhhhhhhhhh
   ssssssssssss  aaaaaaaaaaaaa    ssssssssssss        22     hhhhhhhhhhhhh
            ss   aa         aa            ss      22        hh         hh
            ss   aa         aa            ss    22          hh         hh
  ss        ss   aa         aa   ss        ss  22            hh         hh
```



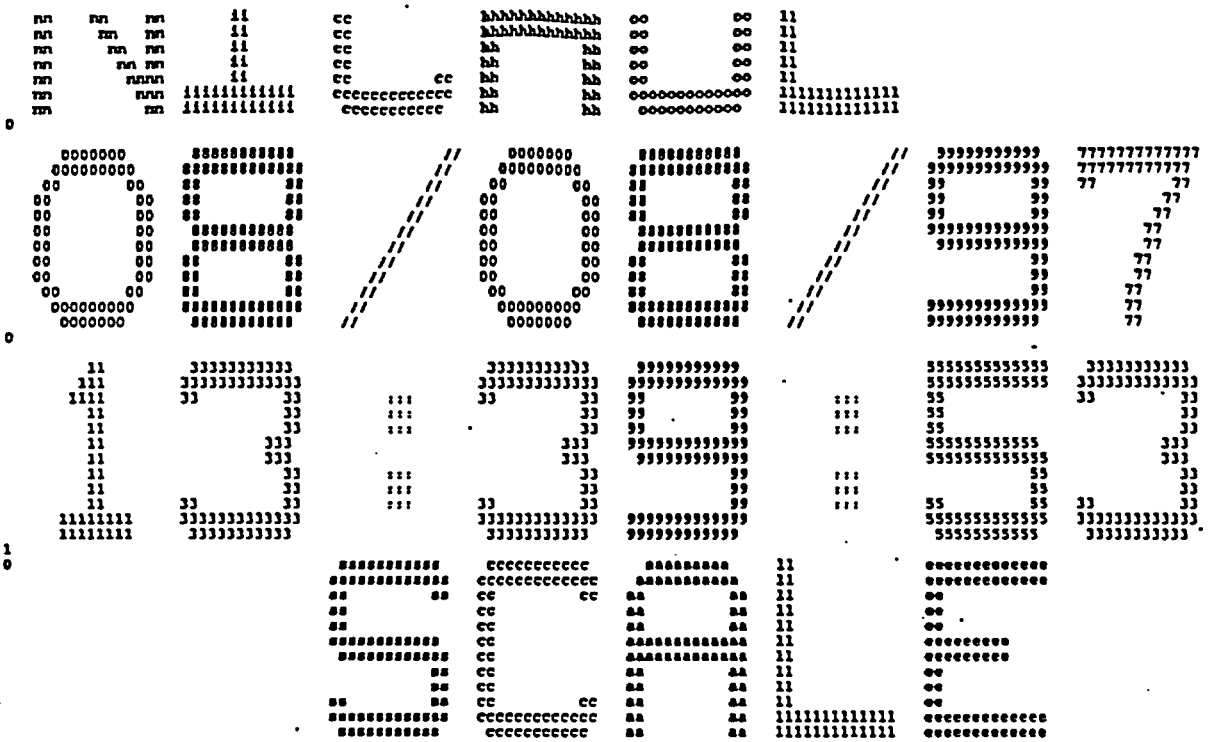
```
program verification information
code system:    scale  version:    4.3

program:  sas2
creation date:  03/07/97
library:  /opt/neut/Scale4.3/bin

this is not a   scale  configuration controlled code

jobname:  nichol
date of execution:  08/08/97
time of execution:  13:29:31
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

          initial  1E-18 d
    o 16  1.35E+05  1.35E+05
total     3.90E+05  3.90E+05

                                  nuclide concentrations, grams
                                  basis =single reactor assembly

          initial  1E-18 d
   u234   2.85E+02  2.85E+02
   u235   3.21E+04  3.21E+04
   u236   2.08E+02  2.08E+02
   u238   9.67E+05  9.67E+05
total     1.00E+06  1.00E+06
                                 basis =
```

0	initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0	initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.64E+00	3.78E+00	3.89E+00	3.90E+00	3.90E+00	3.90E+00	3.90E+00
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	8.06E-04	8.24E-04	8.43E-04	8.62E-04	8.81E-04	9.00E-04	9.19E-04
u234	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02
u235	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04
u236	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03
u238	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05
np237	5.93E+01	6.37E+01	6.37E+01	6.37E+01	6.38E+01	6.38E+01	6.38E+01
pu236	1.97E-05	1.64E-05	1.35E-05	1.10E-05	9.05E-06	7.41E-06	6.08E-06
pu238	4.47E+00	4.66E+00	4.65E+00	4.63E+00	4.60E+00	4.57E+00	4.54E+00
pu238	4.47E+00	4.66E+00	4.65E+00	4.63E+00	4.60E+00	4.57E+00	4.54E+00
pu239	2.97E+03	3.05E+03	3.05E+03	3.05E+03	3.05E+03	3.05E+03	3.05E+03
pu240	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02
pu241	1.39E+02	1.33E+02	1.28E+02	1.23E+02	1.18E+02	1.14E+02	1.09E+02
pu242	1.02E+01	1.02E+01	1.02E+01	1.02E+01	1.02E+01	1.02E+01	1.02E+01
am241	1.04E+00	6.51E+00	1.18E+01	1.68E+01	2.16E+01	2.62E+01	3.07E+01
am242m	1.25E-02	1.24E-02	1.24E-02	1.23E-02	1.23E-02	1.22E-02	1.22E-02
am243	4.16E-01	4.19E-01	4.19E-01	4.19E-01	4.19E-01	4.19E-01	4.19E-01
total	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05
0			element concentrations, grams				
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	9.32E+01	2.11E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	2.20E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02
ru101	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
rh103	9.47E+01	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02
ag109	1.05E+01	1.06E+01	1.06E+01	1.06E+01	1.06E+01	1.06E+01	1.06E+01
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	2.52E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02
nd145	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02
sm147	6.78E+00	2.64E+01	4.21E+01	5.48E+01	6.49E+01	7.30E+01	7.96E+01
sm149	1.96E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00
sm150	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01
sm151	8.38E+00	8.56E+00	8.51E+00	8.45E+00	8.40E+00	8.34E+00	8.29E+00
eu151	8.51E-03	6.36E-02	1.18E-01	1.73E-01	2.27E-01	2.80E-01	3.34E-01
sm152	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.52E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01
gd155	4.78E-03	9.80E-02	1.80E-01	2.53E-01	3.18E-01	3.75E-01	4.25E-01
total	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03

mih86b03.sum

```
0*************************************************************************
*                                                                       *
*                  SCALE4.3  Bulletin  Board                            *
*                  --------  --------  -----                            *
*                                                                       *
*                    Welcome to SCALE-4.3.                              *
*                                                                       *
*                                                                       *
*************************************************************************
1         primary module access and input record [ scale driver - 95/03/29 - 09:06:37 ]
-   module sas2h    will be called
     Mihama-3, 1, 6.92 GWd/MTU, 86b03, June 97
     '
     '
     '   mixtures of fuel-pin-cell
     '
     '
     '
     44group    latticecell
     '
     '
     '
     uo2  1 den=9.996 1 922
       92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
     kr-83   1 0 1-20 922  end
     kr-85   1 0 1-20 922  end
     y-89    1 0 1-20 922  end
     zr-90   1 0 1-20 922  end
     zr-93   1 0 1-20 922  end
     zr-94   1 0 1-20 922  end
     zr-95   1 0 1-20 922  end
     nb-94   1 0 1-20 922  end
     mo-95   1 0 1-20 922  end
     tc-99   1 0 1-20 922  end
     ru-101  1 0 1-20 922  end
     ru-106  1 0 1-20 922  end
     rh-103  1 0 1-20 922  end
     rh-105  1 0 1-20 922  end
     pd-105  1 0 1-20 922  end
     pd-108  1 0 1-20 922  end
     ag-109  1 0 1-20 922  end
     sb-124  1 0 1-20 922  end
     xe-131  1 0 1-20 922  end
     xe-132  1 0 1-20 922  end
     xe-135  1 0 1-20 922  end
     xe-136  1 0 1-20 922  end
     cs-134  1 0 1-20 922  end
     cs-135  1 0 1-20 922  end
     cs-137  1 0 1-20 922  end
     ba-136  1 0 1-20 922  end
     la-139  1 0 1-20 922  end
     pr-141  1 0 1-20 922  end
     pr-143  1 0 1-20 922  end
     ce-144  1 0 1-20 922  end
     nd-143  1 0 1-20 922  end
     nd-145  1 0 1-20 922  end
     nd-147  1 0 1-20 922  end
     pm-147  1 0 1-20 922  end
     pm-148  1 0 1-20 922  end
     sm-147  1 0 1-20 922  end
     sm-149  1 0 1-20 922  end
     sm-250  1 0 1-20 922  end
     sm-151  1 0 1-20 922  end
     sm-152  1 0 1-20 922  end
     eu-153  1 0 1-20 922  end
     eu-154  1 0 1-20 922  end
     eu-155  1 0 1-20 922  end
     gd-155  1 0 1-20 922  end
     '
     arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                40000 98.18 2 1.0 634   end
     h2o 3 den=0.6788  1  596 end
     arbm-borwod  0.6788 1 1 0 0 5000 100 3 450.0e-6  596  end
     end comp
     '
     squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
     '
     npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
     printlevel=5 lightel=9 inplevel=2 numxtotal=5 end
     '
     3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
     '
     power=32.20 burn=215 down=1825 end
     '
     '
         o 135.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
     '
     '
1    ###########      #########      ###########     22222222222    kk         kk
     ############    ##########     ############    2222222222222   kk         kk
     ##         ##   ##        ##   ##         ##   22          22   kk         kk
     ##              ##        ##   ##              22          22   kk         kk
     ##              ##        ##   ##              22          22   kk         kk
     ############    ##########     ############              22    kkkkkkkkkkkkkk
      ############   ##########     ############             22     kkkkkkkkkkkkkk
                ##   ##        ##   ##                     22       kk         kk
                ##   ##        ##   ##                 22           kk         kk
     ##         ##   ##        ##   ##         ##   22             kk         kk
     ############    ##        ##   ############    2222222222222   kk         kk
      ###########    ##        ##    ###########    2222222222222   kk         kk
0

     nn          nn  iiiiiiiiiiii     cccccccccc    kk         kk    oooooooooo    ll
     nnn         nn  iiiiiiiiiiii    cccccccccccc   kk         kk   oooooooooooo   ll
     nnnn        nn      ii         cc          cc   kk         kk   oo        oo   ll
     nn nn       nn      ii         cc               kk         kk   oo        oo   ll
     nn  nn      nn      ii         cc               kk         kk   oo        oo   ll
```



```
                    program verification information
                  code system:    scale  version:    4.3

                        program:  sas2
                  creation date:  03/07/97
                        library:  /opt/neut/Scale4.3/bin
   this is not a   scale  configuration controlled code
                        jobname:  nichol
   date of execution:  08/08/97
   time of execution:  13:39:53
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
              initial  1E-18 d
    o 16   1.35E+05  1.35E+05
  total    3.90E+05  3.90E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
              initial  1E-18 d
    u234   2.85E+02  2.85E+02
    u235   3.21E+04  3.21E+04
    u236   2.08E+02  2.08E+02
    u238   9.67E+05  9.67E+05
  total    1.00E+06  1.00E+06
                                  basis =
                 initial        10.8 d         21.5 d         32.3 d         43.0 d         43.0 d
                 initial        10.8 d         21.5 d         32.3 d         43.0 d         43.0 d
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
              initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    o 16   1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
              initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
   mo 95   1.46E+00  3.35E+00  3.45E+00  3.46E+00  3.46E+00  3.46E+00  3.46E+00
  total    3.90E+05  3.90E+05  3.90E+05  3.90E+05  3.90E+05  3.90E+05  3.90E+05
```

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	7.30E-04	7.46E-04	7.61E-04	7.77E-04	7.93E-04	8.09E-04	8.24E-04
u234	2.57E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02	2.57E+02
u235	2.48E+04	2.48E+04	2.48E+04	2.48E+04	2.48E+04	2.48E+04	2.48E+04
u236	1.53E+03	1.53E+03	1.53E+03	1.53E+03	1.53E+03	1.53E+03	1.53E+03
u238	9.63E+05	9.63E+05	9.63E+05	9.63E+05	9.63E+05	9.63E+05	9.63E+05
np237	4.92E+01	5.27E+01	5.27E+01	5.27E+01	5.27E+01	5.28E+01	5.28E+01
pu236	1.44E-05	1.20E-05	9.80E-06	8.03E-06	6.58E-06	5.39E-06	4.42E-06
pu238	3.26E+00	3.39E+00	3.38E+00	3.36E+00	3.34E+00	3.32E+00	3.30E+00
pu239	3.26E+00	3.39E+00	3.38E+00	3.36E+00	3.34E+00	3.32E+00	3.30E+00
pu239	2.75E+03	2.81E+03	2.81E+03	2.81E+03	2.81E+03	2.81E+03	2.81E+03
pu240	3.47E+02	3.47E+02	3.47E+02	3.47E+02	3.47E+02	3.47E+02	3.47E+02
pu241	1.04E+02	9.98E+01	9.59E+01	9.21E+01	8.84E+01	8.50E+01	8.16E+01
pu242	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00	6.26E+00
am241	7.77E-01	4.87E+00	8.79E+00	1.26E+01	1.62E+01	1.96E+01	2.30E+01
am242m	8.79E-03	8.75E-03	8.72E-03	8.68E-03	8.65E-03	8.61E-03	8.58E-03
am243	2.25E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
total	9.92E+05	9.92E+05	9.92E+05	9.92E+05	9.92E+05	9.92E+05	9.92E+05

element concentrations, grams
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	7.79E+01	1.77E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02	1.82E+02

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	1.84E+02	1.87E+02	1.87E+02	1.87E+02	1.87E+02	1.87E+02	1.87E+02
ru101	1.62E+02	1.62E+02	1.62E+02	1.62E+02	1.62E+02	1.62E+02	1.62E+02
rh103	7.93E+01	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02
ag109	8.25E+00	8.31E+00	8.31E+00	8.31E+00	8.31E+00	8.31E+00	8.31E+00

nuclide concentrations, grams
basis =single reactor assembly

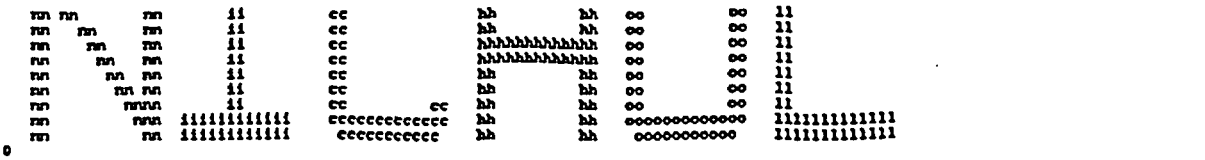
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	2.14E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02
nd145	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02	1.67E+02
sm147	5.77E+00	2.24E+01	3.58E+01	4.65E+01	5.52E+01	6.21E+01	6.76E+01
sm149	2.01E+00	2.95E+00	2.95E+00	2.95E+00	2.95E+00	2.95E+00	2.95E+00
sm150	5.26E+01	5.26E+01	5.26E+01	5.26E+01	5.26E+01	5.26E+01	5.26E+01
sm151	8.34E+00	8.47E+00	8.42E+00	8.37E+00	8.31E+00	8.26E+00	8.21E+00
eu151	9.57E-03	6.41E-02	1.18E-01	1.72E-01	2.26E-01	2.79E-01	3.32E-01
sm152	2.67E+01	2.67E+01	2.67E+01	2.67E+01	2.67E+01	2.67E+01	2.67E+01

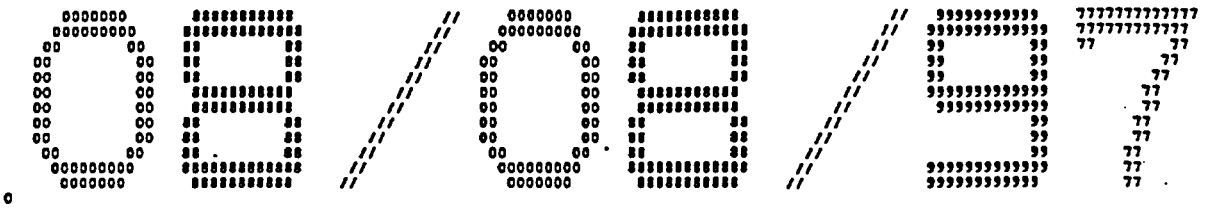
nuclide concentrations, grams
basis =single reactor assembly

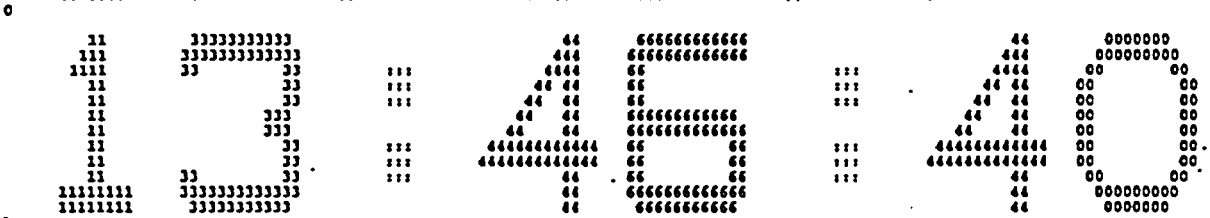
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.21E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.23E+01	1.21E+01
gd155	5.26E-03	8.49E-02	1.55E-01	2.17E-01	2.72E-01	3.21E-01	3.64E-01
total	7.19E+03	7.19E+03	7.19E+03	7.19E+03	7.19E+03	7.19E+03	7.19E+03

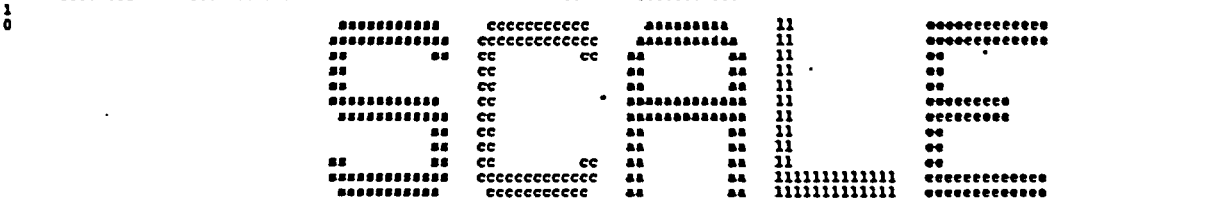
mih86g03.sum

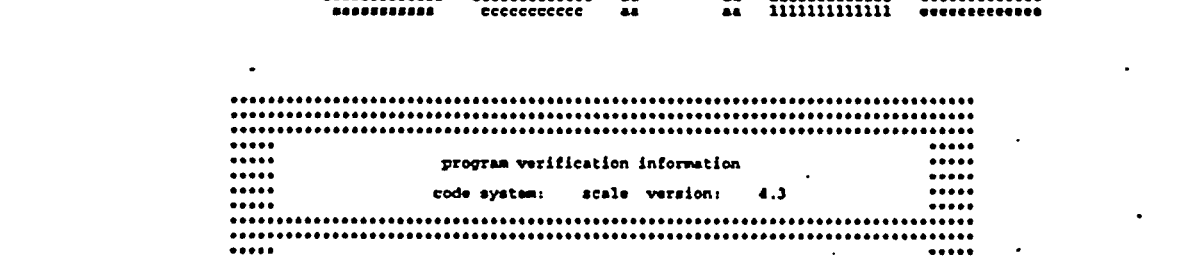
```
0*****************************************************************************
 *                                                                           *
 *                    SCALE4.3  Bulletin  Board                              *
 *                    --------  --------  -----                              *
 *                                                                           *
 *                      Welcome to SCALE-4.3.                                *
 *                                                                           *
 *****************************************************************************
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-    module sas2h    will be called
      mihama-3, 3, 21.29 GWd/MTU, 86g03, June 97
      '
      'mixtures of fuel-pin-cell
      44group    latticecell
      '
      '
      uo2  1 den=9.996 1 933
        92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
      kr-83  1 0 1-20 922  end
      kr-85  1 0 1-20 922  end
      y-89   1 0 1-20 922  end
      sr-90  1 0 1-20 922  end
      zr-93  1 0 1-20 922  end
      zr-94  1 0 1-20 922  end
      zr-95  1 0 1-20 922  end
      nb-94  1 0 1-20 922  end
      mo-95  1 0 1-20 922  end
      tc-99  1 0 1-20 922  end
      ru-101 1 0 1-20 922  end
      ru-106 1 0 1-20 922  end
      rh-103 1 0 1-20 922  end
      rh-105 1 0 1-20 922  end
      pd-105 1 0 1-20 922  end
      pd-108 1 0 1-20 922  end
      ag-109 1 0 1-20 922  end
      sb-124 1 0 1-20 922  end
      xe-131 1 0 1-20 922  end
      xe-132 1 0 1-20 922  end
      xe-135 1 0 1-20 922  end
      xe-136 1 0 1-20 922  end
      cs-134 1 0 1-20 922  end
      cs-135 1 0 1-20 922  end
      cs-137 1 0 1-20 922  end
      ba-136 1 0 1-20 922  end
      la-139 1 0 1-20 922  end
      pr-141 1 0 1-20 922  end
      pr-143 1 0 1-20 922  end
      ce-144 1 0 1-20 922  end
      nd-143 1 0 1-20 922  end
      nd-145 1 0 1-20 922  end
      nd-147 1 0 1-20 922  end
      pm-147 1 0 1-20 922  end
      pm-148 1 0 1-20 922  end
      sm-147 1 0 1-20 922  end
      sm-149 1 0 1-20 922  end
      sm-150 1 0 1-20 922  end
      sm-151 1 0 1-20 922  end
      sm-152 1 0 1-20 922  end
      eu-153 1 0 1-20 922  end
      eu-154 1 0 1-20 922  end
      eu-155 1 0 1-20 922  end
      gd-155 1 0 1-20 922  end
      '
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 625   end
      h2o 3 den=0.6995  1  585 end
      arbm-boxmod  0.6995 1 1 0 0 5000 100 3 450.0e-6  585  end
      end comp
      '
      '
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      '
      '
      '
      '
      npin/assm=204 fuelnght=820.74 ncycles=3 nlib/cyc=5
      printlevel=5 lightel=9 inplevel=2 numztotal=5 end
      '
      '
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      '
      '
      power=31.95 burn=215.0 down=388 end
      power=44.10 burn=157.0 down=9.0 end
      power=44.10 burn=170.0 down=1825 end
      '
      '
          o 135.0  cr 5.9   mn 0.33
          fe 13.0  co 0.075 ni 9.9
          zr 221.0 nb 0.71  sn 3.6
      '
1   ############      ##########      ############     22222222222    hh          hh
    ##############    ##########      ##############   2222222222222  hh          hh
    ##          ##    ##      ##      ##          ##   22          22  hh          hh
    ##              ##          ##    ##                          22  hh          hh
    ##              ##          ##    ##                          22  hh          hh
    ############    ##############    ############             22     hhhhhhhhhhhhhh
     ############   ##############     ############          22        hhhhhhhhhhhhhh
                ##  ##          ##                    ##    22          hh          hh
                ##  ##          ##                  22      22          hh          hh
    ##          ##  ##          ##    ##          22        22          hh          hh
    ##############  ##          ##    ##############  2222222222222    hh          hh
     ############   ##          ##     ############   2222222222222    hh          hh
0

    mm          mm  iiiiiiiiiiii      cccccccccc     hh          hh     oooooooooo     11
    mmm         mm  iiiiiiiiiiii     cccccccccccc    hh          hh    oooooooooooo    11
    mmmm        mm      ii          cc          cc   hh          hh    oo          oo  11
```

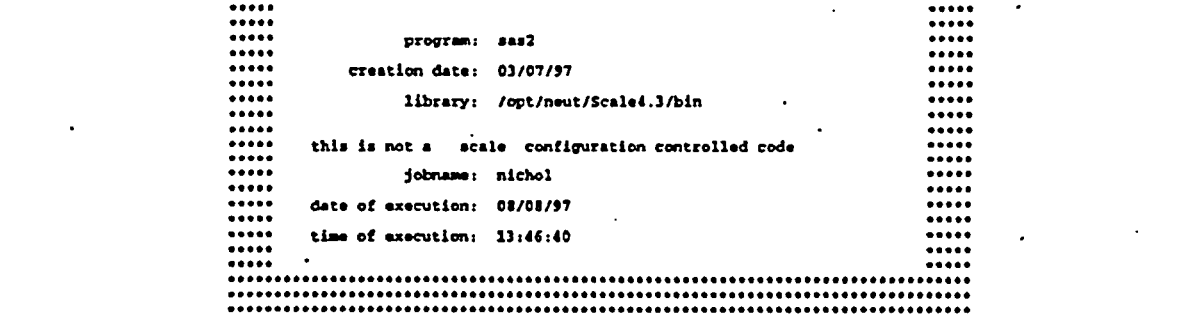












```
1
0
0                                  nuclide concentrations, grams
                                   basis =single reactor assembly

             initial  1E-18 d
    o 16  1.35E+05  1.35E+05
   total  3.90E+05  3.90E+05
0                                  nuclide concentrations, grams
                                   basis =single reactor assembly

             initial  1E-18 d
    u234  2.85E+02  2.85E+02
    u235  3.20E+04  3.20E+04
    u236  1.09E+02  1.09E+02
    u238  9.67E+05  9.67E+05
   total  1.00E+06  1.00E+06
0                                  basis =
0                  initial       10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                  initial       10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                                  nuclide concentrations, grams
                                   basis =single reactor assembly
             initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    o 16  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
0                                  nuclide concentrations, grams
                                   basis =single reactor assembly
             initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    mo 95  7.78E+00  1.10E+01  1.11E+01  1.11E+01  1.11E+01  1.11E+01  1.11E+01
```

tc 99	1.30E-05	1.33E-05	1.33E-05	1.33E-05	1.33E-05	1.33E-05	1.33E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.59E-03	1.66E-03	1.73E-03	1.81E-03	1.88E-03	1.95E-03	2.02E-03
u234	2.05E+02	2.05E+02	2.05E+02	2.05E+02	2.06E+02	2.06E+02	2.06E+02
u235	1.39E+04	1.39E+04	1.39E+04	1.39E+04	1.39E+04	1.39E+04	1.39E+04
u236	3.25E+03	3.25E+03	3.25E+03	3.25E+03	3.25E+03	3.25E+03	3.25E+03
u238	9.52E+05	9.52E+05	9.52E+05	9.52E+05	9.52E+05	9.52E+05	9.52E+05
np237	2.34E+02	2.43E+02	2.43E+02	2.43E+02	2.43E+02	2.44E+02	2.44E+02
pu236	2.24E-04	1.85E-04	1.52E-04	1.24E-04	1.02E-04	8.34E-05	6.84E-05
pu238	4.72E+01	5.07E+01	5.11E+01	5.10E+01	5.08E+01	5.04E+01	5.01E+01
pu238	4.72E+01	5.07E+01	5.11E+01	5.10E+01	5.08E+01	5.04E+01	5.01E+01
pu239	4.87E+03	4.98E+03	4.98E+03	4.98E+03	4.98E+03	4.98E+03	4.98E+03
pu240	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03
pu241	7.81E+02	7.51E+02	7.21E+02	6.93E+02	6.65E+02	6.39E+02	6.14E+02
pu242	1.76E+02	1.76E+02	1.76E+02	1.76E+02	1.76E+02	1.76E+02	1.76E+02
am241	1.45E+01	4.53E+01	7.48E+01	1.03E+02	1.30E+02	1.56E+02	1.81E+02
am242m	2.77E-01	2.76E-01	2.75E-01	2.73E-01	2.72E-01	2.71E-01	2.70E-01
am243	2.25E+01	2.25E+01	2.25E+01	2.25E+01	2.25E+01	2.25E+01	2.25E+01
total	9.78E+05	9.78E+05	9.78E+05	9.78E+05	9.78E+05	9.78E+05	9.78E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	3.79E+02	5.13E+02	5.20E+02	5.20E+02	5.21E+02	5.21E+02	5.21E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	5.40E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02
ru101	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02
rh103	2.81E+02	3.35E+02	3.35E+02	3.35E+02	3.35E+02	3.35E+02	3.35E+02
ag109	4.73E+01	4.75E+01	4.75E+01	4.75E+01	4.75E+01	4.75E+01	4.75E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	5.78E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02
nd145	4.67E+02	4.68E+02	4.68E+02	4.68E+02	4.68E+02	4.68E+02	4.68E+02
sm147	4.48E+01	7.78E+01	1.04E+02	1.25E+02	1.43E+02	1.56E+02	1.67E+02
sm149	2.32E+00	3.99E+00	3.99E+00	3.99E+00	3.99E+00	3.99E+00	3.99E+00
sm150	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02
sm151	1.23E+01	1.25E+01	1.24E+01	1.24E+01	1.23E+01	1.22E+01	1.21E+01
eu151	1.11E-02	9.18E-02	1.72E-01	2.51E-01	3.30E-01	4.09E-01	4.87E-01
sm152	8.84E+01	8.84E+01	8.84E+01	8.84E+01	8.84E+01	8.84E+01	8.84E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	6.15E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01	6.23E+01
gd155	1.54E-02	3.28E-01	6.04E-01	8.48E-01	1.06E+00	1.25E+00	1.42E+00
total	2.19E+04	2.19E+04	2.19E+04	2.19E+04	2.19E+04	2.19E+04	2.19E+04

mih86g05.sum

```
                    SCALE4.3  Bulletin  Board
                    --------  --------  -----

                      Welcome to SCALE-4.3.

1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
      Mihama-3, 2, 15.36 GWd/MTU, 86g05, June 97
      .
      .
      'mixtures of fuel-pin-cell
      44group    latticecell
      .
      .
      uo2  1 den=9.996 1 922
        92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
      kr-83   1 0 1-20 922  end
      kr-85   1 0 1-20 922  end
      y-89    1 0 1-20 922  end
      zr-90   1 0 1-20 922  end
      zr-93   1 0 1-20 922  end
      zr-94   1 0 1-20 922  end
      zr-95   1 0 1-20 922  end
      nb-94   1 0 1-20 922  end
      mo-95   1 0 1-20 922  end
      tc-99   1 0 1-20 922  end
      ru-101  1 0 1-20 922  end
      ru-106  1 0 1-20 922  end
      rh-103  1 0 1-20 922  end
      rh-105  1 0 1-20 922  end
      pd-105  1 0 1-20 922  end
      pd-108  1 0 1-20 922  end
      ag-109  1 0 1-20 922  end
      sb-124  1 0 1-20 922  end
      xe-131  1 0 1-20 922  end
      xe-132  1 0 1-20 922  end
      xe-135  1 0 1-20 922  end
      xe-136  1 0 1-20 922  end
      cs-134  1 0 1-20 922  end
      cs-135  1 0 1-20 922  end
      cs-137  1 0 1-20 922  end
      ba-136  1 0 1-20 922  end
      la-139  1 0 1-20 922  end
      pr-141  1 0 1-20 922  end
      pr-143  1 0 1-20 922  end
      ce-144  1 0 1-20 922  end
      nd-143  1 0 1-20 922  end
      nd-145  1 0 1-20 922  end
      nd-147  1 0 1-20 922  end
      pm-147  1 0 1-20 922  end
      pm-148  1 0 1-20 922  end
      sm-147  1 0 1-20 922  end
      sm-149  1 0 1-20 922  end
      sm-150  1 0 1-20 922  end
      sm-151  1 0 1-20 922  end
      sm-152  1 0 1-20 922  end
      eu-153  1 0 1-20 922  end
      eu-154  1 0 1-20 922  end
      eu-155  1 0 1-20 922  end
      gd-155  1 0 1-20 922  end
      .
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 612   end
      h2o 3 den=0.7298  1  572 end
      arbm-boxmod  0.7298 1 1 0 0 5000 100 3 450.0e-6 .572  end
      end comp
      .
      .
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      .
      .
      .
      mpin/assm=204 fuelnght=820.76 ncycles=3 nlib/cyc=5
      printlevel=5 lightel=9 inplevel=2 numztotal=5 end
      .
      .
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      .
      .
      power=22.99 burn=215.0 down=388 end
      power=31.87 burn=157.0 down=9.0 end
      power=31.87 burn=170.0 down=1825 end
      .
      .
          o 135.0  cr 5.9   mn 0.33
          fe 13.0  co 0.075 ni 9.9
          zr 221.0 nb 0.71  sn 3.6
      .
1   ###########      #########      ###########     2222222222    hh        hh
    ############    ###########    ############   2222222222222  hh        hh
    ##         ##   ##         ##  ##         ##  22         22  hh        hh
    ##             ##         ##  ##             22          22  hh        hh
    ##             ##         ##  ##                         22  hh        hh
    ############   ##############  ############             22    hhhhhhhhhhhhhh
     ############  ##############   ############          22      hhhhhhhhhhhhhh
              ##   ##         ##               ##       22        hh        hh
              ##   ##         ##               ##    22           hh        hh
    ##        ##   ##         ##  ##           ##  22             hh        hh
    ############   ##         ##  ############   2222222222222   hh        hh
     ###########   ##         ##   ###########   2222222222222   hh        hh
0

    nn          nn  iiiiiiiiiiii    eeeeeeeeeee    hh        hh   ooooooooooo    11
    nnn         nn  iiiiiiiiiiii   eeeeeeeeeeeee   hh        hh  ooooooooooooo   11
```

```
NICHOL
0
08/08/97
0
14:16:55
1
0
SCALE

     program verification information

     code system:   scale  version:   4.3

     program:  sas2

     creation date:  03/07/97

     library:  /opt/neut/Scale4.3/bin

     this is not a   scale  configuration controlled code

     jobname:  nichol

     date of execution:  08/08/97

     time of execution:  14:16:55

1
0
0
0                                   nuclide concentrations, grams
                                    basis =single reactor assembly
            initial   1E-18 d
     o 16   1.35E+05  1.35E+05
   total    3.90E+05  3.90E+05
0                                   nuclide concentrations, grams
                                    basis =single reactor assembly
            initial   1E-18 d
     u234   2.85E+02  2.85E+02
     u235   3.20E+04  3.20E+04
     u236   1.09E+02  1.09E+02
     u238   9.67E+05  9.67E+05
   total    1.00E+06  1.00E+06
0                                  basis =
0                  initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                  initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                                   nuclide concentrations, grams
                                    basis =single reactor assembly
            initial   304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
     o 16   1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
0                                   nuclide concentrations, grams
                                    basis =single reactor assembly
```

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	5.34E+00	7.46E+00	7.58E+00	7.58E+00	7.58E+00	7.58E+00	7.58E+00
tc 99	4.03E-06	4.14E-06	4.14E-06	4.14E-06	4.14E-06	4.14E-06	4.14E-06
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.30E-03	1.34E-03	1.39E-03	1.43E-03	1.48E-03	1.52E-03	1.57E-03
u234	2.26E+02	2.26E+02	2.26E+02	2.27E+02	2.27E+02	2.27E+02	2.27E+02
u235	1.77E+04	1.77E+04	1.77E+04	1.77E+04	1.77E+04	1.77E+04	1.77E+04
u236	2.63E+03	2.63E+03	2.63E+03	2.63E+03	2.63E+03	2.63E+03	2.63E+03
u238	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05
np237	1.44E+02	1.49E+02	1.49E+02	1.49E+02	1.49E+02	1.49E+02	1.49E+02
pu236	9.08E-05	7.50E-05	6.15E-05	5.04E-05	4.13E-05	3.38E-05	2.77E-05
pu238	2.07E+01	2.21E+01	2.23E+01	2.22E+01	2.21E+01	2.19E+01	2.18E+01
pu238	2.07E+01	2.21E+01	2.23E+01	2.22E+01	2.21E+01	2.19E+01	2.18E+01
pu239	4.23E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03
pu240	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03
pu241	4.61E+02	4.43E+02	4.25E+02	4.09E+02	3.93E+02	3.77E+02	3.62E+02
pu242	7.04E+01	7.04E+01	7.04E+01	7.04E+01	7.04E+01	7.04E+01	7.04E+01
am241	8.86E+00	2.70E+01	4.44E+01	6.11E+01	7.72E+01	9.25E+01	1.07E+02
am242m	1.53E-01	1.52E-01	1.52E-01	1.51E-01	1.50E-01	1.50E-01	1.49E-01
am243	6.05E+00	6.06E+00	6.06E+00	6.06E+00	6.06E+00	6.06E+00	6.06E+00
total	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	2.81E+02	3.82E+02	3.87E+02	3.87E+02	3.87E+02	3.87E+02	3.87E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	4.00E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02	4.04E+02
ru101	3.60E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02	3.61E+02
rh103	2.07E+02	2.43E+02	2.43E+02	2.43E+02	2.43E+02	2.43E+02	2.43E+02
ag109	2.84E+01	2.85E+01	2.85E+01	2.85E+01	2.85E+01	2.85E+01	2.85E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	4.51E+02	4.74E+02	4.74E+02	4.74E+02	4.74E+02	4.74E+02	4.74E+02
nd145	3.51E+02	3.52E+02	3.52E+02	3.52E+02	3.52E+02	3.52E+02	3.52E+02
sm147	3.67E+01	6.35E+01	8.49E+01	1.02E+02	1.16E+02	1.27E+02	1.36E+02
sm149	2.11E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00
sm150	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02	1.26E+02
sm151	1.05E+01	1.06E+01	1.06E+01	1.05E+01	1.04E+01	1.04E+01	1.03E+01
eu151	1.40E-02	8.24E-02	1.50E-01	2.18E-01	2.85E-01	3.52E-01	4.18E-01
sm152	6.45E+01	6.45E+01	6.45E+01	6.45E+01	6.45E+01	6.45E+01	6.45E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	3.78E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01
gd155	1.23E-02	2.02E-01	3.71E-01	5.19E-01	6.50E-01	7.67E-01	8.69E-01
total	1.59E+04	1.59E+04	1.59E+04	1.59E+04	1.59E+04	1.59E+04	1.59E+04

mih86g07.sum

```
0*************************************************************************
 *                                                                       *
 *                  SCALE4.3  Bulletin  Board                            *
 *                  --------  --------  -----                            *
 *                                                                       *
 *                    Welcome to SCALE-4.3.                              *
 *                                                                       *
 *************************************************************************
1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
      Mihama-3, 2, 14.66 GWd/MTU 86g07, June 97
      '
      '
      'mixtures of fuel-pin-cell
      44group    latticecell
      '
      '
      uo2  1 den=9.996 1 922
        92234 0.0285 92235 3.203 92236 0.0109 92238 96.757  end
      kr-83   1 0 1-20 922  end
      kr-85   1 0 1-20 922  end
      y-89    1 0 1-20 922  end
      sr-90   1 0 1-20 922  end
      sr-93   1 0 1-20 922  end
      sr-94   1 0 1-20 922  end
      sr-95   1 0 1-20 922  end
      nb-94   1 0 1-20 922  end
      mo-95   1 0 1-20 922  end
      tc-99   1 0 1-20 922  end
      ru-101 1 0 1-20 922  end
      ru-106 1 0 1-20 922  end
      rh-103 1 0 1-20 922  end
      rh-105 1 0 1-20 922  end
      pd-105 1 0 1-20 922  end
      pd-108 1 0 1-20 922  end
      ag-109 1 0 1-20 922  end
      sb-124 1 0 1-20 922  end
      xe-131 1 0 1-20 922  end
      xe-132 1 0 1-20 922  end
      xe-135 1 0 1-20 922  end
      xe-136 1 0 1-20 922  end
      cs-134 1 0 1-20 922  end
      cs-135 1 0 1-20 922  end
      cs-137 1 0 1-20 922  end
      ba-136 1 0 1-20 922  end
      la-139 1 0 1-20 922  end
      pr-141 1 0 1-20 922  end
      pr-143 1 0 1-20 922  end
      ce-144 1 0 1-20 922  end
      nd-143 1 0 1-20 922  end
      nd-145 1 0 1-20 922  end
      nd-147 1 0 1-20 922  end
      pm-147 1 0 1-20 922  end
      pm-148 1 0 1-20 922  end
      sm-147 1 0 1-20 922  end
      sm-149 1 0 1-20 922  end
      sm-150 1 0 1-20 922  end
      sm-151 1 0 1-20 922  end
      sm-152 1 0 1-20 922  end
      eu-153 1 0 1-20 922  end
      eu-154 1 0 1-20 922  end
      eu-155 1 0 1-20 922  end
      gd-155 1 0 1-20 922  end
      '
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 625   end
      h2o 3 den=0.6995  1  585 end
      arbm-boxmod  0.6995 1 1 0 0 5000 100 3 450.0e-6  585  end
      end comp
      '
      '
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      '
      '
      '
      npin/assm=204 fuelngbt=820.74 ncycles=3 nlib/cyc=5
      printlevel=5 lightel=9 inplevel=2 numztotal=5 end
      '
      '
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      '
      '
      power=22.00 burn=215.0 down=388 end
      power=30.37 burn=157.0 down=9.0 end
      power=30.37 burn=170.0 down=1825 end
      '
      '
         o 135.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
      '
1   ssssssssssss      aaaaaaaaaa      ssssssssssss     22222222222    hh          hh
    ssssssssssss     aaaaaaaaaaaa     ssssssssssss    2222222222222   hh          hh
    ss          ss   aa          aa   ss          ss  22          22   hh          hh
    ss               aa          aa   ss                      22   hh          hh
    ss               aa          aa   ss                      22   hh          hh
    ssssssssssss     aaaaaaaaaaaaaa   ssssssssssss            22   hhhhhhhhhhhhh
     ssssssssssss    aaaaaaaaaaaaaa    ssssssssssss          22    hhhhhhhhhhhhh
              ss     aa          aa            ss        22       hh          hh
              ss     aa          aa            ss      22         hh          hh
    ss        ss     aa          aa   ss       ss    22           hh          hh
    ssssssssssss     aa          aa   ssssssssssss   2222222222222  hh          hh
     ssssssssssss    aa          aa    ssssssssssss   2222222222222  hh          hh
0
    nn          nn  iiiiiiiiiiii     cccccccccc    hh          hh    oooooooooo    11
    nnn         nn  iiiiiiiiiiii    cccccccccccc   hh          hh   oooooooooooo   11
```

```
NICHOL
0
08/09/97
0
14:44:10
1
0
SCALE
```

```
**********************************************************************
*****                                                            *****
*****              program verification information              *****
*****                                                            *****
*****              code system:   scale  version:   4.3          *****
*****                                                            *****
**********************************************************************
*****                                                            *****
*****              program:  sas2                                *****
*****                                                            *****
*****        creation date:  03/07/97                            *****
*****                                                            *****
*****              library:  /opt/neut/Scale4.3/bin              *****
*****                                                            *****
*****   this is not a  scale  configuration controlled code      *****
*****                                                            *****
*****              jobname:  nichol                              *****
*****                                                            *****
*****    date of execution:  08/09/97                            *****
*****                                                            *****
*****    time of execution:  14:44:10                            *****
*****                                                            *****
**********************************************************************
```

```
1
0
0
0                                             nuclide concentrations, grams
                                              basis =single reactor assembly
           initial  1E-18 d
     o 16  1.35E+05  1.35E+05
   total   3.90E+05  3.90E+05
0                                             nuclide concentrations, grams
                                              basis =single reactor assembly
           initial  1E-18 d
     u234  2.85E+02  2.85E+02
     u235  3.20E+04  3.20E+04
     u236  1.09E+02  1.09E+02
     u238  9.67E+05  9.67E+05
   total   1.00E+06  1.00E+06
0                                            basis =
0                 initial         10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                 initial         10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
0                                             nuclide concentrations, grams
                                              basis =single reactor assembly
           initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
     o 16  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
0                                             nuclide concentrations, grams
                                              basis =single reactor assembly
```

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	5.23E+00	7.30E+00	7.41E+00	7.41E+00	7.42E+00	7.42E+00	7.42E+00
tc 99	3.83E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.29E-03	1.33E-03	1.37E-03	1.42E-03	1.46E-03	1.50E-03	1.54E-03
u234	2.28E+02	2.28E+02	2.28E+02	2.28E+02	2.29E+02	2.29E+02	2.29E+02
u235	1.83E+04	1.83E+04	1.83E+04	1.83E+04	1.83E+04	1.83E+04	1.83E+04
u236	2.54E+03	2.54E+03	2.54E+03	2.54E+03	2.54E+03	2.54E+03	2.54E+03
u238	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05	9.57E+05
np237	1.38E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02	1.43E+02
pu236	8.46E-05	6.99E-05	5.73E-05	4.70E-05	3.85E-05	3.15E-05	2.58E-05
pu238	1.93E+01	2.05E+01	2.07E+01	2.06E+01	2.05E+01	2.04E+01	2.03E+01
pu238	1.93E+01	2.05E+01	2.07E+01	2.06E+01	2.05E+01	2.04E+01	2.03E+01
pu239	4.22E+03	4.29E+03	4.29E+03	4.29E+03	4.29E+03	4.29E+03	4.29E+03
pu240	9.70E+02	9.70E+02	9.70E+02	9.70E+02	9.69E+02	9.69E+02	9.69E+02
pu241	4.41E+02	4.24E+02	4.07E+02	3.91E+02	3.76E+02	3.61E+02	3.47E+02
pu242	6.33E+01	6.33E+01	6.33E+01	6.33E+01	6.33E+01	6.33E+01	6.33E+01
am241	8.55E+00	2.59E+01	4.26E+01	5.86E+01	7.39E+01	8.86E+01	1.03E+02
am242m	1.49E-01	1.48E-01	1.47E-01	1.47E-01	1.46E-01	1.46E-01	1.45E-01
am243	5.32E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00
total	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05	9.84E+05

0
element concentrations, grams
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	2.69E+02	3.65E+02	3.70E+02	3.70E+02	3.70E+02	3.70E+02	3.70E+02

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	3.82E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02	3.86E+02
ru101	3.44E+02	3.44E+02	3.44E+02	3.44E+02	3.44E+02	3.44E+02	3.44E+02
rh103	1.98E+02	2.33E+02	2.33E+02	2.33E+02	2.33E+02	2.33E+02	2.33E+02
ag109	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01	2.69E+01

0
nuclide concentrations, grams
basis =single reactor assembly

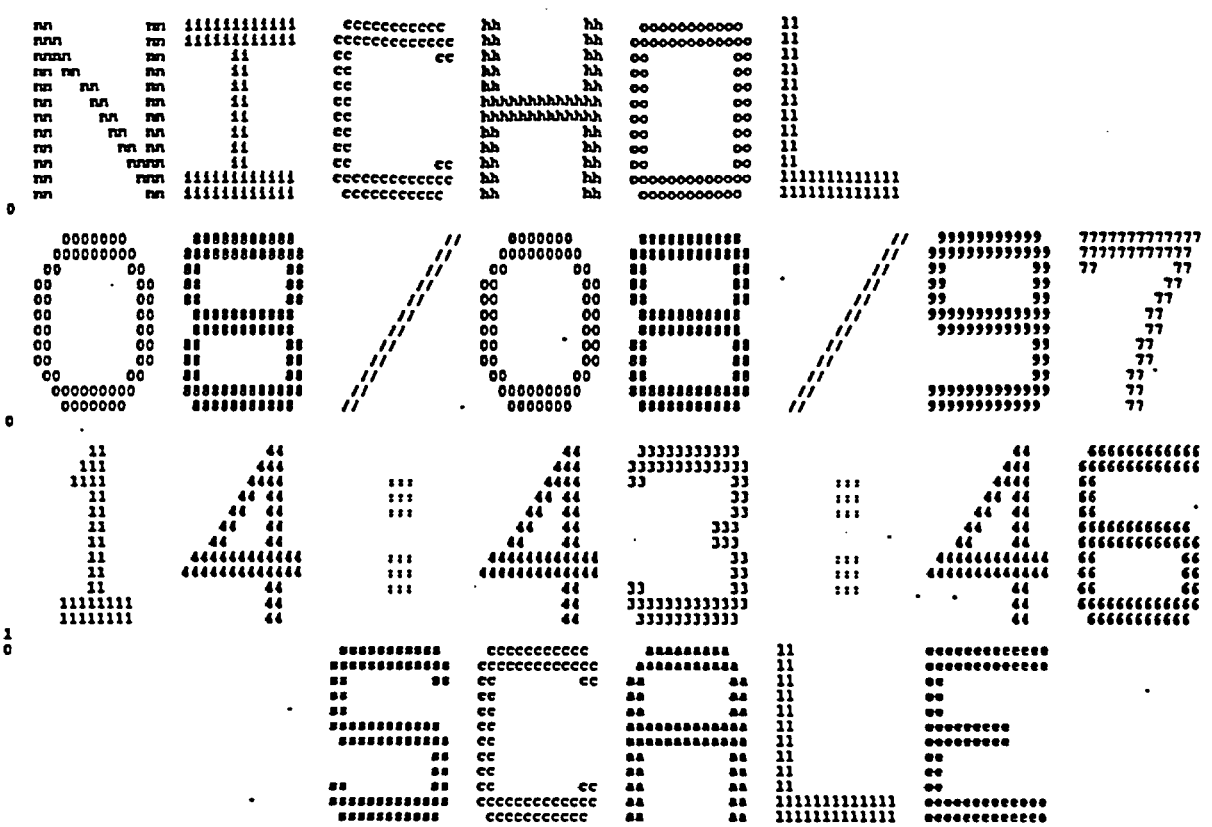
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	4.34E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02	4.56E+02
nd145	3.36E+02	3.36E+02	3.36E+02	3.36E+02	3.36E+02	3.36E+02	3.36E+02
sm147	3.53E+01	6.11E+01	8.17E+01	9.83E+01	1.12E+02	1.22E+02	1.31E+02
sm149	2.16E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00	3.17E+00
sm150	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02
sm151	1.07E+01	1.08E+01	1.08E+01	1.07E+01	1.06E+01	1.05E+01	1.05E+01
eu151	1.52E-02	8.48E-02	1.54E-01	2.23E-01	2.91E-01	3.59E-01	4.26E-01
sm152	6.12E+01	6.12E+01	6.12E+01	6.12E+01	6.12E+01	6.12E+01	6.12E+01

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	3.56E+01	3.60E+01	3.60E+01	3.60E+01	3.60E+01	3.60E+01	3.60E+01
gd155	1.26E-02	1.91E-01	3.49E-01	4.89E-01	6.12E-01	7.21E-01	8.17E-01
total	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04

mih87c03.sum

```
                    SCALE4.3  Bulletin  Board
                    --------  --------  -----

                      Welcome to SCALE-4.3.

1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
      Mihama-3, 5, 29.5 GWd/MTU  87c03, June 97
      .
      .
      .
      .   mixtures of fuel pin cell
      .
      44group    latticecell
      .
      .
      .
      uo2  1 den=9.996 1 922
        92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
      kr-83  1 0 1-20 922  end
      kr-85  1 0 1-20 922  end
      y-89   1 0 1-20 922  end
      sr-90  1 0 1-20 922  end
      zr-93  1 0 1-20 922  end
      zr-94  1 0 1-20 922  end
      zr-95  1 0 1-20 922  end
      nb-94  1 0 1-20 922  end
      mo-95  1 0 1-20 922  end
      tc-99  1 0 1-20 922  end
      ru-101 1 0 1-20 922  end
      ru-106 1 0 1-20 922  end
      rh-103 1 0 1-20 922  end
      rh-105 1 0 1-20 922  end
      pd-105 1 0 1-20 922  end
      pd-108 1 0 1-20 922  end
      ag-109 1 0 1-20 922  end
      sb-124 1 0 1-20 922  end
      xe-131 1 0 1-20 922  end
      xe-132 1 0 1-20 922  end
      xe-135 1 0 1-20 922  end
      xe-136 1 0 1-20 922  end
      cs-134 1 0 1-20 922  end
      cs-135 1 0 1-20 922  end
      cs-137 1 0 1-20 922  end
      ba-136 1 0 1-20 922  end
      la-139 1 0 1-20 922  end
      pr-141 1 0 1-20 922  end
      pr-143 1 0 1-20 922  end
      ce-144 1 0 1-20 922  end
      nd-143 1 0 1-20 922  end
      nd-145 1 0 1-20 922  end
      nd-147 1 0 1-20 922  end
      pm-147 1 0 1-20 922  end
      pm-148 1 0 1-20 922  end
      sm-147 1 0 1-20 922  end
      sm-149 1 0 1-20 922  end
      sm-150 1 0 1-20 922  end
      sm-151 1 0 1-20 922  end
      sm-152 1 0 1-20 922  end
      eu-153 1 0 1-20 922  end
      eu-154 1 0 1-20 922  end
      eu-155 1 0 1-20 922  end
      gd-155 1 0 1-20 922  end
      .
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 600   end
      h2o 3 den=0.7518  1  560 end
      arbm-bormod  0.7518 1 1 0 0 5000 100 3 450.0e-6  560  end
      end comp
      .
      .
      .
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      .
      .
      .
      npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
      printlevel=5 lightel=9 implevel=2 numztotal=5 end
      .
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      .
      power=24.61 burn=215.0 down=388 end
      power=34.92 burn=157.0 down=9.0 end
      power=34.92 burn=170.0 down=176 end
      power=34.15 burn=352.0 down=0 end
      power=27.47 burn=28.00 down=1825 end
      .
      .
         o 135.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
      .
1   ############      ##########      ############     2222222222    hh         hh
  ##############    ############    ##############   2222222222222   hh         hh
  ##          ##    ##        ##    ##          ##   22        22    hh         hh
  ##                ##        ##    ##                        22    hh         hh
  ##                ##        ##    ##                        22    hh         hh
  ############      ##########      ##############          22      hhhhhhhhhhhhh
   ############     ##########      ##############        22        hhhhhhhhhhhhh
               ##   ##        ##                ##     22           hh         hh
               ##   ##        ##                ##  22              hh         hh
  ##           ##   ##        ##    ##          ##  22              hh         hh
  ##############    ##        ##    ##############   2222222222222   hh         hh
   ############     ##        ##     ############    2222222222222   hh         hh
```



```
                    program verification information
                    code system:    scale  version:    4.3

                program:  sas2
            creation date:  03/07/97
                library:  /opt/neut/Scale4.3/bin

    this is not a   scale  configuration controlled code
                jobname:  nichol
    date of execution:  08/08/97
    time of execution:  14:43:46
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

              initial  1E-18 d
    o 16    1.35E+05  1.35E+05
  total     3.90E+05  3.90E+05

                                  nuclide concentrations, grams
                                  basis =single reactor assembly

              initial  1E-18 d
    u234    2.95E+02  2.95E+02
    u235    3.21E+04  3.21E+04
    u236    3.27E+02  3.27E+02
    u238    9.67E+05  9.67E+05
  total     1.00E+06  1.00E+06
                                  basis =
                initial       10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                initial       10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                                  nuclide concentrations, grams
```

basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.25E+01	1.51E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01
tc 99	3.31E-05	3.35E-05	3.35E-05	3.35E-05	3.35E-05	3.35E-05	3.35E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.79E-03	1.90E-03	2.02E-03	2.13E-03	2.24E-03	2.36E-03	2.47E-03
u234	1.86E+02	1.86E+02	1.87E+02	1.88E+02	1.89E+02	1.89E+02	1.90E+02
u235	9.40E+03	9.40E+03	9.40E+03	9.40E+03	9.40E+03	9.40E+03	9.40E+03
u236	4.08E+03	4.08E+03	4.08E+03	4.08E+03	4.08E+03	4.08E+03	4.08E+03
u238	9.46E+05	9.46E+05	9.46E+05	9.46E+05	9.46E+05	9.46E+05	9.46E+05
np237	3.71E+02	3.78E+02	3.78E+02	3.79E+02	3.79E+02	3.79E+02	3.79E+02
pu236	4.87E-04	4.01E-04	3.29E-04	2.69E-04	2.21E-04	1.81E-04	1.48E-04
pu238	1.08E+02	1.16E+02	1.17E+02	1.17E+02	1.16E+02	1.16E+02	1.15E+02
pu238	1.08E+02	1.16E+02	1.17E+02	1.17E+02	1.16E+02	1.16E+02	1.15E+02
pu239	5.04E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03
pu240	2.05E+03	2.05E+03	2.05E+03	2.05E+03	2.05E+03	2.05E+03	2.05E+03
pu241	1.07E+03	1.03E+03	9.90E+02	9.51E+02	9.14E+02	8.78E+02	8.43E+02
pu242	3.81E+02	3.81E+02	3.81E+02	3.81E+02	3.81E+02	3.81E+02	3.81E+02
am241	3.36E+01	7.59E+01	1.16E+02	1.55E+02	1.93E+02	2.28E+02	2.63E+02
am242m	6.35E-01	6.33E-01	6.30E-01	6.27E-01	6.25E-01	6.22E-01	6.20E-01
am243	6.57E+01	6.58E+01	6.58E+01	6.57E+01	6.57E+01	6.57E+01	6.57E+01
total	9.69E+05	9.69E+05	9.69E+05	9.69E+05	9.69E+05	9.69E+05	9.69E+05

0
element concentrations, grams
0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	5.91E+02	6.89E+02	6.95E+02	6.95E+02	6.95E+02	6.95E+02	6.95E+02

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	7.26E+02	7.29E+02	7.29E+02	7.29E+02	7.29E+02	7.29E+02	7.29E+02
ru101	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02
rh103	3.97E+02	4.39E+02	4.39E+02	4.39E+02	4.39E+02	4.39E+02	4.39E+02
ag109	7.46E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01	7.47E+01

0
nuclide concentrations, grams
basis =single reactor assembly

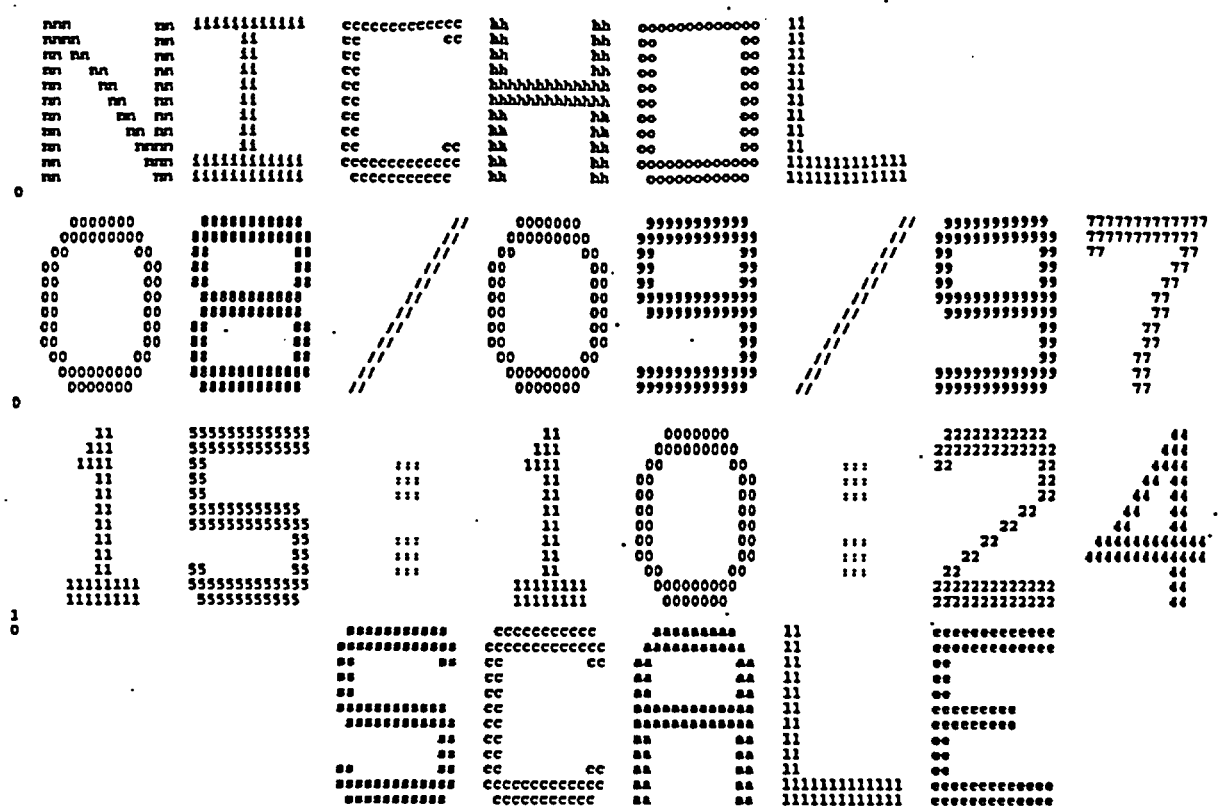
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	7.33E+02	7.52E+02	7.52E+02	7.52E+02	7.52E+02	7.52E+02	7.52E+02
nd145	6.19E+02	6.19E+02	6.19E+02	6.19E+02	6.19E+02	6.19E+02	6.19E+02
sm147	8.03E+01	1.15E+02	1.41E+02	1.66E+02	1.84E+02	1.98E+02	2.10E+02
sm149	2.06E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00
sm150	2.56E+02	2.56E+02	2.56E+02	2.56E+02	2.56E+02	2.56E+02	2.56E+02
sm151	1.27E+01	1.28E+01	1.27E+01	1.27E+01	1.26E+01	1.25E+01	1.24E+01
eu151	1.45E-02	9.70E-02	1.79E-01	2.60E-01	3.41E-01	4.22E-01	5.02E-01
sm152	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02	1.20E+02

0
nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	9.78E+01	9.85E+01	9.85E+01	9.85E+01	9.85E+01	9.85E+01	9.85E+01
gd155	3.50E-02	5.54E-01	1.01E+00	1.42E+00	1.78E+00	2.09E+00	2.37E+00
total	3.03E+04	3.03E+04	3.03E+04	3.03E+04	3.03E+04	3.03E+04	3.03E+04

mih87c04.sum

```
0**********************************************************************
*                                                                    *
*                  SCALE4.3  Bulletin  Board                         *
*                  --------  --------  -----                         *
*                                                                    *
*                    Welcome to SCALE-4.3.                           *
*                                                                    *
**********************************************************************
1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
      Mihama-3, 6, 32.2 GWd/MTU, 87c04, June 97
      '
      'mixtures of fuel-pin-cell
      44group    latticecell
      '
      '
      uo2  1 den=9.996 1 922
        92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
      kr-83   1 0 1-20 922  end
      kr-85   1 0 1-20 922  end
      y-89    1 0 1-20 922  end
      zr-90   1 0 1-20 922  end
      zr-93   1 0 1-20 922  end
      zr-94   1 0 1-20 922  end
      zr-95   1 0 1-20 922  end
      nb-94   1 0 1-20 922  end
      mo-95   1 0 1-20 922  end
      tc-99   1 0 1-20 922  end
      ru-101  1 0 1-20 922  end
      ru-106  1 0 1-20 922  end
      rh-103  1 0 1-20 922  end
      rh-105  1 0 1-20 922  end
      pd-105  1 0 1-20 922  end
      pd-108  1 0 1-20 922  end
      ag-109  1 0 1-20 922  end
      sb-124  1 0 1-20 922  end
      xe-131  1 0 1-20 922  end
      xe-132  1 0 1-20 922  end
      xe-135  1 0 1-20 922  end
      xe-136  1 0 1-20 922  end
      cs-134  1 0 1-20 922  end
      cs-135  1 0 1-20 922  end
      cs-137  1 0 1-20 922  end
      ba-136  1 0 1-20 922  end
      la-139  1 0 1-20 922  end
      pr-141  1 0 1-20 922  end
      pr-143  1 0 1-20 922  end
      ce-144  1 0 1-20 922  end
      nd-143  1 0 1-20 922  end
      nd-145  1 0 1-20 922  end
      nd-147  1 0 1-20 922  end
      pm-147  1 0 1-20 922  end
      pm-148  1 0 1-20 922  end
      sm-147  1 0 1-20 922  end
      sm-149  1 0 1-20 922  end
      sm-150  1 0 1-20 922  end
      sm-151  1 0 1-20 922  end
      sm-152  1 0 1-20 922  end
      eu-153  1 0 1-20 922  end
      eu-154  1 0 1-20 922  end
      eu-155  1 0 1-20 922  end
      gd-155  1 0 1-20 922  end
      '
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 607   end
      h2o 3 den=0.7390  1   567 end
      arbm-borsod  0.7390 1 1 0 0 5000 100 3 450.0e-6  567  end
      end comp
      '
      '
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      '
      '
      '
      '
      npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
      printlevel=5 lightel=9 inplevel=2 numxtotal=5 end
      '
      '
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      '
      '
      power=26.87 burn=215.0 down=388 end
      power=38.12 burn=157.0 down=9.0 end
      power=38.12 burn=170.0 down=176 end
      power=37.25 burn=352.0 down=0 end
      power=30.35 burn=28.00 down=1825 end
      '
      '
          o 135.0  cr 5.9   mn 0.33
          fe 13.0  co 0.075 ni 9.9
          zr 221.0 nb 0.71  sn 3.6
      '
1   ssssssssssss      aaaaaaaaaa      ssssssssssss     22222222222    hh         hh
   ssssssssssssss    aaaaaaaaaaaa    ssssssssssssss   2222222222222   hh         hh
   ss          ss   aa          aa   ss          ss   22          22   hh         hh
   ss               aa          aa   ss               22          22   hh         hh
   ss               aa          aa   ss               22          22   hh         hh
   ssssssssssss     aaaaaaaaaaaaaa   ssssssssssss              22     hhhhhhhhhhhhhh
    ssssssssssss    aaaaaaaaaaaaaa    ssssssssssss           22       hhhhhhhhhhhhhh
             ss     aa          aa             ss        22          hh         hh
             ss     aa          aa             ss     22             hh         hh
   ss        ss     aa          aa   ss        ss   22               hh         hh
   ssssssssssssss   aa          aa   ssssssssssssss 2222222222222   hh         hh
    ssssssssssss    aa          aa    ssssssssssss   2222222222222   hh         hh
0

   nn          nn  iiiiiiiiiiii     eeeeeeeeeee    hh         hh    oooooooooo    11
```



program verification information

code system: scale version: 4.3

program: sas2

creation date: 03/07/97

library: /opt/neut/Scale4.3/bin

this is not a scale configuration controlled code

jobname: nichol

date of execution: 08/09/97

time of execution: 15:10:24

nuclide concentrations, grams
basis =single reactor assembly

	initial	1E-18 d
o 16	1.35E+05	1.35E+05
total	3.90E+05	3.90E+05

nuclide concentrations, grams
basis =single reactor assembly

	initial	1E-18 d
u234	2.95E+02	2.95E+02
u235	3.21E+04	3.21E+04
u236	3.27E+02	3.27E+02
u238	9.67E+05	9.67E+05
total	1.00E+06	1.00E+06

basis =

initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.40E+01	1.69E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01	1.70E+01
tc 99	4.65E-05	4.71E-05	4.71E-05	4.71E-05	4.71E-05	4.71E-05	4.71E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.84E-03	1.96E-03	2.09E-03	2.22E-03	2.34E-03	2.47E-03	2.60E-03
u234	1.77E+02	1.77E+02	1.78E+02	1.79E+02	1.80E+02	1.81E+02	1.82E+02
u235	8.31E+03	8.31E+03	8.31E+03	8.31E+03	8.31E+03	8.31E+03	8.31E+03
u236	4.23E+03	4.23E+03	4.23E+03	4.23E+03	4.23E+03	4.23E+03	4.23E+03
u238	9.44E+05	9.44E+05	9.44E+05	9.44E+05	9.44E+05	9.44E+05	9.44E+05
np237	4.16E+02	4.25E+02	4.25E+02	4.25E+02	4.25E+02	4.26E+02	4.26E+02
pu236	6.21E-04	5.11E-04	4.19E-04	3.43E-04	2.81E-04	2.30E-04	1.89E-04
pu238	1.33E+02	1.43E+02	1.44E+02	1.44E+02	1.43E+02	1.42E+02	1.41E+02
pu238	1.33E+02	1.43E+02	1.44E+02	1.44E+02	1.43E+02	1.42E+02	1.41E+02
pu239	5.16E+03	5.21E+03	5.21E+03	5.21E+03	5.21E+03	5.21E+03	5.21E+03
pu240	2.22E+03	2.22E+03	2.23E+03	2.23E+03	2.23E+03	2.23E+03	2.23E+03
pu241	1.18E+03	1.14E+03	1.09E+03	1.05E+03	1.01E+03	9.69E+02	9.31E+02
pu242	4.69E+02	4.69E+02	4.69E+02	4.69E+02	4.69E+02	4.69E+02	4.69E+02
am241	3.57E+01	8.23E+01	1.27E+02	1.70E+02	2.11E+02	2.51E+02	2.88E+02
am242m	6.88E-01	6.85E-01	6.82E-01	6.79E-01	6.76E-01	6.74E-01	6.71E-01
am243	8.93E+01	8.94E+01	8.94E+01	8.94E+01	8.94E+01	8.94E+01	8.94E+01
total	9.66E+05	9.66E+05	9.66E+05	9.66E+05	9.66E+05	9.66E+05	9.66E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	6.36E+02	7.42E+02	7.48E+02	7.48E+02	7.48E+02	7.48E+02	7.48E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	7.83E+02	7.86E+02	7.86E+02	7.86E+02	7.86E+02	7.86E+02	7.86E+02
ru101	7.49E+02	7.49E+02	7.49E+02	7.49E+02	7.49E+02	7.49E+02	7.49E+02
rh103	4.27E+02	4.73E+02	4.73E+02	4.73E+02	4.73E+02	4.73E+02	4.73E+02
ag109	8.47E+01	8.48E+01	8.48E+01	8.48E+01	8.48E+01	8.48E+01	8.48E+01

0 nuclide concentrations, grams
basis =single reactor assembly

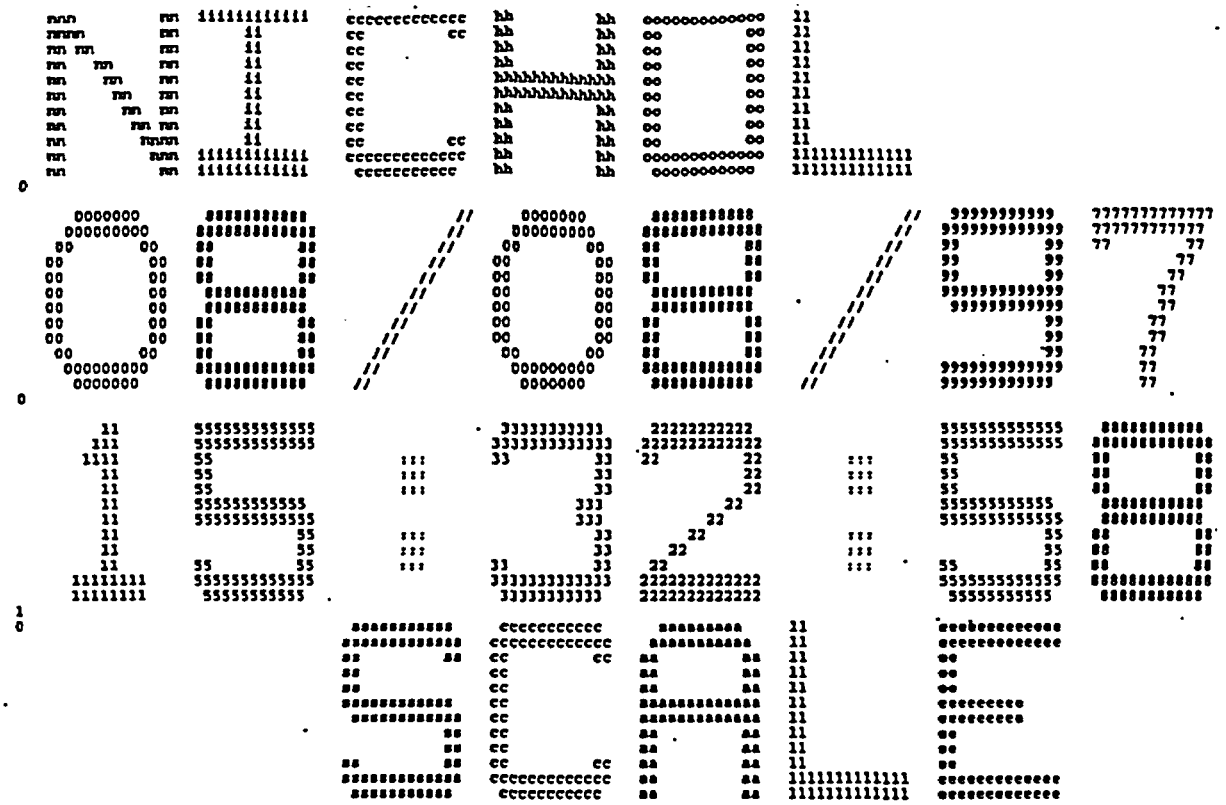
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	7.71E+02	7.92E+02	7.92E+02	7.92E+02	7.92E+02	7.92E+02	7.92E+02
nd145	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02
sm147	8.24E+01	1.19E+02	1.48E+02	1.71E+02	1.90E+02	2.05E+02	2.17E+02
sm149	2.10E+00	3.32E+00	3.32E+00	3.32E+00	3.32E+00	3.32E+00	3.32E+00
sm150	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02	2.84E+02
sm151	1.34E+01	1.36E+01	1.35E+01	1.34E+01	1.33E+01	1.32E+01	1.32E+01
eu151	1.38E-02	1.01E-01	1.88E-01	2.74E-01	3.60E-01	4.45E-01	5.30E-01
sm152	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02
gd155	3.75E-02	6.35E-01	1.16E+00	1.63E+00	2.04E+00	2.41E+00	2.73E+00
total	3.30E+04	3.30E+04	3.30E+04	3.30E+04	3.30E+04	3.30E+04	3.30E+04

mih87c07.sum

```
0**********************************************************************
*                                                                    *
*                  SCALE4.3  Bulletin  Board                         *
*                  --------  --------  -----                         *
*                                                                    *
*                    Welcome to SCALE-4.3.                           *
*                                                                    *
**********************************************************************
1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h    will be called
     Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
     '
     'mixtures of fuel-pin-cell
     44group    latticecell
     '
     '
     uo2  1 den=9.996 1 922
       92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
     kr-83   1 0 1-20 922  end
     kr-85   1 0 1-20 922  end
     y-89    1 0 1-20 922  end
     sr-90   1 0 1-20 922  end
     zr-93   1 0 1-20 922  end
     zr-94   1 0 1-20 922  end
     zr-95   1 0 1-20 922  end
     nb-94   1 0 1-20 922  end
     mo-95   1 0 1-20 922  end
     tc-99   1 0 1-20 922  end
     ru-101  1 0 1-20 922  end
     ru-106  1 0 1-20 922  end
     rh-103  1 0 1-20 922  end
     rh-105  1 0 1-20 922  end
     pd-105  1 0 1-20 922  end
     pd-108  1 0 1-20 922  end
     ag-109  1 0 1-20 922  end
     sb-124  1 0 1-20 922  end
     xe-131  1 0 1-20 922  end
     xe-132  1 0 1-20 922  end
     xe-135  1 0 1-20 922  end
     xe-136  1 0 1-20 922  end
     cs-134  1 0 1-20 922  end
     cs-135  1 0 1-20 922  end
     cs-137  1 0 1-20 922  end
     ba-136  1 0 1-20 922  end
     la-139  1 0 1-20 922  end
     pr-141  1 0 1-20 922  end
     pr-143  1 0 1-20 922  end
     ce-144  1 0 1-20 922  end
     nd-143  1 0 1-20 922  end
     nd-145  1 0 1-20 922  end
     nd-147  1 0 1-20 922  end
     pm-147  1 0 1-20 922  end
     pm-148  1 0 1-20 922  end
     sm-147  1 0 1-20 922  end
     sm-149  1 0 1-20 922  end
     sm-150  1 0 1-20 922  end
     sm-151  1 0 1-20 922  end
     sm-152  1 0 1-20 922  end
     eu-153  1 0 1-20 922  end
     eu-154  1 0 1-20 922  end
     eu-155  1 0 1-20 922  end
     gd-155  1 0 1-20 922  end
     '
     arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                40000 98.18 2 1.0 601   end
     h2o 3 den=0.7510  1  561 end
     arbm-boramod  0.7510 1 1 0 0 5000 100 3 450.0e-6  561  end
     end comp
     '
     '
     squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
     '
     '
     '
     '
     mpin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
     printlevel=5 lightel=9 inplevel=2 numxtotal=5 end
     '
     '
     3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6670
     '
     '
     power=28.13 burn=215.0 down=388 end
     power=39.91 burn=157.0 down=9.0 end
     power=39.91 burn=170.0 down=176 end
     power=38.99 burn=352.0 down=0 end
     power=31.77 burn=28.00 down=1825 end
     '
     '
         o 135.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
     '
1    ssssssssss      aaaaaaaaa      ssssssssss     22222222222    hh         hh
     ssssssssssss    aaaaaaaaaa    ssssssssssss   2222222222222   hh         hh
     ss          ss  aa        aa  ss          ss  22        22   hh         hh
     ss              aa        aa  ss              22        22   hh         hh
     ss              aa        aa  ss              22        22   hh         hh
     ssssssssssss    aaaaaaaaaaaa  ssssssssssss            22    hhhhhhhhhhhhh
      ssssssssssss   aaaaaaaaaaaa   ssssssssssss          22     hhhhhhhhhhhhh
                ss   aa        aa              ss      22        hh         hh
                ss   aa        aa              ss    22          hh         hh
     ss         ss   aa        aa  ss          ss  22            hh         hh
     ssssssssssss    aa        aa  ssssssssssss   2222222222222  hh         hh
      ssssssssss     aa        aa   ssssssssss    2222222222222  hh         hh
0

     nn          nn  iiiiiiiiiiii     eeeeeeeeee    hh         hh    oooooooooo    ll
```



program verification information

code system: scale version: 4.3

program: sas2

creation date: 03/07/97

library: /opt/neut/Scale4.3/bin

this is not a scale configuration controlled code

jobname: nichol

date of execution: 08/08/97

time of execution: 15:32:58

nuclide concentrations, grams
basis =single reactor assembly

	initial	1E-18 d
o 16	1.35E+05	1.35E+05
total	3.90E+05	3.90E+05

nuclide concentrations, grams
basis =single reactor assembly

	initial	1E-18 d
u234	2.95E+02	2.95E+02
u235	3.21E+04	3.21E+04
u236	3.27E+02	3.27E+02
u238	9.67E+05	9.67E+05
total	1.00E+06	1.00E+06

basis =

initial 10.8 d 21.5 d 32.3 d 43.0 d 43.0 d

initial 10.8 d 21.5 d 32.3 d 43.0 d 43.0 d

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05

nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.46E+01	1.76E+01	1.78E+01	1.78E+01	1.78E+01	1.78E+01	1.78E+01
tc 99	5.26E-05	5.33E-05	5.33E-05	5.33E-05	5.33E-05	5.33E-05	5.33E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.82E-03	1.95E-03	2.09E-03	2.22E-03	2.35E-03	2.49E-03	2.62E-03
u234	1.72E+02	1.73E+02	1.74E+02	1.75E+02	1.76E+02	1.77E+02	1.78E+02
u235	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7.63E+03
u236	4.31E+03	4.31E+03	4.31E+03	4.31E+03	4.31E+03	4.31E+03	4.31E+03
u238	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05
np237	4.36E+02	4.45E+02	4.45E+02	4.45E+02	4.46E+02	4.46E+02	4.46E+02
pu236	6.85E-04	5.63E-04	4.62E-04	3.78E-04	3.10E-04	2.54E-04	2.08E-04
pu238	1.45E+02	1.55E+02	1.57E+02	1.56E+02	1.56E+02	1.55E+02	1.54E+02
pu238	1.45E+02	1.55E+02	1.57E+02	1.56E+02	1.56E+02	1.55E+02	1.54E+02
pu239	5.11E+03	5.19E+03	5.19E+03	5.19E+03	5.19E+03	5.19E+03	5.19E+03
pu240	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03
pu241	1.22E+03	1.17E+03	1.12E+03	1.08E+03	1.04E+03	9.97E+02	9.58E+02
pu242	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02
am241	3.59E+01	8.39E+01	1.30E+02	1.74E+02	2.16E+02	2.57E+02	2.96E+02
am242m	6.86E-01	6.83E-01	6.80E-01	6.77E-01	6.75E-01	6.72E-01	6.69E-01
am243	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
total	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	6.62E+02	7.72E+02	7.78E+02	7.78E+02	7.78E+02	7.78E+02	7.78E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	8.15E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02
ru101	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02
rh103	4.42E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02
ag109	8.99E+01	9.01E+01	9.01E+01	9.01E+01	9.01E+01	9.01E+01	9.01E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	7.87E+02	8.09E+02	8.09E+02	8.09E+02	8.09E+02	8.09E+02	8.09E+02
nd145	6.88E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02
sm147	8.39E+01	1.21E+02	1.51E+02	1.74E+02	1.94E+02	2.09E+02	2.21E+02
sm149	2.06E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00
sm150	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02
sm151	1.34E+01	1.36E+01	1.35E+01	1.34E+01	1.33E+01	1.32E+01	1.31E+01
eu151	1.28E-02	1.00E-01	1.87E-01	2.73E-01	3.59E-01	4.44E-01	5.29E-01
sm152	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02
gd155	3.76E-02	6.81E-01	1.25E+00	1.75E+00	2.20E+00	2.59E+00	2.94E+00
total	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04

mih87c08.sum

```
0*************************************************************************
*                                                                       *
*                  SCALE4.3  Bulletin  Board                            *
*                  --------  --------  -----                            *
*                                                                       *
*             .      Welcome to SCALE-4.3.                              *
*                                                                       *
*                                                                       *
*************************************************************************
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-    module sas2h    will be called
      Mihama-3, 8, 34.2 GWd/MTU, 87c08, June 97
      '
      'mixtures of fuel-pin-cell
      44group    latticecell
      '
      '
      uo2  1 den=9.996 1 922
        92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
      kr-83   1 0 1-20 922  end
      kr-85   1 0 1-20 922  end
      y-89    1 0 1-20 922  end
      sr-90   1 0 1-20 922  end
      zr-93   1 0 1-20 922  end
      zr-94   1 0 1-20 922  end
      zr-95   1 0 1-20 922  end
      nb-94   1 0 1-20 922  end
      mo-95   1 0 1-20 922  end
      tc-99   1 0 1-20 922  end
      ru-101  1 0 1-20 922  end
      ru-106  1 0 1-20 922  end
      rh-103  1 0 1-20 922  end
      rh-105  1 0 1-20 922  end
      pd-105  1 0 1-20 922  end
      pd-108  1 0 1-20 922  end
      ag-109  1 0 1-20 922  end
      sb-124  1 0 1-20 922  end
      xe-131  1 0 1-20 922  end
      xe-132  1 0 1-20 922  end
      xe-135  1 0 1-20 922  end
      xe-136  1 0 1-20 922  end
      cs-134  1 0 1-20 922  end
      cs-135  1 0 1-20 922  end
      cs-137  1 0 1-20 922  end
      ba-136  1 0 1-20 922  end
      la-139  1 0 1-20 922  end
      pr-141  1 0 1-20 922  end
      pr-143  1 0 1-20 922  end
      ce-144  1 0 1-20 922  end
      nd-143  1 0 1-20 922  end
      nd-145  1 0 1-20 922  end
      nd-147  1 0 1-20 922  end
      pm-147  1 0 1-20 922  end
      pm-148  1 0 1-20 922  end
      sm-147  1 0 1-20 922  end
      sm-149  1 0 1-20 922  end
      sm-150  1 0 1-20 922  end
      sm-151  1 0 1-20 922  end
      sm-152  1 0 1-20 922  end
      eu-153  1 0 1-20 922  end
      eu-154  1 0 1-20 922  end
      eu-155  1 0 1-20 922  end
      gd-155  1 0 1-20 922  end
      '
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 626   end
      h2o 3 den=0.6984  1  586 end
      arbm-bormod  0.6984 1 1 0 0 5000 100 3 450.0e-6  586  end
      end comp
      '
      '
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      '
      '
      '
      npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
      printlevel=5 lightel=9 inplevel=2 numstotal=5 end
      '
      '
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6670
      '
      '
      power=28.65 burn=215.0 down=388 end
      power=40.62 burn=157.0 down=9.0 end
      power=40.62 burn=170.0 down=176 end
      power=39.72 burn=352.0 down=0 end
      power=31.85 burn=28.00 down=1825 end
      '
      '
         o 115.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
      '
1   ###########      #########     ###########     22222222222    hh         hh
   ############    ###########    ############   2222222222222   hh         hh
   ##          ##   ##         ##  ##          ##  22          22  hh         hh
   ##              ##         ##  ##                          22  hh         hh
   ##              ##         ##  ##                          22  hh         hh
   ############    ###############  ############              22  hhhhhhhhhhhhh
    ############   ###############   ############          22      hhhhhhhhhhhhh
              ##   ##         ##                  ##      22          hh         hh
              ##   ##         ##                  ##    22            hh         hh
   ##         ##   ##         ##  ##          ##  22                  hh         hh
   ############    ##         ##  ############    2222222222222       hh         hh
    ###########    ##         ##   ###########    2222222222222       hh         hh
0

   nn          nn  iiiiiiiiiiii     cccccccccc    hh         hh    oooooooooo    ll
```

```
NICHOL
0
08/08/97
0
16:22:30
1
0
SCALE

     *****************************************************************
     *****************************************************************
     *****************************************************************
     *****                                                       *****
     *****            program verification information           *****
     *****                                                       *****
     *****           code system:    scale  version:    4.3      *****
     *****                                                       *****
     *****************************************************************
     *****************************************************************
     *****                                                       *****
     *****                                                       *****
     *****            program:  sas2                             *****
     *****                                                       *****
     *****      creation date:  03/07/97                         *****
     *****                                                       *****
     *****            library:  /opt/neut/Scale4.3/bin           *****
     *****                                                       *****
     *****                                                       *****
     *****   this is not a   scale  configuration controlled code *****
     *****                                                       *****
     *****            jobname:  nichol                           *****
     *****                                                       *****
     *****  date of execution:  08/08/97                         *****
     *****                                                       *****
     *****  time of execution:  16:22:30                         *****
     *****                                                       *****
     *****                                                       *****
     *****************************************************************
     *****************************************************************
     *****************************************************************
1
0'
0                                     nuclide concentrations, grams
                                      basis =single reactor assembly
          initial   1E-18 d
    o 16  1.35E+05  1.35E+05
  total   3.90E+05  3.90E+05
0                                     nuclide concentrations, grams
                                      basis =single reactor assembly
          initial   1E-18 d
    u234  2.93E+02  2.95E+02
    u235  3.21E+04  3.21E+04
    u236  3.27E+02  3.27E+02
    u238  9.67E+05  9.67E+05
  total   1.00E+06  1.00E+06
0                                    basis =
0                initial         10.8 d         21.5 d         32.3 d         43.0 d         43.0 d
0                initial         10.8 d         21.5 d         32.3 d         43.0 d         43.0 d
0                                     nuclide concentrations, grams
                                      basis =single reactor assembly
          initial   304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    o 16  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
0                                     nuclide concentrations, grams
                                      basis =single reactor assembly
```

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.55E+01	1.88E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01	1.89E+01
tc 99	6.56E-05	6.65E-05	6.65E-05	6.65E-05	6.65E-05	6.64E-05	6.64E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.91E-03	2.05E-03	2.19E-03	2.34E-03	2.48E-03	2.62E-03	2.76E-03
u234	1.69E+02	1.70E+02	1.71E+02	1.72E+02	1.73E+02	1.74E+02	1.76E+02
u235	7.77E+03	7.77E+03	7.77E+03	7.77E+03	7.77E+03	7.77E+03	7.77E+03
u236	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03
u238	9.42E+05	9.42E+05	9.42E+05	9.42E+05	9.42E+05	9.42E+05	9.42E+05
np237	4.62E+02	4.71E+02	4.71E+02	4.71E+02	4.71E+02	4.72E+02	4.72E+02
pu236	7.76E-04	6.38E-04	5.23E-04	4.29E-04	3.51E-04	2.88E-04	2.36E-04
pu238	1.60E+02	1.71E+02	1.73E+02	1.72E+02	1.71E+02	1.70E+02	1.69E+02
pu238	1.60E+02	1.71E+02	1.73E+02	1.72E+02	1.71E+02	1.70E+02	1.69E+02
pu239	5.36E+03	5.45E+03	5.45E+03	5.45E+03	5.45E+03	5.45E+03	5.45E+03
pu240	2.38E+03	2.39E+03	2.39E+03	2.39E+03	2.39E+03	2.39E+03	2.39E+03
pu241	1.31E+03	1.26E+03	1.21E+03	1.16E+03	1.11E+03	1.07E+03	1.03E+03
pu242	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02
am241	3.85E+01	9.00E+01	1.39E+02	1.87E+02	2.32E+02	2.76E+02	3.18E+02
am242m	7.70E-01	7.67E-01	7.64E-01	7.61E-01	7.58E-01	7.55E-01	7.52E-01
am243	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02
total	9.64E+05	9.64E+05	9.64E+05	9.64E+05	9.64E+05	9.64E+05	9.64E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	6.68E+02	7.80E+02	7.86E+02	7.86E+02	7.86E+02	7.86E+02	7.86E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	8.24E+02	8.27E+02	8.27E+02	8.27E+02	8.27E+02	8.27E+02	8.27E+02
ru101	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02	7.96E+02
rh103	4.50E+02	5.00E+02	5.00E+02	5.00E+02	5.00E+02	5.00E+02	5.00E+02
ag109	9.33E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01	9.35E+01

0 nuclide concentrations, grams
basis =single reactor assembly

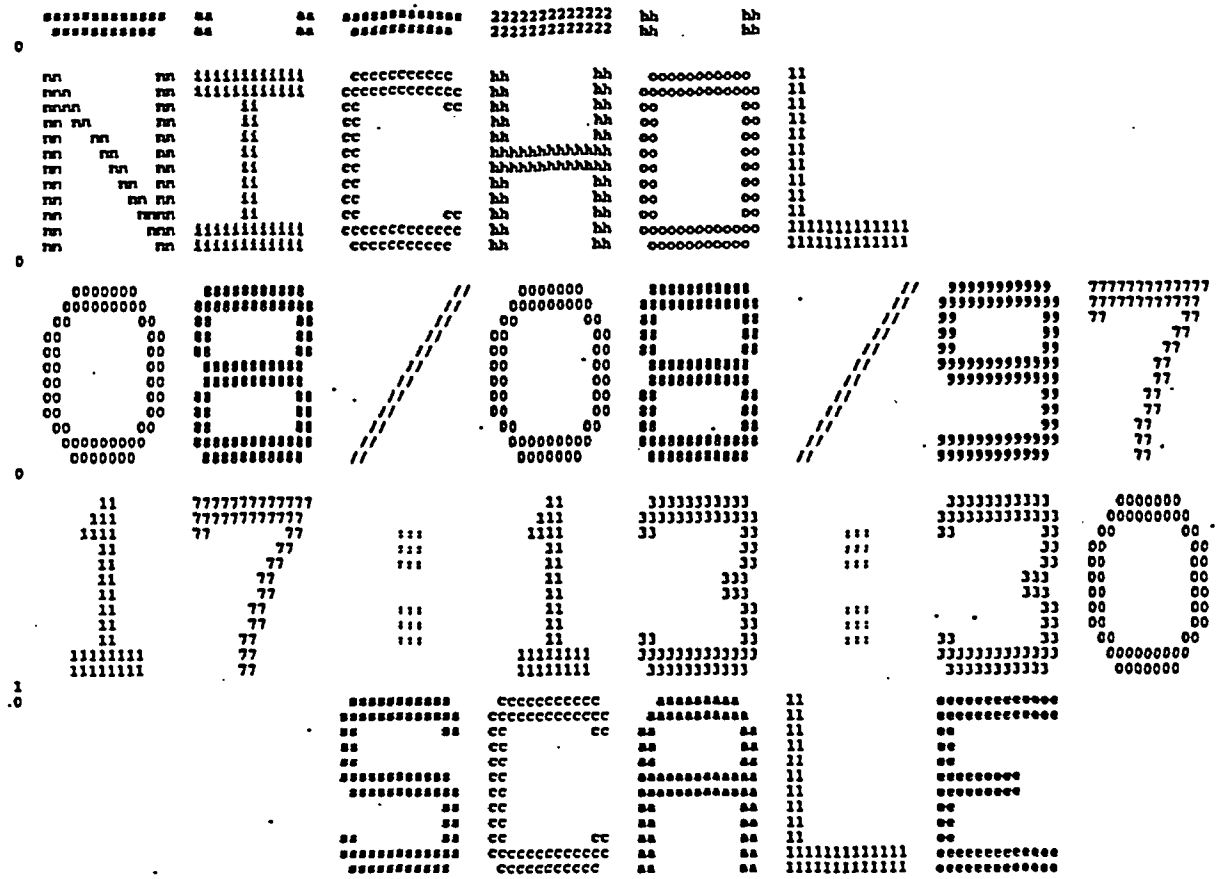
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	8.04E+02	8.26E+02	8.26E+02	8.26E+02	8.26E+02	8.26E+02	8.26E+02
nd145	6.95E+02	6.95E+02	6.95E+02	6.95E+02	6.95E+02	6.95E+02	6.95E+02
sm147	8.27E+01	1.20E+02	1.49E+02	1.73E+02	1.92E+02	2.07E+02	2.20E+02
sm149	2.25E+00	3.56E+00	3.56E+00	3.56E+00	3.56E+00	3.56E+00	3.56E+00
sm150	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02	3.07E+02
sm151	1.48E+01	1.50E+01	1.49E+01	1.48E+01	1.47E+01	1.46E+01	1.45E+01
eu151	1.45E-02	1.11E-01	2.07E-01	3.02E-01	3.96E-01	4.90E-01	5.83E-01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
sm152	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02	1.35E+02
eu153	1.21E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02	1.22E+02
gd155	4.30E-02	7.05E-01	1.29E+00	1.81E+00	2.27E+00	2.67E+00	3.03E+00
total	3.51E+06	3.51E+06	3.51E+06	3.51E+06	3.51E+06	3.51E+06	3.51E+06

mih86b02less100deg.sum

```
0
                    SCALE4.3  Bulletin  Board
                    --------  --------  -----

                      Welcome to SCALE-4.3.

1         primary module access and input record ! scale driver - 95/03/29 - 09:06:37 !
-   module sas2h    will be called
      Mihama-3, 86b02 0, 8.3 GWd/MTU, 86b02, June 97

      mixtures of fuel-pin-unitcell:

      44group        latticecell

      uo2  1 den=9.996 1 822
        92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
      kr-83   1 0 1-20 822  end
      kr-85   1 0 1-20 822  end
      y-89    1 0 1-20 822  end
      sr-90   1 0 1-20 822  end
      zr-93   1 0 1-20 822  end
      zr-94   1 0 1-20 822  end
      zr-95   1 0 1-20 822  end
      nb-94   1 0 1-20 822  end
      mo-95   1 0 1-20 822  end
      tc-99   1 0 1-20 822  end
      ru-101  1 0 1-20 822  end
      ru-106  1 0 1-20 822  end
      rh-103  1 0 1-20 822  end
      rh-105  1 0 1-20 822  end
      pd-105  1 0 1-20 822  end
      pd-108  1 0 1-20 822  end
      ag-109  1 0 1-20 822  end
      sb-124  1 0 1-20 822  end
      xe-131  1 0 1-20 822  end
      xe-132  1 0 1-20 822  end
      xe-135  1 0 1-20 822  end
      xe-136  1 0 1-20 822  end
      cs-134  1 0 1-20 822  end
      cs-135  1 0 1-20 822  end
      cs-137  1 0 1-20 822  end
      ba-136  1 0 1-20 822  end
      la-139  1 0 1-20 822  end
      pr-141  1 0 1-20 822  end
      pr-143  1 0 1-20 822  end
      ce-144  1 0 1-20 822  end
      nd-143  1 0 1-20 822  end
      nd-145  1 0 1-20 822  end
      nd-147  1 0 1-20 822  end
      pm-147  1 0 1-20 822  end
      pm-148  1 0 1-20 822  end
      sm-147  1 0 1-20 822  end
      sm-149  1 0 1-20 822  end
      sm-150  1 0 1-20 822  end
      sm-151  1 0 1-20 822  end
      sm-152  1 0 1-20 822  end
      eu-153  1 0 1-20 822  end
      eu-154  1 0 1-20 822  end
      eu-155  1 0 1-20 822  end
      gd-155  1 0 1-20 822  end

      arbm-sirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 600   end
      h2o 3 den=0.7518  1  560 end
      arbm-bormod  0.7518 1 1 0 0 5000 100 3 430.0e-6  560  end

      450 ppm boron (wt) in moderator

      end comp

      fuel-pin-cell geometry:

      squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end

      assembly and cycle parameters:

      npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
      printlevel=5 lightel=9 implevel=2 numztotal=5 end
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      power=38.61 burn=215 down=1825 end
          o 135.0  cr 5.9  mn 0.33
          fe 13.0 co 0.075 ni 9.9
          zr 221.0 nb 0.71 sn 3.6

1   ssssssssss      aaaaaaaaa      ssssssssss     22222222222    hh         hh
   ssssssssssss    aaaaaaaaaa    ssssssssssss   2222222222222   hh         hh
   ss        ss   aa        aa   ss        ss   22         22   hh         hh
   ss             aa        aa   ss             22         22   hh         hh
   ss             aa        aa   ss                        22   hh         hh
   ssssssssssss   aaaaaaaaaaaa   ssssssssssss             22    hhhhhhhhhhhhh
    ssssssssssss  aaaaaaaaaaaa    ssssssssssss          22      hhhhhhhhhhhhh
             ss   aa        aa             ss       22          hh         hh
             ss   aa        aa             ss     22            hh         hh
   ss        ss   aa        aa   ss        ss   22              hh         hh
```



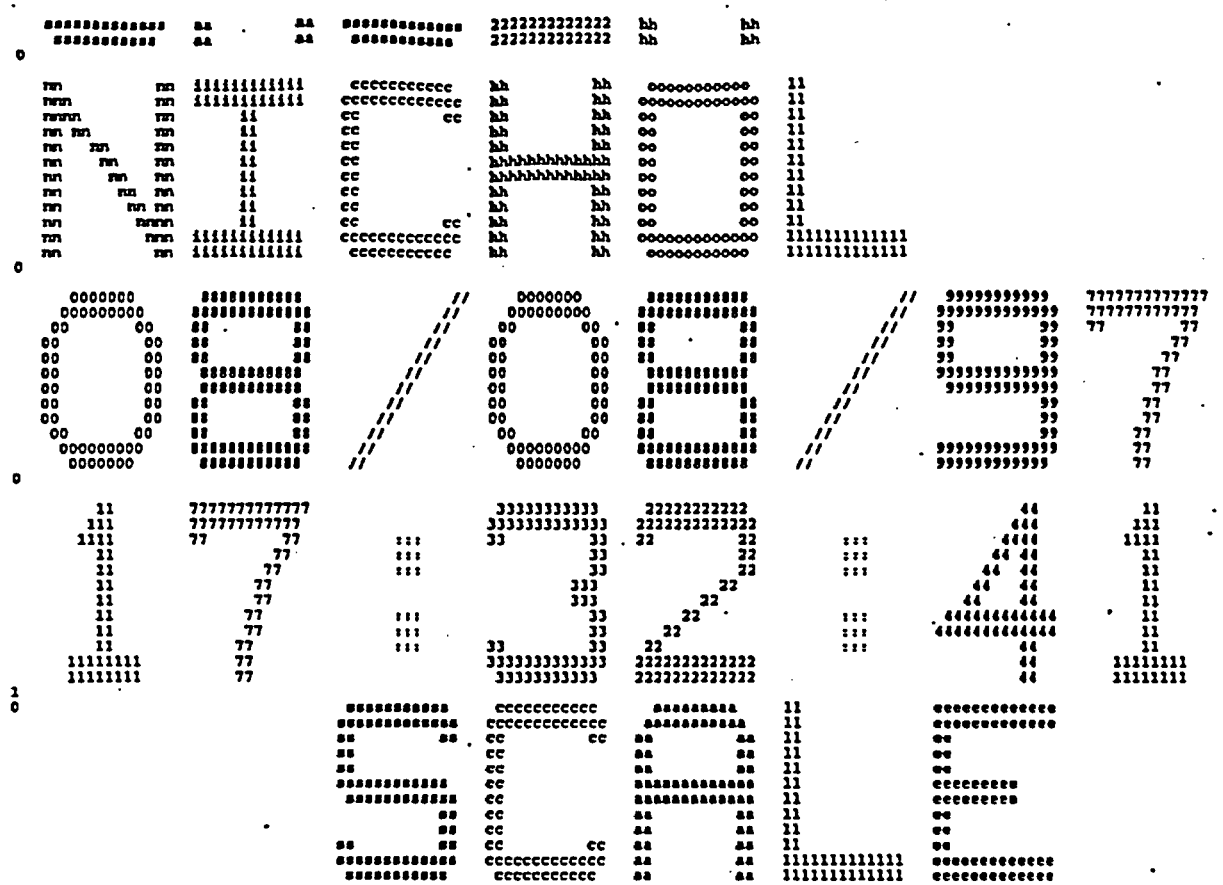

```
                    program verification information
                   code system:    scale  version:    4.3

                program:  sas2
           creation date:  03/07/97
                 library:  /opt/neut/Scale4.3/bin

   this is not a   scale  configuration controlled code
                 jobname:  nichol
   date of execution:  08/08/97
   time of execution:  17:13:30
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

             initial  1E-18 d
     o 16  1.35E+05  1.35E+05
   total   3.90E+05  3.90E+05

                                  nuclide concentrations, grams
                                  basis =single reactor assembly

             initial  1E-18 d
    u234   2.85E+02  2.85E+02
    u235   3.21E+04  3.21E+04
    u236   2.08E+02  2.08E+02
    u238   9.67E+05  9.67E+05
   total   1.00E+06  1.00E+06

                                  basis =
```

0		initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0		initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	mo 95	1.66E+00	3.77E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00
	total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	u233	8.06E-04	8.22E-04	8.41E-04	8.60E-04	8.79E-04	8.98E-04	9.17E-04
	u234	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02
	u235	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04
	u236	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03
	u238	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05
	np237	5.92E+01	6.36E+01	6.36E+01	6.36E+01	6.36E+01	6.36E+01	6.37E+01
	pu236	1.96E-05	1.64E-05	1.34E-05	1.10E-05	9.01E-06	7.38E-06	6.05E-06
	pu238	4.66E+00	4.66E+00	4.65E+00	4.62E+00	4.59E+00	4.56E+00	4.53E+00
	pu238	4.66E+00	4.66E+00	4.65E+00	4.62E+00	4.59E+00	4.56E+00	4.53E+00
	pu239	2.94E+03	3.02E+03	3.02E+03	3.02E+03	3.02E+03	3.02E+03	3.02E+03
	pu240	4.28E+02	4.28E+02	4.28E+02	4.28E+02	4.28E+02	4.28E+02	4.28E+02
	pu241	1.38E+02	1.32E+02	1.27E+02	1.22E+02	1.17E+02	1.13E+02	1.08E+02
	pu242	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01
	am241	1.03E+00	6.45E+00	1.16E+01	1.66E+01	2.14E+01	2.60E+01	3.04E+01
	am242m	1.24E-02	1.23E-02	1.23E-02	1.22E-02	1.22E-02	1.21E-02	1.21E-02
	am243	4.16E-01	4.16E-01	4.16E-01	4.16E-01	4.16E-01	4.16E-01	4.16E-01
	total	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05
0				element concentrations, grams				
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	mo 95	9.33E-01	2.11E-02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	tc 99	2.20E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02
	ru101	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
	rh103	9.46E+01	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02
	ag109	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01	1.05E+01
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	nd143	2.52E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02
	nd145	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02
	sm147	6.78E+00	2.64E+01	4.21E+01	5.48E+01	6.49E+01	7.30E+01	7.96E+01
	sm149	1.96E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00	3.13E+00
	sm150	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01
	sm151	8.36E+00	8.54E+00	8.48E+00	8.43E+00	8.38E+00	8.32E+00	8.27E+00
	eu151	8.48E-03	6.34E-02	1.18E-01	1.72E-01	2.26E-01	2.80E-01	3.33E-01
	sm152	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01
0				nuclide concentrations, grams				
				basis =single reactor assembly				
		initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
	eu153	1.52E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01	1.55E+01
	gd155	4.75E-03	9.77E-02	1.80E-01	2.53E-01	3.17E-01	3.74E-01	4.24E-01
	total	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03

mih86b02plus100boron.sum

```
0**********************************************************************
*                                                                    *
*                  SCALE4.3  Bulletin  Board                         *
*                  --------  --------  -----                         *
*                                                                    *
*                    Welcome to SCALE-4.3.                           *
*                                                                    *
**********************************************************************
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-    module sas2h    will be called
     Mihama-3, 86b02 C, 8.3 GWd/MTU, 86b02, June 97
     *
     *
     '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
     *
     *       mixtures of fuel-pin-unitcell:
     *
     44group        latticecell
     *
     *
     *
     uo2  1 den=9.996 1 922
       92234 0.0285 92235 3.208 92236 0.0208 92238 96.742  end
     kr-83   1 0 1-20 922  end
     kr-85   1 0 1-20 922  end
     y-89    1 0 1-20 922  end
     sr-90   1 0 1-20 922  end
     zr-93   1 0 1-20 922  end
     zr-94   1 0 1-20 922  end
     zr-95   1 0 1-20 922  end
     nb-94   1 0 1-20 922  end
     mo-95   1 0 1-20 922  end
     tc-99   1 0 1-20 922  end
     ru-101  1 0 1-20 922  end
     ru-106  1 0 1-20 922  end
     rh-103  1 0 1-20 922  end
     rh-105  1 0 1-20 922  end
     pd-105  1 0 1-20 922  end
     pd-108  1 0 1-20 922  end
     ag-109  1 0 1-20 922  end
     sb-126  1 0 1-20 922  end
     xe-131  1 0 1-20 922  end
     xe-132  1 0 1-20 922  end
     xe-135  1 0 1-20 922  end
     xe-136  1 0 1-20 922  end
     cs-134  1 0 1-20 922  end
     cs-135  1 0 1-20 922  end
     cs-137  1 0 1-20 922  end
     ba-136  1 0 1-20 922  end
     la-139  1 0 1-20 922  end
     pr-141  1 0 1-20 922  end
     pr-143  1 0 1-20 922  end
     ce-144  1 0 1-20 922  end
     nd-143  1 0 1-20 922  end
     nd-145  1 0 1-20 922  end
     nd-147  1 0 1-20 922  end
     pm-147  1 0 1-20 922  end
     pm-148  1 0 1-20 922  end
     sm-147  1 0 1-20 922  end
     sm-149  1 0 1-20 922  end
     sm-150  1 0 1-20 922  end
     sm-151  1 0 1-20 922  end
     sm-152  1 0 1-20 922  end
     eu-153  1 0 1-20 922  end
     eu-154  1 0 1-20 922  end
     eu-155  1 0 1-20 922   end
     gd-155  1 0 1-20 922  end
     *
     arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                40000 98.18 2 1.0 600   end
     h2o 3 den=0.7518  1  560 end
     arbm-bormod  0.7518 1 1 0 0 5000 100 3 550.0e-6  560  end
     *
     *    450 ppm boron (wt) in moderator
     '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
     end comp
     *
     '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
     *
     *     fuel-pin-cell geometry:
     *
     squarepitch   1.4300  0.929 1 3 1.072 2 0.948 0  end
     *
     *
     '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
     *
     *     assembly and cycle parameters:
     *
     npin/assm=204 fuelnght=820.74 ncycles=1 nlib/cyc=5
     printlevel=5 lightel=9 implevel=2 numstotal=5 end
     3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
     power=38.61 burn=215 down=1825 end
         o 135.0  cr 5.9  mn 0.33
         fe 13.0 co 0.075 ni 9.9
         zr 221.0 nb 0.71 sn 3.6
     *
     '- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
     *
1    ssssssssss      aaaaaaaaa      ssssssssss     222222222222    hh          hh
     ssssssssssss    aaaaaaaaaa    ssssssssssss   2222222222222   hh          hh
     ss          ss  aa        aa  ss          ss  22          22  hh          hh
     ss              aa        aa  ss              22          22  hh          hh
     ss              aa        aa  ss              22          22  hh          hh
     ssssssssssss    aaaaaaaaaaaa  ssssssssssss              22  hhhhhhhhhhhhh
      ssssssssssss   aaaaaaaaaaaa   ssssssssssss          22      hhhhhhhhhhhhh
                ss   aa        aa              ss      22          hh          hh
                ss   aa        aa              ss  22              hh          hh
     ss         ss   aa        aa  ss          ss  22              hh          hh
```



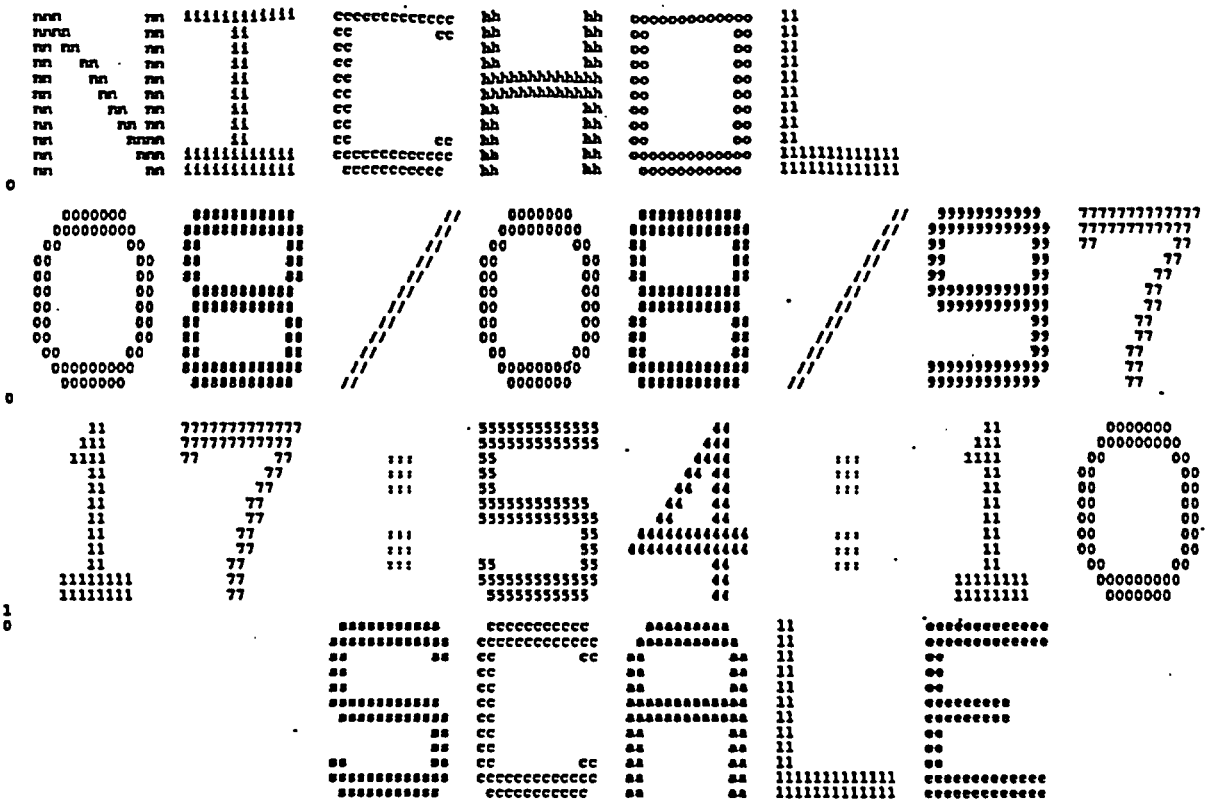
```
                    program verification information
                    code system:    scale  version:    4.3

                          program:  sas2
                    creation date:  03/07/97
                          library:  /opt/neut/Scale4.3/bin

    this is not a   scale  configuration controlled code
                          jobname:  nichol
                 date of execution:  08/08/97
                 time of execution:  17:32:41
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

              initial  1E-18 d
    o 16   1.35E+05  1.35E+05
  total    3.90E+05  3.90E+05

                                  nuclide concentrations, grams
                                  basis =single reactor assembly

              initial  1E-18 d
     u234   2.85E+02  2.85E+02
     u235   3.21E+04  3.21E+04
     u236   2.08E+02  2.08E+02
     u238   9.67E+05  9.67E+05
  total     1.00E+06  1.00E+06

                                basis =
```

0	initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0	initial	10.8 d	21.5 d	32.3 d	43.0 d	43.0 d	
0			nuclide concentrations, grams				
			basis =single reactor assembly				
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
o 16	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05	1.35E+05
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.66E+00	1.80E+00	3.92E+00	3.93E+00	3.93E+00	3.93E+00	3.93E+00
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	8.14E-04	8.32E-04	8.52E-04	8.71E-04	8.90E-04	9.09E-04	9.29E-04
u234	2.52E+02	2.52E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02	2.53E+02
u235	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04	2.34E+04
u236	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03	1.75E+03
u238	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05	9.62E+05
np237	5.99E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.44E+01
pu236	2.01E-05	1.67E-05	1.37E-05	1.12E-05	9.22E-06	7.55E-06	6.19E-06
pu238	4.53E+00	4.73E+00	4.72E+00	4.69E+00	4.66E+00	4.63E+00	4.60E+00
pu238	4.53E+00	4.73E+00	4.72E+00	4.69E+00	4.66E+00	4.63E+00	4.60E+00
pu239	2.99E+03	3.07E+03	3.07E+03	3.07E+03	3.07E+03	3.07E+03	3.07E+03
pu240	4.33E+02	4.33E+02	4.33E+02	4.33E+02	4.33E+02	4.33E+02	4.33E+02
pu241	1.40E+02	1.35E+02	1.30E+02	1.24E+02	1.20E+02	1.15E+02	1.10E+02
pu242	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01	1.03E+01
am241	1.05E+00	6.59E+00	1.19E+01	1.70E+01	2.19E+01	2.66E+01	3.10E+01
am242m	1.27E-02	1.27E-02	1.26E-02	1.26E-02	1.25E-02	1.25E-02	1.24E-02
am243	4.24E-01	4.27E-01	4.27E-01	4.27E-01	4.27E-01	4.27E-01	4.27E-01
total	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05	9.91E+05
0				element concentrations, grams			
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	9.32E+01	2.11E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	2.20E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02	2.24E+02
ru101	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
rh103	9.48E+01	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02	1.33E+02
ag109	1.06E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01	1.07E+01
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	2.52E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02	2.82E+02
nd145	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02	1.99E+02
sm147	6.77E+00	2.66E+01	4.21E+01	5.47E+01	6.48E+01	7.30E+01	7.95E+01
sm149	1.97E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00	3.14E+00
sm150	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01	6.43E+01
sm151	8.42E+00	8.60E+00	8.54E+00	8.49E+00	8.43E+00	8.38E+00	8.32E+00
eu151	8.55E-03	6.39E-02	1.19E-01	1.73E-01	2.28E-01	2.82E-01	3.35E-01
sm152	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01	3.33E+01
0				nuclide concentrations, grams			
				basis =single reactor assembly			
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.52E+01	1.56E+01	1.56E+01	1.56E+01	1.56E+01	1.56E+01	1.56E+01
gd155	4.81E-03	9.82E-02	1.81E-01	2.54E-01	3.18E-01	3.75E-01	4.26E-01
total	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03	8.62E+03

mih87c07less100deg.sum

```
0*************************************************************************
*                                                                       *
*                  SCALE4.3  Bulletin  Board                            *
*                  --------  --------  -----                            *
*                                                                       *
*                    Welcome to SCALE-4.3.                              *
*                                                                       *
*************************************************************************
1         primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-   module sas2h     will be called
     Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
     '
     'mixtures of fuel-pin-cell
     44group    latticecell
     '
     '
     uo2  1 den=9.996 1 822
       92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
     kr-83   1 0 1-20 822  end
     kr-85   1 0 1-20 822  end
     y-89    1 0 1-20 822  end
     sr-90   1 0 1-20 822  end
     zr-93   1 0 1-20 822  end
     zr-94   1 0 1-20 822  end
     zr-95   1 0 1-20 822  end
     nb-94   1 0 1-20 822  end
     mo-95   1 0 1-20 822  end
     tc-99   1 0 1-20 822  end
     ru-101  1 0 1-20 822  end
     ru-106  1 0 1-20 822  end
     rh-103  1 0 1-20 822  end
     rh-105  1 0 1-20 822  end
     pd-105  1 0 1-20 822  end
     pd-108  1 0 1-20 822  end
     ag-109  1 0 1-20 822  end
     sb-124  1 0 1-20 822  end
     xe-131  1 0 1-20 822  end
     xe-132  1 0 1-20 822  end
     xe-135  1 0 1-20 822  end
     xe-136  1 0 1-20 822  end
     cs-134  1 0 1-20 822  end
     cs-135  1 0 1-20 822  end
     cs-137  1 0 1-20 822  end
     ba-136  1 0 1-20 822  end
     la-139  1 0 1-20 822  end
     pr-141  1 0 1-20 822  end
     pr-143  1 0 1-20 822  end
     ce-144  1 0 1-20 822  end
     nd-143  1 0 1-20 822  end
     nd-145  1 0 1-20 822  end
     nd-147  1 0 1-20 822  end
     pm-147  1 0 1-20 822  end
     pm-148  1 0 1-20 822  end
     sm-147  1 0 1-20 822  end
     sm-149  1 0 1-20 822  end
     sm-150  1 0 1-20 822  end
     sm-151  1 0 1-20 822  end
     sm-152  1 0 1-20 822  end
     eu-153  1 0 1-20 822  end
     eu-154  1 0 1-20 822  end
     eu-155  1 0 1-20 822  end
     gd-155  1 0 1-20 822  end
     '
     arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                40000 98.18 2 1.0 601   end
     h2o 3 den=0.7510  1  561 end
     arbm-boromod  0.7510 1 1 0 0 5000 100 3 450.0e-6  561  end
     end comp
     '
     '
     squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
     '
     '
     '
     '
     npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
     printlevel=5 lightel=9 inplevel=2 numztotal=5 end
     '
     '
     3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
     '
     '
     power=28.13 burn=215.0 down=388 end
     power=39.91 burn=157.0 down=9.0 end
     power=39.91 burn=170.0 down=176 end
     power=38.99 burn=352.0 down=0 end
     power=31.77 burn=28.00 down=1825 end
     '
     '
        o 135.0  cr 5.9   mn 0.33
        fe 13.0  co 0.075 ni 9.9
        zr 221.0 nb 0.71  sn 3.6
     '
1    ###########      aaaaaaaaa      ###########     22222222222    hh         hh
     #############    aaaaaaaaaaa    #############   2222222222222  hh         hh
     ##          ##   aa         aa  ##          ##  22         22  hh         hh
     ##          ##   aa         aa  ##          ##  22         22  hh         hh
     ##          ##   aa         aa  ##          ##  22         22  hh         hh
     #############    aaaaaaaaaaaaa  #############  22         22  hhhhhhhhhhhhh
      ############    aaaaaaaaaaaaa   ############  22         22  hhhhhhhhhhhhh
                ##    aa         aa              ##  22         22  hh         hh
                ##    aa         aa              ##  22         22  hh         hh
     ##         ##    aa         aa  ##          ##  22         22  hh         hh
     #############    aa         aa  #############  2222222222222  hh         hh
      ###########     aa         aa   ###########   2222222222222  hh         hh
0

     mm          mm  iiiiiiiiiiii     eeeeeeeeeee    hh         hh    oooooooooo    ll
```



```
                    program verification information
                    code system:    scale  version:    4.3

                 program:  sas2
              creation date:  01/07/97
                 library:  /opt/neut/Scale4.3/bin
        this is not a  scale  configuration controlled code
                 jobname:  nichol
           date of execution:  08/08/97
           time of execution:  17:54:10
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
          initial  1E-18 d
    o 16  1.35E+05  1.35E+05
total     3.90E+05  3.90E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
          initial  1E-18 d
   u234   2.95E+02  2.95E+02
   u235   3.21E+04  3.21E+04
   u236   3.27E+02  3.27E+02
   u238   9.67E+05  9.67E+05
total     1.00E+06  1.00E+06
                                 basis =
                 initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                 initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
          initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    o 16  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
```

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.46E+01	1.76E+01	1.78E+01	1.78E+01	1.78E+01	1.78E+01	1.78E+01
tc 99	5.27E-05	5.34E-05	5.34E-05	5.34E-05	5.34E-05	5.34E-05	5.34E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.81E-03	1.94E-03	2.07E-03	2.21E-03	2.34E-03	2.47E-03	2.60E-03
u234	1.72E+02	1.73E+02	1.74E+02	1.75E+02	1.76E+02	1.77E+02	1.78E+02
u235	7.57E+03	7.57E+03	7.57E+03	7.57E+03	7.57E+03	7.57E+03	7.57E+03
u236	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03	4.32E+03
u238	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05
np237	4.34E+02	4.43E+02	4.43E+02	4.43E+02	4.44E+02	4.44E+02	4.44E+02
pu236	6.81E-04	5.60E-04	4.59E-04	3.76E-04	3.08E-04	2.53E-04	2.07E-04
pu238	1.45E+02	1.55E+02	1.56E+02	1.56E+02	1.55E+02	1.54E+02	1.53E+02
pu238	1.45E+02	1.55E+02	1.56E+02	1.56E+02	1.55E+02	1.54E+02	1.53E+02
pu239	5.04E+03	5.12E+03	5.12E+03	5.12E+03	5.12E+03	5.12E+03	5.12E+03
pu240	2.29E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2.30E+03
pu241	1.21E+03	1.16E+03	1.11E+03	1.07E+03	1.03E+03	9.86E+02	9.47E+02
pu242	5.17E+02	5.17E+02	5.17E+02	5.17E+02	5.17E+02	5.17E+02	5.17E+02
am241	3.54E+01	8.28E+01	1.28E+02	1.72E+02	2.14E+02	2.54E+02	2.93E+02
am242m	6.73E-01	6.71E-01	6.68E-01	6.65E-01	6.62E-01	6.60E-01	6.57E-01
am243	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02	1.02E+02
total	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	6.62E+02	7.73E+02	7.78E+02	7.79E+02	7.79E+02	7.79E+02	7.79E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	8.15E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02
ru101	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02
rh103	4.40E+02	4.89E+02	4.89E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02
ag109	8.96E+01	8.97E+01	8.97E+01	8.97E+01	8.97E+01	8.97E+01	8.97E+01

0 nuclide concentrations, grams
basis =single reactor assembly

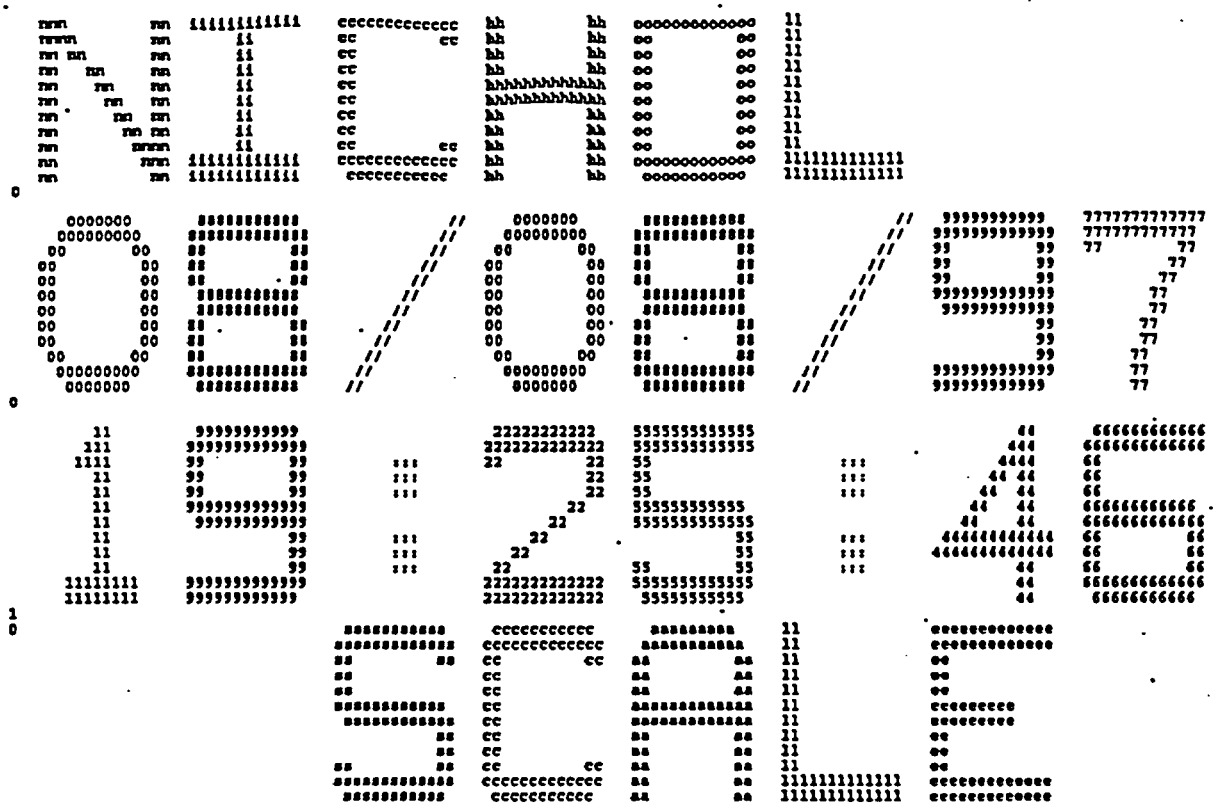
	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	7.85E+02	8.07E+02	8.07E+02	8.07E+02	8.07E+02	8.07E+02	8.07E+02
nd145	6.88E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02	6.89E+02
sm147	8.38E+01	1.21E+02	1.50E+02	1.74E+02	1.93E+02	2.09E+02	2.21E+02
sm149	2.04E+00	3.34E+00	3.34E+00	3.34E+00	3.34E+00	3.34E+00	3.34E+00
sm150	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02
sm151	1.33E+01	1.35E+01	1.34E+01	1.33E+01	1.32E+01	1.31E+01	1.30E+01
eu151	1.26E-02	9.92E-02	1.85E-01	2.71E-01	3.56E-01	4.40E-01	5.24E-01
sm152	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.17E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02
gd155	3.71E-02	6.80E-01	1.25E+00	1.75E+00	2.19E+00	2.59E+00	2.93E+00
total	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04

mih87c07plus100boron.sum

```
0*************************************************************************
*                                                                       *
*                  SCALE4.3  Bulletin  Board                            *
*                  --------  --------  -----                            *
*                                                                       *
*                    Welcome to SCALE-4.3.                              *
*                                                                       *
*************************************************************************
1          primary module access and input record ( scale driver - 95/03/29 - 09:06:37 )
-    module sss2h    will be called
      Mihama-3, 7, 33.7 GWd/MTU, 87c07, June 97
      '
      'mixtures of fuel-pin-cell
      44group    latticecell
      '
      '
      uo2  1 den=9.996 1 922
        92234 0.0295 92235 3.21 92236 0.0327 92238 96.727  end
      kr-83   1 0 1-20 922  end
      kr-85   1 0 1-20 922  end
      y-89    1 0 1-20 922  end
      sr-90   1 0 1-20 922  end
      zr-93   1 0 1-20 922  end
      zr-94   1 0 1-20 922  end
      zr-95   1 0 1-20 922  end
      nb-94   1 0 1-20 922  end
      mo-95   1 0 1-20 922  end
      tc-99   1 0 1-20 922  end
      ru-101  1 0 1-20 922  end
      ru-106  1 0 1-20 922  end
      rh-103  1 0 1-20 922  end
      rh-105  1 0 1-20 922  end
      pd-105  1 0 1-20 922  end
      pd-108  1 0 1-20 922  end
      ag-109  1 0 1-20 922  end
      sb-124  1 0 1-20 922  end
      xe-131  1 0 1-20 922  end
      xe-132  1 0 1-20 922  end
      xe-133  1 0 1-20 922  end
      xe-136  1 0 1-20 922  end
      cs-134  1 0 1-20 922  end
      cs-135  1 0 1-20 922  end
      cs-137  1 0 1-20 922  end
      ba-136  1 0 1-20 922  end
      la-139  1 0 1-20 922  end
      pr-141  1 0 1-20 922  end
      pr-143  1 0 1-20 922  end
      ce-144  1 0 1-20 922  end
      nd-143  1 0 1-20 922  end
      nd-145  1 0 1-20 922  end
      nd-147  1 0 1-20 922  end
      pm-147  1 0 1-20 922  end
      pm-148  1 0 1-20 922  end
      sm-147  1 0 1-20 922  end
      sm-149  1 0 1-20 922  end
      sm-150  1 0 1-20 922  end
      sm-151  1 0 1-20 922  end
      sm-152  1 0 1-20 922  end
      eu-153  1 0 1-20 922  end
      eu-154  1 0 1-20 922  end
      eu-155  1 0 1-20 922  end
      gd-155  1 0 1-20 922  end
      '
      arbm-zirc4 6.56 5 0 0 0 8016 0.12 24000 0.10 26000 0.20 50000 1.40
                 40000 98.18 2 1.0 601   end
      h2o 3 den=0.7510  1  561 end
      arbm-boromd  0.7510 1 1 0 0 5000 100 3 550.0e-6  561  end
      end comp
      '
      '
      squarepitch   1.430  0.929 1 3 1.072 2 0.948 0  end
      '
      '
      '
      '
      npin/assm=204 fuelnght=820.74 ncycles=5 nlib/cyc=5
      printlevel=5 lightel=9 implevel=2 numstotal=5 end
      '
      '
      3 0.6500 2 0.6935 3 0.8068 500 2.6408 3 2.6470
      '
      '
      power=28.13 burn=215.0 down=388 end
      power=39.91 burn=157.0 down=9.0 end
      power=39.91 burn=170.0 down=176 end
      power=38.99 burn=352.0 down=0 end
      power=31.77 burn=28.00 down=1825 end
      '
      '
         o 135.0  cr 5.9   mn 0.33
         fe 13.0  co 0.075 ni 9.9
         zr 221.0 nb 0.71  sn 3.6
      '
1   ############      ##########      ############     22222222222    hh         hh
   ##############    ############    ##############  2222222222222   hh         hh
   ##          ##   ##          ##  ##          ##  22          22   hh         hh
   ##              ##          ##  ##                          22   hh         hh
   ##              ##          ##  ##                          22   hh         hh
   ##############  ##############  ##############              22   hhhhhhhhhhhhhh
    ############   ##############   ############              22    hhhhhhhhhhhhhh
                ##  ##          ##              ##          22     hh         hh
                ##  ##          ##              ##        22       hh         hh
   ##           ##  ##          ##  ##          ##      22         hh         hh
   ##############   ##          ##  ##############  2222222222222  hh         hh
    ############    ##          ##   ############   2222222222222  hh         hh
0

   mm          mm  iiiiiiiiiiii     eeeeeeeeeee    hh         hh    ooooooooooo    11
```



```
                    program verification information
                  code system:    scale  version:    4.3

                          program:  sas2
                     creation date:  03/07/97
                          library:  /opt/neut/Scale4.3/bin
               this is not a   scale  configuration controlled code
                          jobname:  nichol
               date of execution:  08/08/97
               time of execution:  19:25:47
```

```
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

             initial  1E-18 d
    o 16  1.35E+05  1.35E+05
  total   3.90E+05  3.90E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly

             initial  1E-18 d
    u234  2.95E+02  2.95E+02
    u235  3.21E+04  3.21E+04
    u236  3.27E+02  3.27E+02
    u238  9.67E+05  9.67E+05
  total   1.00E+06  1.00E+06
                                  basis =
                 initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                 initial        10.8 d        21.5 d        32.3 d        43.0 d        43.0 d
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
             initial  304.2 d   608.3 d   912.5 d  1216.7 d  1520.8 d  1825.0 d
    o 16  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05  1.35E+05
                                  nuclide concentrations, grams
                                  basis =single reactor assembly
```

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	1.47E+01	1.77E+01	1.79E+01	1.79E+01	1.79E+01	1.79E+01	1.79E+01
tc 99	5.38E-05	5.45E-05	5.45E-05	5.45E-05	5.45E-05	5.45E-05	5.45E-05
total	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05	3.90E+05

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
u233	1.84E-03	1.98E-03	2.11E-03	2.24E-03	2.38E-03	2.51E-03	2.65E-03
u234	1.72E+02	1.73E+02	1.74E+02	1.75E+02	1.76E+02	1.77E+02	1.78E+02
u235	7.70E+03	7.70E+03	7.70E+03	7.70E+03	7.70E+03	7.70E+03	7.70E+03
u236	4.30E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03	4.30E+03
u238	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05	9.43E+05
np237	4.39E+02	4.48E+02	4.48E+02	4.48E+02	4.49E+02	4.49E+02	4.49E+02
pu236	6.96E-06	5.73E-04	4.69E-04	3.85E-04	3.15E-04	2.58E-04	2.12E-04
pu238	1.47E+02	1.57E+02	1.58E+02	1.58E+02	1.57E+02	1.56E+02	1.55E+02
pu238	1.47E+02	1.57E+02	1.58E+02	1.58E+02	1.57E+02	1.56E+02	1.55E+02
pu239	5.16E+03	5.24E+03	5.24E+03	5.24E+03	5.24E+03	5.24E+03	5.24E+03
pu240	2.30E+03	2.31E+03	2.31E+03	2.31E+03	2.31E+03	2.31E+03	2.31E+03
pu241	1.23E+03	1.18E+03	1.14E+03	1.09E+03	1.05E+03	1.01E+03	9.67E+02
pu242	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02	5.19E+02
am241	1.64E+01	8.48E+01	1.31E+02	1.76E+02	2.19E+02	2.60E+02	2.99E+02
am242m	6.98E-01	6.95E-01	6.93E-01	6.90E-01	6.87E-01	6.84E-01	6.81E-01
am243	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02	1.03E+02
total	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05	9.65E+05

0 element concentrations, grams
0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
mo 95	6.61E+02	7.72E+02	7.77E+02	7.78E+02	7.78E+02	7.78E+02	7.78E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
tc 99	8.14E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02	8.18E+02
ru101	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02	7.83E+02
rh103	4.42E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02	4.91E+02
ag109	9.01E+01	9.03E+01	9.03E+01	9.03E+01	9.03E+01	9.03E+01	9.03E+01

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
nd143	7.89E+02	8.10E+02	8.10E+02	8.10E+02	8.10E+02	8.10E+02	8.10E+02
nd145	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02	6.88E+02
sm147	8.36E+01	1.21E+02	1.50E+02	1.74E+02	1.93E+02	2.08E+02	2.21E+02
sm149	2.09E+00	3.39E+00	3.39E+00	3.39E+00	3.39E+00	3.39E+00	3.39E+00
sm150	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02	2.99E+02
sm151	1.36E+01	1.37E+01	1.36E+01	1.35E+01	1.35E+01	1.34E+01	1.33E+01
eu151	1.31E-02	1.01E-01	1.89E-01	2.76E-01	3.63E-01	4.49E-01	5.34E-01
sm152	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02

0 nuclide concentrations, grams
basis =single reactor assembly

	initial	304.2 d	608.3 d	912.5 d	1216.7 d	1520.8 d	1825.0 d
eu153	1.18E+02	1.19E+02	1.19E+02	1.19E+02	1.19E+02	1.19E+02	1.19E+02
gd155	3.82E-02	6.82E-01	1.25E+00	1.75E+00	2.20E+00	2.59E+00	2.94E+00
total	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04	3.46E+04